About the Editors

Dr. Prasanta Kumar Barik, an Assistant Professor at Rajiv Gandhi University, India was born in the district of Jharsuguda, Odisha in 1973. He has obtained his M.A. (Education), M.A (History) and Ph.D. in Education from Sambalpur University. He qualified UGC-NET examination in Education. His areas of interest and specialization are Higher Education, Teacher Education, Secondary Education and Pedagogy of Social Sciences. Currently, Dr. Barik is associated with Post graduate teaching and research work. He is a 'teacher educator too'. He has participated and presented in many national and international conferences, seminars, symposia, etc. He has published articles in journals, edited books at national and international repute. He acts a resource persons for various departments and colleges. He has completed a project work sponsored under ICSSR, New Delhi, India. He has also credited to publish a book titled "College Autonomy and Quality in Higher Education" along with his mentor Dr. Harihar Sahoo, Former Head, Department of Education, G.M. University, Sambalpur, Odisha.

Dr. Shishira Bania is currently working as a Lecturer in Education (SS), Department of Higher Education, Govt. of Odisha) in Bimalaraipur College under Sambalpur University, Odisha. He has done his Post Graduation in Education from G.M. Autonomous College (Now G.M. University) Sambalpur, Odisha; Post Graduation in Sociology from IGNOU, New Delhi and Post-Graduation in English from Odisha State Open University; M.Phil. in Education from Dr. P.M. Institute of Advanced Study in Education, Sambalpur, Odisha. He has qualified UGC NET and JRF in Education. He is awarded with Ph.D. degree in the subject Education from Sambalpur University, Odisha, India. He has more than 07 years of teaching experience. He has participated and presented many papers in National and International Seminars. He is the author of two Books. He has 18 research publications to his credit.

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A Quality Concern in Public versus Private School Education

Narender Singh* *and* P. K. Barik†

Abstract

The last three decades in India are dedicated to progress and development as a whole in all areas. The progress in the field of education is awareness and interest of the masses towards importance of education. The government policies strengthened public trust in education and in improving the life of the educated one in particular and common people in general. India being a densely populated country with limited resources is struggling to provide quality education to all its children though efforts have been made on the part of the government but economic strength and infrastructural weak position makes it hard to be completely successful. Right to Education, 2005 act binds government to make provision for free and compulsory education for all learners up to the age of 14. To fulfil this provision government decided to use various avenues like privatisation of at all level. However, before this act, education was in private hands ,too, at some levels but implementation of act boosted the process of privatisation. The process of privatisation of school education increased enrolment but it significantly increased the gap of quality among learners. This paper is an attempt to highlight the quality issue in school education.

INTRODUCTION

Many states in the world consider education as an essential service and it is solely the responsibility of the state to provide education to all its citizens. The

* *Assistant Professor*, Department of Education, Rajiv Gandhi University, Rono Hills Doimukh, Arunachal Pradesh

† *Assistant Professor*, Department of Education, Rajiv Gandhi University, Arunachal Pradesh

research in the field of education suggests that providing education to its citizen by the state is a real investment and that always pays back with huge benefits leading to collective contribution having cumulative rewards in each domain of life. In India , The last three decades in India are dedicated to progress and development as a whole in all areas. The progress in the field of education is awareness and interest of the masses towards importance of education. The government policies strengthened public trust in education and in improving the life of the educated one in particular and common people in general. India being a densely populated country with limited resources is struggling to provide quality education to all its children though efforts have been made on the part of the government but economic strength and infrastructural weak position makes it hard to be completely successful. Right to Education, 2005 act binds government to make provision for free and compulsory education for all learners up to the age of 14. To fulfil this provision government decided to use various avenues like privatisation of at all level.

However, before this act, education was in private hands ,too, at some levels but implementation of act boosted the process of privatisation. The process of privatisation of school education increased enrolment but it significantly increased the gap of quality among learners. Some Critics in India and aboard points out that it is the policy fault and inefficiency of the government that has made privatisation of education (Chubb & Moe, 1990; Richards, shore.& Sawicky, 1966) as a business and profit gaining enterprise. Economic compulsion in India also forces the state to go for privatisation. To make education as business may lose its character but with certain rules it may be privatised to ensure that nation could maximise its efforts for universalization of education.

Privatisation will boost other democratic norms of decentralisation of education. Various strategies like magnet school or alternate schools in USA provide an option to parents and students but it does not mean that education has been a private matter. It is regulated by government agencies but adds values to the work culture and creativity of the individual organisation that views education as an area of experimentation and improvement. Other strategies like Voucher System, Charter System and private management have been successful in various countries because of flexibility adopted by the system and decision-making power has been decentralised to the extent that an improved system of policy governance is clearly visible in private institutes. Voucher system (USA) guarantee distribution of governmental funds in the form of voucher to the parents that they can redeem in any type of school (public or private). It is based upon natural selection theory of Darwin that manifest survival of fittest. Evidence based results show that quality of education is better in private schools as compared to public schools. Voucher system increases competition among institutions. If parents are not satisfied

with the quality of education that the school is providing to their children then they shall opt for another school foe their wards and the school will lose funds leading to closure of the school if it does not work on improving the quality of the education. In India private school education and quality education has become the right of the rich.

Government in India provides financial helps to government run or government aided schools only. Parents are forced to send their children in government run schools despite the fact that quality standard in government school is inferior to private run schools. If government introduce voucher system in India too, it may revolutionise the mean and mechanism of providing education in India. Gap between education of children of poor and rich parents will be over and institutions (private or government) will become more competitive in nature leading to quality enhancement. Government of India under right to education act is bound to provide free and compulsory education to children under the age of fourteen. The question that stirs controversy is that, this free education shall be available through government run schools only. There is no provision to know how much money is spent on educating a child for a period of eight years or up to the age of fourteen years. If the calculated money is given to parents in the form of a voucher/ coupon or cheques directly to the parents in instalments in that form it will motivate parents to enrol their children in a school that provides quality education. The procedure adopted will force the schools and teaching staff to be competitive, innovative and quality productive. Another most popular form of privatisation in USA is Charter school. Under this scheme state transfer grants directly to schools. In India, in some states, there is provision for grants in aids schools where government provides funds but all affairs of the school are managed by Private management board. It is a somewhat more stable and provides teachers a non-transferrable security.

Private management fixes accountability of persons working in this school and resources utilisation practice is almost perfect. Like Voucher System, Charter school system too, is not working in India, as various states do not have enough financial resources to maintain this sort of practice. Another practice that is adapted in various other countries is handing over management of schools to private contractors. This practice too is not feasible in India as it again requires sufficient financial budget for education. Government at both levels, centre and state, struggle for budget allocation for education. There is fixed budget allocation, not as per the requirement and any well-established procedure, but to maintain the minimum standard of the education I the states and country.

The quality concerns in public and private sectors that have been identified are:

- **Sense of Belonging to Institutions:** Teachers and staff working in private schools have their identity attached to the schools and are recognised by the place where they work that motivates them to improve and establish a bond with the institution. Reputation of the institution is their identity in the society. Contrary to private schools, teachers and staff working in public school suffers from identity crisis and motivation factor for excellence is missing there.
- **Resources Utilisation:** Private schools may run with minimum resources but management there brings efficiency in the system while in public schools there is poor management of resources. Both human and material resources impact quality of the education in an institution. In public school head teacher/ principal are the main custodian of material resources while in private schools they are accountable to private board of management.
- **Parents Awareness:** Parents awareness is another factor that promotes quality in education. Parents of the private school visit and enquire about the facility being offered by the school while in public school there is school management committee that may not be functional with its prime objective. Parents of public school going students do rarely visit to enquire about the quality of the education being offered in that school.

CONCLUSION

Level of education and training of teachers' impacts quality standards but it is not the sole criteria to determine quality education standard in an institution. If highly qualified and trained teachers are not managed properly then it is like a donkey lading an army of lions. Management may overcome many quality parameters by its virtues of skilful management of both human and material resources. Another factor that is most important in raising the quality standard is the parents involvement and continuous monitoring of the progress of the students and fixing accountability of the teachers.

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Adaptability in Crisis

A Psychological Perspective

Dr. Dharmeshwari Lourembam
Dr. Kakali Goswami
Dr. Sandeep Panchal
Dr. Satchit Prasun Mandal

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This book is a compilation of empirical research and review papers, which focuses on pertinent issues in current situation. The articles have been contributed by different researchers and experienced academicians from all over the country. The articles are thoroughly based on their original research work presented during Two Day National Conference titled **"Adaptability In Crisis: Psychology, Education And Society"** organized by the Department of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh, India on the 17th& 18th of August 2021 through virtual mode.

The objective of the book is to highlight various issues related to the present COVID-19 pandemic to foster better preparedness and adaptability in crisis. The chapters delve on the themes of Physical &Mental Health, Health Care System, Work-Life Balance, Resilience, Coping Skills and Effects of COVID-19 on Mental Health. It consists of selected unpublished articles of diverse aspects of psychological and overall mental health highly relevant on both individual and community levels in every sphere of life. The findings will also contribute to public welfare and policy documentation for the Government.

Dr. Dharmeshwari Lourembam is working as an Assistant Professor in Department of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh. She is currently the Head in-charge of the Department. She has specialized in Clinical Psychology, Positive Psychology and Counseling. She has obtained her U.G., P.G. and Ph.D. Degree in Psychology from Panjab University, Chandigarh. She was a UGC-JRF and SRF after which she joined Sikkim University (A Central University) as a Guest Faculty in Department of Psychology. She is currently part of a research project sponsored by National Commission for Women and has published research articles in journals and book chapters in the field of psychology. Her area of research includes Health Psychology and Positive Psychology.

Dr. Kakali Goswami is working as an Assistant Professor in Department of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh. She was former Head in-charge of the Department. She has specialized in Organizational Psychology and Positive Psychology. She has obtained her PG from Jamia Milia Islamia, New Delhi and Ph.D. Degree in Psychology from Gauhati University, Assam. Her area of research is positive psychology and organizational psychology. She has published numerous research papers and book chapters in the field of psychology. She is currently carrying out research project sponsored by National Commission for Women.

Dr. Sandeep Panchal is an Assistant Professor in Dept. of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh. He has Specialization in Clinical Psychology, Health Psychology and Sports Psychology. He has obtained Ph.D. Degree in Psychology from Kurukshetra University, Kurukshetra, Haryana, India. Previously, he worked as Senior Research Fellow (SRF) in DIPR, DR&DO, DELHI & Sports Psychologist in Sports Authority of India, Delhi, & Assistant Professor (Guest) at Central University of Haryana & Teaching Faculty at Indira Gandhi University (State University), Meerpur Rewari, Haryana. He has published more than 26 publications in National and International Journal of repute.

Dr. Satchit Prasun Mandal is presently working as an assistant professor in the Department of Psychology, Rajiv Gandhi University, Arunachal Pradesh. Prior to his present occupation, he was employed as a Scientist in the Defence Research and Development Organization (DRDO). He obtained his Ph.D. and Master's degree in Psychology from Banaras Hindu University (BHU). He completed his graduation from University of Calcutta. His area of research includes Personality Psychology, Health and Well-being, Positive Psychology.

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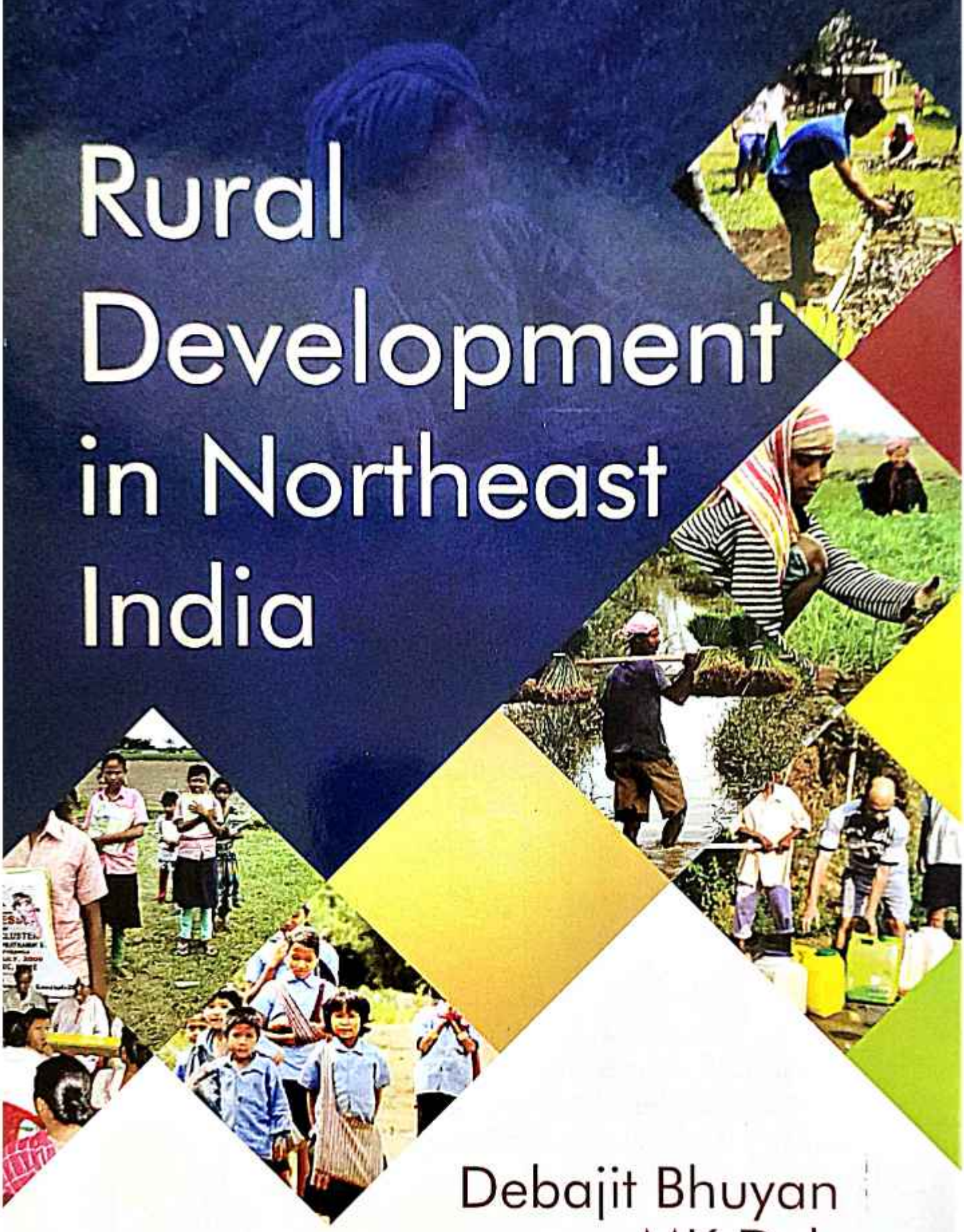

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ANKITA KOTOKY, Ph.D Scholar, Department of Economics, Dibrugarh University, Assam

ANULEKHA BHAGAWATI, Ph.D Scholar, Department of Management, North-Eastern Hill University, Tura Campus, Meghalaya

APILANG APUM, Assistant Professor, Department of Economics, Jomin Tayeng Government Model Degree College Roing, Arunachal Pradesh

BIRI AMJI, Assistant Professor, Department of Commerce, Wangcha Rajkumar Govt. College, Deomali, Arunachal Pradesh

DR ABHIGYAN BHATTACHARJEE, Associate Professor, Department of Management, North-Eastern Hill University, Tura Campus, Meghalaya

DR. ARCHANA SINHA, Associate Professor, Department of Women's Studies, Indian Social Institute, 10, Institutional Area, Lodi Road, New Delhi

DR. DIL BAHADUR GURUNG, Assistant Professor, Department of Economics, Rajiv Gandhi University, Rono Hills, Doimukh, Arunachal Pradesh

HEEROCK JYOTI BARUAH, Ph.D. scholar, Department of Anthropology, University of Hyderabad, Hyderabad, Telangana

KAROBI BORAH, Assistant Professor, Department of Economics, Doomdooma College, Assam

MONDIRA TAMULI, Ph.D Scholar, Department of Social, Science (Economics), OKDISCD, Guwahati, Assam

MUKUR GANGULY, Forest Protection Division, Tropical Forest Research Institute, Jabalpur, MP.

NAGENDRA KUMAR CHANDRAWANSHI, School of Studies in Biotechnology, Pt. Ravishankar Shukla University, Raipur, Chhatisgarh

PRIYANKA BORAH, Ph.D Scholar, Department of Sociology, Assam University, Silchar, Assam

PRIYANKU HAZARIKA, Assistant Professor, Department of Sociology, Government Model College, Deithor

RURAL DEVELOPMENT IN NORTHEAST INDIA

Edited by

DEBAJIT BHUYAN

M K DEB

Contributors include

DRABHIGYAN BHATTACHARJEE
ANKITA KOTOKY
ANULEKHA BHAGAWATI
APILANG APUM
DR. ARCHANA SINHA
BIRI AMJI
DR. DIL BAHADUR GURUNG
HEEROCK JYOTI BARUAH
KAROBI BORAH
MONDIRA TAMULI
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RURAL WOMEN'S WORK IN EASTERN HIMALAYA'S: A Case Study of Selected District of Arunachal Pradesh

DIL BAHADUR GURUNG

1. Introduction

The women's work patterns in the Himalayas region are influenced by many factors. Male migration to an urban centre on the one hand and hilly terrains, on the other hand, make it more difficult for the women's who stays in villages (Chopra and Ghosh, 2020). Rural women are considered as the drivers of developed as well as developing economies of the world. They not only play a crucial role in shaping families and societies, rather women are actively involved in farm and non-farm activities. In traditional societies, domestic work is the main input for household production and consumption. Household economic activities consist of both market production and non-market production; and non-market production is meant for household consumption (Shimray, 2004). Women continue to do the majority of the household work, whether employed or not, which is the most striking characteristic of household labour (Shelton and Daphne, 1996). In rural areas, the basic nature of women works falls in the non-market activity. Women perform seasonal work, raising children, cattle work (milking, feeding and cleaning cow sheds), fetching water, fuel wood and fodder etc. "In poor agrarian

75 YEARS OF INDEPENDENCE OF INDIA: OPPORTUNITIES AND CHALLENGES

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Why China Is Interested In Arunachal Pradesh?

Dr. Arvind Kumar Kushwaha

Assistant Professor, Department of National Security Studies, Rajiv Gandhi University, Rono Hills, Doimukh, Itanagar, Arunachal Pradesh, India.

Introduction

The state of Arunachal Pradesh (formerly known as the North-East Frontier Agency) is the largest state in India's North East. Itanagar is the capital city of Arunachal Pradesh. The state of Arunachal Pradesh shares international borders with Bhutan in the west, Tibet in the north, and Myanmar in the east. Arunachal Pradesh, an Indian state, shares a 1129-kilometre border with China. China has claimed the entire state of Arunachal Pradesh as its own. Arunachal Pradesh is known in China as "South Tibet or Zangnan."[1] On the basis of its history, China claimed the entire state of Arunachal Pradesh. The Chinese, on the other hand, are primarily interested in the Tawang district of Arunachal Pradesh, for obvious strategic reasons.[2]

Before getting into why China is interested in Tawang, it is crucial to first grasp Arunachal Pradesh's political past.

Political History Of Arunachal Pradesh.

The British first came into contact with Assam after the Anglo-Burmese war of 1824-1826. Between

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[1] China says Arunachal Pradesh part of it "since ancient times".(2021, December 31). The Economic Times,p.1

[2] Goswami, N.(2010). China's Territorial Claim on Arunachal Pradesh: Crafting an Indian Response. *Manohar Parrikar Institute of Defence Studies and Analysis.*

1824 and 1861, the present-day state of Arunachal Pradesh was left unregulated. Under British rule, Arunachal Pradesh had a distinct character long before it became a Union Territory. The British administration began mapping an administrative jurisdiction in regard to the border tribes that inhabited the area in 1875.[3] Finally, in 1912-1913, the British administration was able to carve off the North-East Frontier Tracts (NEFT), which are divided into three sections: the Ballipara Frontier Tract, the Lakhimpur Frontier Tract, and the Sadiya Frontier Tract. These territories were maintained out of the reach of ordinary laws.

Map showing the North-East Frontier Tracts, 1946

The Shimla Convention was signed between British India and Tibet in 1914, delineating the border between the two countries and giving rise to the renowned Mcmahon line (which separates the boundary

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[3] Braj,J.(1996). POLITICS OF POSA : A CASE STUDY OF PRE AND POST INDEPENDENCE SCENARIO IN ARUNACHAL PRADESH AND ASSAM. *Indian History Congress*.https://www.jstor.org/stable/44133349?casa_token=aaXm_Jg2NVQAAAAA%3A2q4_jGfn5WdbpHyCSIMz4kDndwZlnoZGMVfPpATeiR3y-zc71sGuJ27c5jk8MtQyivBCcf5UdKme9q2GW9yFXPkyu6p5eWqvnLiGKac8sruCrIkcwcIz&seq=1

between India and Tibet).[4] The Tracts were reorganised and controlled by the Governor of Assam by 1946, the year before independence. Sadiya, Lakhimpur, Tirap, Sela Sub Agency, and Subansiri were now included (Sela and Subansiri constituted what was the erstwhile Ballipara Frontier Tract). NEFT was under the control of the Government of Assam till January 26, 1950, when India became independent. This came after a sub-committee led by then-Assam Chief Minister Lokpriya' Gopinath Bordoloi proposed that the territory be taken over by the Assamese government, given the territory's size. However, the Indian government opted to rule it as an "Excluded Area," with the Governor of Assam serving as the President of India's envoy.[5]

An approximate representation of the North-East Frontier Agency in 1961

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[4] Kalha,R.(2014). The Mcmahon Line: A Hundred Year on. *MANOHAR PARRIKAR INSTITUTE OF DEFENCE STUDIES AND ANALYSIS.* https://www.idsa.in/idsacomments/TheMcMahonLine_rskalha_030714

[5] Robert, R.(1944). The Excluded Areas of Assam, 103(2), 18-29. *The Geographical Journal.*https://www.jstor.org/stable/1789063?seq=1

The administration of the plain-land areas of Balipara, Tirap, Abor Hill district, and Mishmi Hills district was handed to the Government of Assam in 1950. Units of the tracts were reconstructed in 1951, with the creation of the Tuensang Frontier Division, which ultimately merged with Nagaland. Following the implementation of the North-East Frontier (Administration) Regulation, 1954, the remaining areas of the Tracts were designated as the North-East Frontier Agency (NEFA). NEFA was first placed under the Ministry of External Affairs, then moved to the Ministry of Home Affairs in August 1965, which monitored and managed the territory until 1972, when it was granted the status of a Union Territory.[6] In Ziro, the headquarters of Lower Subansiri district, then-Prime Minister Indira Gandhi formally renamed NEFA as Arunachal Pradesh and accorded it the status of a Union Territory on the frigid morning of January 20, 1972. Local troupes performed songs and dances to commemorate the historic occasion. On February 20, 1987, Arunachal Pradesh became a state for the first time after a 15-year wait.

Geo-Political Significance Of Arunachal Pradesh

Among both India's North East and China, Arunachal Pradesh serves as a protective shield. Due to its strategic location, Arunachal Pradesh is vital to both India and China. Arunachal Pradesh has considerable resource potential that is virtually untapped. Rivers, coal, and petroleum are among the state's energy resources, and hydroelectric facilities generate the majority of the state's power. Arunachal Pradesh's

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[6] Arunachal Pradesh, Mizoram celebrate Statehood day.(2021, February 20).The Times of India,p.1

mineral resources include dolomite, quartzite, limestone, and marble, in addition to hydrocarbons. Early in the twenty-first century, efforts were undertaken to enhance hydropower and solar power generation.

The Chinese PLA occupied the Tawang area during the Sino-Indian conflict in 1962, but China returned Tawang to India after the war. The Chinese PLA made frequent incursions into the Indian side of Arunachal Pradesh. In 1987, the Indian military and the Chinese PLA engaged in a standoff at Somdurung Chu. However, tensions between the two countries were lowered as a result of negotiations. Since 1954, China has invested heavily in its infrastructure. China is pushing its development efforts in Tibet aggressively in order to mobilise soldiers quickly and win the hearts and minds of the people.[7] Tibet currently has almost 40,000 kilometres of road, with 5 national highways, 15 trunk highways, and 315 feeder roads. In 2006, China also inaugurated the Qinghai-Tibet rail line. China is also constructing three more railway lines in Tibet to connect it to the rest of the country. Not only this, but China has also constructed frontier defensive petrol highways of more than 15,000 km and is also developing permanent resident quarters for the troops stationed at the border. People living on the Chinese side of the border had four times the per capita income of those living on the Indian side of the border.[8] India has prioritised border

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[7] Goswami, N.(2011). China's 'Aggressive' Territorial Claim on India's Arunachal Pradesh: A Response to Changing Power Dynamics in Asia,35(5), 782-791. *STRATEGIC ANALYSIS*. https://doi.org/10.1080/09700161.2011.591248

[8] Das, P.(2008). Management of India-China Border Area: A Case Study of Arunachal Pradesh,3(3),92-105. *Indian Foriegn Affairs Journal*. https://www.jstor.org/stable/45340743

resolution with China, while China has taken a more aggressive stance against India in order to enforce its claim. China refused to provide a visa to an Indian official who planned to visit China in May 2007, because he was from Arunachal Pradesh.[9] The Chinese PLA also made frequent incursions into the Indian state of Arunachal Pradesh. In March 2009, China attempted to prevent a $ 2.9 billion Asian Development Bank (ADB) loan to India on the grounds that it was intended for the development of Arunachal Pradesh.[10] In 2017, China renamed six places in Arunachal Pradesh, and again in December 2021, it renamed fifteen places in Arunachal Pradesh.[11] According to the Pentagon report from November 2021, China built an illegal 100-home village on the Indian side of the Line of Actual Control, but the Indian government refuted the information, claiming that the village was built wholly on the Chinese side.[12] In January 2022, China enacted new border laws. These laws give the Chinese People's Liberation Army and the people's armed police the authority to deal with any threat in border areas. As a result, India will be directly affected by the passage of this new border law. The land boundary law's overall goal is to provide legal support for and formalise Chinese military incursions across the LAC (Line of Actual Control). During previous border negotiations between the two countries,

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[9] Arunachal Officer denied China Visa.(2007,May 26). Hindustan Times,p.1

[10] China blocks ADB India loan.(2009, April 11). Financial Times,p.1

[11] China renamed fifteen places in Arunachal Pradesh.(2021,December 31). India Today, p.1

[12] China has built 100 home village in Arunachal Pradesh: US Defence Report.(2021, November 6). CNBCTV18, p.1

China even offered India Aksai Chin in the western sector in exchange for Tawang in the eastern sector. For the following reasons, China is obsessed with the Arunachal Pradesh especially the Tawang region:

To begin with, China claimed that the inhabitants of Arunachal Pradesh, particularly in the Tawang region, had a culture and customs that is quite similar to that of Tibetans living on the Chinese side. On historical and cultural grounds, China claimed the whole state of Arunachal Pradesh. In Arunachal Pradesh, particularly in the Tawang region, there are several Tibetan monasteries. It is also clear that individuals who live near border areas share cultural and historical similarities with those on the other side. Several cross border community groups, such as the Monpas (who reside in the Tawang and West Kameng Districts), the Sherdukpans (who live in the Tawang and West Kameng Districts), and the Mishmi (who live in the Tawang and West Kameng Districts), dwell near the border areas (who live in the districts of Lohit, Anjaw, Lower Dibang Valley and Dibang Valley), they frequently move to the other side of the border in the past.[13] They maintained regular cross-border interactions with Tibet in order to purchase basic household necessities, primarily rock salt and other commodities. Transborder connection was

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[13] Ambika,K & Claire,L.(2017). Living on the Sino-Indian Border: The Story of the Mishmis in Arunachal Pradesh, Northeast India, 76(2), 367-395. *Asian Ethnology*. https://www.jstor.org/stable/90017668?casa_token=Lq_o26cmgGAAAAAA%3Ar4Bz1SnM3G41tzRtawCjt3vsHs_ces9Rs2pTE8eTViU_KRTjvvcsOdTZ9CxtbEqUbEW2pluc69mu4viapOC0w5f91EEN69XWyi604iKQRucAmwo-9VE&seq=1

halted following the 1962 Sino-India conflict, but unofficial relations continue today.[14]

Tsangyang Gyatso, the Sixth Dalai Lama, was also born in Arunachal Pradesh, according to China. China is concerned that Tibetans residing in India, who fled after the 1962 Sino-Indian conflict, may launch an anti-Chinese uprising from Tawang in Arunachal Pradesh.[15]

Second, the Tawang region gives critical access to Assam's Brahmaputra Valley. It is an important gateway to North-East India. The Chinese attacked India in the Eastern sector of the 1962 Sino-Indian conflict because Tawang serves as the critical link connecting other states in North East India. The Chinese may easily penetrate the Assam Plains if they take Tawang. It's worth noting that the Dalai Lama, together with the Tibetan people, enter to India via Tawang during the 1962 conflict.[16]

Third, India gave Bhutan security from Arunachal Pradesh on its eastern side. If the Chinese take Tawang, Bhutan will be vulnerable from the east, since it will come into touch with the Chinese. Bhutan is an Indian protectorate, hence it is critical for India to safeguard Bhutan at any costs.[17]

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[14] Explained: Why China rakes up Arunachal Pradesh time and again.(2021, October 14). The Times of India,p.1

[15] Dalai Lama may name his successor in Tawang.(2017, April 10). Economic Times,p.1

[16] Sahdev,V.(1989). The North-Eastern Frontier of India and China Claim.*MANOHAR PARRIKAR INSTITUTE OF DEFENCE STUDIES AND ANALYSIS*.https://idsa.in/system/files/TheNorth-EasternFrontierofIndiaandChinaClaim_SahdevVohra.pdf

[17] Why Bhutan is India's Achilles' heel.(2022, February 23). The Tribune,p.1

Finally, as the Tawang area is higher in elevation than the Tibetan Autonomous Region, it gives the Indian military a significant edge against Chinese PLA deployment in the Tibetan Autonomous Region. This is something that China is well aware of. Since Arunachal Pradesh is adjacent to China, the deployment of various types of missiles, including both long-range and short-range missiles, will hit and harm China. Furthermore, the deployment of heavy military equipment such as artillery, multiple launch rocket systems, and anti-aircraft guns in such critical sites will inflict significant damage to the Chinese People's Liberation Army. The installation of a multi-layered air defence system at such a vital location will assist the Indian military in neutralising any approaching aircraft threat.[18]

The Chinese claim to Arunachal Pradesh was made solely for geopolitical reasons. Even if India is sincere about settling the border dispute with China, it is the Chinese who are deliberately delaying the resolution of the border conflict. In fact, China is content to leave the question of India's border to future generations. In reality, the Chinese are waiting for the appropriate moment to launch an attack on India, thus it is critical for India to be prepared politically, diplomatically, militarily, and economically to thwart any Chinese strategy.

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[18] Explained: Why China rakes up Arunachal Pradesh time and again.(2021, October 14). The Times of India,p.1

Adaptability in Crisis

A Psychological Perspective

Dr. Dharmeshwari Lourembam
Dr. Kakali Goswami
Dr. Sandeep Panchal
Dr. Satchit Prasun Mandal

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2

Curriculum Adaptions for Learning Disabled Children

Akash Ranjan[1]

Abstract

This chapter highlights the specific requirements of certain conditions of exceptionality and ensuing curricular needs to help children with special needs specially learning disabilities. This chapter also highlights the understanding the factors that affects the curriculum performance for children with special needs (Learning disability) and all instructions needed for designing the appropriate curricula to develop skills in reading, writing and arithmetic for specific learning disability conditions. This chapter will be helpful to all working professional in the field of disabilities, curriculum planers, policy makers, special education teachers, special school authority, educationists, parents of disabled children, and philanthropists.

Keywords: Curriculum Adaptation, Learning Disabled Children.

Introduction

The advent of the new millennium shows a phenomenal increase in the concern for children with special needs. Since education has been universally accepted as fundamental right of all children, as RTE Act 2009, RPWD Act 2016 also supports for all learners,

[1]Department of Education, Rajiv Gandhi University, Rono Hills, Doimukh, Arunachal Pradesh

This book is a compilation of empirical research and review papers, which focuses on pertinent issues in current situation. The articles have been contributed by different researchers and experienced academicians from all over the country. The articles are thoroughly based on their original research work presented during Two Day National Conference titled **"Adaptability In Crisis: Psychology, Education And Society"** organized by the Department of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh, India on the 17th& 18th of August 2021 through virtual mode.

The objective of the book is to highlight various issues related to the present COVID-19 pandemic to foster better preparedness and adaptability in crisis. The chapters delve on the themes of Physical &Mental Health, Health Care System, Work-Life Balance, Resilience, Coping Skills and Effects of COVID-19 on Mental Health. It consists of selected unpublished articles of diverse aspects of psychological and overall mental health highly relevant on both individual and community levels in every sphere of life. The findings will also contribute to public welfare and policy documentation for the Government.

Dr. Dharmeshwari Lourembam is working as an Assistant Professor in Department of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh. She is currently the Head in-charge of the Department. She has specialized in Clinical Psychology, Positive Psychology and Counseling. She has obtained her U.G., P.G. and Ph.D. Degree in Psychology from Panjab University, Chandigarh. She was a UGC-JRF and SRF after which she joined Sikkim University (A Central University) as a Guest Faculty in Department of Psychology. She is currently part of a research project sponsored by National Commission for Women and has published research articles in journals and book chapters in the field of psychology. Her area of research includes Health Psychology and Positive Psychology.

Dr. Kakali Goswami is working as an Assistant Professor in Department of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh. She was former Head in-charge of the Department. She has specialized in Organizational Psychology and Positive Psychology. She has obtained her PG from Jamia Milia Islamia, New Delhi and Ph.D. Degree in Psychology from Gauhati University, Assam. Her area of research is positive psychology and organizational psychology. She has published numerous research papers and book chapters in the field of psychology. She is currently carrying out research project sponsored by National Commission for Women.

Dr. Sandeep Panchal is an Assistant Professor in Dept. of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh. He has Specialization in Clinical Psychology, Health Psychology and Sports Psychology. He has obtained Ph.D. Degree in Psychology from Kurukshetra University, Kurukshetra, Haryana, India. Previously, he worked as Senior Research Fellow (SRF) in DIPR, DR&DO, DELHI & Sports Psychologist in Sports Authority of India, Delhi, & Assistant Professor (Guest) at Central University of Haryana & Teaching Faculty at Indira Gandhi University (State University), Meerpur Rewari, Haryana. He has published more than 26 publications in National and International Journal of repute.

Dr. Satchit Prasun Mandal is presently working as an assistant professor in the Department of Psychology, Rajiv Gandhi University, Arunachal Pradesh. Prior to his present occupation, he was employed as a Scientist in the Defence Research and Development Organization (DRDO). He obtained his Ph.D. and Master's degree in Psychology from Banaras Hindu University (BHU). He completed his graduation from University of Calcutta. His area of research includes Personality Psychology, Health and Well-being, Positive Psychology.

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भारतीय संस्कृति के समस्त तत्व लोक-साहित्य में विद्यमान है, जो शास्त्र में है वह भी, और जिनका उल्लेख शास्त्र में नहीं है, वह भी। लोक-साहित्य समाज की सृष्टि है, जो लोगों की जुबान पर रचा गया है और लोगों की जुबान से ही प्रचारित होता है। लोक समाज की मानसिकता लोक-साहित्य में साकार हो उठती है। लोक समाज क्या सोचता है, क्या चाहता है, क्या करना चाहता है, क्या पाना चाहता है, लोक-साहित्य को पढ़कर उसके मनोभाव को समझा जा सकता है। सही अर्थों में लोक-साहित्य सामाजिक सद्भाव का श्रेष्ठ मानक है। इस पुस्तक में अरूणाचल प्रदेश की गालो जनजाति की जातीय पहचान के नियामक तत्वों को उधेड़ा गया है। इसके अन्तर्गत इस जनजाति की सामाजिक, आर्थिक, और धार्मिक संरचना को, उसकी बुनावट को दुनिया से परिचित कराने का प्रयास किया गया है।

डॉ० अरुण कुमार पाण्डेय (13 सितम्बर 1973 को जन्में) ने काशी हिन्दू विश्वविद्यालय, वाराणसी से स्नातकोत्तर (हिन्दी) एवं पी.एच.डी. की उपाधि प्राप्त की है। विगत 20 वर्षों से अरुणाचल प्रदेश के राजकीय महाविद्यालय में हिन्दी का अध्यापन कर रहे हैं। लोक-साहित्य के प्रति इनकी गंभीर जिज्ञासा रही है। इन्होंने 'गालो जनजाति की लोकोक्तियों' पर यू.जी.सी. द्वारा अनुदानित लघु शोध परियोजना पूर्ण की है। अरुणाचल प्रदेश की अनेक जनजातियों के लोक-साहित्य और लोक-संस्कृति पर इन्होंने संगोष्ठियों में अनेक व्याख्यान दिये हैं। देश के अनेक ख्यातिलब्ध शोध-पत्रिकाओं में दो दर्जन से अधिक शोध पत्र प्रकाशित हैं। केंद्रीय हिन्दी संस्थान, आगरा की महत्वाकांक्षी शब्द परियोजना के अन्तर्गत 'नोक्ते' भाषा विशेषज्ञ के रूप में 'हिन्दी नोक्ते अध्येता कोश' का संपादन भी किया है।

सम्प्रति : राजीव गाँधी विश्वविद्यालय (केंद्रीय विश्वविद्यालय) दोइमुख, ईटानगर में सह-आचार्य के रूप में कार्यरत हैं।

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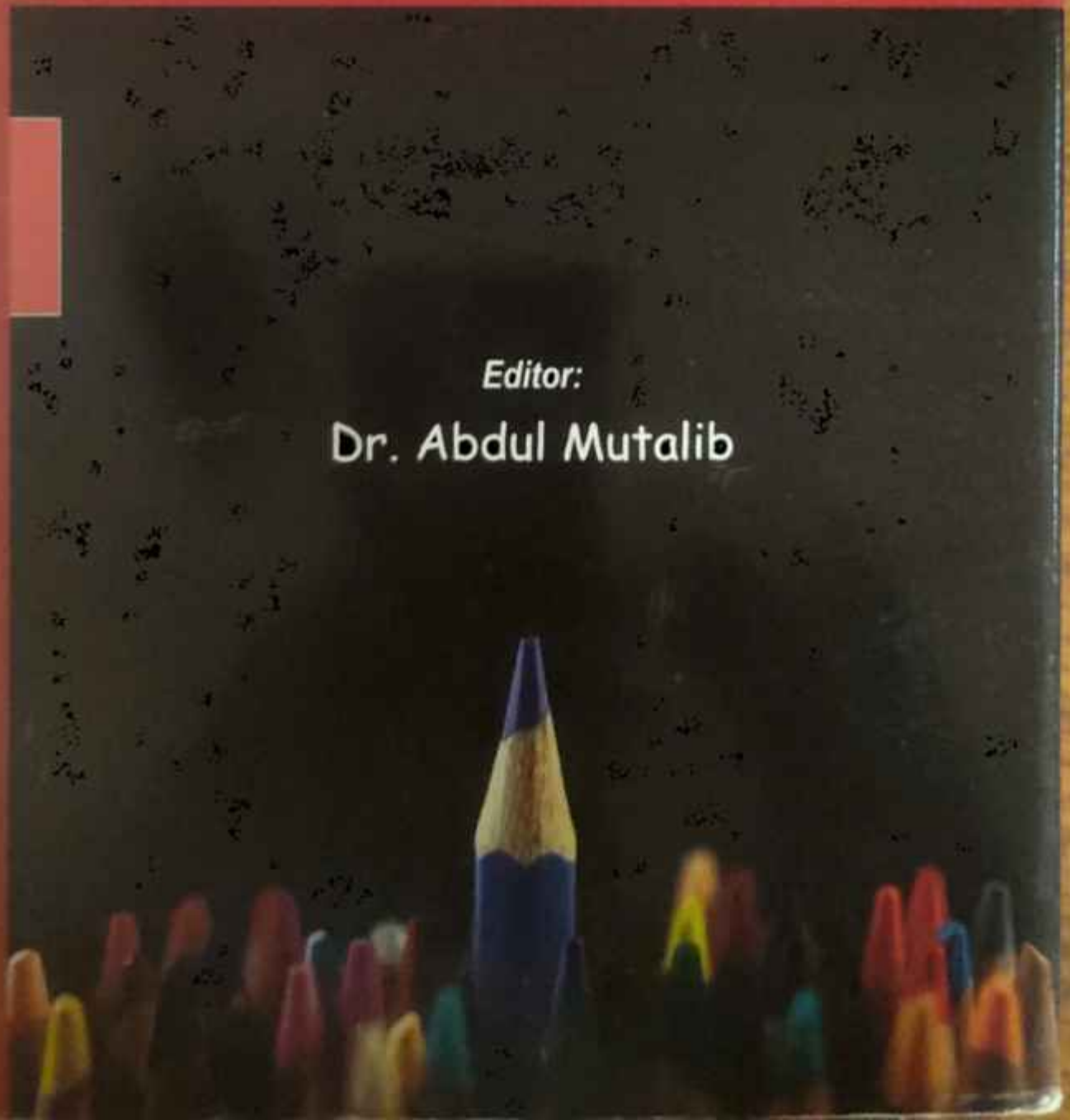

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5

EMILE DURKHEIM AND 'THEORY OF SUICIDE' —A Critical Analysis by a Student of Sociology

BIKASH BAGE*

Introduction

Published in 1897, originally "Le Suicide" by French thinker Emile Durkheim is a classic work for the discipline of sociology today and in sociological interpretation of study of suicide in unfolding the findings on suicide having its identity on origins in social factors and not because of exclusively on individual factors leading to such consequences. He concluded that suicide can be a consequence of social factors and integration in particular and not just emotional factors. He says an individual's possession of feeling of general belongingness to the society within the social context can pave lesser number of suicides.

Durkheim opined that the chances of committing suicide by an individual can be less if an individual is more socially integrated and connected as compared to other individuals in the society. Durkheim works are well reflected and focused on topics like division of labour, suicide and

* Assistant Professor, Department of Sociology, Rajiv Gandhi University, Rono Hills, Doimukh (Arunachal Pradesh)

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Insights on Quality at Higher Level in Arunachal Pradesh with regard to NEP-2020

Dr. C. Siva Sankar
Associate Professor, Dept. of Education, Rajiv Gandhi University (CU), Arunachal Pradesh
Dr. Tayum Saroh
Assistant Professor, Dept. of Education, Rajiv Gandhi University (CU), Arunachal Pradesh
Dr. P.K Barik
Assistant Professor, Dept. of Education, Rajiv Gandhi University (CU), Arunachal Pradesh

Abstract

NEP-2020 is the first education policy of the 21st century aims to transform India into a vibrant knowledge and equitable society by making education more holistic, flexible, multidisciplinary, suited to 21st century needs. It is based on the foundational pillars of Access, Equity, Quality, Affordability and Accountability. Quality in Higher Education aims at developing well-rounded and creative individuals. In the light of NEP-2020, quality in Higher Education enables scientific temper and specialized areas as per interest of the individual. It focuses on developing creativity, character, ethical and Constitutional values, spirit of service and 21st century capabilities across the range of disciplines. It also reiterates on personal accomplishment and enlightenment by preparing students for more meaningful and satisfying lives and work roles and for economic independence. The present paper deals with specific context of the state of Arunachal Pradesh, initiatives and necessary strategies of implementation in the light of NEP-2020.

Key words: Quality, strategies and Arunachal Pradesh.

Introduction

Higher Education system in India has been suffering from various major problems such as rigid separation of disciplines, fragmented higher educational ecosystem, limited access in socio-economically disadvantaged areas, limited teacher and institutional autonomy, lesser emphasis on research, ineffective regulatory system etc. NEP-2020 is the first education policy of the 21st century aims to transform India into a vibrant knowledge and equitable society by making education

more holistic, flexible, multidisciplinary, suited to 21st century needs. It is based on the foundational pillars of Access, Equity, Quality, Affordability and Accountability.

Rationale of the Theme

Quality in Higher Education aims at developing good, thoughtful, well-rounded, and creative individuals. It enables intellectual curiosity, scientific temper, and specialized areas as per interest of the individual. It also focuses on developing character, ethical and Constitutional values, creativity, spirit of service and 21st century capabilities across a range of disciplines including sciences, social sciences, arts, humanities, languages, as well as professional, technical, and vocational subjects. Quality in Higher Education enables personal accomplishment and enlightenment, constructive public engagement, and productive contribution to the society. It must prepare students for more meaningful and satisfying lives and work roles and enable economic independence.

Sub-Themes of Quality in the context of Arunachal Pradesh

1. Multidisciplinary and Holistic Education
2. Flexibility of Courses and Student Mobility: Multiple Entry and Exit.
3. Indian Knowledge System
4. Research , Innovation and Ranking
5. Capacity Building of Faculty

Details of Sub-Themes in the context of Arunachal Pradesh; Initiatives and Strategies for Implementation of NEP-2020:

Sub-Theme-1: Multidisciplinary and Holistic Education

State Specific Context and Challenges:

There are 45 UG colleges in the state of Arunachal Pradesh. Out of these 45 colleges, there are 18 UG Government colleges offering B.A courses, out of which there are 3 UG colleges offering B.Sc. courses and 6 UG colleges offering B.Com courses for the students. The state has only one Central University (Rajiv Gandhi University) offering Ph.D, PG, UG, diploma and certificate courses for different subjects. There is one Government college (JNC) offering PG and UG degrees in few Arts subjects. The Government of Arunachal Pradesh has established

one Medical college, three Nursing colleges and one Law college. There are 10 private B.Ed colleges. All these colleges are affiliated to Rajiv Gandhi University. The aforementioned colleges don't possess any multidisciplinary and holistic education. Now, it is crucial and need of the hour to look into multidisciplinary and holistic education in the state in the light of NEP-2020 with a view to strengthen the students with necessary knowledge, skills, competencies, inclinations and desired outcome based behaviours as per the demands of society and industry.

Initiatives and Strategies for Implementation:

1. The Government has to take initiative to establish multi-disciplinary colleges in Arunachal Pradesh. All the multidisciplinary colleges in Arunachal Pradesh need to facilitate high-quality education. There will be flexibility in opting courses for students, in addition to specialization in a subject or subjects.

2. The flexible curricula of all UG colleges in Arunachal Pradesh shall include credit-based courses and projects in the areas of Environmental Education, Value-Based Education, Global Citizenship Education (GCED) and Community Engagement and Services.

i) Environmental Education will include areas such as climate change, pollution, waste management, sanitation, conservation of biological diversity, management of biological resources and biodiversity, forest and wildlife conservation, and sustainable development and living.

ii) Value-Based Education will include the development of humanistic, ethical, Constitutional, and universal human values along with scientific temper and life-skills;

iii) Global Citizenship Education (GCED) will include contemporary global issues and challenges with a view to promote more peaceful, tolerant, inclusive, secure, and sustainable societies.

iv) Engaging and participating in community service programmes will be considered an integral part every major/minor course.

3. Pedagogy will have an increased emphasis on communication, discussion, debate, research, and opportunities for cross-disciplinary and interdisciplinary thinking. Pedagogy need be added to all major courses such as English, Hindi, Psychology, Sociology, Education, Physical Education, Economics, Mathematics, Physics, Chemistry, Botany, Zoology and other pure and applied sciences with multidisciplinary approach.

4.The undergraduate curricula will be formulated to give more space for flexibility to integrate the Humanities and Arts with Science, Technology, Engineering and Mathematics (STEM) under same umbrella. It will create positive learning outcomes including increased creativity and innovation, critical thinking and higher-order thinking capacities, problem-solving abilities, team work, communication skills, more in-depth learning and mastery of curricula across fields.

5.Students of all UG colleges in Arunachal Pradesh will be provided with opportunities for internships with artists, crafts persons, local industry, businesses etc., as well as research internships with faculty at their own or other UG colleges with a view to engage students for practical learning and improving their employability.

6.Workshops and seminars regarding implementation of multidisciplinary and holistic education are to be conducted at University and college level for smooth implementation by revising existing curriculum at UG and PG level.

Sub-Theme-2: Flexibility of courses and student Mobility: Multiple Entry and Exit:

State Specific Context and Challenges:

In the state of Arunachal Pradesh, there is no opportunity for the learners to study the creative combination of disciplines with flexibility. There is no space for flexible learning which provides possibility of learning from anywhere and anytime based on preference, convenience, or necessity. It is fact that flexible learning encourages lifelong learning. It is important to choose one's academic pathway leading to the award of certificate, diploma, and degree. It will reduce the drop-out rate as well as improve Gross Enrolment Ratio (GER). It will offer creative combination of disciplines. The achievement of objectives of flexible learning depends on the principle of Multiple Entry and Exit system.

Initiatives and Strategies for Implementation:

1. The Multiple Entry and Exit option at UG and PG level would nullify rigid boundaries and create opportunity for students to choose and learn the subject(s) of their choice. In Arunachal Pradesh, It needs to provide platform for seamless student mobility, between or within degree-granting HEIs through a formal system of credit recognition, credit accumulation, credit transfers, and credit redemption.

2. In Arunachal Pradesh, Multiple Entry and Exit option needs to offer flexibility in curriculum and novel course options to students in addition to discipline specific specializations and it will enable credit accumulation and transfer along with provision of evaluation and validation of non-formal and informal learning for the award of a degree and encourage lifelong learning.

3. It will facilitate encashing credits earned when the learner resumes his/her programmes of study. Multiple Entry and Exit options at the undergraduate and Master's levels would facilitate credit accumulation through the facility created by the Academic Bank of Credits(ABC) scheme

Operationalization of Multiple Entry and Exit System

For 4-year UG Programme:

1st Year

Entry 1: The 1st Year entry requires Secondary School Leaving Certificate with Grade 12. The first year of the UG programme is open to those who have fulfilled admission regulations of the colleges affiliated to University.

Exit 1: A certificate will be awarded when a student exits at the end of 1st year (Level 5). The first year (two semesters) of the undergraduate programme requires 36-40 credits for certificate.

2nd Year

Entry 2: The 2nd Year entry requires a certificate obtained after completing the one year (two semesters) of the UG programme. The second year of UG programme is open to those who have fulfilled admission regulations of the colleges affiliated to University.

Exit 2: A Diploma shall be awarded when student exits at the end of the 2nd year (Level 6). A diploma requires 72-80 credits with the completion of four semesters.

3rd Year

Entry 3: The 3rd Year entry requires diploma obtained after completing two years (four semesters) of the UG programme. The third year of UG programme is open to those who have fulfilled admission regulations of the colleges affiliated to University.

Exit 3: If student exits after completion of three years, the relevant Bachelor's degree shall be awarded (Level 7). A Bachelor's degree re-

quires 108-120 credits with completion of six semesters.

4th Year

Entry 4: The 4th Year entry requires the relevant three-year Bachelor's degree. The fourth year of UG programme is open to those who have fulfilled admission regulations of the colleges affiliated to University.

Exit 4: On the successful completion of the fourth year (Level 8), a student shall be awarded a Bachelor's degree (Honours/Research). A Bachelor's degree (Honours/Research) requires a total of 144-160 with completion of eight semesters.

However, the 4-year degree shall be the preferred option since it allows the opportunity to experience the full range of multidisciplinary approach and focus on the chosen major and minors as per the choices of the student.

For PG Master's programme:

PG Master's programme and PG Diploma Programme are open to those who have fulfilled admission regulations of the colleges affiliated to University.

Entry 5:

- The entry for Two year (Four Semesters) PG Master's Programme(Level 9) requires three-year Bachelor's degree. The two year PG programme requires total of 72-80 credits
- The entry for One year (Two Semesters) PG Master's Programme(Level 9) requires four-year Bachelor's Degree (Honours/Research). The one year PG programme requires total of 36-40 credits.
- The entry for one-year (two-semester) Post-Graduate Diploma programme requires three-year Bachelor's degree. The Post-Graduate Diploma programme requires total of 36-40 credits

Exit 5:

For postgraduate programmes, there shall only be one exit point for those who join the two-year Master's programme, that is, at the end of the first year of the Master's programme. Students who exit after the first year shall be awarded the Post-Graduate Diploma.

There may be an integrated five-year Bachelor's/Master's programme with an option to exit at the end of the third year with a Bachelor's degree, with an entry to a Master's programme in another HEI

The Academic Bank of Credits (ABC), a national-level facility will promote the flexibility of the curriculum framework and interdiscipli-

nary/multidisciplinary academic mobility of students across the HEIs in the country with appropriate "credit transfer" mechanism. The ABC is an academic service mechanism as a digital/virtual/online entity established and managed by Ministry of Education (MoE)/UGC to facilitate students to become its academic account holders. It shall be a mechanism to facilitate the students to choose their own learning path to attain a Degree/ Diploma/ Certificate, working on the principle of Multiple Entry and Exit. ABC shall enable the integration of multiple disciplines of higher learning leading to the desired learning outcomes including increased creativity, innovation, higher order thinking skills and critical analysis. ABC shall provide significant autonomy to the students by providing an extensive choice of courses for a programme of study. It will promote distributed and flexible teaching-learning.

Sub-Theme-3: Indian Knowledge System

State specific context and challenges

With the development of Science and Technology as well as Education, there is more emphasis on imparting professional skills and developing intellectual knowledge, most of the institutions are ignoring the indigenous practices and holistic development. India has a rich heritage of knowledge system that was practiced from our ancient times. Various forms of ancient practices such as yoga, meditation and spiritual healing practices exist in our ancient knowledge system. It also includes tribal knowledge, indigenous and traditional ways of learning various subjects like agriculture, medicine, art, architecture, culture, games, sports, polity, indigenous medical practices, forest management, organic farming, natural farming, handicrafts, textile and tribal literature. Arunachal Pradesh having more than 25 major tribes and more than 100 sub tribes is rich in indigenous culture, tradition, traditional knowledge and practices. Hence, the Govt. of Arunachal Pradesh has to rethink about indigenous practices and holistic development in the light of Indian Knowledge System.

Initiatives and strategies for implementation

1. Indigenous practices to be encouraged by the state for establishing tribe-based learning centers. Emphasis is to be given on the development of indigenous medical practices, forest management, organic farming, natural farming, handicrafts, horticulture, textile and tribal

literature.

2. Creation of repository of ancient practices focusing on holistic development in terms of physical, mental and emotional well beings is essential. Initiatives to be taken for the preservation of ancient practices by the Government of Arunachal Pradesh by establishing sound repository system.

3. Developing strategies for implementation with pilot studies in selected districts or major towns of the state is the need of the hour. District wise pilot project to be carried out for the development of indigenous knowledge based on various practices.

4. For wider outreach & dissemination of traditional knowledge of the state, policy level strategies to be incorporated. Strategies to be taken for the promotion of indigenous knowledge through conducting outreach programmes like Melas or fairs on traditional culture and practices in and outside of the state. Social media, print media and electronic media have to take vital role in promoting incredible practices of the state.

5. Planning for integrating sports in education to foster holistic development, physical and psychological well-being and enhancing cognitive abilities through establishing adequate sport departments in different colleges the state are needed. Even for the promotion of traditional games and sports experts from different fields to be recruited with handsome salary packages.

6. The state should focus on more experiential and holistic approach in connection with handicraft, textile, indigenous medical practices, architecture and astronomy etc. in Higher Education Institutions.

7. Introducing own culture related disciplines in various subjects such as Indology, Indian languages, AYUSH systems of Medicine, Yoga, Music, Indian languages, Comparative Literature, Creative Writing, Arts, Translation and Interpretation, Folklore, Folk Literature, Oral Literature, Philosophy, History and Culture in colleges should be the significant part of the state.

8. Statewide promotions for sports, dance, music, photography, fine arts, theatre activities, extension activities, literary activities, animation and designing etc. for up-skilling of the students at Higher Education level are to be done. Funds and special scholarships are to be sanctioned for conducting project works and participating in such areas respectively.

9. Offering a course on ethnic-based education including the development of humanistic, ethical, Constitutional, and universal human values is also significant in the state of Arunachal Pradesh.

Sub-Theme-4: Research, Innovation and Ranking

State specific context and challenges

In Arunachal Pradesh, faculty members of UG colleges have been doing research activities to pursue Ph.D degree in respective discipline, but they don't have relevant research skills in respective disciplines due to lack of research facilities in colleges. The state has only one Central University which facilitates research programmes. There is no any public State University to strengthen the research skills in pursuing Ph,D degrees and doing reach projects. Knowledge creation through research and innovation is very vital for the academic progress, growth of economy and documentation of the traditional knowledge's for the upcoming generations. The research attitude among the teaching faculties of HEIs of the state should be developed by giving proper opportunities to them by creating research cell in every HEIs of the state. The newly established UG colleges are yet to get NAAC accreditation which is a big challenge for the state in terms of academic ranking and innovations. Hence, research, innovation and ranking of HEIs are the crucial elements in the state.

Initiatives and strategies for implementation:

1. The UG colleges of the state will be instructed to fulfill the criteria required for NAAC accreditation in phase wise and time bound manner and the curriculum will be framed to give maximum scope for the research and innovations by introducing project related courses in each discipline. The UG college teachers will be allowed to avail study leave to pursue research work or Ph.D degree.

2. It will be good initiative to establish research cell in the PG offering college like J.N college, Paasighat of Arunachal Pradesh to facilitate the desirable faculties and students to do research work in the area of their interest. This will promote research culture among the students and faculty.

3. Provision of research grant should be incorporated in the annual college budget. It is very vital for the growth of research culture in the institution. The outstanding research work done by the students

and faculty will be duly recognized by the institutions and financial assistance will be provided from the institution research grant for new proposal areas.

4. There will be a research board in every HEI of the state to promote and coordinate research activities. It will also guide and encourage interdisciplinary research work among the students and faculty. The same will act as a liaison between researchers and relevant branches of Government as well as industry, so that research scholars are constantly made aware of the most urgent national research issues, and so that policymakers are constantly made aware of the latest research breakthroughs.

5. It is needed to establish state universities. The functioning of state universities will encourage and facilitate many students and faculties to conduct research work in various new areas. The state is a biological hotspot of many plants and animals of global importance. The state universities will also guide the affiliating state colleges to build up best academic atmosphere as per the demand of the community living in the various parts of the state.

6. Every HEI of the state will be encouraged to develop their academic and infrastructural facilities as per the criteria mentioned in the NIRF Ranking. It will help to achieve better position in the NIRF Ranking in the future.

7. Teaching, Learning & Resources need to be provided in HEIs of the state. The faculty- student ratio will be maintained for maximum quality output. The financial resources will be mobilized by tie up with the various agencies.

8. The students and faculty members will be encouraged publishing more quality books and papers by following research and academic ethics for publication. The researcher will be encouraged to patent their quality finding and work to preserve for intellectual property and also to follow professional ethics. The reservation policy will be applied to attract students from outside states and foreign countries. The common entrance test will be conducted for various research oriented courses.

Sub-Theme-5: Capacity Building of Faculty:

State specific context and challenges

To improve skills and capacity building of the faculty, continuous

training and developmental programmes are indispensable. In this state, there is no HRD centre for carrying capacity building programmes for faculty of RGU in spite of having 45 colleges. As a result teaching community of HEIs of the state are putting effort to update their knowledge through attending Orientation Courses, Induction Programmes, Refresher courses, Short term courses and Leadership Development Training from the universities of the other states.

Initiatives and strategies

1. Initiative to be taken to establish at least one HRD Centre facilitate with modern infrastructure and innovative teacher training programme in the state for strengthening capacities of teaching communities of the state. Facilitating with innovative and technology enabled teaching and learning for building capacities of the teaching communities in HRD Centre is needed.

2. Initiatives are to be taken for the faculty of the state to organize virtual academy of teaching and learning, awareness programmes on innovative methods of teaching and learning. Disseminating best practices within and between colleges among the teachers in the state is highly needed.

3. Supporting teaching faculties to improve their instruction through regular training, sharing experiences by experts and senior teachers and engaging them in various academic activities are essential elements. Adequate funds are to be sanctioned for the collaborative extension activities within and between colleges.

4. Initiatives are to be taken to appoint and fulfill all sanctioned vacancies of teaching posts in various subjects. There should be scope for Continuous Professional Development in their respective areas among the teaching community of the state.

5. There should be a provision to sponsor international academic and research exposure to each faculty by devising the appropriate institutional mechanism facilitating foreign visits of faculty for academic, research and extension activities.

6. Proper recognition and awards are to be provided by the state to the faculty adopting and engaging innovative methods and tools for teaching in their respective fields.

Conclusion

Multidisciplinary and holistic education, flexibility of courses and student mobility through Multiple Entry and Exit options, Indian knowledge system, research, innovation and ranking as well as capacity building of faculty are the essential ingredients of Higher Education specifically in the context of Arunachal Pradesh. The higher order thinking skills, meta-cognition, problem solving abilities, research and innovation can be fostered and enhanced by integration of multidisciplinary and holistic education. In Arunachal Pradesh, Multiple Entry and Exit option needs to offer flexibility in curriculum and novel course options to students in addition to discipline specific specializations and it should enable credit accumulation and transfer along with provision of evaluation and validation of non-formal and informal learning for the award of a degree and encourage lifelong learning. Indigenous practices are to be encouraged by the state through tribe-based learning centers. Emphasis is to be given on the development of indigenous medical practices, forest management, organic farming, natural farming, handicrafts, horticulture, textile and tribal literature. There should be a research board in every HEI of the state to promote and coordinate research activities. At least one HRD Centre is needed to facilitate with innovative teacher training programme in the state for strengthening capacities of teaching communities of the state. The roadmap provided by NEP, 2020 would make highly significant contribution to the development of a sustainable and dynamic knowledge society.

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About the Editors

Dr. Prasanta Kumar Barik, an Assistant Professor at Rajiv Gandhi University, India was born in the district of Jharsuguda, Odisha in 1977.He has obtained his M.A. (Education), M.A.(History) and Ph.D. in Education from Sambalpur University. He qualified UGC-NET examination in Education. His areas of interest and specialization are Higher Education, Teacher Education, Secondary Education and Pedagogy of Social Sciences. Currently, Dr. Barik is associated with Post graduate teaching and research work. He is a teacher educator too. He has participated and presented in many national and international conferences, seminars, symposia, etc. He has published articles in journals, edited books at national and international repute. He acts a resource persons for various departments and colleges. He has completed a project work sponsored under ICSSR, New Delhi, India. He has also credited to publish a book titled "College Autonomy and Quality in Higher Education" along with his mentor Dr.Harihar Sarangi, Former Head, Department of Education, G.M. University, Sambalpur, Odisha.

Dr. Shishira Bania is currently working as a Lecturer in Education (SSB, Department of Higher Education, Govt. of Odisha) in Birmaharajpur College under Sambalpur University, Odisha. He has done his Post Graduation in Education from G.M. Autonomous College (Now G.M. University) Sambalpur, Odisha; Post Graduation in Sociology from IGNOU, New Delhi and Post-Graduation in English from Odisha State Open University; M.Phil. in Education from Dr. P.M. Institute of Advanced Study in Education, Sambalpur, Odisha. He has qualified UGC NET and JRF in Education. He is awarded with Ph.D. degree in the subject Education from Sambalpur University, Odisha, India. He has more than 07 years of teaching experience. He has participated and presented many papers in National and International Seminars. He is the author of two Books. He has 18 research publications to his credit.

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Privatisation of Higher Education in India

Editors
Prasanta Kumar Barik
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10

Essential Ingredients of Quality in private Teacher Education Institutions

I C. Siva Sankar*

Abstract

Quality is a key element in every field. It is indispensable notion in the field of Education or Teacher Education. However, the thought of quality has become increasingly an important element in all branches of education, as evidenced by the amount of time and effort that is invested in quality assurance procedures in private educational institutions and across sectors that are under privatization. Teaching is often regarded as a conservative profession, sticking to traditions, tried and trusted practices, and the same is true in the case of private teacher education institutions, with an inevitable multiplier effect as each new generation of teachers would be prepared. Poor standards in Pre-Service Teacher Education Programme (PSTE) in private sector will inevitably results in less than satisfactory teaching at institution level, and consequently inadequate outcomes for the next generation of the learners. For this reason, it is worth taking a careful look at some of the essential ingredients of quality in Pre-Service Teacher Education Programme (PSTE) under private sector and some of the factors that underline them. Hence, the present paper touches upon essential ingredients of quality in private teacher education institutions.

Keywords: *Quality, Essential ingredients, and Private Teacher Education Institutions.*

INTRODUCTION

Quality in all fields is a difficult notion to pin down and education or Teacher

* Associate Professor , Dept. of Education, Rajiv Gandhi University, Arunachal Pradesh, India

Adaptability in Crisis

A Psychological Perspective

Dr. Dharmeshwari Lourembam
Dr. Kakali Goswami
Dr. Sandeep Panchal
Dr. Satchit Prasun Mandal

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This book is a compilation of empirical research and review papers, which focuses on pertinent issues of the current situation. The articles have been contributed by different researchers and experienced academicians from all over the country. The articles are thoroughly based on their original research work presented during the Two Day National Conference titled **"Adaptability In Crisis: Psychology, Education And Society"** organized by the Department of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh, India on the 17th& 18th of August 2021 through virtual mode.

The objective of the book is to highlight various issues related to the present COVID-19 pandemic to foster better preparedness and adaptability in crisis. The chapters delve on the themes of Physical &Mental Health, Health Care System, Work-Life Balance, Resilience, Coping Skills and Effects of COVID-19 on Mental Health. It consists of selected unpublished articles of diverse aspects of psychological and overall mental health highly relevant on both individual and community levels in every sphere of life. The findings will also contribute to public welfare and policy documentation for the Government.

Dr. Dharmeshwari Lourembam is working as an Assistant Professor in Department of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh. She is currently the Head in-charge of the Department. She has specialized in Clinical Psychology, Positive Psychology and Counseling. She has obtained her U.G., P.G. and Ph.D. Degree in Psychology from Panjab University, Chandigarh. She was a UGC-JRF and SRF after which she joined Sikkim University (A Central University) as a Guest Faculty in Department of Psychology. She is currently part of a research project sponsored by National Commission for Women and has published research articles in journals and book chapters in the field of psychology. Her area of research includes Health Psychology and Positive Psychology.

Dr. Kakali Goswami is working as an Assistant Professor in Department of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh. She was former Head in-charge of the Department. She has specialized in Organizational Psychology and Positive Psychology. She has obtained her PG from Jamia Milia Islamia, New Delhi and Ph.D. Degree in Psychology from Gauhati University, Assam. Her area of research is positive psychology and organizational psychology. She has published numerous research papers and book chapters in the field of psychology. She is currently carrying out research project sponsored by National Commission for Women.

Dr. Sandeep Panchal is an Assistant Professor in Dept. of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh. He has Specialization in Clinical Psychology, Health Psychology and Sports Psychology. He has obtained Ph.D. Degree in Psychology from Kurukshetra University, Kurukshetra, Haryana, India. Previously, he worked as Senior Research Fellow (SRF) in DIPR, DR&DO, DELHI & Sports Psychologist in Sports Authority of India, Delhi, & Assistant Professor (Guest) at Central University of Haryana & Teaching Faculty at Indira Gandhi University (State University), Meerpur Rewari, Haryana. He has published more than 26 publications in National and International Journal of repute.

Dr. Satchit Prasun Mandal is presently working as an assistant professor in the Department of Psychology, Rajiv Gandhi University, Arunachal Pradesh. Prior to his present occupation, he was employed as a Scientist in the Defence Research and Development Organization (DRDO). He obtained his Ph.D. and Master's degree in Psychology from Banaras Hindu University (BHU). He completed his graduation from University of Calcutta. His area of research includes Personality Psychology, Health and Well-being, Positive Psychology.

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Perception of Physical Self and Self-Esteem During Covid-19 Pandemic Among Female Students

Pranaya Rai[1] and Dharmeshwari Lourembam[2]

Abstract

Covid-19 pandemic has imposed certain restrictions and the lockdown implemented have immense impact on eating pattern, fitness behavior and overall well-being of an individual. Restricted outdoor activities and online classes have resulted in a sedentary lifestyle for the youth. This may result in higher body dissatisfaction which is a main cause of distress, negative attitudes towards self, behavior issues and lower self-esteem especially among the young girls. The present research thus aims to explore the relationship between body dissatisfaction, self-criticism, self-reassurance and self- esteem of female adolescents during the pandemic. The sample was exclusively collected through Google Form on female higher secondary students from Itanagar. The sample consisted of 68 female students, age ranging from 15 to 19 years, who were administered standardized questionnaires on the study variables. The results indicate that body dissatisfaction and self-criticism were negatively related to self-esteem and self-reassurance showed significantly positive correlation with self-esteem. Implications of the study are also discussed.

Keywords: Well-being, Body Dissatisfaction, Distress, Self-criticism, Self-reassurance, Self-esteem.

[1]Ph.D. Scholar, [2]Assistant Professor, Department of Psychology, Rajiv Gandhi University, Arunachal Pradesh

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Introduction

The Coronavirus (COVID-19) pandemic has affected every individual and its rapid spread all around the world led to implementation of lockdown including travel, public gathering, social gatherings and events (Bank & Zu, 2020). Such strict implementations might be efficacious against infection and in controlling the disease (Tian et al., 2020) but such prolonged restriction of movement and self-isolation may lead to various negative effects on the psychological health of an individual (Galea et al., 2020). One of the major consequences of restricted movement and sedentary lifestyle is the eating pattern and weight issues which in turn influence the body image or perception of one's physical body. The pressure caused by the Covid 19 pandemic may develop intimidation to body image possibly due to such routine or lifestyle that intensify maladaptive coping, increase worry of its body mass or weight changes and occurrence of negative body cogitation (Swami, 2021). A study done by Zhou and Wade (2021) revealed the significant growth in weight issues and eating disorders among female university students during Covid-19 pandemic as compared to pre Covid-19. Another research noted that stress related with Covid-19 was linked with more negative body image (Swami et al., 2021).

Adolescent's body dissatisfaction can be influenced by numerous factors like age, family, religion and economic income (Monterio et al., 2014). Development factors (formation of late body image disruption of childhood, pubertal timing, being mocked about physical looks, childhood obesity and early sexual molestation) and sociocultural factors (social norms, impact of mass media and gender role social construct) are emphasized in the theories on development of body image dissatisfaction (Heinberg, 1996). Social media is flooded with information related to exercise and proper diet depicting perfect bodies which are aimed to serve as inspiration but sometimes it may also lead to reverse unanticipated consequences mainly for the young females to set too high target for themselves. Previous literature had found high level of body dissatisfaction during Covid-19 pandemic (Akhtar et al., 2020; Ahuja et al., 2021). Body dissatisfaction is a main cause or source of distress among all ages

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of women (Albertso et al., 2014) and it develops negative attitudes towards their body image and makes negative assessments towards their own physical appearance. Development of unhealthy eating habits and inappropriate dieting due to body dissatisfaction also may progress to eating psychopathology (Stice et al., 2011). It contributes to low self-esteem, depression and behavior issues (Griffiths et al., 2010). Another important area related to body dissatisfaction usually seen among young females is self-criticism. When an individual is unhappy with the body image, they tend to criticize and dislike their real self as they think their physical appearance is not up to their ideal image. Self-criticism is associated with negative feelings about individual's weight and appearance; however, being self-assuring is another very related characteristics which buffer the negative thoughts towards oneself and is linked to positive feelings about self. Gilbert (2006) highlighted that people use self-criticism as a defensive approach to enhance a sense of belonging to the community and evading from denial or rejection. An individual's sense of oneself as inferior or flawed is related to negative feelings of one's body image and body-dissatisfaction (Ferreira et al., 2014).

There is no doubt that the younger generation, especially females, tend to be susceptible to get drawn away by the beauty standards portrayed by the media or society at large. This leads to high expectation to achieve those standards of physical appearance. The frequent comparisons led to self-criticism and body dissatisfaction which in turn affect their mental health. One of the domains of mental health which have significant relation with one's perception of physical self is self-esteem as Krishen (2011) also noted it and body dissatisfaction to be the source of many research investigations. Self-esteem is described as a person's self-assessment of oneself which indicates how they feel and believe about their significance and potential (Rosenberg, 1965). Having high body dissatisfaction is known to be associated with low self-esteem (Fingeret & Gleaves, 2004; Paxton et al., 2006). There are numerous studies indicating self-esteem having a large effect on mental health (Gilbert, 2004) revealing that self-esteem is linked with shame, emotions and a

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negative sense of self, which has a negative association with eating behavior (Duarte et al., 2017). Cheng's (2006) study found that the Body Mass Index and internalization of thinness ideals were significant risk elements for body image dissatisfaction and associated with lower levels of self-esteem. After the lockdown, there is an immense decrease in our movement and more indulgence in social media which might have a great impact on the relationship of body image and mental health. Research conducted in Spain found that the increased usage of social media constitutes to an increased level of drive for thinness, low level of body dissatisfaction and self-esteem among young women during pandemic (Vall-Roque et al., 2021).

In the state of Arunachal Pradesh, the major traditional cuisine is mainly boiled food and as it is evident that the type of food habit contributes greatly to the development of the physical body, hence, understanding the relation of body dissatisfaction, self-criticism and self-esteem in the state is worth exploring. The present study thus aims to explore the level of body dissatisfaction, self-criticism, self-reassurance and its relationship with self-esteem among female students in Arunachal Pradesh during the Covid-19 pandemic.

Aim

To explore the relationship between body dissatisfaction, self-criticism (inadequate-self and hated-self), self-reassurance and self-esteem of the female students during Covid-19 pandemic.

Hypotheses

- There will be a negative relation between body dissatisfaction and self-esteem among the female students.
- There will be a negative relation between self-criticism (inadequate-self and hated-self) and self-esteem among the female students.
- There will be a positive relation between self-reassurance and self-esteem among the female students.

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Methodology

Sample: The sample consists of 68 female higher secondary students studying in XIth and XIIth standard and age ranging from 15 to 19 years (Mean age = 17.13, S.D. = 2.29). 74 responses were received of which 6 have been excluded due to incomplete response of the questionnaire. The sample was taken from 3 schools in Itanagar complex of Papum Pare district, Arunachal Pradesh and 31% of them belonged to science stream, 5.6% to commerce, 61% to humanities and 1.9% to other streams. The questionnaires were first converted into Google form and higher secondary school teachers were contacted. Due to the pandemic, the teachers were requested to share the Google form link through the WhatsApp platform. Snowball sampling was thus employed for the study.

Tools

The following tools were employed along with the consent form and collection of the demographic profile which included their age, class, stream and family annual income.

Body Shape Questionnaire-Short Form (BSQ): This scale was developed by Evan & Dolan in 1993 and is a 6 point Likert scale (never=1, rarely=2, sometimes=3, often=4, very often=5 and always= 6). Higher score indicates a higher level of body dissatisfaction. The scale has good reliability with Cronbach alpha of 0.93 for students (Silva et al., 2014).

Forms of Self- Criticizing and Reassurance scale (FSCRS): This 22 item scale was developed by Gilbert et al. in 2004 which has 3 dimensions – Inadequate-self (a sense of personal inadequacy), Hated-self (desire to hurt) and Self-reassurance (individual's comfort Intended to make them less worried). The items are scored in a 5 point Likert scale ranging from 0 = "not at all" to 4= "extremely like me". The scale has good reliability with Cronbach alpha of 0.90 and 0.86 for the Inadequate Self and Hated Self respectively which are dimensions of self-criticism and 0.86 for Self-reassurance (Gilbert et al., 2004).

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Rosenberg Self-Esteem Scale: This scale was developed by Rosenberg in 1965. It has 10 items which measures the positive and negative feelings about the self. The items were scored on a 4 point Likert scale (strongly agree=4, agree=3, disagree=2, strongly disagree=1). Item number 2, 5, 6, 8 and 9 are to be reverse scored. A higher score indicates a higher level of self-esteem. The scale has good reliability with Cronbach alpha of 0.86 for adolescents (Ciarrochi et al., 2007).

Self-constructed Questionnaire: It consisted of three questions to know their food habit and physical activity. The questions are given below: 1) How frequently you take junk food/street food? 2) How often do you engage in physical activities? 3) Type of food mostly prepared at home. The first two questions have five options - never, rarely, sometimes, often and always while the third question has three options, namely, boil food, fried food and mixed (both boil and fried) food.

Result and Discussion

Table 1: Table showing Mean, S.D., Cornbach alpha and Pearson correlation of the study variables.

	Body Dissatis-faction	Inade-quate Self	Hated-Self	Self-Criti-cism	Self-Reas-surance	Self-Esteem
N	68	68	68	68	68	68
Mean	47.02	19.61	7.19	26.80	17.58	15.07
S.D.	20.35	7.89	4.71	10.75	7.19	4.08
Cronbach Alpha	.934	.782	.637	.795	.799	.725
Body Dis-satisfaction	1					
Inadequate Self	.513**	1				

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	Body Dissatis-faction	Inade-quate Self	Hated-Self	Self-Criti-cism	Self-Reas-surance	Self-Esteem
Hated Self	.359**	.419**	1			
Criticism	.534**	.918**	.745**	1		
Reassur-ance	-.362**	-.247*	-.299*	-.312*	1	
Self-Es-teem	-.526**	-.560**	-.548**	-.650**	.403**	1

**Correlation is significant at 0.01 (2-tailed)

*Correlation is significant at 0.05 (2-tailed)

Table 2: Table showing the percentage of responses on the self-constructed questions.

Theme of the question	Response	Percentage (N)
Intake of junk food	Never & Rarely	2.9% (2)
	Sometimes	55.7% (37)
	Often & Always	32.9% (29)
Physical activities	Never & Rarely	4.3% (3)
	Sometimes	74.3% (50)
	Often & Always	21.5% (15)
Type of Food prepared at home	Boiled food	7% (5)
	Fried food	31% (6)
	Both Boiled and fried	53.5% (57)

The current pandemic situation has created a lot of restriction which impact each and every person's thoughts and life style. The present study focused on exploring the relationship between body dissatisfaction, self-criticism (inadequate-self and hated-self), self-reassurance and self-esteem of young females during the pandemic. Table 1 showed the mean score of body dissatisfaction which was 17.02 indicated mild concern with their body shape among the participants. It can be said that negative perception of physical

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self is quite prevalent during the ongoing pandemic because of the sedentary and restricted lifestyle as studies have highlighted an increase in weight issues and eating disorders among females during the pandemic (Zhou & Wade, 2021). A similar pattern can be seen among the female participants of the study as the mean score highlighted that the participants have some concern about their body. Further, the mean score of the dimensions of self-criticism, that is, inadequate-self, hated-self was 19.61 and 7.19 respectively indicating average level on the dimensions and the mean of total self-criticism was 26.80 which also indicated average level of self-criticism among the participants. For the positive dimension of the above scale, namely, self-reassurance, the mean score came out to be 17.58 indicating average level. This showed that although the students were not completely happy or satisfied with their physical body yet they do not criticize or hate themselves and reassure themselves that they can do improve it. On the other hand, the mean of self-esteem was 15.07 indicating that the participants were slightly low on self-esteem.

Table 1 also highlighted the result of the correlational analysis which showed that body dissatisfaction, inadequate self, hated self and self-criticism has a significantly negative correlation with self-esteem. This indicated that a young female who is not happy with her physical appearance, criticize herself on the basis of her appearance and who has a negative perception of her own physical self will have lower self-esteem. On the other hand, self-reassurance showed significantly positive correlation with self-esteem indicating that a young female who is high on self-reassurance or who believes in herself will also experience high self-esteem and vice versa. Hence, both the hypotheses have been proved as body dissatisfaction, inadequate self, hated self and self-criticism were negatively related to self-esteem while self-reassurance was positively related to self-esteem. Many researches have highlighted the positive outcome of high self-esteem on mental health and well-being, so it is important to know the factors which are related to one's self-esteem. Female are more sensitive towards their body image and physical appearance,

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especially, the young girls. The information available in media and exposure to the constant judgment of female's physical attributes by the society hugely influence the young girls to aspire for too high beauty standards leaving them dissatisfied with their actual physical self. As noted earlier, Albertso and his colleagues (2014) highlighted that body dissatisfaction is a main cause of distress among women.

The responses on the self-constructed questions related to the participant's eating habit and physical activity has been highlighted in Table 2. On the question of frequency of intake of junk food, 2.9% of the participants responded never and rarely, 55.7% responded sometimes and 32.9% responded frequently and always. This showed that majority of the participants enjoy eating junk food. The average consumption of junk food may also be due to the restriction of public movement and curfew, which makes it unmanageable to have street food during that situation. Hence, the frequency of indulging in junk foods may increase as the restrictions due to pandemic are over and it is easily available. In terms of indulgence in physical activity, 4.3% of the participants responded never and rarely, 74% responded sometimes and 21.5% responded frequently and always. A positive picture can be seen as majority of the female students were physically active even during the pandemic. A survey research done by Robertson et al. (2021) in United Kingdom also reported that the women, both old and young, were doing physical exercise as well as thought about exercise during the lockdown. Finally, in the question on the type of food usually consumed or prepared at home, 7% of the participants responded boiled food, 31% responded fried food and 53.5% responded both boiled and fried food. This showed that almost half of participants said they usually eat boiled as well as fried food at home. Culturally, most of the traditional cuisines of Arunachal Pradesh are boiled, but in the present scenario, due to acculturation with Assam and other mainland states, the Arunachalis have adapted to consuming both fried and boiled food at home.

Thus, it can be said that the participants of the study are slightly dissatisfied with their body or physical self; however, they do not hate or criticize themselves and even if they are not fully satisfied

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with their body, they do reassure themselves that they can do better. Although they were slightly high on body dissatisfaction, they do not have very low self-esteem as they do not criticize or hate themselves and have a feeling of reassurance. Further, the participants also engage in moderate physical activity which might work as a buffer from negative thoughts and boost their self-esteem. As previous studies have reported that physical activity improve well-being, body image and self-esteem (Hausenblas & Fallon, 2006; Nordin-Bates et al., 2011), the engagement in moderate physical activities might work as a positive resource for the participants for not having very low self-esteem despite the stress due to pandemic. Life exposure or experiences influenced an individual to develop an opinion of a perfect body or an ideal body which keeps changing throughout life (Forney & Ward, 2013) and so proper intervention at such stage of life may help them to inculcate positive attitude towards their physical body and develop positive body image which in turn will promote various positive outcomes.

Conclusion

The study highlighted that the female students in the study who were high on body dissatisfaction, inadequate-self, hated-self and self-criticism have lower self-esteem. On the other hand, those who had high self- reassurance experienced higher self-esteem. It was also see that overall the participants have mild concern about body. So, the youth, especially the females need to be made aware that having negative perception of their physical self or body image may lead to poor mental health. The social standards of beauty and portrayal of unattainable physical attributes as attractive often lead the young females to criticize themselves leading to self-hate. Hence, various awareness and counseling programmes must be organized for the students to inculcate positive attitude towards their physical body and develop positive body image which in turn will promote various positive outcomes. Teachers and parents must also be made conscious about the ill effects of body dissatisfaction as they can influence the youth for better outlook and also work as strong support system for them.

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Politics of Identity and Home in the Context of Indian Chinese in India: A Study of *Chinatown Days* and *The Palm Leaf Fan*

Doyir Ete

The complex dynamics of home, nation, and nationality most often raises the existential crisis of the most marginal of the minority communities within a Nation-State. India houses several designated minority communities like Muslims, Christians, Parsis, Sikhs and Indian Jews. These communities enjoy rights that the Constitution guarantees to the citizens of the country. But there are also communities who are not designated as minority communities but nevertheless marginalized within the socio-political discourse of the nation because of their precarious position entailed by a checkered history of migration, settlement, and experience in India. The Chinese community settled in India is an exemplary of such a group whose history presents an intriguing insight into a journey that is rich yet turbulent, joyous yet heart wrenching at the same time. It becomes imperative to interrogate and present an overview of the writings and the social context of stories narrating the complex journey of the Chinese community settled in India. Every minority community like the Parsis and Indian Jews have their own history of migration and settlement in India. Like them the Chinese Indians also has a history that narrates their arrival during the colonial period and subsequent settlement predominantly in Calcutta and Makum in Assam. The Chinese Indian experience in India

> voices contests, contradict and complement each other, and what results is no cacophony but the essential composite nature of the collectivity called nation. (xii)

The Chinese Community in India is a community that exists in a space of 'in-between' a space full of engagements of identity, politics, nation, and nationalism. Nonetheless, their stories and perspectives are as much a part of the national discourse as any mainstream narrative. Yes, the community grieves the darkest period of their history in India and they look forward to an acknowledgement of this by the state agencies. But most significantly they are open to reconciliation and social acceptance since many of them still reside in India and know no other home. The discourse of nationalism and nationhood which became a part of their very existential identity was the result of the 1962 Indo-China war in which the community was caught in between. They were forced to confront their Chinese ancestry and their outsider status even after decades of co-existence in India. 'Home' as a physical space was no longer the one that they had known for so long; rather 'home' had to be constructed at a designated place where they were deported back by the government. So, they had no control anymore about what they could consider as home, nation, or nationality. Therefore, to understand the dilemma of the Chinese-Indians and their interstitial position one must acknowledge the stories of their checkered history in India.

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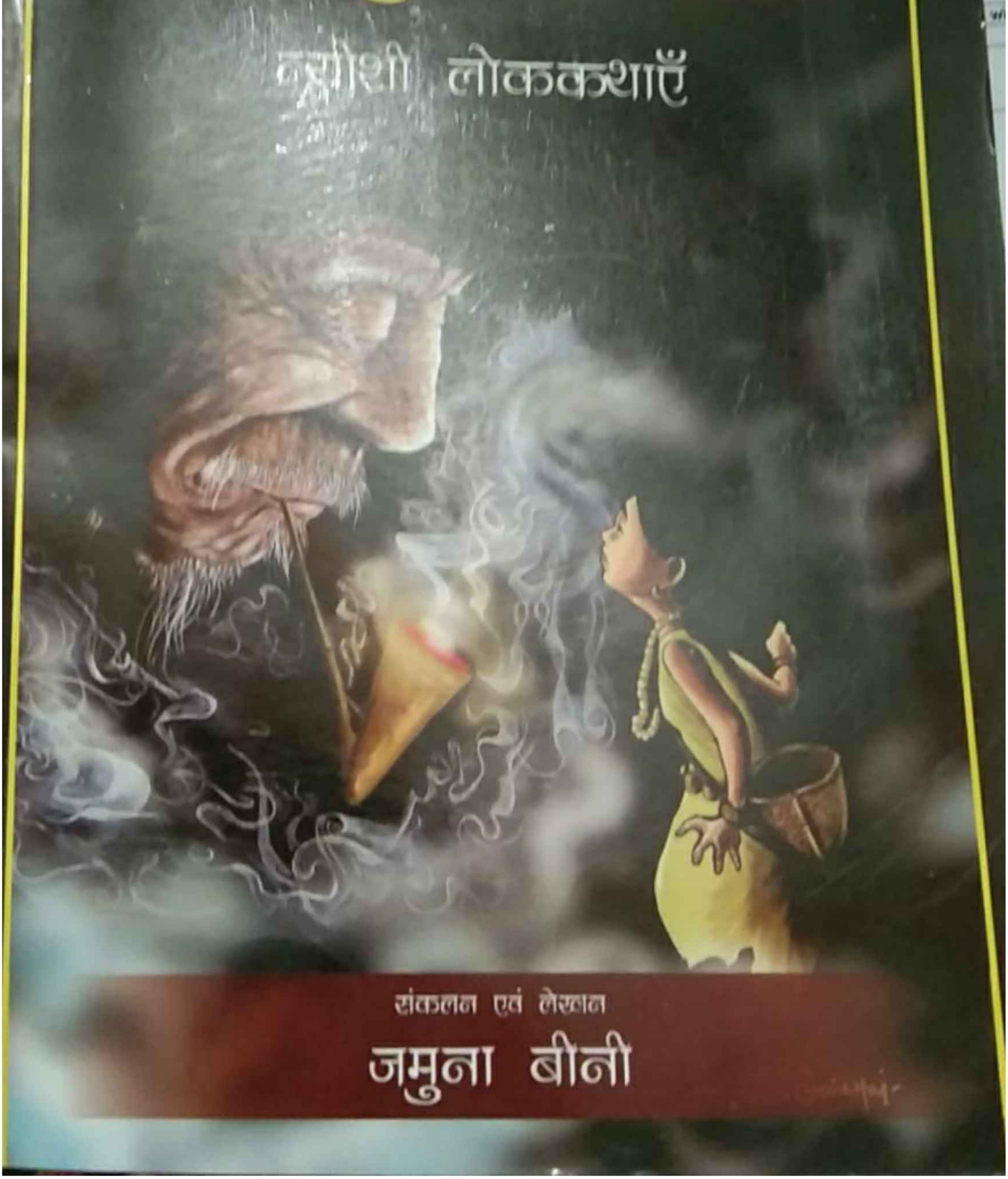

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प्राक्कथन

जमुना बीनी की यह पुस्तक न केवल अरुणाचल अथवा पूर्वोत्तर के साहित्यिक परिदृश्य में वरन् हिंदी साहित्य के विस्तारित फलक पर भी महत्वपूर्ण सिद्ध होगी। इस बहुमूल्य रचनात्मक कृति का विचार उस समय पनपा जब जमुना बीनी 'जनजातीय साहित्य महोत्सव 2018' में सक्रियता से भागीदारी कर रही थी। पूर्वोत्तर के वाचिक साहित्य में अभिरुचि रखने वाले पाठक एवं विद्वानों को तो यह ज्ञात होगा ही कि पहली बार सन् 1958 में अंग्रेजी भाषा में वेरियर एल्विन की 'मिथस् ऑफ नेफा' पुस्तक प्रकाशित हुई थी। अरुणाचल प्रदेश की विभिन्न जनजातियों के मौखिक साहित्यिक परम्परा के गहन अध्ययन तथा मनन के लिए आज भी कई विद्वान उक्त पुस्तक का संदर्भ एवं उल्लेख देते हैं।

'उईमोक' अरुणाचल प्रदेश की न्यीशी जनजाति विशेष पर केंद्रित चित्रांकनों से सुसज्जित हिंदी में पहला और ऐतिहासिक प्रयास है। अरुणाचल के जनजातीय साहित्य की अपार संभावनाओं की खोज करते हुए इसे हिंदी के वृहद पाठकवर्ग के सम्मुख लाने के लिए नि:संदेह जमुना बीनी साधुवाद की पात्र है (उनकी निष्ठा, समर्पण एवं सुंदर प्रयास की जितनी भी भूरि-भूरि प्रशंसा की जाये कम है। हम सभी जानते है कि अकादमिक जगत में ईटानगर स्थित राजीव गाँधी विश्वविद्यालय के हिंदी विभाग की वह एक समर्पित टीचर है और सबसे मुख्य बात यह है कि वह हिंदी साहित्य में महत्वपूर्ण दखल रखने वाली पूर्वोत्तर की बहुचर्चित लेखिका भी है।

जेने हाई से मेरी प्रथम भेंट 2018 के अरुणाचल आर्ट एण्ड लिट्रेचर फेस्टिवल के दौरान हुई थी। मैं उनके सृजनात्मक ऊर्जा की खुले मन से प्रशंसा करता हूँ। उनके चित्र प्रत्येक लोककथा की मूल संवेदना के बखूबी चित्रण में सफल रहे है। मुझे विश्वास है कि यह सचित्र पुस्तक पाठकों के लिए रुचिकारक तथा वर्तमान में पूर्वोत्तर आधारित लोकसाहित्य की अन्य पुस्तकों से भिन्न एवं विशेष होगी। यह पुस्तक भारतीय साहित्य की व्यापक परिधि पर स्थापित सीमांत राज्य अरुणाचल प्रदेश की युवा पीढ़ी की सृजनात्मक शक्ति का परिचायक है। इंदिरा गाँधी राष्ट्रीय मानव संग्रहालय,

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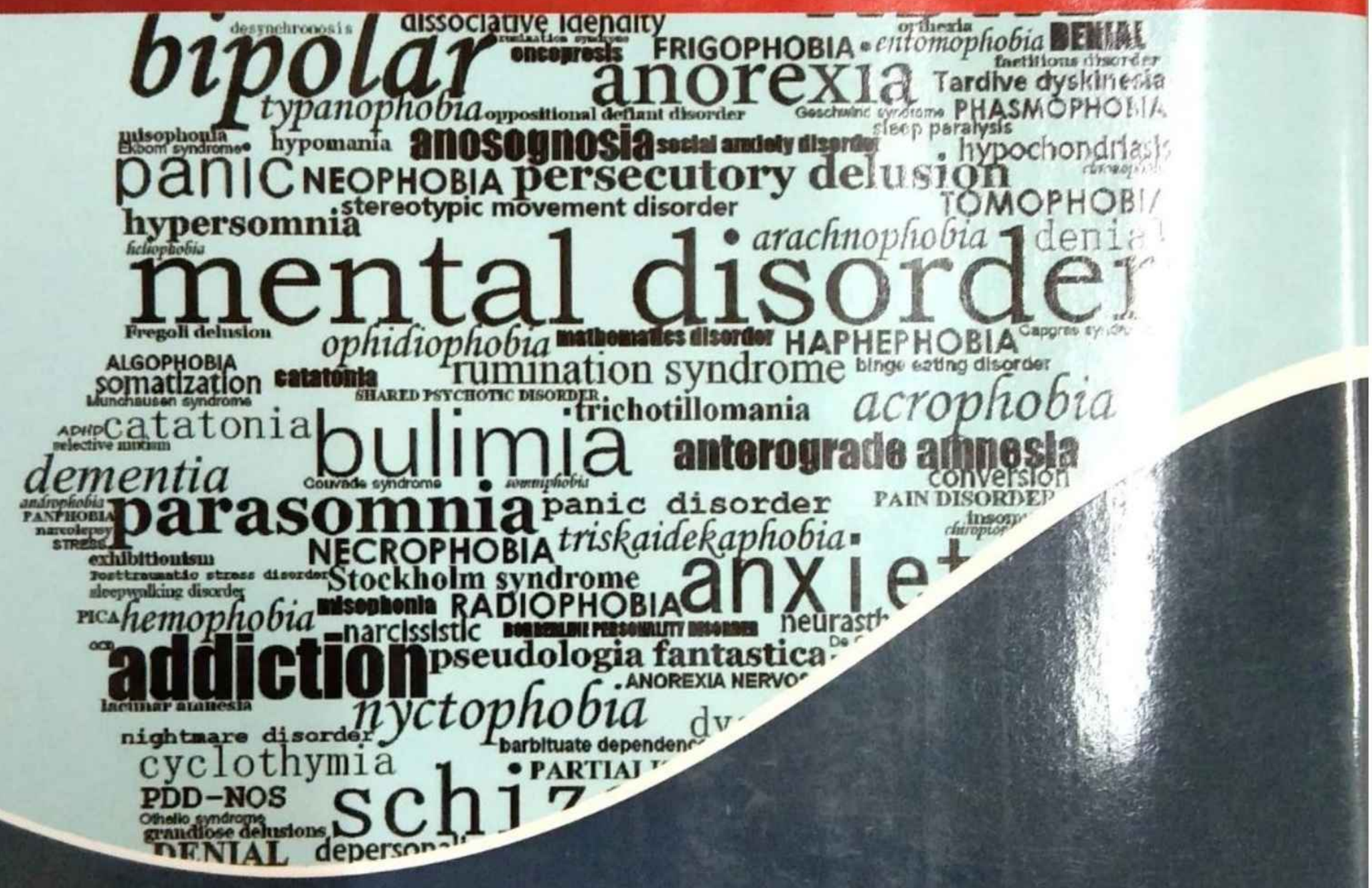
A Psychological Perspective



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Mental Health and Coping Strategies among Health Professionals during Covid-19 Pandemic

Oyin Mibang[1] and Kakali Goswami[2]

Abstract

Mental health is a state of well-being in which the individual realizes their own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to the community. All over the globe, general population as well as health professionals has suffered due to COVID-19 pandemic, which became one of the most common reasons for mental health consequences. The aim of the study was to find out the level of mental health and coping strategies five dimensions i.e. Approach (Behavioral, Cognitive and Cognitive- Behavioural) and Avoidance (Behavioural; Cognitive). This correlational, health sector-based survey study collected socio-demographic data, mental health inventory questionnaire and coping strategies scale questionnaire from 71 health professionals from Arunachal Pradesh. The Mental Health Inventory-5 (MHI-5) was developed by Berwick DM, et.al.; 1991, was used to measure the mental health and Coping Strategies Scale developed by Srivastava (2001) was used to measure the five sub-scales of coping strategies among the health professionals during COVID 19 pandemic. The findings revealed that there was a positive and significant correlation between the mental health and coping strategies of health

[1]Research Scholar, [2]Assistant Professor, Dept. of Psychology, Rajiv Gandhi University, Rono Hills, Doimukh, Arunachal Pradesh

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7

The Important Role of Social Maturity and Family Environment among Tribal Students of Arunachal Pradesh

Kakali Goswami* and Jomyir Bagra**

Abstract

The present study was carried out to explore the relationship between social maturity and family environment among university students of Arunachal Pradesh. It was well understand from literature that social mature level of a person is well connected with family environment of a person. But there is a need to understand the context of family environment among tribal society and how it is connected with their students' level of social maturity. A sample of ninety was taken from the students pursuing any non technical post graduation in a central university in Arunachal Pradesh. The data was collected by administering two standardized psychological test named Social Maturity Scale by Dr. Nalini Rao and Family Environment Scale by Bhatia and Chadha (2015). The obtained results showed that family environment and social maturity level of a person are positively and significantly related and there was an average correlation between social maturity and family environment. The study can be ended with significant findings about relevance of positive family environment for a more socially mature person among the tribal students also.

Keywords: social maturity, family environment, Arunachal Pradesh, tribal students

*Assistant Professor, Department of Psychology, Rajiv Gandhi University, Arunachal Pradesh
**Guest Assistant Professor, Department of Psychology, Rajiv Gandhi University, Arunachal Pradesh.
jomyirbagra@gmail.com**

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Issues, Challenges, and Reflections

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Internationalization of Higher Education in India: Action Plans and Implementation Strategies in the Light of NEP-2020

Prasanta Kumar Acharya[1], Arindam Chakrabarty[2], K. P. Singh[3] & Saket Kushwaha[4]

Rajiv Gandhi University, Arunachal Pradesh

1. prasanta.acharya@rgu.ac.in
2. arindam.managemant@gmail.com; arindam.chakrabarty@rgu.ac.in
3. gaur.kpsingh@gmail.com
4. saket.kushwaha@bhu.ac.in

The Context

The contemporary world is ushering in an era of liberalization, privatization and globalization; in short popularly known as LPG framework. The whole gamut of education is no more exception to it. In fact, education has no boundary to define and defend its horizon. It has pervaded its tentacles in every sphere of human life irrespective of any confinement to a particular nation or society. Education is also an important investment in building human capital that drives for economic growth and technological innovation. As a service industry, education is a part of globalization process under the umbrella of General Agreement on Trade in Services (GATS). The globalization has tremendous impact on the entire education system especially on higher education in the developing countries. The higher education system of India cannot remain isolated, as it is an indispensable part of global economy. There is a strong emphasis on global co-operation and exchanges for information and knowledge. Nowadays, the educational Institutions are developing their own strategies to globalize their research and teaching in multifarious ways. Many foreign universities are eying at Indian students as potential customers. So, in this age of borderless education, we must welcome the ideas, knowledge and practices of various communities across the world.

Contemporary Studies in Social Work

Kaushalendra Pratap Singh

UPPAL

Contemporary Studies in Social Work

Kaushalendra Pratap Singh

"Contemporary Studies in Social Work" comprise a brief of some of the recent doctoral research studies conducted by scholars under the supervision of one of the eminent social work teachers of our time namely, Professor Gracious Thomas, Founder Director, School of Social Work (SOSW), IGNOU. This book highlights relevant and important topics on social work that were taken up for research by scholars who pursued their doctoral research under the professor in the recent past. This book has compiled some of the contemporary research studies in social work which are expected to have a far reaching impact on Social Work Research in Indian context. This book would be of interest to social work teachers, students, NGO functionaries, policy makers and social activists.

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Dr. Kaushalendra Pratap Singh

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UPPAL PUBLISHING HOUSE
23 Ansari Road, Darya Ganj, New Delhi - 110002
Phones: 23273756, 23286571, 43580500
Fax: 91-011-23286571
Email: uppalbooks@gmail.com

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1

Relevance of Social Work Intervention in the Care of Aged

Kaushalendra Pratap Singh

Introduction

Indian society has been proud of its culture of caring for its aged parents and grandparents. However, the scenario has been changing drastically over the last one decade. The change is obviously due to the sweeping transformation occurring at the basic structure of the Indian society (Help Age India, 2008). These changes have brought diverse issues pertaining to the elderly care in our Indian society. Family was the primary institution providing all types of care to its elderly members, which has undergone structural changes as well. Old age is the last phase of one's life where elderly confronts many challenges with regard to their physical, mental health and support system. Although, Central and State Governments have adopted various policies and legislations to deal with the challenges of older people for their well-being. However, these policies and legislations are not being implemented effectively therefore, social work intervention can deal with the problems of the elderly as it tries to help, individuals, groups or communities to balance between the needs and demands of the environment. Social work profession enhances the well-being of people by intervening at the points where people find difficulties and interventions are intended to assist clients in alleviating problems impeding their well-being. The central goal

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Commercialisation of Agriculture in Arunachal Pradesh

Lijum Nochi

Centre for Development Studies
Department of Economics
Rajiv Gandhi University
Rono Hills, Arunachal Pradesh

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Centre for Development Studies
Department of Economics
Faculty of Social Sciences
Rajiv Gandhi University
Rono Hills, Itanagar– 791 112
Arunachal Pradesh, India

Tel.: +0360-2277371 (office)
Fax: +0360-2277317
Email: cds.rgu.itanagar@gmail.com

Maguni Charan Behera *Editor*

Tribe, Space and Mobilisation

Colonial Dynamics and Post-Colonial Dilemma in Tribal Studies

Springer

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Chapter 19
Understanding Socio-economic Subjugation by the British in Mulk Raj Anand's *Two Leaves and a Bud*

Miazi Hazam

Abstract Until the last few decades, the north-eastern part of the Indian Union had not received attention in the eyes of Indian writers writing in English. As a matter of fact, in the early periods of the rise of Indian writing in English, the northeast remained a non-entity. If one was to cast a glance over the fictional world of the celebrated trio of fiction writing in the early stage of Indian Writing in English in India, the northeast is absent except in Mulk Raj Anand's Two Leaves and a Bud. As the only novel dealing with the northeast in the early stage of development of fictional writing in English in India and coming from the pen of one the three giants of Indian fiction in English, the novel is significant. However, the greater significance of the novel lies more in its examination and critique of the 'dirty work of the empire' in the tea gardens of Assam. Economically, the tea gardens of Assam and West Bengal held a significant position as they accounted for a considerable portion of the revenue collection in India for the British coffer. The proposed paper intends to attempt an analytical study of Mulk Raj Anand's Two Leaves and a Bud in order to understand the exploitative nature of the power structure developed by the agents of the companies that owned the tea estates of Assam on the basis of Anand's representation of the trials and tribulations of the male protagonist who has been lured from his native village in Hoshiarpur to work in the tea plantation of Assam by the agents of the company. Since the novel is primarily based on the experience of the migrated tea garden labourers, an understanding of their 'lived' versus 'projected/expected' experience will also form a part of the study of this paper. The outcome of the paper is expected to be contributory to the socio-economic subjugation of the migrated tea garden labourers in the tea estates of Assam during the British rule. The approach of study will be a combination of the post-colonial and the Marxist.

Keywords Mulk Raj Anand · Northeast India · Assam · Colonial exploitation · Power structure · Post-colonial approach · Marxism · Socio-economic subjugation · Tea Tribes

M. Hazam (✉)
Department of English, Rajiv Gandhi University, Rono Hills, Doimukh, Arunachal Pradesh 791112, India

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Until the last few decades, the north-eastern part of the Indian Union had remained almost a non-entity in the creative Indian mind. It had not received proper attention in the eyes of Indian writers writing in English. A quick glance over the fictional world of the celebrated trio of fiction writing in Indian Writing in English in India (Raja Rao, R. K. Narayan and Mulk Raj Anand), the northeast is conspicuously absent except in Mulk Raj Anand's *Two Leaves and a Bud* (1937). As the only novel dealing with the northeast in the early stage of development of fictional writing in English in India and coming from the pen of one the three giants of Indian fiction in English, the novel is significant as a very strong literary representation of the northeast in the large body of Indian fiction written in English. However, the greater significance of the novel lies more in its examination and critique of the 'dirty work of the empire' in the tea gardens of Assam. Economically, the tea gardens of Assam and West Bengal held a significant position as they accounted for a considerable portion of the revenue collection in India for the British coffer, yet the condition of those who created this immense wealth remained miserable.

It is a commonplace knowledge that the colonial machinery operated in all the colonies with the sole motive of exploiting the resources and the natural wealth of the regions and the logic they provided, such as the 'white man's burden' (Kipling, 1899)[1] amounted to nothing but a lame excuse for carrying on the vicious process of socio-economic exploitation in the colonies. If Africa attracted the European powers with her minerals and ivory, the exotic spices and food brought them to India. The cardamom, pepper, other spices, cotton, indigo and tea held special attraction for the European imperial powers, including the British, in this sub-continent. The proposed paper intends to attempt an analytical study of Mulk Raj Anand's *Two Leaves and a Bud* (1937) in order to understand the exploitative nature of the power structure developed by the English trading houses in the tea estates of Assam on the basis of Anand's representation of the trials and tribulations of the male protagonist who has been lured from his native village in Hoshiarpur to work in the tea plantation of Assam by the agents of the company. Since the novel is primarily based on the experience of the migrated tea garden labourers, an understanding of their 'lived' versus 'projected/expected' experience on Althusserian basis will also form a part of the study of this paper (1984). The outcome of the paper is expected to be contributory to the socio-economic subjugation of the migrated tea garden labourers in the tea estates of Assam during the British rule. The approach of study will be a combination of the post-colonial and the Marxist.

Tea plantation and tea gardens have a long history of existence in Assam and West Bengal. However, since the focus of this paper is limited to *Two Leaves and a Bud* only, the discussion will be limited only to the tea gardens of Assam. It should also be noted that the fictional locale of the McPherson Tea Estate in the novel will serve as a microcosmic representation of the conditions of the tea estate across Assam in general during the British rule. Deluar Hussain, in his *Marginalization and the*

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[1] This is the title of the poem by imperialist poet Rudyar Kipling with the sub-title the United States and the Philippine Islands. It was published first time in *The Times* (London) on 4th February, 1899. See Alison Chapman (2002) for details.

Tea Tribes of Assam: A Study on Mulk Raj Anand's Two Leaves and a Bud and Umakanta Sarma's Ejak Manuh Ekhan Aranya (2018) writes how tea, from being a wild produce in the hilly areas of Assam and West Bengal, turned into a lucrative trading product for the British:

> Joseph Banks, a British Botanist reported to the East India Company that the climate in some parts of British India was ideal for tea plantation. Accordingly, the vast land in the state of Assam and West Bengal were converted to mass tea plantation. (Hussain, 2018:25)

After this disclosure to the East India Company, began the rise of tea gardens and tea trading in Assam and West Bengal. In 1823, Robert Bruce introduced the first tea plantation in Assam and the next year, i.e. 1824, saw the formation of the Tea Board in Assam. In 1837, the first tea garden in Assam in Chabua became operational by engaging indentured labourers brought in from different parts of the country. Since tea had remained a monopoly of the Chinese for a long period in the international market, the British wanted to challenge this Chinese monopoly in the European market with the varieties of Indian-grown (see Sen, 2004:26 and also Hussain, 2018: 19). With this intention, they began growing varieties of tea which included the native ones as well, but the best ones were reserved for the English market so that they would pose a challenge to the Chinese and other varieties. Thus, tea acquired an important position in Britain's list of produce to be taken from India but behind this began a tale of insane exploitation and inhumanity baffling all rationality. Anand's novel takes up this tale of dehumanization of human beings and presents before the readers the pain and agony at their emasculated state of existence in which they are neither able to resist the unjustified torture and humiliation heaped upon them nor escape from this leaving hell. *Two Leaves and a Bud* thus has as its central theme the subjugation of the large population of workers sweating out their lives in the tea plantations of Assam under an exploitative colonial regime.

In the early chapters of the novel itself, the exploitation carried out by the British planters in the McPherson Tea Estate of Assam, which happens to be the locale of the novel, is spelt out in the following words by the sympathetic Dr. De la Havre as he mutters the opinion that '[T]he hunger, the sweat, and the despair of a million Indians' enters into every cup of tea (Anand, 1946:21). This process of hunger and exploitations is a historical one that has churned under its juggernaut wheels the thousands of migrated and native workers who form the common group largely termed as the 'Tea Tribes' of Assam.

The Tea Tribe community serving in the different tea estates of Assam for more than one and a half century is a curious combination of various tribes and sub-tribes. These workers were brought from different regions of India to work in the tea gardens of Assam with high promises. They were lured mostly from the states of Odisha (erstwhile Orissa), Uttar Pradesh, Bihar (including the portion which is now Jharkhand), Chattisgarh and Madhya Pradesh. These people, along with the native Tea Tribe workers of the state, formed the greater Tea Tribe community. Before being brought to the tea estates and being appointed as tea garden workers, these people were often lured with the promise of high and satisfactory wages, bonuses and other necessary amenities such as cheap ration and livery, firewood for cooking,

housing and sanitary facilities, better medical and education facilities for them and their families. But once they were appointed, all these turned out to be mere baits. 'The Workmen's Breach of Contract Act' of 1859 empowered the trading houses dealing in tea in the states of Assam and West Bengal stronger as it reduced the status of the tea garden labourers to that of bonded labours. This anti-worker law increased the suffering of the workers more as it made dereliction of duty and refusal to work punishable offences. They could even be imprisoned and persecuted if they broke the conditions of the contract (see Chatterjee 1980).

Approximately from the middle of the nineteenth to the middle of the twentieth century, the procurement of labourers for the tea gardens of Assam was done through contract and *sardari* system. Under both these systems, the contractor and the *sardar* were given incentives for each labourer that they brought to the tea estates. Their income was thus on commission basis, and it depended on the number of labourers that they could bring. So, they used all means to lure as many unsuspecting people as is the case with Gangu in the novel. He was lured from his native village of Hoshiarpur in the Punjab by Sardar Buta Singh on the promise of better earning opportunities. He was promised not only a good house to live in with educational facilities for his children, but also a plot of land for cultivation on which he could grow his own crop. During the train journey from Hoshiarpur to Assam, Gangu asks several questions to Buta Singh regarding the type of facilities that he may expect to find in the tea estate to which the wily Buta keeps answering in the affirmative. He understands that if Gangu was to smell anything wrong, then he might change his mind of coming to Assam, and consequently, he would lose a good amount of his commission that he was expecting on reaching the tea estate. It is important to mention here that most of the labourers who arrived in the tea estates lured by the wiles of contractors and *sardars* like Buta Singh were the victims of poverty in their native villages. They were either debt-ridden or suffered from inadequate earnings with which they could not support their family. It was this burden of poverty on their shoulders that made them easy targets for recruitment as bonded labourers in the tea estates. Unknown to them, they usually failed to realize that their decision was only a movement from the frying pan into the fire. Little did Gangu realized that he had sealed his own fate the very moment he had agreed to Buta Singh's proposal to sell his ancestral plot of land and migrate to Assam. Such movement of people like Gangu from their ancestral villages to tea estates or coffee plantations or the newly mushrooming factories in the urban areas marks an important phenomenon in the history of all nations. Such movement is an indication of the movement of the working population from one place to another, thus bringing about demographic changes in places where they migrated from as well as in the places where they settled, either by compulsion or by choice.

This sinister process of baiting the workers from the different states of the country was carried out in a very systematic manner. There was a well-established hierarchy that functioned in a well-coordinated manner to locate, identify and lure people into the tea estates of Assam; and once the unsuspecting workers arrived at the tea estates from their native places, it was a point of no return for them. There was, in fact, a strong system of surveillance and policing the workers so that they should not, or

rather could not, escape from their living hells. In *Two Leaves and a Bud*, the guards ascertain that none of them can escape from the tea gardens through the maintenance of strict vigilance. The guards not only keep an eye upon the men and women as they work in the tea gardens, and they also pay regular visits to the huts in the workers' colonies during night hours to ascertain that all the workers are present. If any of the workers was found trying to escape, then he was sure to be punished severely by the security guards. In the novel, it is disturbing to note how the authority uses the Air Force to subside the demonstration of the workers.

A critical point to be noted is the low bargaining power of the workers against the owners that paves the way for the exploitation of the former in the hands of the latter. Once the workers have been trapped within the stronghold of the tea estates, they have no option left to themselves other than to be at the mercy of the manager and other officers of the tea estate, whose majority comprised of the English. For the fulfilment of every need, they had to either take their help or approach the moneylender who charged interest at a very exorbitant rate. Once the loan is taken, the debtor is trapped in a never-ending cycle of compounding interests. This painful aspect of tea estate life that Anand portrays in his novel can easily remind an avid reader of the predicament of the poor Indian peasants in Munshi Premchand's novel, *Godan* (1936), since both these authors show the incapacity of the poor to break out of the trap of monetary exploitation in the hands of the parasitic class of the society. In *Two Leaves and a Bud*, when Gangu has to approach a trader for a loan in order to fulfil the last rites of his dead wife, one can feel how the poor man is unwillingly burdening himself with a loan which he may not be able to repay till the end of his life. It is also disheartening and painful to watch how Gangu is refused a loan both by Croft-Cooke and Sardar Buta who could have easily lent the meagre amount and spared him the trouble. Later, Dr. Havre tells Barbara how the English have become rich by exploiting the Indian coolies in Assam and the industrial workers in Britain. He also makes it clear that all this is done with the support of the British Government. He says:

> Your father has made his money in this country, but feels no gratitude towards it. Your mother has the mutiny complex, dyes her hair, bullies her servants, and joggles around the dance floor...But the poor, bloody collies sweat their guts out, working for four farthings a day, to the tune of Reggie Hunt's guffaws. Hurrah for the Britons who never, never shall be slaves. Three cheers for the man who imprisons old Gangu on the plantation by false pretences, keeps him well-guarded and refuses to give him a strip of land which he promised by contract. But what's a contract with a slave? Less than a scrap of paper and that's your Empire! (Anand, 1937: 130–31)

Dr. Havre's criticism of the *modus operandi* of the British empire in India lays bare the dirt and squalor of colonialism and socio-economic exploitation of the coolies in the tea estates which contributed considerably to the economic well-being of Britain. When examined from the post-colonial reader's point of view, Craft-Cooke's attitude towards Gangu and the other workers in the tea estate is an example of the typical settler's attitude in colonized spaces. Mrs. Craft-Cooke's calling their butler, Ilahi Bux as 'Lie Box', adds to the same discourse. She, in her prejudice, considers all Indians as liars and thieves and openly states her misconstrued opinion about them. According to her, '...these natives are lazy. And we must not spoil them. They are

born liars. And they steal. I caught a coolie woman plucking roses from our garden the other day, and I shooed her off'. She further adds that they must 'not spoil them' with generosity or any show of kindness. (Ananda, 1946:23). Like her husband, she is incapable of seeing any goodness in the Indians due to her indoctrination in the lies of the empire. The agenda of racial inequality engendered by colonialism does not allow her to see beyond her own superiority. Furthermore, Reggie Hunt's hatred for the male coolies and his lust for the females are an example of the 'ambivalence of desire' that the colonizer normally adopts in his approach towards the colonized sexes.

The condition of the workers, both the native and the migrated ones, in the tea estates of Assam is comparable to a certain degree to the condition of the African slaves brought to the USA for working in the cotton plantations of the southern part of the country. Both these categories of human beings were deprived of their basic human rights and exploited to the utmost capacity. The difference in their conditions lies primarily on two points—first, the African–Americans were forcibly brought to work in the cotton plantations of the southern states of America, while the tea workers in Assam were lured into the vicious trap of exploitation through false promises and dreams of a better future; secondly, the condition of the African–American slaves was far worse than that of the tea workers in Assam. The most important difference in these two groups in terms of being exploited lays in the fact that while in the case of the African–Americans, it was the difference in race between the exploiter and the exploited, and in the case of the Indian tea plantation labourers, it was a difference of both race and class. As a matter of fact, it is possible to interpret the exploitation of the tea garden labourers using the Marxist principle of class struggle emanating from the inequality in control over the means and the result of production of wealth.

It would not be wrong to mention here that to understand the human conflict that Mulk Raj Anand presents in his novels, one has to take recourse to the Marxist bent that he exhibits in his writings. Though caste may take the fore-front in his *Untouchable*, it is also a tale of exploitation based on class difference originating out of an unfortunate combination of class and caste in Hindu society. Similarly, his other masterpiece, *Coolie*, also emerges as a tale of suffering of the underprivileged in Indian society. The present novel, *Two Leaves and a Bud*, also presents exploitation as a consequence of the difference in terms of class and race. In fact, Anand's inclination towards Marxism is no hidden knowledge. The strong Marxist stance which he adopted as an author in discussing the class struggle in Indian society had kept him in the scanner of the government and the intelligentsia for a good number of years. He had remained a suspect in the eyes of the government. Anand's Marxism was the result of his social consciousness. He was a socially conscious writer who viewed writing as a purposeful way of projecting the evils inherent in the society. (Joshi, 1969: vi) Anand was not an advocate of 'Art for Art's sake', thereby devoting himself to the task of being a conscious interpreter of the ills and evils of the society through a rejection of the luxury of pure aestheticism. As a result, his novels emerged as works of serious social purpose. They fit perfectly into what Bhabani Bhattacharya held about the nature of proper novels:

> I hold that a novel must have a social purpose. It must place before the reader something from the society's point of view. Art is not necessarily for art's sake. Purposeless art and literature which is much in vogue does not appear to me as a sound judgement. (as cited in Sharma, 1979:121)

Anand was also influenced by writers such as Rabindra Nath Tagore, Bankim Chandra, Sharat Chandra, Munshi Prem Chand, Mahatma Gandhi and even the great Urdu writers such as Ratan Nath Sarshar and Muhammad Iqbal. The Western influences that operated upon him were Maxim Gorky, Leo Tosltoy, Victor Hugo, James Joyce and Fyodor Dostoevsky (Khan & Rizwan, 2008: xvii–xviii). The exuberant humanism and the mature nature of plot construction in his novels were the result of these diverse influences that shaped his artistic acumen. In his *Apology for Heroism*, Anand sets to record his theory of the novel as a means of social commitment in the following words:

> The form of the creative writing which is the novel came to me much more naturally than any other form, because through this I could live through the experiences of to their people and realize what silent passions burst in their hearts, what silent passions burst in their hearts, what immediate and ultimate sorrows possess them, where they want to go and how they grapple in their ways with their destinies. (Anand, 1975:138–39)

Thus, his views on the novel as a literary form which he could utilize to his purpose coincide with that of Bhabani Bhattacharcharya. He devoted himself sincerely to the great task of asserting civilizing values in a wasteland disintegrating under the burden of selfishness and antipathy of human beings. His unceasing championing of the cause of the poor turned him into a crusader against those who thrived on the blood and the sweat of the underdogs of the society. The plot of *Two Leaves and a Bud* reflects this very concern of Anand as it is firmly based on the conflict between the capitalist owners and the poor labourers in McPherson Tea Estate in Assam. It is because the managing authority of the tea estate has in its hands all the repressive tools to exercise its authority over the workers, and it is always at an advantaged position in its relationship with the poor workers. The repressive system operates on the basis of rewards and punishment; it rewards the sardars and the security henchmen but punishes the innocent workers when they raise even a whisper about their just demands.

In the post-colonial sense, the light that Anand casts on the functioning of the tea estates of Assam in *Two Leaves and a Bud* is a projection of 'the dirty work of the empire'—a term used by George Orwell in his essay 'Shooting an Elephant' (Orwell, 1936). It was the colonial intent of exploitation in the colonies that had led to the dehumanization of the natives—a fact that Joseph Conrad brings forth in his famous novella, *Heart of Darkness* (1899); this is the very process that Anand criticizes in *Two Leaves and a Bud*. By projecting class-conflict between the planters who represented the rich trading houses of the colonial British Government and the Indian labourers in the tea plantations in Assam and combining the racial binary of opposition between the colonizer and the colonized in this novel, Anand makes capitalism coterminous with colonialism and shows how both the systems operate with the same objective. As offshoots of modernism, both colonialism and capitalism share the same original

impulse. Historically, the ideology of modernism has been seen to have within it the very element of colonialism as it becomes dominant in terms of what has been called 'instrumental reason' and division of realms where one term enjoys supremacy over the other. Reason carries on its domination in all spheres through the process of an increased rationalization. (Maura, 2013) As rationalization becomes a requisite of modernization and human emancipation, it becomes dehumanizing at the same time. Hannah Arendt, in her book, *The Origins of Totalitarianism* (1951), writes:

> 'The aim of an arbitrary system is to destroy the civil rights of the whole population, who ultimately become just as outlawed in their own country as the stateless and homeless. The destruction of man's rights, the killing of the juridical person in him, is a pre-requisite for dominating him entirely. In the concentration camps, there is not even the pretense of any civil or human rights—no inmates have any rights'. (Arendt, 1951: 451)

The process that Arendt mentions in the above lines explains the process which is akin to the process of the exploitation of the tea garden workers by the estate owners. Bill Ashcroft was explicit about the inter-woven relationship between modernity and colonialism. For him:

> ...modernity emerged at about the same time as European nations began to conceive of their dominant relationship to a non-European world and began to spread their rule through exploration, cartography and colonization...The imposition of European model of historical change became the tool by which these societies were denied any internal dynamic or capacity for development. (Ashcroft, 2001: 211)

Therefore, the relationship among modernism, colonialism, capitalism and the consequential exploitation of peoples in the European colonies can be probably expressed thus very simplistically: *Modernism = colonialism = capitalism = exploitation in the colonies*; Anand, the socially committed novelist that he was, describes this relationship in the form of the conflicting forces in *Two Leaves and a Bud*.

The pitiful state of existence of the workers leads them to find solace in the fatalistic view of the universe. They see themselves as fated to suffer and blame their misfortune on their *karma*, so that they might get some solace out of it. It serves as a simplified logic for them in times of despondency and acute suffering. This aspect is reflected in Gangu's meeting with his neighbour Narain after the former's arrival in McPherson Tea Estate. Narain tells Gangu that he had been virtually imprisoned in this tea estate by a *sardar* for the last twelve years, though he had been brought from his famine-stricken village in Bikaner on a contract for three years only. He says:

> I suppose it is our *kismet*. But at home it was like a prison and here it is slightly worse...Well, you can't escape from here now...First water, afterwards mire! This prison has no bars, but it is nevertheless an unbreakable jail. The chowkidars keep guard over the plantation, and they bring you back if you should go. (Anand, 1946:35)

This is a shocking revelation to Gangu that his movements will be watched over by the guards, but he had prepared himself for all sorts of unexpected things in this new land. It is at such moments that his fatalistic view of the universe that he had inherited by virtue of being born a Hindu comes to his rescue to make his life easier. This is more pronounced in the manner he deals with the loss of his wife.

But, the humiliation and the exploitation of the coolies do not end with the torture of the males; the women and even the barely young girls are also not spared. With the type of Reggie Hunt prowling around, the women are always at a risk of being molested at his whims. In the novel, Reggie Hunt has been portrayed as a maniac who thinks that the native men are not good, but he fancies their wives and daughters. He exploits the women sexually by force. When Reggie Hunt first catches the glimpse of Leila, Gangu's daughter, he wants to know who she is. On being informed that she is Gangu's daughter, he wants her to be brought before him, but Narain tries to divert his attention by telling him that Leila is only a child. Fortunately, Buta arrives at the moment, and Reggies Hunt goes away with him. On his departure, Narain informs Gangu that nobody's wife or daughter is safe in the plantation because of Reggie Hunt. Towards the end of the novel, it is Reggie Hunt's lust for Leila that leads him to shoot and murder Gangu. He also exploits the other women like Neogi's wife, to whom he makes love forcibly. Thus, this adds the dimension of sexual exploitation of the colonized by the settlers in the novel.

This, in consequence, robs them of the will to resist and turns them into submissive subjects in an exploitative socio-economic structure. And even in the rare cases in which they feel themselves pushed to the wall and decide to raise their voice, they are cruelly suppressed by show of sheer brutal force. They are beaten and even shot at so that their morale is broken. Typical of colonial settlements, the native is not perceived as a human but more as an object to be kept at an inferior level of socio-economic existence. They are stripped of their essential humanity and dragged down to the position of dehumanized 'monstrosities' or aberrations on the basis of the stereotypes built on the basis of colonial prejudice that thrives on racism and the twisted logic of the empire, such as the faulty theory of scientific racism which propounded the superiority of certain races above other races. It is precisely the working of this twisted logic that leads Justice Moberley and his jury of seven European judges to exonerate Reggie Hunt of the charges of killing Gangu. The vote of the two Indian judges on the jury does not stand against Reggie Hunt as Justice Moberley and the seven other European judges belong to his race, and as per the formulation of racism, the native is not a human but an object or something 'to be kept in place'. Justice is thus prejudiced from the very point of inception itself where the 'other'—who is none other than the Indian in this context—is a 'potential criminal' or an aberrant subject in the eyes of the whites.

Mulk Raj Anand adds another dimension to this process of exploitation by making the collaborative native as an integral part of the suppressive machinery for controlling the disempowered workers. Thus, an interesting point in this novel is its emphasis on the role of the native collaborator(s) in perpetuating the process of exploitation initiated by the colonial settlers. The collaborator has always played a historically decisive role in helping the colonial master in successfully carrying on exploitation of the natives for a slice of the power and wealth that the colonial power structure evolved in colonized societies. The collaborator has for long remained an important point of focus for several post-colonial authors. In *Two Leaves and a Bud*, Sardar

Buta Singh and the estate guards, including Neogi, represent that class of collaborators without whom the colonial machinery would not have so successfully operative in the tea estates.

Thus, Anand's *Two Leaves and a Bud* presents the multipronged nature of socio-economic exploitation carried out by the English in the tea estates of Assam. Through the trials and tribulations of Gangu, the novelist has brought forth the monstrous nature of exploitation carried out in the plantations by the colonial powers. The complete disregard for human and ethical values is deeply troubling in the narrative. The repressive structure has been shown as so powerful that even a sympathetic Englishman like Dr. De la Havre has to suffer for his sympathy and concern for the Indians. If Hori in Mushi Premchand's *Godan* remains the quintessential figure of the exploited Indian farmer under a parasitic system, Gangu in *Two Leaves and a Bud*, through his suffering, his resignation and his forgiving nature emerges as the quintessential suffering worker in plantations. It is also clear that in portraying the sufferings of the downtrodden and marginalized section of humanity, Anand presents himself as a socially conscious novelist to the core. Though it is alleged at times that he exhibits Marxist inclination to a great degree in this novel, it cannot be denied that he has successfully created a disturbing text for his readers which is strong enough to shake them out of their apathy for the downtrodden and the marginalized, as he has always done with his other successful novels like *Untouchable* and *Coolie*.

While it seemed that the end of the colonial era or the British Raj in India would mean an end to the woes of the people working in the tea estates, it did not actually happen, for the exploitative machinery of colonialism returned in the guise of international capitalism in all sectors of production. The end of colonialism was almost followed by neo-colonialism. The multinational corporate houses that took over the task of production in these tea states also aimed at only one thing—the maximization of profit. However, methods of checks and balance became operative with the socialist model of development adopted by the independent government of India. Its measures for the eradication of poverty and the betterment of the living conditions of the deprived helped to restore some sort of equilibrium in an otherwise ravaged section of the society. But, does it mean that the condition of the tea estate workers has improved now? The answer is not an easy one. There has definitely been a perceptible improvement in their living standards with the impetus on health, sanitation and education after the country's independence. Today, in most of the tea estates of Assam, there are primary schools and provisions have been made for providing drinking water. However, it remains a fact that the provisions in these regard are still insufficient, and the government has to go a long way to achieve its goal. It is heartening to note that the government has devised and implemented several programmes for the upliftment of this marginalized class, yet the success of these plans and programmes depends on their proper execution by the executing agencies. As a result, the targets have remained elusive to a great extent. An investigation made by Justin Rowlatt and Jane Dieth (2015) for BBC on 8 September 2018 in the tea estates of Assam brought to light the deplorable condition of the workers there. It has transpired from their investigation that the accommodation and sanitary conditions in these tea estates are below standard. The unhygienic condition

of settlements along with malnutrition has resulted in poor health of the workers, including women and children. Many of the workers spraying pesticides were not equipped with proper safety gears. It was also doubted that child labour may also have been a practice in some of these estates. On the basis of this report, several of the multinational tea giants agreed to work for the betterment of the people there.

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Edited by
Jasmeet Kour and Gulzar Ahmad Nayik

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Edited by

Jasmeet Kour
Department of Food Engineering and Technology, Sant Longowal Institute of Engineering and Technology, Longowal, Sangrur, Punjab, India

Gulzar Ahmad Nayik
Department of Food Science & Technology, Government Degree College Shopian, Jammu & Kashmir, India

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Chapter 14

Tocopherol

Jinku Bora[1], Thoithoi Tongbram[2], Nikhil Mahnot[3], Charu Lata Mahanta[2] and Laxmikant Shivnath Badwaik[2]

[1]Department of Food Technology, Jamia Hamdard, New Delhi, Delhi, India; [2]Department of Food Engineering and Technology, School of Engineering, Tezpur University, Napaam, Assam, India; [3]Department of Food Technology, Rajiv Gandhi University, Rono Hills, Doimukh, Arunachal Pradesh, India

14.1 Introduction

Vitamin E was first discovered as "factor X" in 1922 while conducting experiments on the dietary factors essential for reproduction in rats (Evans & Bishop, 1922). Later, the substance was named "vitamin E" in 1924 (Sure, 1924). Subsequent expansion of research studies on vitamin E revealed the importance of it in human nutrition.

Vitamin E found in nature is composed of eight different forms known as homologues (α, β, γ, and δ forms), of which four forms are tocopherols and the other four forms are tocotrienols. The chemical differences between the four homologues of tocopherol are due to the number and position of the methyl groups in and around the chromanol ring. Tocopherols predominantly occur in seeds of higher plants, and are found in significant quantities in green tissues, and synthesized exclusively by all photosynthetic organisms. Plant-derived oils contain the four homologues of tocopherols in different relative quantities, and thus, they represent the major sources of vitamin E. Oils derived from almonds and sunflower contain a higher amount of α-tocopherol; corn oil contains a higher amount of δ-tocopherol; and oils derived from walnut contain mainly γ-tocopherol. The tocopherols are not synthesized in animals and also the interconversion of the different forms by methylation or demethylation does not take place. α-Tocopherol is the most naturally abundant form of tocopherol, due to which it is widely being used in food, pharmaceutical, and cosmetic industries.

Tocopherols, the main biologically active form of vitamin E, function as a lipophilic antioxidant that prevents the propagation of free radical chain reactions and reduces the risk of chronic diseases associated with oxidative stress in tissues (Brigelius-Flohé & Traber, 1999). Vitamin E deficiency may lead to a number of health problems such as AVED (ataxia with vitamin E deficiency), cancer, diabetes, cardiovascular diseases, and aging.

In this chapter, available literature regarding information and knowledge on the sources, chemistry, extraction, stability, safety, toxicity, and applications of tocopherols are reviewed and discussed.

14.2 Sources

Tocopherols are naturally present in a wide range of foods. Being fat-soluble, it is reasonable to understand that vegetable oils are the major sources. Nuts are another excellent source of tocopherols, even certain vegetables and fruits do have appreciable quantities. The quantities (average/range) of tocopherols present in various foods are mentioned in Table 14.1. However, the values are not strict, as different researchers have carried out tocopherol estimation using different analytical methods, moreover the cultivars or varieties considered cause variability. Processing of vegetable oils or domestic cooking methods of vegetables also tends to have an effect on tocopherol content (Diamante et al., 2021; Ergönül & Köseoğlu, 2014). Vitamin E compounds are biologically essential fat-soluble antioxidants derived from 6-chromanol. Industrially most relevant (all-rac)-α-tocopherol is generally synthesized by coupling of arenes with aliphatic precursors. Synthetic vitamin E has been developed commonly using 6-hydroxy-2,5,7,8-tetramethylchroman-2-carboxylic acid (trolox) in either racemic or chiral form as the starting molecule. The commonly used derivatives of vitamin E as supplements are present in the form of esters of acetates and succinates (Nagy et al., 2013).

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TABLE 14.1 Sources of tocopherols in various foods/products.

Sources	Tocopherols (in mg/kg)				References
	α	β	γ	δ	
Vegetable oils					
Sunflower oil	686.5	21.6	8.4	3.7	Cruz and Casal (2018), Ergönül and Köseoglu (2014), FAO/WHO (2002), Zhang et al. (2019)
Crude palm oil	340.5	44.6	–	174.7	
Extra virgin olive oil	281.3	5.0	10.1	–	
Wheat germ	1510–1920	310–650	0–520	–	
Rapeseed oil	331.5	41.8	243.8	–	
Soybean oil	197.3	18.5	434.3	74.8	
Corn oil	350	38	319.2	–	
Camellia oil	378	–	26	12	
Nuts					
Almonds	1132	4.04	21.4	–	Hejtmánková et al. (2018)
Walnuts	42.2	–	442	52.4	
Hazelnut	808	8.39	31.5	2.39	
Brazil nuts	162	–	427	2298	
Vegetables					
Cauliflower	27	–	78	–	Cruz and Casal (2013), Lee et al. (2020)
Broccoli	221	–	65	–	
Rocket salad	63	–	8	–	
Water cress	40	–	11	–	
Lettuce	1.47–3.64	–	4.93–6.25	–	
Fruits					
Chaenomeles varieties	7–26	1.4–6.21	0.13–4.2	0.06–1.85	Chun et al. (2006), Turkiewicz et al. (2020)
Avocadoes	26.6	0.8	6.9	0.3	
Blackberries	14.3	0.4	14.2	8.5	
Raspberries	8.5	0.9	13.9	11.5	
Other products					
Butter	32.5	–	4.2	–	Cruz and Casal (2018)
Margarine	105.3	3.5	56.0	7.5	
Fish oil supplement	11,133.6	103.6	608.4	229.3	

14.3 Extraction and characterization techniques

Various natural and food sources house tocopherol homologues (alpha, beta, gamma, and delta forms) from which they can be isolated and characterized. Isolation of tocopherols is primarily done from a wide variety of normal foods, most conveniently from cereal grain oils (corn, wheat, barley, and rye) and vegetable oils (wheat germ, soybean, cottonseed, safflower, peanut, linseed, sunflower, rapeseed, palm, etc.). The purity of tocopherol concentrate depends on the vegetable source as well as the particular type and/or combinations of available techniques used for isolation.

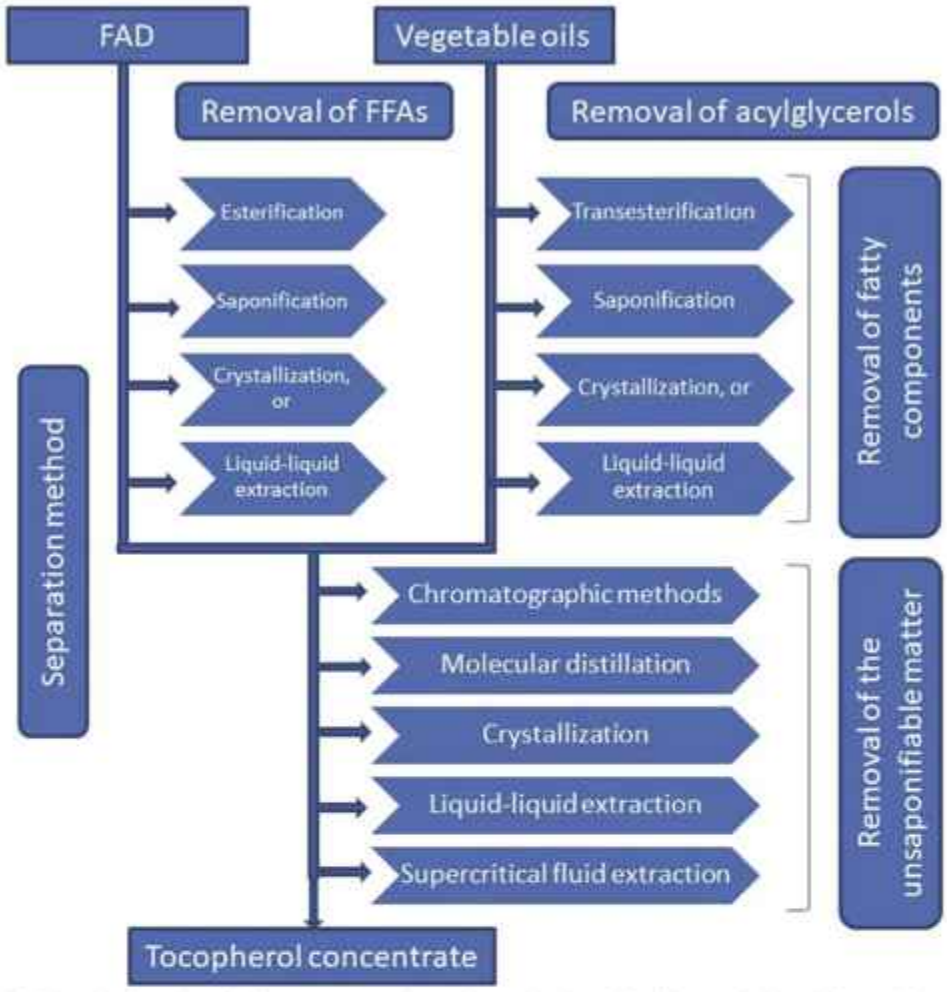


FIGURE 14.1 A brief illustrative flowchart of different tocopherol extraction methods. *Modified from Quek, S.-Y., Chu, B.-S., & Baharin, B. S. (2007). In* The encyclopedia of vitamin E *(pp. 140–152). Trowbridge, UK: Cromwell Press.*

Generally, natural tocopherol is isolated by techniques selected from extraction, saponification, distillation, esterification, ion-exchange, adsorption chromatography, precipitation of sterols, and crystallization (Fig. 14.1). Commercially, it is desirable to follow two-step isolation: first, separate and concentrate the source of tocopherol; then, isolate tocopherols from impurities present therein the concentrate.

14.3.1 Esterification and transesterification

Esterification is one of the most common steps in a series of methods used to extract tocopherols from vegetable oil sources, particularly fatty acid distillate (FAD). Commercially, FAD is an important source because it is high in tocopherol concentration and cheaply available during vegetable oil deodorization. In this method, an acid is used as a catalyst to esterify free fatty acids (FFAs) present in FAD to induce the formation of alkyl esters in an esterification process with lower alkyl alcohol in a reaction vessel. This alkyl alcohol is feed continuously into the vessel; water as a by-product is removed to prevent a backward favoring reaction, such as hydrolysis. The temperature in the reaction vessel ranges from 65 to 130 °C and the vessel is pressurized to maintain reactions in a liquid state. In the case of a vegetable oil source, transesterification is employed; an alkaline catalyst such as potassium hydroxide, sodium hydroxide, sodium methoxide, or zinc oxide is used. In both esterification and transesterification, the catalyst is withdrawn once the reaction is complete, following which the reaction mixture is cooled, washed with water, purged with nitrogen, and dried. Alkyl esters formed in this process are separated either by distillation, adsorption chromatography, liquid–liquid extraction, or other means. Alternately, esterification can also be carried out using sterols or a boric acid source (Fig. 14.2).

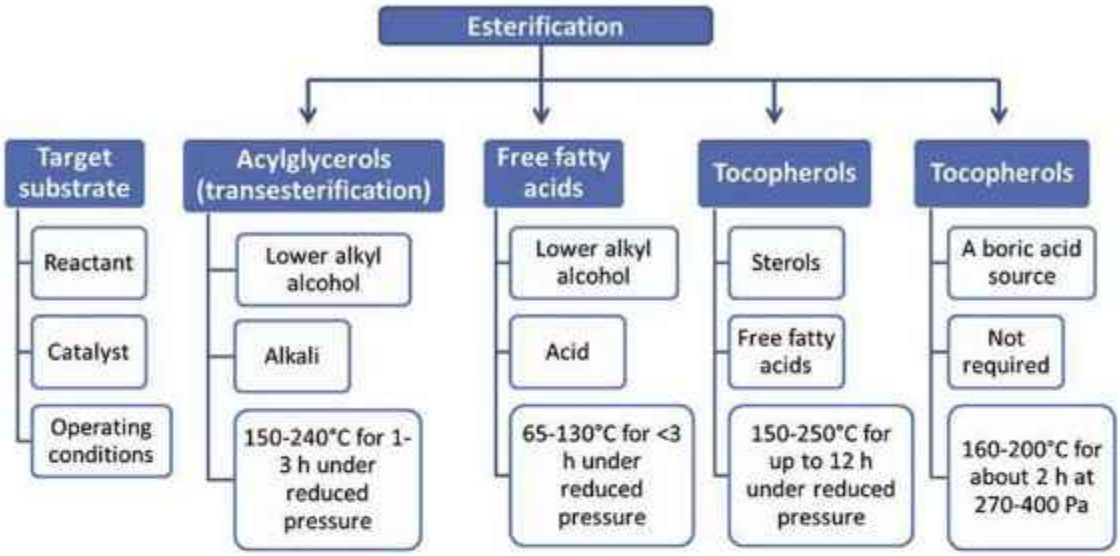


FIGURE 14.2 A demonstrative flowchart of esterification methods for tocopherol extraction. *Modified from Quek, S.-Y., Chu, B.-S., & Baharin, B. S. (2007). In* The encyclopedia of vitamin E *(pp. 140–152). Trowbridge, UK: Cromwell Press.*

14.3.2 Direct solvent extraction

A primitive, but the original method for extraction of tocopherols includes dehydration of sample with anhydrous magnesium sulfate; extraction of lipid-soluble components with isopropanol and methylene chloride; fractionation of the extracted components (vitamins) in a high-performance gel permeation chromatography (Lee et al., 1998). An improved method (Lim et al., 2007) employs hot deionized water to prepare the sample prior to treatment with anhydrous magnesium sulfate. This is followed by repeated washing with extraction solvent (e.g., hexane: ethyl acetate, 90:10 v/v with 0.01% BHT), filtration, and collection of filter cake (filtration 1). The filter cake undergoes another round of treatment with isopropanol and extracting solvent (filtration 2). The combined filtrates (from filtration 1 and 2) are diluted to volume using extraction solvent and filtered through a nylon membrane filter. A small aliquot from this filtrate is then evaporated with N_2 and it is prepared to appropriate concentration of analytes with the mobile phase.

14.3.3 Saponification

Saponification is another method used to remove fatty components from vegetable oils and FAD for extraction of tocopherol. The process is brought into effect in a lower monohydric alcohol medium using hydroxides of sodium, potassium, or calcium at reflux temperature. Back-esterification of glycerine and other ester-forming alcohols with FFAs may occur while using an aqueous alkali saponification process, which is minimal if alcoholic saponification is applied. Due to this and shorter reaction times, the latter is preferably used. The next step for the treatment of the saponified mixture is propagated in various ways (Fig. 14.3).

In a patented method, the mixture is acidulated, allowing it to settle into two phases: glycerine containing phase at the bottom, which is drawn off; and the top phase enriched with FFAs and tocopherol, which is esterified with alkyl alcohol. In another technique known as Fizet's method, alcohol is removed and to the top phase, another solvent such as methyl or ethyl formate or acetate is added for crystallization at 0 °C. The fatty acid calcium salts crystallize and are filtered off; the tocopherol-containing fraction is concentrated on a rotary evaporator from the filtrate. Also, liquid–liquid extraction is another technique used to recover tocopherol using acetone or ethyl ether from saponified FAD. Calcium chloride is added to facilitate extraction by converting sodium or potassium hydroxide to calcium soaps (metathesis), which is ground into particulates with powdering agents. Metathesis can alternatively be carried out by the addition of zinc halide (preferably the chloride) after saponification (Lee et al., 1998; Lim et al., 2007; Quek et al., 2007, pp. 140–152).

14.3.4 Distillation

Distillation is carried out as a usual follow-up step to remove lower alkyl esters postesterification (Quek et al., 2007, pp. 140–152). To avoid any undesirable loss of tocopherols during distillation, a chelating agent such as ascorbic acid, phosphoric acid, malic acid, citric acid, or tartaric acid is added to the feed prior to drying and distillation. The alkyl esters

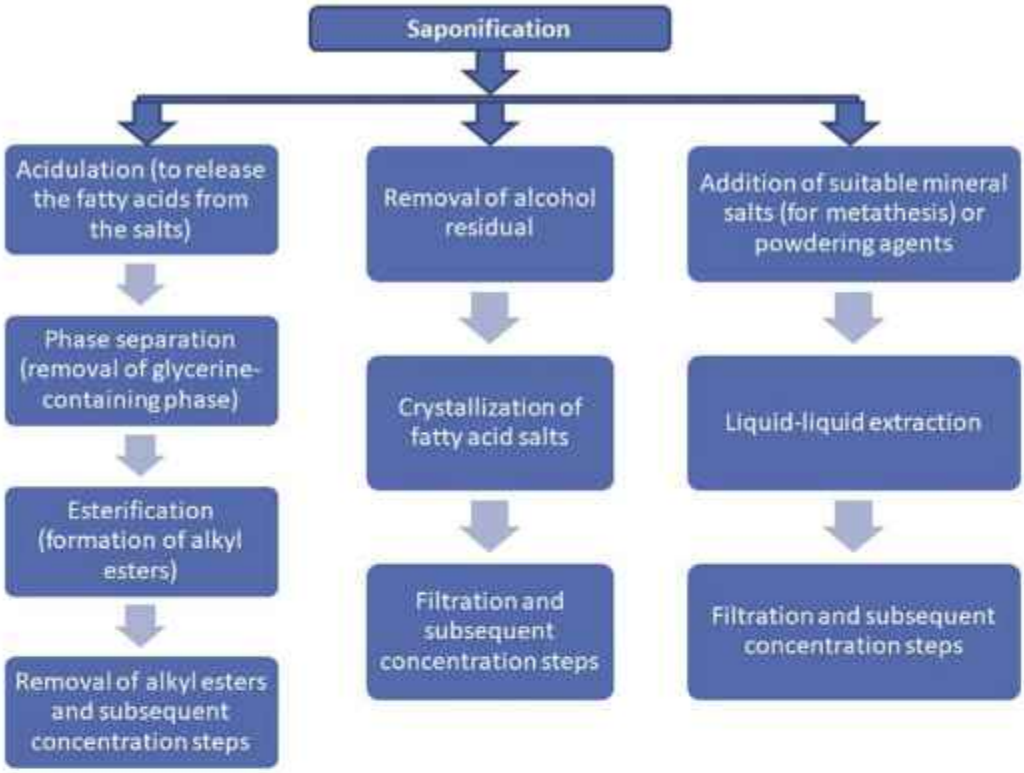


FIGURE 14.3 Concentration steps ensuing after saponification. *Modified from Quek, S.-Y., Chu, B.-S., & Baharin, B. S. (2007). In* The encyclopedia of vitamin E *(pp. 140–152). Trowbridge, UK: Cromwell Press.*

get distilled in the process, which is collected and discharged as a by-product. The tocopherols retained in the distillation column must also be cleared out in the minimum time possible to avoid deterioration losses.

14.3.5 Chromatographic methods

Ion-exchange chromatography and adsorption chromatography are the two most popularly used chromatographic techniques to isolate tocopherols from their sources (Quek et al., 2007, pp. 140–152). A highly effective method for the concentration of tocopherols is the use of ion-exchange chromatography. Tocopherols exhibit a weak acidity and therefore, bind to resins inside the column, which are strongly basic in nature; impurities like sterols, hydrocarbons, acylglycerols, pigment, and foreign basic and neutral substances elute out. It is mandatory to remove FFAs from FAD and also preferable to convert the basic resins from the usually sold Cl^- type to the OH^- anion type with larger adsorption capacity. Lower monohydric alcohol such as ethanol, methanol, or isopropanol is used to purge the column and wash out the impurities not attached to the column. To elute out the adsorbed tocopherols, an acidic solution (sulfuric, acetic, formic, or boric acid) is used. Similarly, a carbon dioxide–treated solvent is also used to selectively desorb tocopherols from the resin.

Normal phase adsorption chromatography functions using a polar stationary phase and a less polar mobile phase; the reverse applies to a reverse-phase adsorption chromatography. Both are based on the concept of hydrophilicity and lipophilicity. A typical normal phase column to isolate tocopherol from the fraction containing alkyl esters as an impurity is packed with alumina, silica gel, magnesium oxide, calcium hydroxide, silicic acid, powdered agar, or cellulose. The fatty acid alkyl esters are removed by eluting the column with a medium-chain alkyl hydrocarbon such as hexane, heptane, or petroleum ether. Tocopherol is then desorbed from the column with lower alkyl alcohol like isopropanol or a mixture with hexane. A classic example of the reverse phase is the separation of tocopherol from esterified palm oil using a reverse-phase C_{18} bonded silica gel column. Polar impurities are removed with methanol: water: acetic acid solution (90:10:0.25 by vol.) while the trapped tocopherol concentrate is extracted from the column with methanol or ethanol.

14.3.6 Liquid–liquid extraction

A binary mixture of two immiscible liquids—a polar and nonpolar solvent—is employed in this technique (Quek et al., 2007, pp. 140–152). Commonly used polar solvents include water, methanol, and acetone with strong hydroxyl or carbonyl groups; preferred nonpolar solvents such as benzene, hexane, and carbon disulfide are categorized by weakly

polar molecular structures. The immiscibility of the two-solvent system must be such that there is separation at a practical rate and the property of immiscibility must be retained even after admixture with FAD. To ensure this, emulsion breakers can be added, the extraction can be carried out in single contact, multistage contact, or countercurrent extraction. The volumetric ratio of the two solvents is an important selection parameter to decide the solubility of tocopherol in either polar or nonpolar solvent. If the design is such that tocopherol is found in the nonpolar solvent, a polar solvent (at a selected volumetric ratio) is later used to contact and dissolve tocopherol from the nonpolar solvent. Evaporation of the polar solvent yields the extracted tocopherol. Another variation of this technique devises the use of alkali to form a two-phase system to extract tocopherol: a generous amount of caustic methanol (tocopherol rich) and a nonpolar solvent (containing organic material). The two phases are separated; acid is used to neutralize caustic methanol; the resulting salt from neutralization is filtered out; the filtrate is evaporated to remove methanol. In order to avoid contamination with FFAs in the caustic methanol phase, they are necessarily removed from the starting material.

14.3.7 Crystallization

Sterols are concentrated together with tocopherols in FAD and crystallization is primarily used to separate them for high purity tocopherols (Quek et al., 2007, pp. 140–152). A process that describes the enhancement of tocopherol content after distillation of fatty acid alkyl esters uses a major amount of a low polarity organic solvent (hexane, heptane, or isooctane), a minor amount of high polarity organic solvent (methanol or ethanol), and water. A homogenous liquid mixture is generated by boiling at the atmospheric boiling point; the ratio of this solvent to the source may vary from 5:1 to 3:1 (v/w). At crystallization temperature (typically −25 to 0 °C), separation takes place with tocopherols still in the liquid phase and sterols in the solid phase, which is then removed by filtration.

This technique is also useful when applied after esterification but before distillation. Immediately after esterification, cold water is introduced into the reaction mixture containing alcohol, which is then cooled to room temperature or ≤ 5 °C. Sterol crystals are formed in this process, which can be separated by centrifugation or filtration while the fraction containing tocopherol is taken up in acetone at −20 °C. In another process, crystallization is employed to segregate tocopherols from FFAs present in palm oil. The procedure uses acetone, methanol, ethanol, or a mixture of them at −75 to −14 °C to extract tocopherols in the liquid phase. Repeated crystallization and separation of solid FFAs can improve the purity of tocopherol.

14.3.8 Enzymatic methods

Microbial lipase-catalyzed reactions are finding applications in the recovery of tocopherol from FAD (Quek et al., 2007, pp. 140–152). Hydrolysis, alcoholysis, and esterification catalyzed by specific or nonspecific lipases or inappropriate combinations can produce fatty acid esters and fatty acids from FAD. The use of 2.7%–4.3% lipase with methanol to esterify 96.5% FFAs in FAD at 50 °C and convert it to methyl esters can increase the concentration of tocopherols up to 1.7 times over the original content. Immobilized lipases present another way to produce alkyl esters; lipases from *Candida cylindracea* can be used to hydrolyze acylglycerols and lipases from *Mucor miehei* to esterify FFAs liberated by the former's action and those already present in FAD to produce butyl esters. Fractional distillation at two temperature ranges removes esters, hydrocarbons, and oxidized products at 180–230 °C for 45 min and recovers tocopherol at 230–260 °C for 15 min. *Candida antarctica* lipase is nonspecific and thermally stable; when immobilized, it can be used to hydrolyze acylglycerols in palm FAD. A distinct advantage of the use of microbial lipases is the reduction in tocopherol loses, as esterification and hydrolysis reactions are carried out at relatively low temperatures of 50–70 °C.

14.3.9 Supercritical fluid extraction

The use of SCF for extraction of tocopherol from sources such as FAD, palm oil, and olive tree leaves presents some pioneering work during the technology's early days. An extracting solvent (organic or inorganic), which is gaseous at room temperature and atmospheric pressure, is used in this technique. The solvent, when pressurized over its critical temperature, increases its density and hence its dissolving power improves. Most commonly, carbon dioxide is used, as it is nontoxic, nonflammable, highly selective in nature, and affordable. In addition, it operates at low temperature and solute–solvent separation is clearly easy. A continuous flow of CO_2 is maintained inside the reaction vessel; when the operating temperature and pressure are set, the feed oil is introduced. As extraction proceeds, the reaction mixture consists of a carbon dioxide fraction containing FFAs and another that has tocopherol and acylglycerols. The solvent is transferred into another chamber where the FFAs are separated; the solvent undergoes this repeated extraction and recirculation until

complete extraction is achieved. The effective partitioning of tocopherols and FFAs depends on the type of feed and coelution of fatty components due to dilution by higher fatty acid and acylglycerol concentration. Other forms of SCF extraction use hydrogen halide as a solvent to separate tocopherol from sources. For the separation of tocopherols from sterols, an inert organic solvent such as hexane, petroleum ether, benzene, or acetone is used to dissolve partially treated FAD. Hydrogen halide (chloride, bromide, or iodide) is introduced into the reaction mix in gaseous or liquid form at reflux temperatures for about 1 h. This produces a tocopherol-enriched liquid phase and an insoluble sterol phase (a product of sterols reacting with hydrogen halide), which can be removed by any conventional method such as filtration and centrifugation (Mendes et al., 2005; Quek et al., 2007, pp. 140–152).

14.3.10 Soxhlet extraction

Soxhlet extraction has high efficacy and is widely used. One of the earliest forms of this method uses a powdered sample: anhydrous sodium sulfate at a ratio of 1:4 (w/w). This thoroughly blended mixture is extracted in a Soxhlet apparatus containing hexane with 0.01% BHT in the dark for 4 h. The extract is then used in further analysis of tocopherol. In another approach, extraction is performed on ground sample with hexane: ethyl acetate (85:15 v/v with 0.01% BHT) under yellow light for 24 h (Lee et al., 1998; Lim et al., 2007; Ribeiro et al., 2019).

14.3.11 Cold pressing

One of the recent methods that stand out from the rest is the cold pressing method of extraction of oils from plant seeds because it is devoid of any harmful chemicals and high temperatures (Ribeiro et al., 2019). Heating, exposure to oxygen, and use of harmful chemicals degrade the composition and overall quality of extracted oil; its bioactive contents such as tocopherols get affected. Cold pressing ensures oil does not have to go through a refinement process to remove toxic chemicals even though the yield is lower than those obtained by solvent extraction methods.

14.3.12 Deep eutectic solvent extraction

This is an emerging solvent system that is gaining popularity as a green solvent due to its biodegradability, volatility, low melting point, and incombustibility — a set of unique physicochemical properties for an extraction solvent (Liu et al., 2019). Generally, deep eutectic solvent (DES) is a uniform combination of a hydrogen bond donor (HBD) and a quaternary ammonium salt set at a temperature of 60–80 °C. Commonly used HBD includes natural sources like urea, carboxylic acids, and polyols; choline chloride (ChCl) makes for role-fitting quaternary ammonium salt. Another advantage of DES as an extraction solvent is its tunability, basis of proportion, ratio, and type of components chosen.

14.3.13 Ultrasound-assisted extraction

The coupling of ultrasound with existing methods can increase the extraction of targeted compounds during sample preparations (Xu, 2008). Sound waves are used to break, disintegrate, and/or damage the natural integrity of micelles or matrix that houses the bioactive compounds, which are otherwise inaccessible by solvent due to their hydrophobic nature. A benefit of ultrasound application is the nonutilization of chemicals for breakdown (e.g., saponification) and freedom of possible chemical degradation of extracted compounds. The extraction efficiency of such assisted technique further increases due to agitation caused by the ultrasonic waves, thus increasing solvent-targeted compound interaction significantly.

14.3.14 Partition of tocopherol homologues for separate use

As per applications of the different properties of tocopherol homologues, there is sometimes demand these homologues be separated for individual usage. Analytically, some chromatographic techniques are available for separation and analysis (qualitative and quantitative), but not all of them are feasible for utilization in a commercial sense. A patented method describes the use of single-step reverse-phase liquid chromatography to execute this separation process on a commercial level. C_{18} bonded silica acts as a lipophilic reverse-phase chromatography medium and this becomes the stationary phase; the mobile phase consists of ethanol and deionized water. Polar impurities are eluted out first; tocotrienol homologues, if present, are eluted out next; the homologues of tocopherol are eluted out in the order of delta, gamma, and alpha forms. Alternatively, the tocopherol concentrate can be adsorbed on the reverse-phase C_{18} silica gel column; CO_2 SCF extraction can then be used to selectively desorb the homologues from the column.

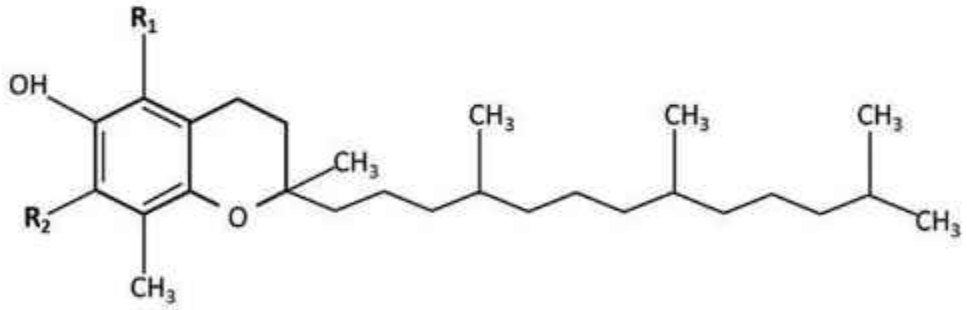
For ease of operation, the homologues can be selectively altered prior to a chromatographic run. This allows the homologues to have increased adsorption affinity toward the resins on stationary phase to varying degrees and thus provides a better chromatographic resolution of the homologues. The technique is achieved by selective deacylation of tocopherol esters by cyclic amines (in the order of delta > beta ~ gamma > alpha) and separation of these esters from free tocopherols in a column. Deacylation of delta homologue acetate undergoes rapidly within 15 min, while acetates of beta and gamma homologues take about 2 h; alpha homologue acetates are unreactive. Since cyclic amines are expensive, they can be replaced with methanol, ethanol, or propanol but the reaction requires 190–210 °C temperatures inside a pressurized vessel. To overcome this limitation, a basic catalyst such as potassium carbonate, potassium hydroxide, or sodium hydroxide that enables the deacylation reaction to happen at <100 °C (by reflux) is devised as an improved method (Quek et al., 2007, pp. 140–152).

14.4 Chemistry and biosynthesis of tocopherol

Tocopherol is the collective term for compounds that are characterized by the presence of a 6-chromanol ring structure; the compound tocol (2-methyl-2-(4′,8′,12′-trimethyltridecyl)-chromanol-6-ol) is considered the parent compound (Fig. 14.4). There is a C_{16} saturated side chain at position 2. The 6-chromanol ring structure is methylated to varying degrees at the 5, 6, and 8 positions, which gives rise to different homologues of tocopherol depending on the position and degree of methylation: alpha (trimethylated), beta and gamma (dimethylated), and delta (monomethylated) (Fig. 14.4). Three asymmetric carbons (chiral centers) are present at position 2 (chromanol ring) and at positions 4′ and 8′ (phytyl side chain).

All homologues of tocopherol, the 6-hydroxychromanols, are synthesized in plants with well-defined biosynthetic pathways present in all photosynthetic organisms (Eitenmiller & Lee, 2004; Lushchak & Semchuk, 2012). The alpha-tocopherol is documented to be present in both photosynthetic and nonphotosynthetic tissues, primarily concentrated in the chloroplasts, while the other homologues are concentrated in nonphotosynthetic tissues (chloroplasts, mitochondria, and microsomes). Biosynthesis of tocopherols happens in the chloroplasts and partitions into the chloroplast membrane (lipid phase). Generally, for most tocopherols, the phytyl tail is found embedded into the lipid membrane bilayer.

The synthesis of tocopherol occurs by the utilization of two precursors from two different pathways: homogentisic acid (HGA) and phytyldiphosphate (PDP) (Fig. 14.5). HGA (2,5-dihydroxyphenylacetate), which is obtained from the cytosolic shikimate pathway, is the precursor for the formation of the aromatic ring of tocopherol. PDP from the plastid methyl-erythritol phosphate pathway is the precursor for the tocopherol tail. HGA and PDP together conjugate to give the different homologues of tocopherol via a cascade of reactions. This condensation reaction is catalyzed by homogentisate phytyl



Tocopherol	R_1	R_2
Alpha	CH_3	CH_3
Beta	CH_3	H
Gamma	H	CH_3
Delta	H	H

FIGURE 14.4 Chemical structure of tocopherol family with number and position of methyl groups on the aromatic ring. *From Špika, M. J., Kraljić, K., & Škevin, D. (2016). Tocopherols: Chemical structure, bioactivity, and variability in Croatian virgin olive oils. In* Products from Olive Tree *(p. 317). BoD–Books on Demand.*

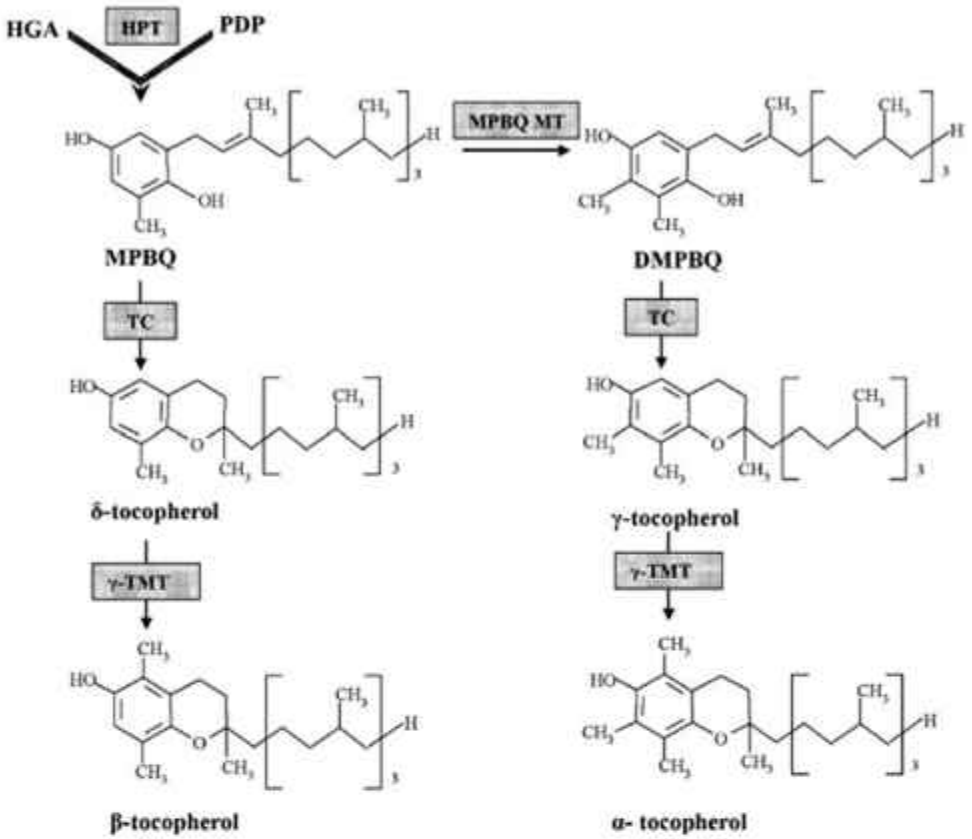


FIGURE 14.5 Tocopherol biosynthesis pathway in photosynthetic organisms. *c-TMT*, c-tocopherol methyltransferase; *DMPBQ*, 2,3-dimethyl-6-phytyl-1,4-benzoquinol; *HGA*, homogentisic acid; *MPBQ*, 2-methyl-6-phytyl-1,4-benzoquinol; *MPBQ MT*, MPBQ methyltransferase; *PDP*, phytyldiphosphate; *TC*, tocopherol cyclase. *From Lushchak, V. I., & Semchuk, N. M. (2012). Tocopherol biosynthesis: chemistry, regulation and effects of environmental factors.* Acta Physiologiae Plantarum, 34*(5), 1607–1628. https://doi.org/10.1007/s11738-012-0988-9.*

transferase (HPT) to yield 2-methyl-6-phytyl-1,4-benzoquinone (MPBQ), which is the committed step in tocopherol biosynthesis. MPBQ gets methylated by MPBQ methyltransferase (MPBQ MT) to 2,3-dimethyl-6-phytyl-1,4-benzoquinone (DMPBQ). Tocopherol cyclase (TC) acts on MPBQ and DMPBQ, and utilizes both as substrates for the formation of gamma and delta tocopherols, respectively. Finally, gamma-tocopherol methyltransferase (TMT) methylates gamma and delta tocopherols to produce alpha and beta tocopherols, respectively (Špika et al., 2016).

14.5 Mechanism of action: antioxidant properties and degradation

14.5.1 Antioxidant properties

The primary role of tocopherols is to prevent lipid peroxidation and protect lipids from it. Hence, its best source is vegetable oils, followed by other plant-based food. Tocopherols act as antioxidants by participating in oxidation chain-breaking events. They quench peroxy radicals of polyunsaturated fatty acids (PUFAs) by ending the oxidation chain reaction. This happens by the transfer of a hydrogen atom from the hydroxyl group on the chromanol ring to the PUFA peroxide radical. The "tocopherol radical" thus formed does not propagate the reaction further, but it is resonance stabilized inside the chromanol ring. It is then quickly recycled back to the corresponding tocopherol thereby allowing each tocopherol molecule to repeat this quenching process, protecting up to 10^3 to 10^6 PUFAs at lower peroxide values. Due to structural differences between the tocopherol homologues, the antioxidant activities vary in the order of: delta > beta > gamma > alpha (in vitro) and alpha > beta > gamma > delta (in vivo). This highest activity of the alpha homologue within living tissues is due to the action of hepatic alpha-tocopherol transfer protein that occurs in higher levels in plasma and tissues, allowing alpha-tocopherol to be preferentially retained and incorporated into lipoproteins. Additionally, tocopherols also react with singlet oxygen or other reactive species (ROS) as part of their antioxidant functions (Špika et al., 2016).

14.5.2 Degradation of alpha tocopherol

Tocopherols are oxidized by ROS, mainly by lipid peroxyl radicals; the mechanism can proceed differently (Fig. 14.6). Oxidation of tocopherols to tocopheryl radicals may occur by one-electron transfer, which can be rereduced to tocopherols by an ascorbate–glutathione system (Asc/GSH). In absence of ascorbate or glutathione, tocopheryl radicals can form adducts (quinones) or self-coupling products (dimers and/or trimers). In another oxidation pathway involving a two-electron transfer and singlet oxygen, tocopherols get converted to hydroperoxide, which irreversibly gets hydrolyzed to tocopherol quinone (TQ). This conversion happens in chloroplast lumen under mildly acidic conditions. TQ can be enzymatically transformed to tocopherol quinol (TQH_2), catalyzed by NADPH-dependent reactions. Both TQ and TQH_2 formed from alpha-tocopherol elucidate antioxidant properties (Špika et al., 2016).

14.6 Bioavailability

Bioavailability of food is the fraction of food ingredients placed at the disposal of tissues after ingestion. The bioavailability of tocopherols, commonly known as Vitamin E, in humans, is assessed using the level of plasma tocopherol. This availability is essential for biological activity, as this fraction will only contribute toward our physiological activities. Out of the four vitamers (homologues) of tocopherol (vitamin E), α-tocopherol is the dominant fraction present in the human body and has the highest biological activity. β- and γ-tocopherol have been shown to have reduced vitamin activity (10%–30%), whereas δ-tocopherol has no activity (Reboul, 2017). In another definition, bioavailability refers to the ingested component that becomes accessible to absorption in the gastrointestinal (GI) tract, followed by its metabolism and further distribution in the body. Bioavailability constitutes three steps: bioaccessibility, absorption, and transformation of the ingested component (vitamin E in this case). To make referencing easier, we shall use the term "vitamin E" synonymously with "tocopherol" from this point onward.

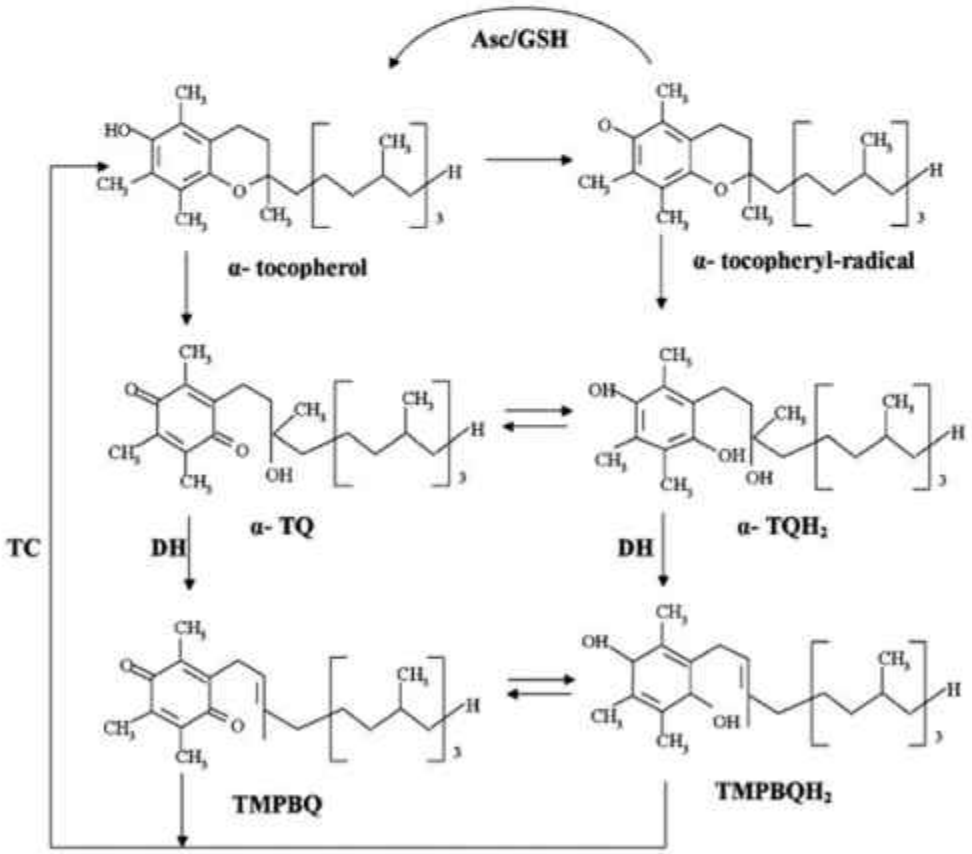


FIGURE 14.6 Possible pathway for degradation of alpha tocopherol. *α-TQ*, α-tocopherol quinone; *α-TQH2*, α-tocopherol quinol; *Asc/GSH*, ascorbate–glutathione cycle; *DH*, unknown dehydratase; *TC*, tocopherol cyclase; *TMPBQ*, 2,3,5-trimethyl-6-phytyl-1,4-benzoquinone; *TMPBQH2*, 2,3,5-trimethyl-6-phytyl-1,4-benzoquinol. *From Lushchak, V. I., & Semchuk, N. M. (2012). Tocopherol biosynthesis: chemistry, regulation and effects of environmental factors.* Acta Physiologiae Plantarum, 34*(5), 1607–1628. https://doi.org/10.1007/s11738-012-0988-9.*

Firstly, let us go through how vitamin E is metabolized in the body. Vitamin E is fat-soluble, and is shown to be associated with major lipids and absorbed mainly in the upper GI tract. However, its absorption is not very efficient. Metabolism of vitamin E in the upper GI tract includes emulsification; incorporation into the micelles; transportation through the unstirred water layer (glycocalyx); assimilation by an apical membrane of enterocytes (intestinal absorptive cells); solubilization into the intestinal lipoproteins; and secretion out of the intestinal cells into the lymph or into the portal vein. The initial phase is the dissolution of vitamin E in the lipid phase of the meal it is present in, which occurs during mastication of food. This is followed by the action of gastric enzymes (pepsin, amylase, and gastric lipase), which assist in the release of vitamin E from the food matrix. It is well established that α-tocopherol does not undergo any significant degradation or absorption in the stomach (Reboul, 2017). In the duodenum (first part of the small intestine), the digestive enzymes (proteases, amylases, and lipases) continue degrading the food matrix, thereby contributing toward further release. Here, the absorption mechanism of vitamin E is quite similar to that of dietary fats. Vitamin E requires biliary and pancreatic secretions in order to form micelles for subsequent uptake by the intestinal epithelial cells (Traber, 2007). The main site for vitamin E absorption is supposedly the midsection of the GI tract. Intestinal absorption of vitamin E is quite complex (Gagné et al., 2009); it is partly mediated by class-B type-1 (SR-B1) scavenger receptors, which are also involved in cholesterol uptake (Reboul, Richelle, et al., 2006). Other mechanisms include intracellular trafficking proteins; modulation of nuclear receptors; and activity of ATP-binding cassette transporters (Traber, 2004). The efficiency of vitamin E absorption is not similar along the intestine; the major sites are where the concentration of vitamin E in micelles and possibly vesicles is the highest. Also, the repartition of vitamin E transporters and distribution of SR-B1 scavengers are not uniform (Borel et al., 2001; Reboul et al., 2007).

The efficiency of vitamin E transportation across the intestinal wall is quite variable ranging from 10% to 95% (Borel et al., 2013; Emmanuelle Reboul, 2017). However, in one study where deuterium-labeled vitamin E was studied for absorption, the range dropped to 10%–33% (Bruno et al., 2006). There are numerous factors that modulate vitamin E bioavailability. A mnemonic term '**SLAMENGHI**" is currently in considerable use to list all factors contributing to vitamin E bioavailability (Desmarchelier et al., 2018, pp. 1181–1196). This term was initially proposed to access carotenoids bioavailability and other fat-soluble micronutrients (West & Castenmiller, 1998). Each term corresponds to one factor: **S** for "**S**pecies of vitamin E" (referring to relative bioavailability of the vitamers); **L** for "Molecular **l**inkages" (e.g., esterification of vitamin E); **A** for "**A**mount of vitamin E consumed in a meal"; **M** for "**M**atrix in which vitamin E is incorporated" (e.g., vegetable oil or supplement); **E** for "**E**ffectors of absorption" (i.e., the effect of other nutrients or drugs); **N** for "**N**utrient status of the host with respect to vitamin E levels"; **G** for "**G**enetic factors"; H for "**H**ost related factors" (viz. individual characteristics such as age, sex, pathologies, etc.); and **I** for "Mathematical **i**nteractions" (referring to interacting effects of two or more of the described factors).

Species of vitamin E—There is less number of studies regarding the variation of vitamin E species in humans. Overall, it has been reviewed by Desmarchelier et al. (2018, pp. 1181–1196) that the relative bioavailability of stereoisomers, *RRR*- and *SRR*-α-tocopherol bioavailability, presented with no significant difference in human studies. Also, α- and γ-tocopherol bioavailability carried out with a low number of human subjects did not reveal any significant difference between them as well.

Molecular linkages—Mostly, dietary vitamin E is consumed in its free form or as supplements. Supplements are usually esterified to protect the hydroxyl group against oxidation. However, no significant differences in bioavailability in human were observed for the free form or esters of succinates and acetates of tocopherols in healthy individuals (Burton et al., 1988; Cheeseman et al., 1995; Nagy et al., 2013).

Amount of vitamin E—The studies comparing nutritional doses with supplemental or pharmacological doses are currently lacking. It has been assumed that the efficiency of vitamin E absorption decreases with increased dose owing to blood saturation. On the contrary, there is no strict evidence of the same. However, one case study has shown that vitamin E levels in chylomicrons increased on the consumption of meals containing large dosages (432 or 937 IU) of α-tocopherol acetates (Borel et al., 1997).

Matrix effects—The matrix within which vitamin E is incorporated is a key factor that governs its bioavailability. Vitamin E needs to be bioaccessible, i.e., to become available for absorption. The bioaccessibility is quite variable among food matrices. For instance, in banana, lettuce, and bread, vitamin E is almost completely bioaccessible, whereas in apples and orange it is quite low (Reboul, Klein, et al., 2006). It has also been found that the addition of eggs to durum wheat pasta reduces the bioaccessibility of vitamin E from around 70%–50% (Werner & Böhm, 2011). In the case of juices blended with whole milk, an increase in bioaccessibility was observed (Cilla et al., 2012). In other studies, where oil-in-water emulsions fabricated with natural emulsifiers and long-chain triglycerides were used, better bioavailability of α-tocopherol was observed (Yang et al., 2017).

Effectors of absorption—Different authors (Desmarchelier et al., 2018, pp. 1181–1196; Reboul, 2017) have concluded from various studies that the amount of dietary fat in a food matrix facilitates vitamin E extraction, stimulates biliary secretion, and promotes micelle formation to increase its bioaccessibility. For example, consumption of toasted bread with butter or cereals with whole fat milk or raw vegetables consumed with canola oil and eggs led to better absorption of vitamin E, as compared to consuming the same without the fat components. On the other hand, the presence of certain micronutrients like vitamin C, carotenoids, and polyphenols negatively impacts intestinal absorption of tocopherol (Reboul et al., 2007). Whereas, with respect to dietary fibers intake, no adverse effects on vitamin E absorption was concluded among different studies concerning rats as well as humans (Desmarchelier et al., 2018, pp. 1181–1196). However, further studies are needed to identify the impact of various other micronutrients and draw real conclusions.

Nutrient status of the host—Vitamins being essential and large amounts of fat-soluble vitamins can lead to toxicity; it is suggested that vitamin E absorption is mediated by the vitamin E status of the host. Studies have suggested that tocopherols can modulate directly or indirectly several nuclear receptors and can act as transcriptional factors for genes encoding proteins for vitamin E uptake (Borel et al., 2013; Desmarchelier et al., 2018, pp. 1181–1196).

Genetic as well as host-related factors—The involvement of intestinal proteins/enzyme in vitamin E absorption has stimulated the hypothesis that genetic factors can modulate vitamin E absorption efficiency. Intestinal absorption of vitamin E requires normal digestive functions, and thus people with genetic diseases such as cystic fibrosis and abetalipoproteinemia suffer from impaired vitamin E absorption. Further, the effect of sex on vitamin E absorption is difficult to access in males and females, as female hormones affect lipid and lipoprotein metabolism differently (Borel et al., 2013). However, a nonsignificant difference in vitamin E levels has been observed in certain studies (Desmarchelier et al., 2018, pp. 1181–1196). Considering aging effects, it has been observed that the bioavailability of α-tocopheryl acetate is apparently lower in healthy older individuals than in younger ones (Borel et al., 1997), which were attributed to age-related altered digestive functions.

Mathematical interactions—This includes synergistic or antagonistic effects on vitamin E absorption when considering the interaction of two or more factors with one another.

Overall understanding of various factors relating to vitamin E absorption can ultimately transfer benefits leading to higher bioavailability, and one can suggest a personalized recommendation for individuals to confer potent health benefits.

14.7 Stability, safety, and toxicology

Lipid oxidation is the major cause of quality deterioration of food products and the destruction of biological membrane structures. Lipid soluble antioxidants such as tocopherols can prevent the oxidation of lipids by competing with unsaturated fatty acids for the lipid peroxy radicals. The reaction rate of tocopherol is 100,000 times faster than the lipid with the lipid peroxy radical (Niki et al., 1984). However, tocopherols themselves may degrade due to improper storage, presence of free radicals, exposure to molecular oxygen, light and elevated temperature, grossly leading to the loss of antioxidant activity, or their role as prooxidants may become available (Choe & Min, 2006; Pignitter et al., 2014). At higher concentrations, tocopherol loses their antioxidant activity or becomes prooxidants, whereas at lower concentrations they have the highest antioxidant activity. The antioxidant activity of tocopherol is inversely related to the stability of tocopherol in vegetable oil (Jung & Min, 1992). The α-tocopherol of soybean oil due to its higher antioxidant activity is destroyed faster than the γ- and δ-tocopherol of soybean oil during storage at 50 °C (Fig. 14.7). Moisture content, the types of oil, and the concentration of tocopherol homologues significantly influence the stability of tocopherol homologues (Jung & Min, 1992). The decomposition of α-tocopherol can be reduced by forming a protein–nutrient complex of α-tocopherol with β-lactoglobulin (Liang et al., 2011).

Vitamin E deficiency is a common phenomenon in humans with fat malabsorption syndromes. Primarily, α-tocopherol is administered in humans to prevent vitamin E deficiency. Tocopherols as food additives have the Generally Recognized as Safe (GRAS) status in the United States. The recommended daily intake of vitamin E is reported as 15 mg (Dietary Reference Intakes for Vitamin C, Vitamin E, Selenium and Carotenoids: A Report of the Panel on Dietary Antioxidants and Related Compounds, Subcommittees on Upper Reference Levels of Nutrients and Interpretation and Uses of Dietary Reference Intakes, and the Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Food and Nutrition Board, Institute of Medicine., 2000). However, the recommended daily intake may increase with the increase in the content of unsaturated fatty acids in a diet (Belitz & Grosch, 1999). Apparently, the adequate intake of this vitamin is not defined and may vary among the population of the world depending on the physiological conditions and diet. Vitamin E daily intake can be increased up to 300 mg without any complications (Yap et al., 2001). Even short-term high-doses and supranutritional (more than nutritionally required) doses administration of vitamin E has no reported adverse effects on health (Curtis et al., 2014; Final Report on the Safety Assessment of Tocopherol, Tocopheryl Acetate, Tocopheryl

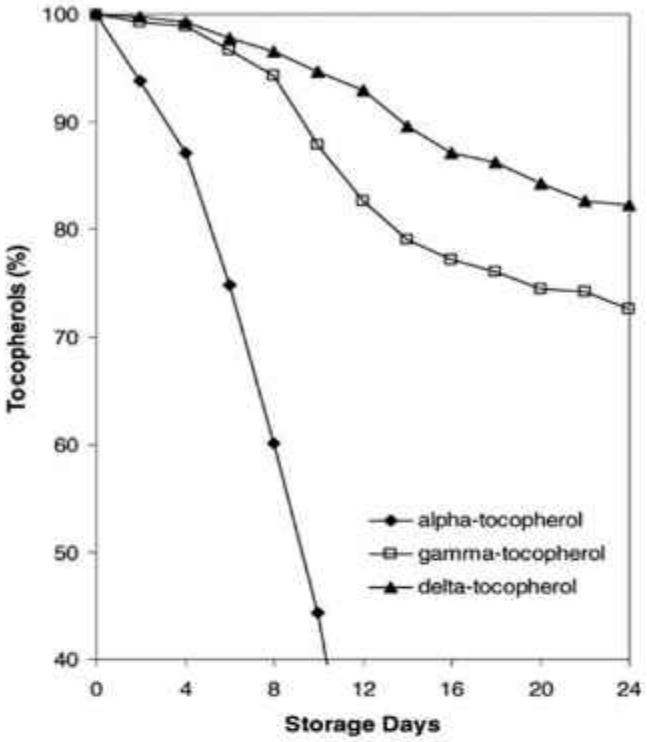


FIGURE 14.7 Degradation of α-, γ-, and δ-tocopherol in soybean oil on a storage time scale of 24 d at 50°C. *From Player, M. E., Kim, H. J., Lee, H. O., & Min, D. B. (2006). Stability of α-, γ-, or δ-Tocopherol during soybean oil oxidation.* Journal of Food Science, 71(8), C456–C460. https://doi.org/10.1111/j.1750-3841.2006.00153.x.

Linoleate, Tocopheryl Linoleate/Oleate, Tocopheryl Nicotinate, Tocopheryl Succinate, Dioleyl Tocopheryl Methylsilanol, Potassium Ascorbyl Tocopheryl Phosphate, and Tocophersolan, 2002). However, the risk of developing side effects in some group of patients at the risk of cardiovascular diseases such as thrombotic risk cannot be ruled out and supplementation must be considered with precautions (Final Report on the Safety Assessment of Tocopherol, Tocopheryl Acetate, Tocopheryl Linoleate, Tocopheryl Linoleate/Oleate, Tocopheryl Nicotinate, Tocopheryl Succinate, Dioleyl Tocopheryl Methylsilanol, Potassium Ascorbyl Tocopheryl Phosphate, and Tocophersolan, 2002). Therefore at present, there is no need for recommendation of higher or supranutritional doses of vitamin E which may lead to health complications in the long term. Taking into consideration with regard to what we know at present, the efficacy and supplementation of vitamin E is worth investigating.

14.8 Applications (clinical and pathological): health benefits

14.8.1 Antioxidant activity

Prolonged oxidative stress could lead to the onset of many metabolic and lifestyle-associated disorders. Such stress is caused due to an imbalance of free radical generation. Free radicals are generated as an impact of various metabolic processes in human. Widely known free radicals such as hydroxyl, superoxide anion, peroxide, singlet oxygen, nitric oxide, etc., are very reactive and capable of damaging DNA, proteins, carbohydrates, and lipids in the cell, leading to unwanted biochemical reactions (Saikia & Mahanta, 2016). These biochemical reactions later lead to serious metabolic and nonmetabolic disorders in human. However, innate defense in humans against such radicals associated damage is modulated by enzymes like superoxide dismutase, glutathione peroxidase, and micronutrients that quench or scavenge such radicals (Lobo et al., 2010), acting as antioxidants. The antioxidant activity of vitamin E (α-tocopherol) is attributed to its ability to neutralize or intercept lipid peroxyl radicals ($LOO^{\cdot}$) thereby terminating the lipid peroxidation. However, vitamin E is not much of a potent scavenger of other radicals, viz.,$^{\cdot}OH$ and alkoxyl radicals ($RO^{\cdot}$) (Nimse & Pal, 2015). A recent study conducted on rats demonstrated that the effectiveness of vitamin E supplementation was effective for decreasing lipid peroxidation and attenuating oxidative stress (Abdulaziz et al., 2020). Studies have also demonstrated improved oxidative stress and antioxidant status in elderly women on intakes of dietary antioxidants, such as carotenoids,

vitamin E, and vitamin C (Boaventura et al., 2020). A recent review has suggested that vitamin E supplementation may lead to increased exercise performance in athletes (Higgins et al., 2020). The same study suggested that vitamin E tends to block free radicals generated during exercise which act as signaling molecules as protection against physical stress. In action, quenching of such radicals supposedly enhances endurance during exercise or sports performance. Thus, it is simple to deduce that vitamin E intake will potentially lead to better antioxidant status in the body, possibly providing protection against health disorders (Lobo et al., 2010).

14.8.2 Antiinflammation

Inflammation is a result of an overreactive immune response to a harmful stimulus (chemical or biological). On such a stimulus, a cascade of reactions is initiated. Inflammation is characterized by the overproduction of reactive oxygen/nitrogen species and pro-inflammatory mediators, including lipid mediators, notably prostaglandins and leukotrienes, and cytokines such as TNF-α and interleukin-6 (IL-6). Chronic inflammation is a major contributor to the pathogenesis of chronic diseases such as cancer, cardiovascular diseases, rheumatoid arthritis, and asthma. Studies on tocopherols dosage on varied animal models induced with burn injury, airway inflammation, and colon inflammation have suggested a significant decrease in inflammatory factors (Jiang, 2014). Vitamin E indirectly reduces inflammation by affecting inflammatory mediators (Lewis et al., 2019). A meta-analysis study carried out by taking into consideration 33 randomized clinical trials suggested that α-tocopherol proved to be more effective in reducing serum levels of C-reactive proteins and IL-6 and overall alleviating subclinical inflammation in adults (Asbaghi et al., 2020). Studies pertaining to role of inflammation in arthritis, vitamin E supposedly retards the progression of osteoarthritis by ameliorating oxidative stress and inflammation of the joints (Chin & Ima-Nirwana, 2018).

14.8.3 Immunity

Having a strong immunity is of utmost importance. It is widely being noted owing to a prevailing scenario where outbreaks of known or unknown infections can cause a toll on human health. The healthy immune response is linked to increased immunoglobulin levels, antibody responses, lymphocyte proliferation, and interleukin (IL)-2 productions. Numerous studies on dietary supplementation on varied animal and human models have shown the immunomodulatory effect of vitamin E. Vitamin E functions as an antiinflammatory agent by modulating T cell function by directly impacting T cell membrane integrity, signal transduction, and cell division, and also indirectly by affecting other inflammatory mediators (Lewis et al., 2019). In animal studies with cows, chicken, and rats, vitamin E supplementation led to overall increased immune responses (Lee et al., 1998). However, with human subjects, multiple studies have reported increased immune function, but at levels more than dietary recommendation (Lewis et al., 2019). Still, there are other studies suggesting no significant effects on immune functions. This might possibly be due to variation in dosage, age of subjects, and determination methodologies utilized in different studies (Lee & Han, 2018). For mice model studies on wound infections with methicillin-resistant *Staphylococcus aureus*, and *Streptococcus pneumoniae* infection of the respiratory tract, vitamin E therapy resulted in good immune responses and subsequent lower microbial counts (Bou Ghanem et al., 2015; Pierpaoli et al., 2017). In humans as well, lower levels of infection in pneumonia, malaria, and the common cold have been reviewed and reported (Lee & Han, 2018). It would be beneficial to focus on further research leading to the identification of optimal doses specific to age health conditions, nutritional status, and genetic variability.

14.8.4 Cancer

Owing to its strong antioxidant nature, tocopherols are linked to reduced cancer risks. Certain studies have shown that deficiency of vitamin E is associated with increased risk in certain cancers (Wilson & Mucci, 2019). Vitamin E vitamers have been reviewed to be effective in inducing growth arrest, apoptosis, autophagy, and endoplasmic reticulum stress in cancer cells (Petronek et al., 2021). However, other studies with human subjects revealed a nonsignificant impact of vitamin E on the prevention or delay of lung cancer and pancreatic carcinoma and urinary tract cancer in humans (Petronek et al., 2021). Nevertheless, it has been suggested that vitamin E can be used as an adjuvant along with other active components such as selenium, doxorubicin for cancer prevention (Fernandes et al., 2018; Fred Gey, 1998; Wilson & Mucci, 2019). Cancer cell line and animal model studies have suggested that tocopherols help in modulating nuclear receptors such as PPARγ (by upregulation) and ERα (by downregulation) to induce cell proliferation and apoptosis in breast cancer (Das Gupta & Suh, 2016). Overall, the impact of tocopherols is minimal, and the data pertaining to its effects are rather inconsistent.

14.8.5 Metabolic disorders

Metabolic disorders constitute a cluster of medical conditions majorly including obesity, hyperglycemia, dyslipidemia, and hypertension. Vitamin E is suggested as a promising agent for the treatment of such disorders (Wong et al., 2017). The impact of vitamin E in diabetic patients has been extensively carried out. One study carried out on Finnish men and women revealed that dietary intake of vitamin E was significantly associated with a reduced risk of type II diabetes (Montonen et al., 2004). In one study with 44 women aged between 20 and 50 years, it was assessed that consumption of grape seed oil rich in tocopherols improved insulin resistance in obese women (Irandoost et al., 2013). Next, in a clinical study in type I and type II diabetic patient vitamin E supplementation was found to delay the onset of diabetic and reduce blood pressure (Baburao Jain & Anand Jain, 2012). In a recent study, vitamin E evaluation on healthy subjects from Singapore suggested that vitamin E could play a role in delaying the onset of type II diabetes (Bi et al., 2019). Dyslipidemia is characterized by increased triglycerides and lowering of low-density lipoproteins (LDLs). Studies have suggested that supplementation of tocopherols do not confer any benefits in dyslipidemia as such but supplementing with tocotrienols or tocotrienol-rich fractions resulted in significant benefits (Wong et al., 2017). On the other hand, a contrasting effect of vitamin E intake was reported in recent Mendelian randomization-based observational study, in which vitamin E was linked to elevated levels of LDL and triglycerides (Wang & Xu, 2019). Thus, future research on revaluation of the therapeutic potential of vitamin E along with an emphasis on mechanistic understanding will be necessary to better confirm and elucidate beneficial effects of vitamin E in metabolic disorders.

14.8.6 Skincare

Vitamin E has been used in dermatological applications for more than 50 years now as a potent antioxidant. Skin is subjected to damage owing to continuous solar radiations which lead to lipid peroxidation in membranes and age-related collagen cross-linking. Tocopherols are found to protect against both lipid peroxidation and collagen cross-linking. Tocopherols stabilize cell membrane by inhibiting the oxidation of arachidonic acid of membrane phospholipids. Also, the topical application of vitamin E has been reviewed to reduce erythema, sunburned cells, UV-inflicted skin damage, and photocarcinogenesis (Schagen et al., 2012). More recently, a study reported synergistic effects of vitamin E with ascorbic acid to improve skin health and brightening effects in the case of female subjects (Rattanawiwatpong et al., 2020), suggesting combinatorial therapies to be better than monotherapies. In another study, authors reported that topical formulation with phosphorylating α-tocopherol monomers better diffuse into skin epidermis thereby increased potential toward damage against UV radiations (Saleh et al., 2021). Existing studies considering preclinical and clinical studies have suggested the benefits of Vitamin E in the case of atopic dermatitis (Ehterami et al., 2019; Teo et al., 2020). Recent studies are more targeted toward enhanced delivery of α-tocopherol in the skin using nanoemulsions (Harun et al., 2021) to benefit skin health.

14.8.7 Eye health

Oxidative stress leads to oxidative damage to the eye lens and is regarded as the major factor leading to the pathogenesis of senile cataract (Nartey, 2017). A meta-analysis evaluation suggested that both dietary and supplemental intake of vitamin E could significantly be associated with reduced age-related cataract development (Zhang et al., 2015). Like other antioxidants, tocopherols are also supposed to minimize oxidative damage. In a recent study, nanomicelles consisting of inulin-D-α-tocopherol succinate bioconjugates loaded with curcumin were able to protect the blood−retina barrier against high glucose levels, thus suggesting that tocopherol can prevent diabetes-induced retinopathy (Rassu et al., 2021). The lens contains α-crystallin (a molecular chaperone) whose function is to maintain the correct folding of other protein and is also affected by oxidation. In one study, it was observed that rats injected with selenite-α-tocopherol had better α-crystallin function when supplemented with coffee. The study suggested that targeting such chaperone activity can be useful in the development of anticataract drug (Nakazawa et al., 2017). Overall, synergistic beneficial effects on eye health for tocopherols are observed with other antioxidants.

14.8.8 Liver health

Nonalcoholic fatty liver disease (NAFLD) is referred to as the accumulation of excessive fat in the liver, without alcohol consumption. It is also strongly associated with obesity and related metabolic disorders such as insulin resistance, dyslipidemia, and oxidative stress. NAFLD also leads to nonalcoholic steatohepatitis (NASH), characterized histologically

by the presence of hepatic steatosis, lobular inflammation, and hepatocyte ballooning leading to cirrhosis and hepatocarcinoma (Hadi et al., 2018; Pacana & Sanyal, 2012). A significant improvement in steatosis, inflammation, ballooning, and resolution of steatohepatitis in adult nondiabetic patients with aggressive NASH can be brought about with vitamin E therapy (Pacana & Sanyal, 2012). From numerous studies on animals, it has been concluded that vitamin E therapy could recover depleted hepatic glutathione (depletion is linked with oxidative stress and marked increase in hepatic fibrosis); ameliorate steatosis, necroinflammation, hepatic stellate cell activation, and collagen mRNA expression (triggered by increase in oxidative stress and metabolic abnormality due to NAFLD); and reduce serum transaminase levels (elevated levels are associated with NAFLD). These effects have been associated with suppressed expression of the fibrotic genes TGF-β and MMP-2, inflammatory factor COX-2, and proapoptotic genes (Bax), inhibition of factor kappa B (NFkB), and increased hepatic superoxide dismutase activity. On the contrary, multiple human clinical trials with long-term vitamin E monotherapies have reportedly shown both significant and no significant improvement on liver biochemistry and histopathology. However, long-term (>2 years) combinatorial treatment strategies such a vitamin E + ursodeoxycholic acid or vitamin E + vitamin C + atorvastatin have demonstrated overall modest benefits in liver health and histopathological improvements in majority of adults and pediatric patients (Abdel-Maboud et al., 2020; Hadi et al., 2018). On meta-analysis of a controlled clinical trial carried out, the effect of dosage and formulation variation among various clinical studies makes it difficult to ascertain their effects comparatively (Amanullah et al., 2019). Still, there is a need for further studies to comprehend the physiology of NADH/NASH which would help us to better understand and develop a targeted approach for treatments using vitamin E.

14.9 Conclusion

This chapter presents essential and relevant information on the sources, extraction, antioxidant properties, and health-benefiting properties of tocopherols, which are the most important and active forms of vitamin E. After a century of studies since its discovery, some aspects of tocopherols are still far from being completely compiled in literature, especially the nutritional recommendations, therapeutic applications, and disease prevention. Taking into account all these aspects, the research studies on this compound are gaining interest and hence, reemerged as a topic of intense research for the scientific community.

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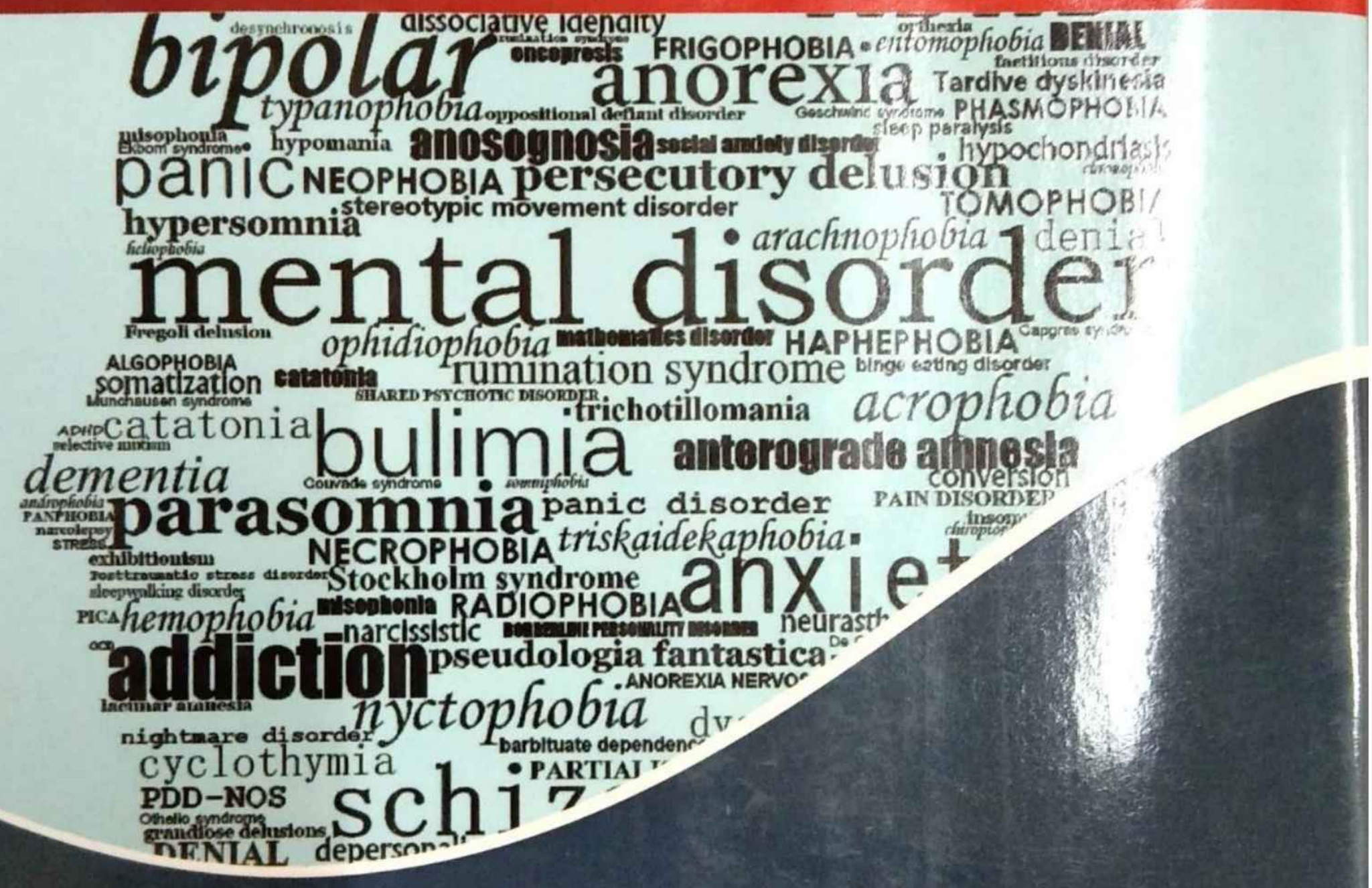

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Career Preferences of The Secondary School Students: A Meta-Analysis

Samiran Kalita[1], Nandita Chitrakar[1] and Nisanth P.M[2].

Abstract

The present study aims to explore the career preferences of the secondary school students. Career preference at the stage of adolescence is a very serious concern among youths and for their parents because the entire base of life is dependent at this crucial point of life. Career preference refers to decision made by a student on his/her future work, occupation or career or profession. It has been seen that career preference is very essential in student's life. Due to the advancement of science and technologies, various changes have been taken place over a period of time and in turn it also changes the perspectives of the career preferences. The present study is an attempt to analyse the pattern of career preferences of the secondary school students over the last three decades and also to reveal the factors that affects the career preferences of the secondary school students. This paper will also analyse the previous research findings to arrive at conclusions about the particular research in order to integrate the findings.

Keywords: Career Preferences, Productivity, Secondary school students.

[1]Research Scholar, [2]Assistant Professor, Department of Education, Rajiv Gandhi University, Arunachal Pradesh

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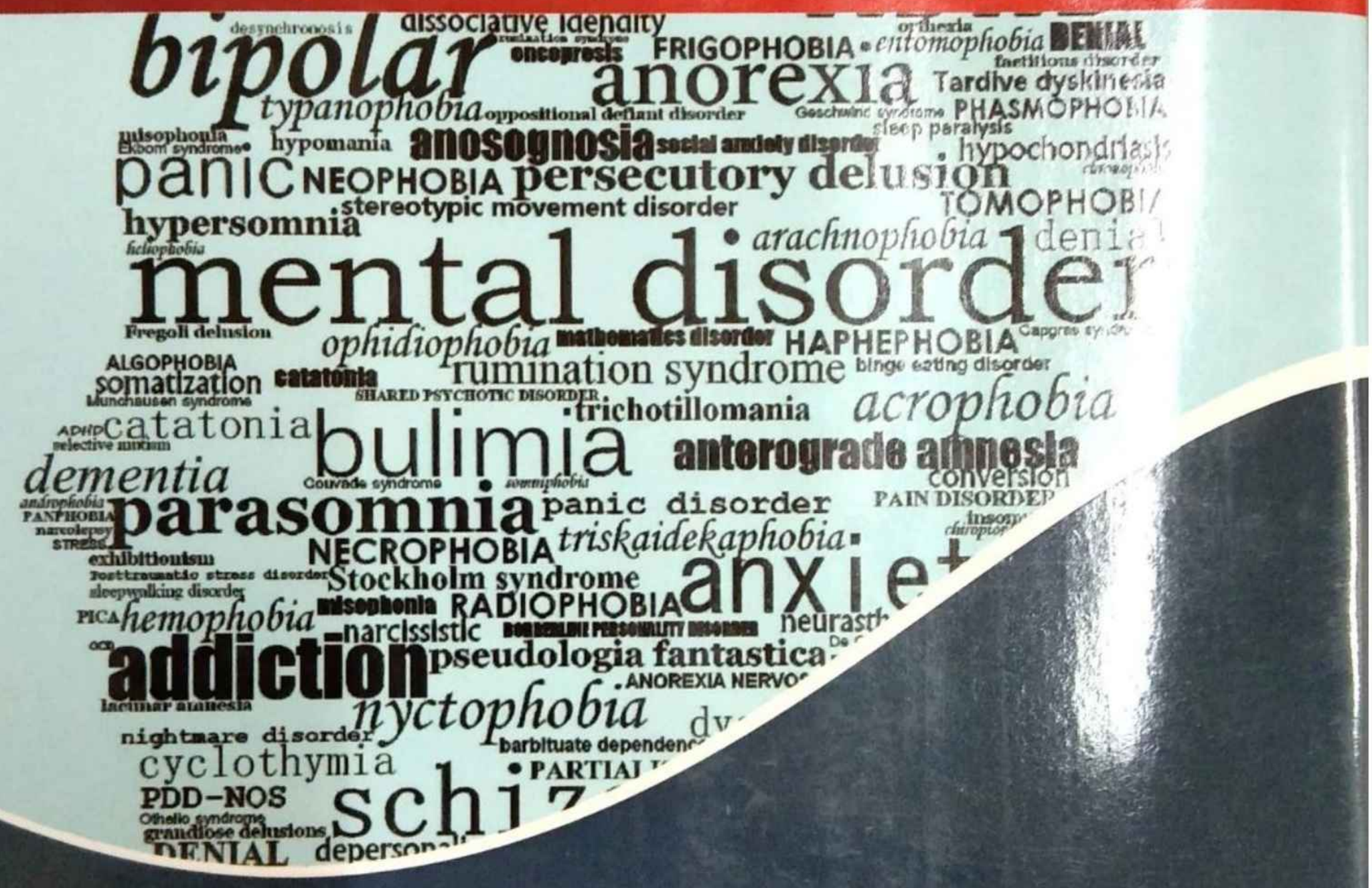

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21st Century Skills: Human *vs.* Machine

Nisanth. P. M.

Abstract

The digital age appeals to a transformative change in the teaching learning process. A constructive discourse is needed amongst the academia, researchers, teachers and stake holders of education on how to harness and fasten the teacher's role to imbibe 21st century skills from centuries commencing from ancient India to the contemporary times. The teacher needs to enrich her skills with an understanding of how students learn, how skills are developed, how knowledge is represented through different digital media. It will involve impound efforts on the construction of knowledge in the digital era. The learner does not have one epitome source of knowledge (teacher) but, a set of multiple digital resources to learn form. This aspect has become more significant with the occurrence and high penetration of Artificial Intelligence in the education sector. The aspect of this paper would focus on how Artificial Intelligence dominating on 21st century skills over humans.

Keywords: Education, Digital Age, Artificial Intelligence (AI), Education Technology

Introduction

The digital world of networked objects, such as computers, tablets, and phones, appears to be given in the vision of the world.

About the Editors

Dr. Prasanta Kumar Barik, an Assistant Professor at Rajiv Gandhi University, India was born in the district of Jharsuguda, Odisha in 1973. He has obtained his M.A. (Education), M.A (History) and Ph.D. in Education from Sambalpur University. He qualified UGC-NET examination in Education. His areas of interest and specialization are Higher Education, Teacher Education, Secondary Education and Pedagogy of Social Sciences. Currently, Dr. Barik is associated with Post graduate teaching and research work. He is a 'teacher educator too'. He has participated and presented in many national and international conferences, seminars, symposia, etc. He has published articles in journals, edited books at national and international repute. He acts a resource persons for various departments and colleges. He has completed a project work sponsored under ICSSR, New Delhi, India. He has also credited to publish a book titled "College Autonomy and Quality in Higher Education" along with his mentor Dr. Harihar Sahoo, Former Head, Department of Education, G.M. University, Sambalpur, Odisha.

Dr. Shishira Bania is currently working as a Lecturer in Education (SS), Department of Higher Education, Govt. of Odisha) in Bimalaraipur College under Sambalpur University, Odisha. He has done his Post Graduation in Education from G.M. Autonomous College (Now G.M. University) Sambalpur, Odisha; Post Graduation in Sociology from IGNOU, New Delhi and Post-Graduation in English from Odisha State Open University; M.Phil. in Education from Dr. P.M. Institute of Advanced Study in Education, Sambalpur, Odisha. He has qualified UGC NET and JRF in Education. He is awarded with Ph.D. degree in the subject Education from Sambalpur University, Odisha, India. He has more than 07 years of teaching experience. He has participated and presented many papers in National and International Seminars. He is the author of two Books. He has 18 research publications to his credit.

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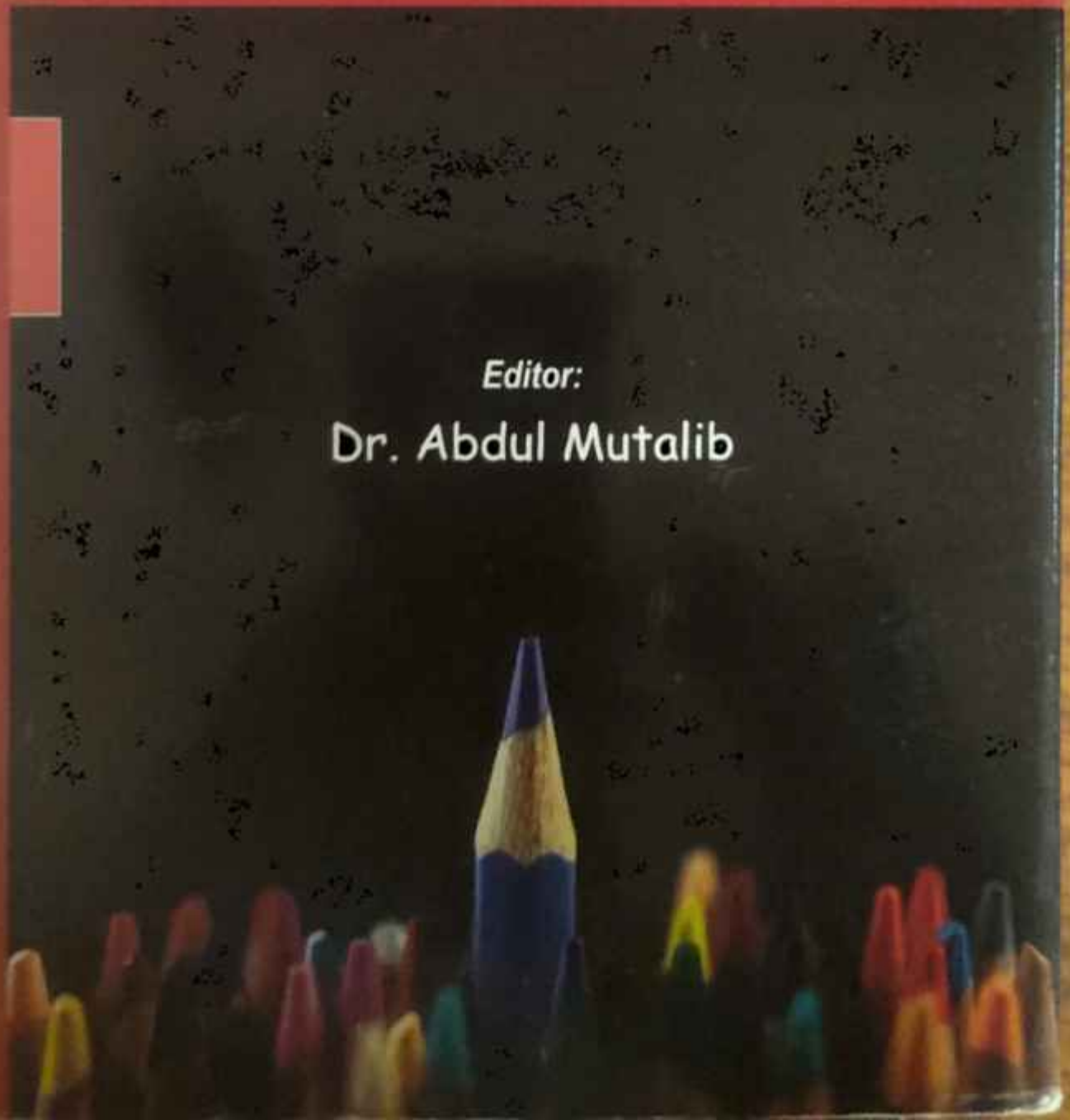

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6

CHANGE AND CONTINUITY IN *NIIPO APING* (BIRTHDAY) CELEBRATION IN APATANI SOCIETY —A Socio-cultural Study on Tribes of N.E. INDIA

PADI HANA*

Introduction

The earth is a special place for living being and there is no such planets consist of living organism and non - living co- existing side by side. The continuity of the species takes places by the process of reproduction and birth of new sibling. According to the historical growth of society, when the process of reproduction take place rapidly there is population growth and a type of society and communities is formed.

Human society is different from the animal world in terms of upbringing and socialization of the siblings. The introduction of new born baby into family is one of the fascinating and anticipating moments. Around the world the birth of child is rejoiced and celebrated in different manners and style. The

* Assistant Professor, Department of Sociology, Rajiv Gandhi University, Rono Hills, Doimukh (Arunachal Pradesh)

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ABOUT THE AUTHORS

DR PHILIP MODY- After teaching for more than 18 years, Philip Mody is currently an Associate Professor of Commerce in the Department of Commerce at the Rajiv Gandhi University. Dr. Mody has extensively published more than 135 research papers in recognized national and international journals, such as in Springer, Turkish Online Journal of Qualitative Inquiry (Scopus and TR Dizin Abstracting and Indexed), East African Scholars Journal of Economics, Business and Management- Kenya, International Journal of Research in Commerce and Management, the International Review of Business and Finance, Shodh Sansar Bulletin so on and so forth. The author has published 20 books like- 'Role of Ginger in Socio-Economic Development of Lower Dibang Valley' (LAMBERT Academic Publishing KG, Germany, 2012), 'Business Research in Arunachal Pradesh- Vol I' etc. Till date, Dr. Mody has participated and presented papers in more than 90 national and international seminars and conferences. Further, he has completed many Major Research Projects. The field of specialization of the author is HRM and Organizational Behavior with Leadership and Motivation being his core areas of research interest.

MR. MOBOM NYORAK is a Ph.D. research scholar in Rajiv Gandhi University, Arunachal Pradesh who obtained his M.Phil. degree in 2018 and M. Com degree in 2016 from the same University in 2016. In 2014, he completed his B.Com degree from Donyi Polo Government College, Kamki, Arunachal Pradesh. He had a short stint in Department of Commerce in Saint Claret College, Ziro and Arunodoya University, Lekhi, Arunachal Pradesh, as an Assistant Professor (Accounting and Finance).

His area of interest in teaching and research includes Financial Management, Corporate Accounting, Managerial Economics and organizational behaviour. He has also qualified National Eligibility Test several times and he was awarded Junior Research Fellow by University Grant Commission in 2019. He has presented and participated in several national level and state level seminars.

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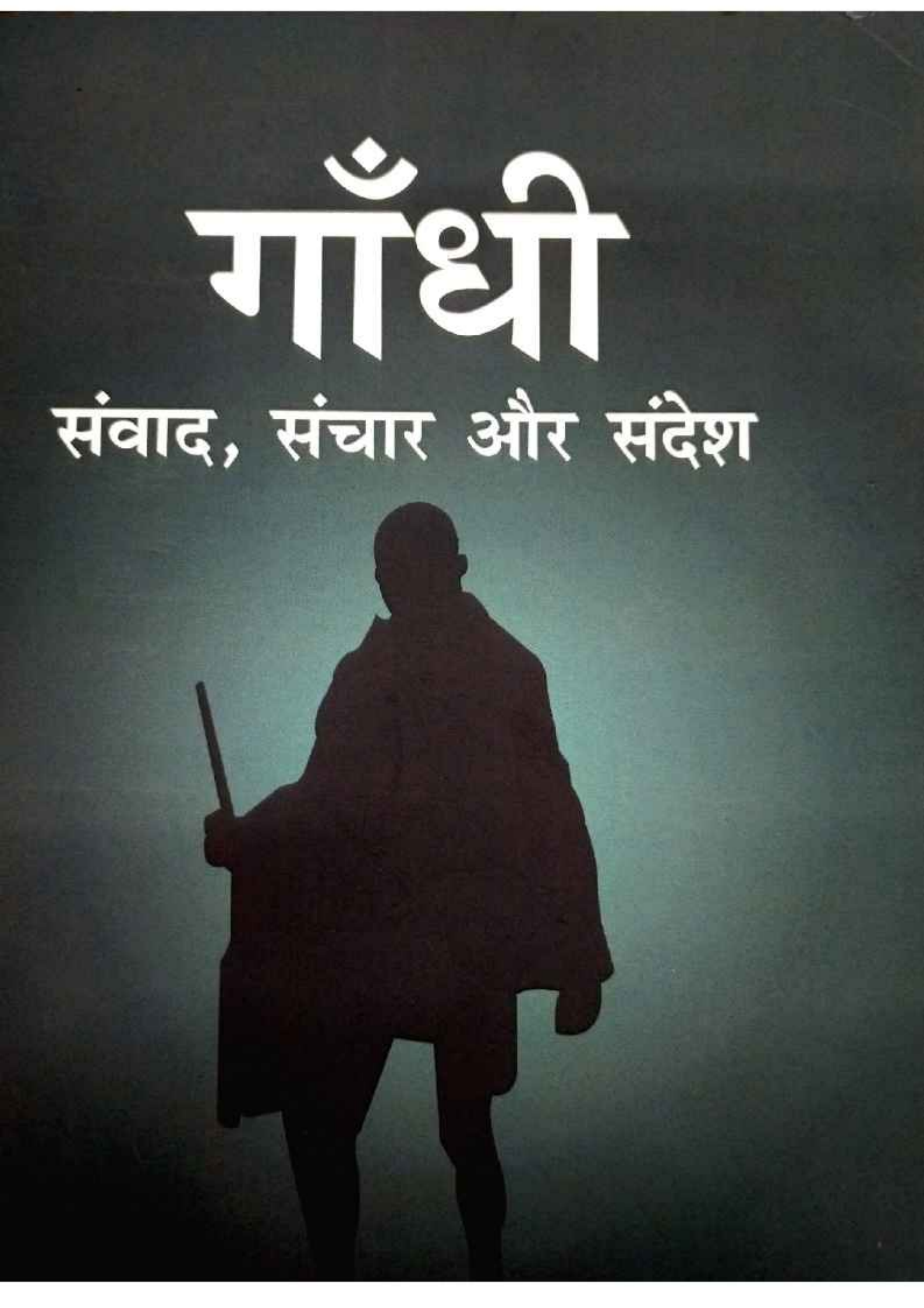

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नई दिल्ली-110096
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radhikabooks198@gmail.com
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गाँधीजी पत्रकारिता के राष्ट्रीय प्रतिमान

डॉ. अवधेष नारायण मिश्र[1] एवं डॉ. राजीव रंजन प्रसाद[2]

आजादीपूर्व स्वराज के लिए प्रयास करने वाले राजनीतिज्ञों में गाँधीजी का कद बड़ा और सबसे अलग है। महात्मा गाँधी जनप्रियता के शिखरबिन्दु थे। हर क्षेत्र और अनुशासन में उनकी चर्चा आदरपूर्वक होती थी। उनके कहे का व्यापक प्रभाव और जन–जन तक असर देख सकते हैं। युगीन सम्पादकों ने गाँधीजी को हाथोहाथ लिया। पत्रकारिता में गाँधी युग का श्री गणेश हुआ। कुछ ख़ास बौद्धिक प्रवृत्तियाँ थीं जो गाँधी युग में तेजी से फैलीं तथा पत्रकारिता में अपने विशेष प्रभाव को अंकित करती चली गईं। राष्ट्रभाषा के मुद्दे पर भाषाई एकजुटता का समर्थन गाँधीजी ने खुलकर किया। डॉ. श्रीषचन्द्र जैसवाल गाँधी युग को रेखांकित करते हुए कहते हैं–"महात्मा गाँधी ने हिंदी को राष्ट्रभाषा के रूप में स्वीकार किया था। स्वयं गुजराती भाषी होते हुए भी गाँधीजी ने हिंदी के व्यापक प्रचार–प्रसार को अपने राष्ट्रीय कार्यक्रम

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1. बीते दो दशकों से भी अधिक समय से हिंदी पत्रकारिता आदि विषयों के शिक्षण–प्रशिक्षण और शोध क्षेत्रों में सक्रिय। मीडिया पर गंभीर दृष्टि के साथ लगातार अवलोकन करने वाले डॉ. राजीव वर्तमान में राजीव गाँधी केंद्रीय विश्वविद्यालय, अरूणाचल प्रदेश में हिंदी विभाग में असिसटेंट प्रोफेसर हैं।
2. हिंदी के सेवानिवृत्त प्राध्यापक हैं।

में सम्मिलित किया था। वे यह जानते थे कि हिंदी का आश्रय लिए बिना वह अपने आन्दोलन को राष्ट्रीय स्वरूप प्रदान नहीं कर सकते थे। गाँधीजी द्वारा स्वयं हिंदी पत्रों का प्रकाशन इस बात का प्रमाण था कि वह हिंदी को कितना महत्त्व देते थे। 'हिंदी नवजीवन' और 'हरिजन सेवक' के माध्यम से गाँधीजी ने भारत के हर भाग में बसे हिंदीभाषियों तक अपने विचारों को पहुँचाने का प्रयास किया था।" भाषाई मुद्दे पर गाँधीजी हिंदी के पक्ष–समर्थन में खड़े थे। उनका दृढ़मत था कि राष्ट्रीय हित सर्वप्रमुख है। दरअसल, गाँधी की खुली दृष्टि उदार, समन्वयवादी थी और व्यापक राष्ट्रीय हितों के लिए क्षेत्रीय या जातीय हितों की कुर्बानी करने के लिए सदा तत्पर रहती थी। गाँधी इस बात को बखूबी जानते थे कि अनेक पत्र–पत्रिकाएँ ऐसी हैं जो जातीय, क्षेत्रीय, धार्मिक और भाषागत संकीर्णता से ग्रस्त थीं और उनमें कट्टरता की भावना स्पष्ट रूप से मुखरित होती थीं। ऐसे में गाँधीजी ने 'भाषा–सेतु' बनने का काम किया। उनकी भाषा सम्बन्धी स्पष्टता या कहें बेबाकीपन ने हिंदी के प्रति लोगों के दुराव और द्वंद्व को पाटने की न सिर्फ पूरी कोशिश की, अपितु राष्ट्रभाषा के रूप में हिंदी की स्वीकार्यता को आगे बढ़ाने का काम भी कारगर तरीके से किया। गाँधीजी की आलोचना प्रायः हिन्दुस्तानी–आंदोलन के पक्ष में होने के कारण की जाती है। यह अलग से बात करने का विषय है। लेकिन इस बात में सौ फीसदी सचाई है कि गाँधी हिंदी के पक्ष–समर्थन में स्वयं हिंदी में काम करते हुए खड़े थे। हिंदी भाषा की दावेदारी तथा इसके अखिल भारतीय स्वरूप को मजबूती प्रदान करने का प्रयास कर रहे थे।

गाँधीजी राजनीतिक मनुष्य ही थे, लेकिन उनका व्यक्तित्व विराट था। पत्रकारिता उनकी कर्मभूमि थी। उनके विचार–दर्शन, मत–अभिमत, समझ–चेतना, विवेक–दृष्टि को समझना हो, तो गाँधी के पत्रों की ओर मुड़ना और उन्हें देखना आवश्यक होगा। गाँधीजी युगीन चेतना को जगा सके। लोगों को एकजुटता का संदेश दे सके। विभिन्न मत–भिन्नताओं के बीच अपनी स्वतन्त्र विचारधारा स्थापित कर सके, तो उसमें उनकी पत्रकारीय प्रतिभा, कौशल, अर्हता और दायित्व–बोध का योगदान सबसे ज्यादा है। गाँधीजी के वैचारिक आंदोलन और ज़मीनी सक्रियता की बात अवश्य होनी चाहिए। राष्ट्रनिर्माण की दिशा में तत्कालिन पत्र–पत्रिकाओं की भूमिका एवं निष्ठा अद्‌भुत रही है। गाँधी के स्वराज को लेकर भाषाई चेतना विकसित करने का उत्तरदायित्व

स्वतन्त्रतापूर्व की पत्र–पत्रिकाएँ पूरी शिद्दत से निभा रही थीं। हर भाषा के अखबार में आजादी की बातें थीं। जोश और जुनून थे। अधिसंख्य सम्पादकीय इस उद्देश्य के साथ लिखे जा रहे थे कि जन–जागरण आधारित पूर्ण स्वराज की मांग हर एक भारतीय के कंठ में पैठ जाये। इसके लिए आवश्यक था कि रचनात्मक ढंग से सही एवं उपयुक्त सूचना–सामग्री पहुँचाने के विकल्प को निर्बाध जारी रखा जाये। संवादहीनता की स्थिति न उपजे। जन–जागरूकता के लक्ष्य में बाधा न पड़े। हिन्दुस्तानी लोग अपने देश की मौजूदा हाल–हालात से रू–ब–रू हों। देश की आर्थिक दशा और उनके कारणों की खोज करने में उनकी सीधी और हस्तक्षेपकारी भूमिका हो। आत्म–मूल्यांकन का महती कार्य भी पत्रकारिता को खुद से ही करना था। स्वाधीनताकालीन पत्रकारिता की बड़ी खूबी थी कि वे बिना डरे, बिना झुके और बिना समझौता किए अपनी बात कह सकते थे। इस तरह की प्रवृत्तियों को सिरजने और विकसित करने का काम भारतीय पत्रकारिता से जुड़े लोगों ने पूर्ण निष्ठा से किया था। कई लोगों ने जनचेतना निर्माण के इस कार्य में अपना सर्वस्व होम कर दिया। कष्ट झेले।

दुर्गम या कहें कंटिकापूर्ण मार्ग पर चलना स्वीकार किया, लेकिन औपनिवेशिक सत्ता और अंग्रेजी शासन की खुली भर्त्सना करने से पीछे नहीं हटे। सीधे विरोध किया। यह अंतःचेतना या कहें आत्मबल पत्रकारिता के पुरोधाओं में जबर्दस्त रही। पंडित गंगाधर भट्टाचार्य, राजा राममोहन राय, पंडित युगल किशोर शुक्ल, राजा शिवप्रसाद सितारेहिंद, भारतेन्दु हरिश्चन्द्र, प्रताप नारायण मिश्र, बालकृष्ण भट्ट, बालमुकुंद गुप्त, महावीर प्रसाद द्विवेदी, गणेश शंकर विद्यार्थी एवं अन्य का योगदान प्रातःस्मरणीय है। ये सब पत्रकारिता के युगपुरुष कहलाये क्योंकि उनका योगदान अप्रतिम है। इस दृष्टि से देखें, तो उन्नीसवीं सदी में कलकत्ता में फोर्ट विलियम कॉलेज की स्थापना पत्रकारिता को आगे बढ़ाने और इस प्रवृत्ति को गति देने में 'प्रशिक्षण–केन्द्र' की भूमिका में रही। योरोपीय शिक्षा के साथ भारतीय भाषाओं का जिस तरीके से मेलजोल और साक्षात्कार हुआ उसकी परिणति पत्रकारिता में उत्तरोत्तर विकास के रूप में देखी जा सकती है। नवजागरण की धुरी पर भारतीय जनमानस में राजनीतिक चेतना का संचार हुआ। संगठित राजनीति की नई मनोवृत्ति बनी, जिसका कुल हासिल 1885 ई. में संस्थापित

भारतीय राष्ट्रीय कांग्रेस को माना जाना चाहिए।

आजादीपूर्व के दिनों में भारतीय राजनीतिज्ञों ने पत्रकारिता को गंभीरता से लिया। सम्पादक के गरिमामय जीवन तथा गौरवपूर्ण उपलब्धि को आदर्श माना। राजनीति से जुड़े लोग अखबारों की ताकत और उसके महत्त्व को भली–भाँति समझ रहे थे। मदन मोहन मालवीय, बाल गंगाधर तिलक जैसे नेताओं ने सशक्त, नैतिक तथा उच्च आदर्शों वाला पत्रकारीय मानदण्ड स्थापित किये और पत्रकारिता को गरिमामय ऊँचाई प्रदान की। महात्मा गाँधी जिस काल में पैदा हुए वह समय पत्रकारिता का भारतेन्दु युग था। गाँधीजी ने पत्रकारिता से प्रभावित होकर पत्र निकालना शुरू नहीं किए, अपितु उनके जन्मकाल से ही देश–काल–परिवेश ऐसा था जिस दौर में पत्रकारिता ने लोगों की चेतना को सर्वाधिक प्रभावित कर रखा था। महात्मा गाँधी ने 'यंग इंडिया', 'हरिजन', 'नवजीवन' के प्रकाशन का बीड़ा उठाया। ज्योतिश जोशी की एक पठनीय पुस्तक है 'साहित्यिक पत्रकारिता' शीर्षक से जिसमें वे लिखते हैं कि–"1918 से गुजराती तथा हिंदी में प्रकाशित होने वाले 'नवजीवन' का सम्पादन गाँधीजी ने अपने हाथों में ले लिया।

एक पत्रकार के रूप में गाँधी जी का लम्बा अनुभव 'नवजीवन' के सम्पादन में काम आया। ज्ञातव्य है कि जब वे दक्षिण अफ्रिका में थे तो उन्होंने 1903 ई. में 'इण्डियन ओपिनियन' का प्रकाशन किया था। यह पत्र हिंदी सहित तीन अन्य भाषाओं में प्रकाशित होता था–अंग्रेजी, गुजराती तथा तमिल। गाँधीजी ने 'यंग इंडिया' और 'हरिजन' के माध्यम से भी भारतीय पत्रकारिता की दिशा बदल दी थी। अंग्रेजी शासन को उनका कार्य तनिक नहीं सुहाता था, पर इनके माध्यम से गाँधीजी ने क्रांतिकारी कार्य संभव किए। गाँधीजी ने 1931 तक 'नवजीवन' का सम्पादन किया था। 'नवजीवन' में प्रति सप्ताह उनका आलेख प्रकाशित होता था जो जागरण का सन्देश जैसा होता था। 'नवजीवन' तथा 'हरिजन' में छपे गाँधीजी के आलेखों को देश के महत्त्वपूर्ण पत्रों और पत्रिकाओं में प्रकाशित किया जाता था। स्वाधीनता की प्रेरणा से लेकर जनता की समस्याओं और समाज की सड़ी–गली परम्पराओं पर लिखते हुए गाँधीजी ने देश को जहाँ एक महान लक्ष्य की ओर अग्रसर करने में सफलता पाई, वहीं हिंदी पत्रकारिता को एक नई दिशा भी दी।"

गाँधीजी का मूल व्यक्तित्व कई तरह की खूबियों से समादृत था जिसमें

पत्रकारिता उनकी आत्मा के चित्रपट थे। वह जो थे उसका दिग्दर्शन उनके पत्रों में लिखे टिप्पणियों, सम्पादकीय लेखों, स्वतन्त्र आलेखों आदि में होता है। कई दृष्टियों से गाँधीजी की छवि असाधारण थी। वे उच्च नैतिक मानदण्ड वाले नेता थे। उनकी स्वाभाविक प्रकृति सहिष्णु नेता की थी। गाँधीजी सत्ता के गलत निर्णयों के विरोध में नैतिक–बल से जुटाए समर्थन द्वारा बुलंद खड़े मालूम होते थे। पत्रकारिता में उनका अवदान स्तुत्य है। मोहनदास करमचन्द गाँधी उन गिने–चुने राजनीतिज्ञों में से हैं जिन्होंने पत्रकारिता के नट–बोल्ट कसे। पत्रकारिता को नई ऊँचाई तक ले गए। जनता की चेतना को सुगठित करने में उनका योगदान अहम रहा क्योंकि वे पत्रकारिता के राष्ट्रीय प्रतिमान बन चुके थे। उनके समाचार–पत्र राष्ट्रीय ही नहीं, अन्तरराष्ट्रीय सुर्खियों का विषय बनते थे। दुनिया भर की निगाहों में उनके कहे का ही नहीं, चुप्पियों तक का विशेष महत्त्व हुआ करता था। विदेशी भाषा के अख़बार उनके कहे और लिखे का प्रकाशन अपनी भाषा के अख़बारों में प्रमुखता से कर रहे थे। पूरी दुनिया में उन दिनों गाँधीजी की तूती बोलती थी। गाँधीजी सफल संचारक के रूप में लोकप्रिय थे। समाचार–पत्र से लेकर रेडियो की दुनिया तक उनकी पैठ एवं पहुँच जबर्दस्त थी। यह सब संभव कैसे हुआ? यह जानकारी आवश्यक है।

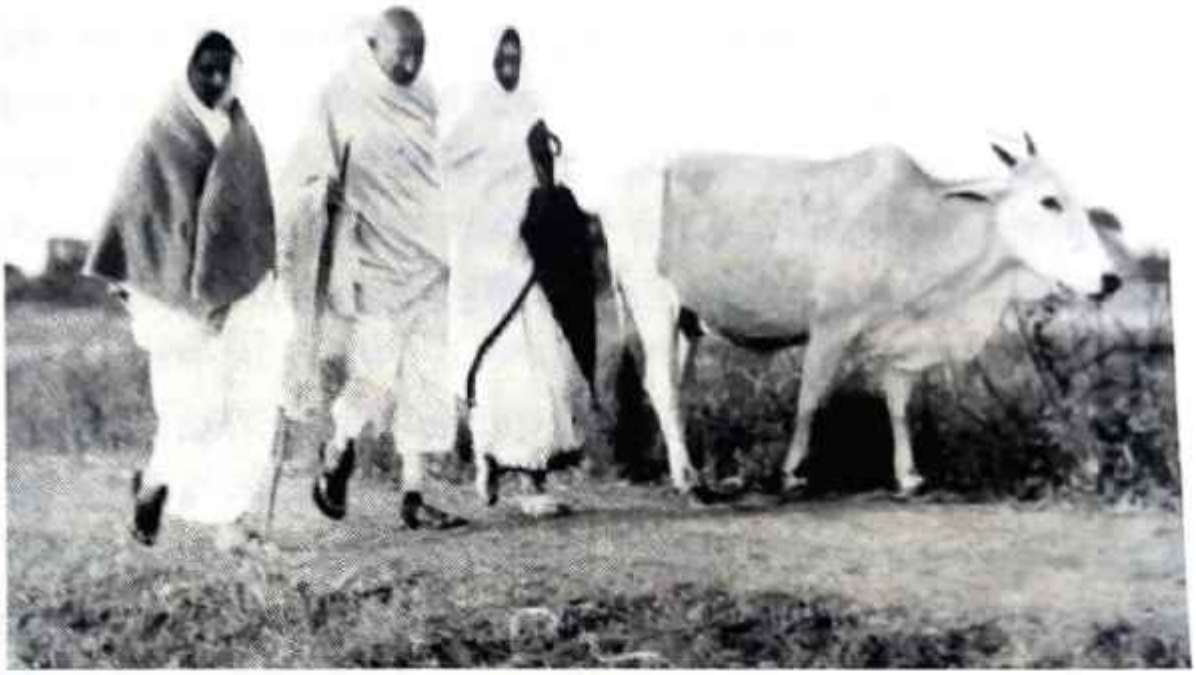
गणेश शंकर विद्यार्थी का गाँधीजी के प्रति विशेष आदर था। वे कहते थे–'अच्छा नेता वही हो सकता है जिसका अपना व्यक्तिगत एवं सार्वजनिक दोनों ही जीवन सदाचार एवं नैतिकता से सम्पन्न हो।' गाँधी यों ही नहीं महात्मा थे। वे व्यक्ति की साधारणता में असाधारणता खोज लेते थे। विद्यार्थी जी की पत्रकारीय प्रतिभा और कौशल से वे पूर्णतया सुपरिचित थे। 25 मार्च, 1931 को बुरी ख़बर मिली जिसमें गणेश शंकर विद्यार्थी के मृत्यु की सूचना थी। गाँधीजी ने कहा–'गणेश शंकर विद्यार्थी को ऐसी मृत्यु मिली है, जिस पर हम सबको स्पर्धा है।' दरअसल, गाँधीजी कृत्रिम बनाव–शृ 'गार के आदमी नहीं थे। उनका सरलरेखीय जीवन अपनेआप में उदाहरण है। उन्होंने अपने जीवन और आचरण से यह सिद्ध कर दिखाया कि विजय सदैव सत्य और नीति की होती है। गाँधीजी स्वाधीनता आन्दोलन को जन–जन तक ले जा सके। जन–साधारण के साथ 'कनेक्ट' कर सके। उसके पीछे की प्रेरक शक्ति तद्युगीन प्रभाव भी थे।

पत्रकारिता जनमानस से गहरे संपृक्त थी। बौद्धिक–संवाद कायम करने और कारगर सेतु बनाने में वैचारिक पत्र–पत्रिकाओं की भूमिका प्रमुख रही। गाँधीजी इसी मार्ग से आगे बढ़े। विद्वानों की मानें, तो महात्मा गाँधी का शांति और सद्भावना का संदेश सबके लिए था, किसी विशिष्ट वर्ग या दल के लिए नहीं। लोकतंत्र, सामाजिक न्याय और सर्वराष्ट्रीयता के वे अनन्य साधक थे। वे हठधर्मी नहीं थे, किसी भी नए विचार को परखने के लिए वे सदा तैयार रहते थे। उनका इस बात में दृढ़विश्वास था कि वर्गभेदों और सामाजिक तथा आर्थिक विशमताओं को मिटाए बिना समाज में से हिंसा का उन्मूलन नहीं हो सकता।

गाँधीजी की उपासना या उन पर अंधास्था रखने की बजाय गाँधी को जानने–समझने की जरूरत आज कहीं अधिक है। उन्हें याद 'अहो रुपम, अहो ध्वनि' के सुरताल में नहीं किए जाने चाहिए। क्योंकि गाँधीवाद वैज्ञानिक मनोवृत्ति नहीं है; जीवन के प्रति इसकी नैतिक मनोवृत्ति है। गाँधीजी ने उस समय सूचनाओं के माध्यम से देश में क्रांतिकारी परिवर्तन लाया, जबकि माध्यमों की कमी से जनसंचार जूझ रहा था। उस समय जनसंचार की कोई अधोसंरचना नहीं थी। दुनिया में सूचनाओं का संप्रेषण एक जटिल प्रक्रिया थी। आज सूचनाओं को भेजने के लिए माध्यमों की कोई कमी नहीं है। वैश्वीकरण की अवधारणा और उसकी सर्वमान्यता के कारण दुनिया एक हो गई और इसमें संचार माध्यमों ने बड़ी अहम भूमिका निभाई है।

इस दौर में उस समय की कल्पना की जानी चाहिए जबकि संसाधनों का अभाव था और आवश्यकताओं की कोई कमी नहीं थी। उस दौर में गाँधीजी ने कहा कि मैं पत्रकारिता सिर्फ पत्रकारिता करने के लिए नहीं करता, मेरा लक्ष्य है–सेवा करना। उन्होंने 2 जुलाई 1925 के 'यंग इंडिया' में लिखा– 'मेरा लक्ष्य धन कमाना नहीं है। समाचार–पत्र एक सामाजिक संस्था है। पाठकों को शिक्षित करने में ही इसकी सफलता है। मैंने पत्रकारिता को पत्रकारिता के लिए नहीं, बल्कि अपने जीवन में एक मिशन के तौर पर लिया है। मेरा मिशन उदाहरणों द्वारा जनता को शिक्षित करना है। नीति वाचन, सेवा करना और सत्याग्रह के समान कोई अस्त्र नहीं है, जो सीधे ही अहिंसा तथा सत्य की उपसिद्धि है।' उनका कहना था कि पत्रकारिता लोगों की भावनाओं को समझने और उनकी भावनाओं को अभिव्यक्ति देना है। अभिव्यक्ति देने में

सफल आदमी ही सफल संचारक हो सकता है। इस अवधारणा को आज संचार के सभी माध्यम और प्रकार भलीभाँति अपना रहे हैं। लेकिन आज प्रेस की आजादी और उसके आचरण पर कई सवाल उठ खड़े हुए हैं। उससे किस प्रकार से सही सूचना की अपेक्षा की जा सकती है? इस पर गाँधीजी ने प्रेस को गैरजिम्मेदार और अशुद्ध माना कि उसमें ऐसे व्यक्ति की गलत तस्वीर पेश की जा रही है। सही और न्याय देखने वाले को सिर्फ गलत राह दिखाई जा रही है।



वर्धा में 1934 के एक दिल टहलते हुए बापू (साभार: mkgandhi.org)

महात्मा गाँधी न केवल एक राजनीतिज्ञ थे बल्कि जीवन के विभिन्न पहलुओं में उनका अच्छा–खासा हस्तक्षेप था। वे एक सफल नीति निर्धारक, अच्छे समाज सुधारक, कुशल अर्थशास्त्री तो थे ही, उनका विशेष गुण था, उनका उत्कृष्ट जन–संचारक होना। आज भारत में जनसंचार के विभिन्न माध्यम हैं। इनमें समाचार–पत्र, रेडियो, टेलीविजन, इंटरनेट प्रमुख हैं। आजादी के पूर्व बहुत सीमित संचार के साधनों के बाद भी गाँधी जी की लोकप्रियता जबर्दस्त थी। ऐसे समय में जब मुद्रण माध्यम अँगरेजी हुकूमत की निगरानी में था, गाँधीजी ने अपनी वैचारिक लहर गाँव–गाँव और शहर–शहर तक पहुँचाई। उनका सरल, सादी आम भाषा का प्रयोग और सबसे ज्यादा

बोली जाने वाली भाषा के प्रयोग ने जनसामान्य को उनके संदेशों से जुड़ने में सहूलियत प्रदान की। इंडियन ओपिनियन में गाँधीजी ने लिखा है–"व्यक्ति का प्रमुख संघर्ष आंतरिक है। वह आंतरिक शक्ति ही प्रेरणा देती है। यह कार्य समाचार–पत्र अच्छी तरह कर सकता है।" एक पत्रकार के रूप में उन्होंने सामाजिक, आर्थिक, राजनीतिक विचार प्रस्तुत किए, जिसमें बुद्धिजीवी वर्ग यथा वकील, शिक्षक, विद्यार्थी, पत्रकार, ट्रेड यूनियन नेता आदि ने उन्हें अपनी प्रेरणा का अजस्त्र स्रोत माना। जनसेवक गाँधीजी ने अपने व्यक्तित्व के प्रयास से स्त्री, पुरुष, शिक्षित, अशिक्षित, किसान, मजदूर, पूँजीपति, सभी को प्रभावित किया और देश की स्वतंत्रता के लिए सबको एक साथ पिरोने का कार्य किया। वे अपने विचार समाचार–पत्रों के माध्यम से सामान्य जन तक तो पहुँचाया ही करते थे, परंतु प्रेस स्वातंत्र्य और प्रसार संख्या में कमी के कारण पाठकों को भी अंतःप्रसार के लिए प्रेरित किया करते थे। अहमदाबाद से प्रकाशित 'सत्याग्रही' में उन्होंने लिखा था–"कृपया पढ़ें, कॉपी करें और अपने दोस्तों के मध्य प्रसारित करें और वे भी इसकी प्रतियाँ बनाएँ और प्रचार करें।"

'हरिजन' हो या 'यंग इंडियन' इन समाचार–पत्रों का मुख्य उद्देश्य ही ग्रामीण जन की भलाई तथा उनके जीवन–स्तर में आमूल बदलाव तथा तत्काल सुधार लाना था। सामाजिक सुधार, शिक्षाप्रद लेखों के अलावा गाँधीजी के समाचार–पत्रों में आगामी राजनीतिक कार्यक्रम, रणनीति आदि का भी विवरण होता था। महात्मा गाँधी इस बात से पूरी तरह अवगत हो चुके थे कि भारत जैसे बहुलतावादी देश में एक राष्ट्र की अवधारणा को बढ़ावा देने का कार्य एक कुशल संचारक ही कर सकता है। इसीलिए गाँधी जी ने जन–संवाद की प्रक्रिया हमेशा जारी रखा। दरअसल, गुलाम भारत में असली आजादी बिना किसी सुदृढ़ नेतृत्व के नहीं आ सकती थी; और सुदृढ़ नेतृत्व का निर्माता था एक सुदृढ़ जनसंचार माध्यम। ऐसे समय में गाँधीजी ने अपने व्यक्तित्व के प्रयास से स्त्री, पुरुष, शिक्षित, अशिक्षित, किसान, मजदूर, पूँजीपति, सभी को प्रभावित किया और देश की स्वतंत्रता के लिए सबको एक साथ पिरोने का कार्य किया। हम गौर करें, तो पाएंगे कि उनकी विचार–दृष्टि 'आर्थिक मानव' की जगह 'पूर्ण मानव' से संबंध रखती है।

गाँधीजी मानव और उसके पर्यावरण, मानव और मशीन, श्रम और पूंजी

तथा गाँव और नगर के बीच के संबंधों में आने वाली विकृतियों को दूर करने की प्रेरणा का संचार करते हैं।

गाँधी के विचार मुख्यतः भारत के लिए आवश्यक एवं प्राथमिक है, तब भी तीसरी दुनिया के देशों के लिए गाँधी सर्वथा उपयुक्त और स्वीकार्य माने जाने लगे हैं। इस घड़ी भारत औपनिवेशिक दासता से मुक्त हो कर विकास और निर्माण की सतत प्रक्रिया में जुटा हुआ है। ऐसे में उनके विचार अत्यन्त प्रासंगिक हो जाते हैं। गाँधीजी का मानना था कि उन तकनीकी अविष्कारों का कोई उपयोग नहीं, जो मनुष्य को अमानवीय बनाएं, जो उसे उसके काम से या उसके साथी कामगारों से काटें और जो यंत्रमानवों की एक सभ्यता पैदा करें, जिसमें आदमियों का एक समूह आसानी से दूसरों का इस्तेमाल अपने लाभ के लिए करे। गाँधी जी के लिए संदेश की शक्ति या फिर माध्यम की सत्ता बहुत महत्व रखते थे। वह साध्य और साधन दोनों की पवित्रता और उसके सही इस्तेमाल पर बल देते थे।

अतः संचारक के रूप में महात्मा गाँधी आज प्रत्येक भारतीय आत्मा की खास जरूरत हैं। वे सर्वमान्य नेता बन सके, तो इसके कई कारण अथवा विशिष्टता गिनाई जा सकती है। लेकिन जो सर्वप्रमुख है वह यह कि उनकी कथनी और करनी में कोई अंतर नहीं है। वह संचार साधनों से आम–आदमी का विकास चाहते हैं। ग्रामीण क्षेत्रों की मूलभूत समस्याओं का समाधान चाहते हैं। जैसा कि हम वर्तमान समय में देख रहे हैं, गाँव और खेती का संबंध आज भी यथावत है, जबकि गाँव और उद्योग परस्पर विरोधी हो गए हैं। आत्मनिर्भर ग्रामीण अर्थतंत्र के बिखराव के कारण परम्परागत व्यवसायों में लगे करोड़ों लोगों के रोजगार का साधन लगभग छिन गया है।

उदाहरण स्वरूप अब बनारस बुनकरों के लिए नहीं जाना जाता। इस शहर का यह सांस्कृतिक पक्ष गौण हो चला है। इसकी जगह दूसरी चीजें उभर आई हैं या ज़बरिया उभारने का नव–साम्राज्यवादी खेल खेला जा रहा है। असल में, गाँधी जी जिन गाँवों की बात करते हैं, उस पर गहराई से और संवेदनशीलता के साथ विचार किया जाना अपेक्षित है। उनका मानना है, "हमें मानसिक रूप से गाँवों में वापस जाना चाहिए और उनसे सीखना चाहिए। नागरिक जीवन का आदर्श ग्रामीणों के सामने रखने के बदले, ग्रामीणों के जीवन को अपना नमूना बनाना चाहिए। वास्तविक विकास के लिए हमें गाँवों

की ओर मुड़ना होगा। उनके पूर्वग्रहों, उनके अंधविश्वासों, उनके संकीर्ण दृष्टिकोण को ख़त्म करना होगा, और ऐसा हम उनके बीच रहकर, उनकी खुशियों और दुःखों में भागीदार बनकर और उनमें शिक्षा और बौद्धिक सूचनाएं फैलाकर ही कर सकते हैं, किसी अन्य उपाय से नहीं।"

हर व्यक्ति से रचनात्मक भागीदारी एवं सक्रिय भागीदारी की माँग महात्मा गाँधी करते हैं। लेकिन उनके आग्रह में कहीं वाकपटु दुराग्रह नहीं है। जिस जन के साथ उनकी गहरी लगाववृत्ति और आत्मीयता है उन्हें वह अपने हृदय का काम सौंप देने को हमेशा इच्छुक रहते थे। गाँधीजी ने 'हिन्द स्वराज' के 'सत्याग्रह' वाले प्रकरण में बड़ी सटीक टिप्पणी की है कि–"दुनिया में इतने लोग आज भी जिन्दा हैं। यह बताता है कि दुनिया का आधार हथियार के बल पर नहीं; बल्कि सत्य, दया और आत्मबल पर है। इसका सबसे बड़ा प्रमाण यह है कि दुनिया लड़ाई के हंगामों के बावजूद टिकी हुई है। हजारों, बल्कि लाखों प्रेम के वश रहकर अपना जीवन बसर करते हैं। निःसंदेह लड़ाई या हिंसा–प्रतिहिंसा जैसी दुष्प्रवृत्तियाँ रही हैं। लेकिन अब तक न सिर्फ मानव, बल्कि मानवेतर प्राणी भी बचे हुए हैं, तो प्रेम सौहार्द, दयाभाव के कारण। त्याग, परहित, अहिंसा, प्रेम का आचरण करने वाले लोगों के जीवन को अवास्तविक या स्वप्निल के अर्थ में आदर्शवादी कहकर हरगिज़ खारिज़ नहीं किया जा सकता।"

आज की पत्रकारिता अपनी इन स्मृतियों पर गर्व करने लायक स्थिति में नहीं है। वह बिकाऊ और दिखाऊ इस कदर हो चली है कि विचार, विवेक, विश्लेषण, विश्वदृष्टि आदि की बातें बेमानी मालूम देने लगी है। पाठकीय दृष्टि से इस तरह की पत्र–संस्कृति राष्ट्रीय स्वाभिमान का सिर बूड़ना है। अतीत की उपलब्धियों को शर्मसार कर देना है। चाहे जो हो, पत्रकारिता इस लाँछन से बरी नहीं हो सकती है क्योंकि वर्तमान समय की पत्रकारिता में राष्ट्रीयता बोध और जवाबदेही का संकट सर्वाधिक है। सर्वसाधारण की चिंता और उसके प्रति सहज संवेदनशीलता का घोर अभाव है। पत्रकारिता बुनियादी लक्षण से दूर जा छिटकी है।

पत्रकारिता आज कारोबार है। पैसे कमाने की हवस है। पूँजी और सत्ता की पाट में पिसने को मजबूर है क्योंकि वह अपने इतिहास–बोध से कट चुकी है। बीती स्मृतियों से बावास्ता बिल्कुल नहीं है। सच कहें, तो पत्रकारिता की दुनिया के लिए यह समय जटिल अधिक है। अख़बार लुग्दी समाचारों से अटे

पड़े हैं। चॉकलेटी, नॉनस्टॉपी खबरों की आमद तो धुँआधार है। लिखने–पढ़ने का चलन आजकल बदला है। कागज़ रंगीन अवश्य हुए है। उनकी प्रस्तुति में 'वैरायटी' भी बहुत है। लेकिन विचार रंगहीन, गंधहीन, स्वादहीन हो चले हैं। जनपक्षधर–मूल्य और जनसरोकारी संवेदना धुंधली परछाई की तरह मटमैले आइकॉन हैं जिनमें मूल 'इसेंस' नदारद है। ऐसे में गाँधीजी की पत्रकारिता का हाशिए पर जाना तय है। इस निष्कासन के लिए सब जिम्मेदार हैं, लेकिन इसे सहजतापूर्वक मान और स्वीकार लेना आसान नहीं है। पत्रकारीय बिरादरी में भी स्तरहीन पत्रकारिता पर कोई आलोचनात्मक रुख नहीं दिखाई देते हैं। प्रभाष जोशी की चिंता और बेचैनी 'पेड न्यूज़' को लेकर थी। इसको लेकर उन्होंने देश भर की यात्रा की।

पत्रकारीय बिरादरी में घूम–घूम कर कहा कि यह नया 'ट्रेंड' पत्रकारिता को ख़त्म करने की कीमत पर प्रकट हुआ है। उनकी मृत्यु के बाद इस ओर से ध्यान जाता रहा। सब मोटी बात ही कहते रहे। ऊपरी दबाव बनाने में ही जुटे रहे। इस दिशा में परांजपे गुहा ठाकुरता की छानबीन–पड़ताल आश्वस्तिपूर्ण तथा संवेदनशील कही जानी चाहिए। बाहरी–भीतरी दबाव के बावजूद ठाकुरता ने रिपोर्ट तैयार की, लेकिन उसे ठंडे बस्ते में डाल दिया गया। प्रभाष जोशी हों या परांजपे; दोनों गाँधी के घोषित अनुयायी नहीं थे। हार्डकोर गाँधीवादी हरगिज़ नहीं। दोनों अपने–अपने तरीके से गाँधीजी की सोच से सहमति रखते हैं। गाँधीजी मानते थे कि–आमजन का रक्षा–कवच यदि कोई हो सकता है, तो वह सिर्फ पत्रकारिता है। जन–मन का गान पत्रकारिता द्वारा ही संभव है।

गाँधीजी पत्रकारिता में लम्बी लकीर खींचे, लम्बे डेग भरे। उनके तदयुगीन प्रभाव को देखते हुए गाँधीयुगीन पत्रकारिता का कालखंड बना जिसके मुख्यकर्मी गाँधीजी स्वयं थे। उनके पत्र आज भी उदाहरण हैं। यथाः। समाचार–पत्रों के माध्यम से गाँधीजी अपनी बेबाक राय रखते थे। तीखी प्रतिक्रिया व्यक्त करने में वे क्रांतिकारी स्वभाव के न रहे हों, लेकिन उनकी बात में स्पष्टता थी। निर्णय में सफाई था। उनकी वैचारिक निष्ठा असंदिग्ध थी क्योंकि वे भारतीय जनमानस के नायक की भूमिका में थे।

पत्र–पत्रिकाओं में या कि अन्यत्र विभिन्न मुद्दों के प्रति उनकी सोच कैसी थी, वे उस बारे में क्या सोचते थे; उनके लिखे सम्पादकीय टिप्पणियों

से जगजाहिर है। गांधीजी फुलटाइमर पत्रकार नहीं थे, लेकिन उनमें पत्रकारिता का शीलगुण जबर्दस्त था। गांधीजी ने नसीहत नहीं दी, लेकिन पत्रकार–बंधुओं को दायित्व–निर्वहन का पाठ अवश्य पढ़ाया। आज भी आखिरी आदमी के चेहरे को याद रखना और उसके बारे में सोचना बिना गांधीजी के जंतर को आत्मसात किये हुए संभव नहीं है। अपने समय से आगे की सोच रखने वाले गांधीजी दूरदर्शी व्यक्ति थे। वे अखबार की ताकत बखूबी समझते थे। उन्हें भली–भाँति पता था कि किसी भी जनतांत्रिक राष्ट्र में संचार–प्रणाली की हैसियत क्या है और क्या होने चाहिए?

वैसे भी अंग्रेज रहे हों या हिटलर जैसे तानाशाह, सबको यह मालूम था कि सैन्य शक्ति के अलावा असली सत्ता जनसंचार में निहित होती है। गाँधीजी पत्रकारिता से जुड़े, तो उनके मंसूबे साफ थे। उनकी दृष्टि में पत्रकारिता मूल्य–सृजन और जनमत–निर्माण की अनुशंगी कार्यशाला थी जिसको लेकर उन्होंने अथक प्रयास किए। पूरे युग पर उनका प्रभाव पड़ा। गाँधीयुगीन पत्रकारिता में गाँधीजी के हाथ में खुद पत्र रूपी गांडीव थे। कई बार जानकारी का सही सिरा न पकड़े होने के कारण कई सारी भ्रांतियाँ हमारे मन में होती है। हम यह मान लेते हैं कि वे जनप्रिय थे इसलिए सब उनकी सुनते थे या कि उनके कहे का अनुसरण करते थे।

दरअसल, गाँधीजी सत्य और अहिंसा के उपाधिधारी उपासक मात्र नहीं थे, बल्कि यह उनके मन–प्राण में रची–बसी आत्मा की प्रतिमा थी जिस पर पूर्ण समर्पण के अमिट छाप अंकित थे। इसी तरह जनपक्षधरता के मुद्दे पर पत्रकारिता उनका मुख्य हथियार बन चुका था। स्वभाव से निर्भीक और व्यवहार में आत्मीय गाँधीजी यह मानते थे कि पत्रकारिता सिर्फ निष्ठा और निश्पक्षता की पैरोकारी करके नहीं की जा सकती है। इसके लिए जन–मन से गहरे लगाव होने आवश्यक हैं। वैचारिक सरोकार की बात सर्वोपरि है, लेकिन यह भी सिर्फ संवादी अथवा विमर्शात्मक मात्र न हो। सम्पादकीय अर्हता की मुख्य कसौटी लोक–व्यवहार का अनुग्राहक होना है। यह उपलब्धि भाषा द्वारा ही संभव है। गाँधीजी ने जनता की भावना को समझने हेतु जन–मन की भाषा को गले लगाने की बात कही। हिन्दुस्तानी को लेकर वे आग्रही इन कारणों से अधिक थे। उनका भाषा से रागात्मक जुड़ाव था। गहरी मित्रता थी। हिंदी को लेकर गाँधी ने व्यापक अभियान छेड़े। राष्ट्रभाषा

के मुद्दे पर पत्र–पत्रिकाओं में निरन्तर लेखन किया। सार्वजनिक मंचों से बोलने में हिचके नहीं।

गाँधीजी पत्रकारिता के प्रेरक–पुरुष बने तो इसके पीछे उनके 'मन–वचन–कर्म' की विश्वसनीयता का योगदान अन्यतम है। वे करोड़ों भारतीय–मन तक पहुँच सके और उन्हें प्रभावित कर सके तो इसके पीछे उनके कथनी तथा करनी में समानता का होना प्रमुख है। गाँधीजी व्यवहारकुशल थे, लेकिन अपने बात पर सदैव अडिग रहने वाले योद्धा थे। गाँधीजी ज़बान और उसूल के पक्के थे। मोहनदास नैमिषराय बाबा साहेब भीमराव आम्बेडकर के व्यक्तित्व पर लिखते हुए गाँधीजी के स्वभाव की चर्चा करते हैं। वे बताते हैं–'सचमुच गाँधी अड़ियल थे और बेहद जिद्दी भी। धरती को भी पकड़ लें तो छोड़े नहीं। भले ही हर प्रकार का विसर्जन वहीं करना पड़े।' समाचार–पत्रों से उनका जुड़ाव गहरा तो सम्बन्ध घनिष्ठ थे। राजनीतिक आन्दोलन को गति देने और आजादी की लड़ाई को मजबूत करने के लिए गाँधीजी ने वैचारिक समर्थन जुटाने का काम उन्होंने पत्रकारिता का बागडोर थामकर किया। समाचार–पत्र के प्रकाशन की खुद नींव रखी। गाँधीजी पत्रकारिता के नज़ीर बने और राष्ट्रीय आन्दोलन को दिशा देने का काम प्रमुखता से किया। पूरे देश को आलोड़ित करने और जन–जन में राजनीतिक चेतना को उपजाने में गाँधी की पत्रकारिता ने उर्वर ज़मीन बनाने का महती कार्य किया। उन्होंने रेडियो से अपनी बात करोड़ों–करोड़ भारतीय जन तक पहुँचाया।

31 जनवरी, 1947 को उन्होंने लखनऊ रेडियो से कहा कि–'जो भारतवर्ष के भविष्य के लिए सचेष्ट हैं, जो चाहते हैं कि उसकी उन्नत अवस्था हो, जो उसको आज पतन की अवस्था से बचाना चाहते हैं, उनका यह कर्तव्य है कि वे संघबद्ध होकर, इस राजनीति के पचड़े को छोड़ना हो तो उसको भी छोड़कर, इस देश में एक ऐसे जीते–जागते सांस्कृतिक आन्दोलन का प्रचार करें, जिस आन्दोलन के बल पर उनकी शिक्षा इस देश में टिक सके। प्रार्थी हूँ कि भारतवर्ष में, ऐसे विशाल देश में, जहाँ अनगिनत लोग बसते हों, यहाँ के नर–नारियों में थोड़े से लोग अवश्य होंगे जो आज की परिस्थितियों से उठकर साम्प्रदायिक शान्ति के लिए चेष्टा करेंगे। और यदि ऐसा हुआ तो हमारा भविष्य उज्ज्वल है, इस देश का कल्याण होने वाला है।'

गाँधी के आरंभिक पत्र 'इंडियन ओपेनियन' की लोकप्रियता उन दिनों

जबर्दस्त थी। बावजूद वह आज के संचार माध्यमों द्वारा अपनाये जा रहे नीतियों के पक्ष-समर्थक नहीं थे, जिसमें किसी राष्ट्र का सांस्कृतिक गौरव, राजनीतिक परंपरा और प्रभुसत्ता ही दांव पर लगा दी जाए। दरअसल, भारत जैसे विकासशील देश में संचार की परिकल्पना तथा नए समाज के निर्माण की अवधारणा गाँधी-नेहरू की दृष्टि से की जानी चाहिए न कि औपनिवेशिक मानसिकता अथवा हिटलरशाही 'अप्रोच' से। ध्यातव्य है कि आधुनिक संचार की अच्छाइयाँ बहुत ज्यादा हैं, संचार आधारित समाजीकरण से उपजी नवाधुनिक प्रवृत्तियाँ बेहद यथार्थपूर्ण व वास्तविक हैं। बावजूद इसके संचार के मौजूदा स्वायत को भाषा और संस्कृति की दृष्टि से देखना और उन्हें प्रश्नांकित किया जाना इसलिए भी जरूरी है; ताकि संचार के अकूत ताकत और गतिशीलता के बरास्ते असंगत-अनावश्यक चीजें घुसपैठ न कर बैठें, अपना वर्चस्व न जमा लें।

पत्रकारिता इन दिनों जिस बेतरतीब ढंग से बदल रही है अथवा जिस ढर्रे पर गतिमान है, बेहद खतरनाक है। पत्रकारिता की नयी स्वायत ईमानदार नहीं कही जा सकती है। अब प्रतिबद्धता की बात पत्रकारिता नहीं करती है। क्योंकि आज समाचार-पत्रों की लोकप्रियता के प्रतिमान दूसरे हैं। लोकमत कसौटियाँ कुछ और हैं। आज का पाठक-वर्ग 'अनवांटेड' और 'प्लांटेड' समाचारों के बटोर से हर दिन गुज़र रहा है। उसके मन का थाह लेना जरूरी है। फिक्र करना आवश्यक है। पाठकीय चेतना पर यथार्थ और विभ्रम का बोझ गठर की तरह लाद दिया गया है। उस पर जो बीत रहा है उसकी बात कहीं नहीं हो रही। बस राग अलापने में सभी अलमस्त हैं। जबकि गाँधीजी राष्ट्र के आखिरी आदमी की सुध लेने की बात करते थे।

पत्रकारिता से उनका आशय लाभ-हानि का मसौदा नहीं था। जबकि आज मुनाफे के सवाल सबसे पहले आते हैं; तथ्य और कथ्य के विश्वसनीय, प्रामाणिक, निश्पक्ष और जनहितकारी होने का प्रश्न बहुत बाद में उठाया जाता है। एक ही समय में एक ही घटना के अलग-अलग दृष्टांत और अनगिनत व्याख्याएँ हैं। पाठक-वर्ग को चालाकीपूर्वक बरगलाने में इन प्रस्तुतियों का हाथ ज्यादा है, दिमाग का इस्तेमाल करना अधिसंख्य सम्पादकों ने लगभग बंद कर दिया है। चंद मनस्वी सम्पादक अपनी जिद और धुन के धनी हैं। पत्रकारिता इन्हीं के पास भूखी-प्यासी बची है। बाकी जगहों पर मरणासन्न

हैं या कि बिक जाने अथवा बंद हो जाने को मजबूर हैं।

संस्करणसेवी ज्यादातर अख़बार समाचार के नाम पर जिन बातों को छाप अथवा परोस रहे हैं; उसे सम्पादक नहीं बल्कि दूसरे लोग तय कर रहे हैं। सम्पादक की अपनी खुद की वैचारिकी पर ग्रहण लग चुका है। सरकारी रिपोर्ट की भाषा में हो रही पत्रकारिता की विश्वसनीयता संदिग्ध ही नहीं, आपराधिक भी है। पन्ने रंगीन और छपाई आकर्षक जरूर हो गए हैं लेकिन विचार व दृष्टि नदारद है। जनपक्षधर सूचनाओं एवं घटनाओं को आज की पत्रकारिता हाशिए पर धकेलने का काम इरादतन कर रही है। वह उन मुद्दों और बातों पर सारा बल कूट रही है जिनका इतिहास–बोध और जन–स्मृति से कोई लेना–देना नहीं है। मौजूदा यथार्थ भी सच को बरगालने ख़ातिर नाना तरीके के विभ्रम पैदा कर रहा है, कुचक्र रच रहा है। छल–छद्म से भरा पत्रकारिता का यह दौर सामाजिक लगाववृत्ति और आपसी सहोदरपन को नष्ट–विनष्ट करने पर तुला है।

गाँधीजी के सत्य और अहिंसा से अनुप्राणित गंगा–जमुनी तहजीब की बात करना बेकार है। पत्रकारिता अपने उद्देश्य से भटकी हुई मूल्यहीन महफ़ीलों में विचरण कर रही है। समाचार–पत्र हैं लेकिन उनकी आत्मा गायब है। यानी समाचार–मूल्य, निष्पक्षता, वस्तुनिष्ठता, यथार्थता इत्यादि जैसे सवालों पर अब बल कम है जिस कारण पत्रकारिता स्तरहीन तथा अगम्भीर होती जा रही है। सियासी गठजोड़ और लाभ–हानि के समीकरण ने पत्रकारिता के गले में फांस डाल रखा है। समाचार–पत्र की प्रतिष्ठा को पूँजी के दावेदार निलाम करने पर तुले हैं। ऐसा क्यों हैं, इसका कारण अनेक है। 'जिन ढूँढा तिन पाइयाँ' की नियत हो, तो उत्तर मिलेंगे। समुचित और सम्यक् जवाब हासिल होंगे।

गाँधीजी का स्मरण इन अर्थ–सन्दर्भों में अनिवार्य है। उनकी भूमिका की तलाश की जानी चाहिए। स्वतन्त्रतापूर्व के दिनों में उन्होंने पत्रकारिता में उच्चतर मूल्य गढ़े। जनपक्षधरता की मानक कसौटी बनायी। पत्रकारिता की मर्यादा तय की। पत्र एवं पत्र–सम्पादकों की जवाबदेहियों को गरिमामय आचरण का हिस्सा बनाया। पत्रकारीय चेतना से लैस लोगों में दायित्व–निवर्हन का स्थूल–सूक्ष्म विवेक जगाने का काम गाँधीजी ने बखूबी किया। यह सब हो सका, क्योंकि गाँधीजी स्वयं भी पत्रकार थे। यह और बात है, उनका

राजनीतिक–सामाजिक व्यक्तित्व विराट है, लेकिन इस विशालता में उनकी सम्पादकीय कुशलता और पत्रकारीय कौशल शामिल है।

उनकी खुद की स्वीकृति गौरतलब है–'यदि मैं राजनीति में नहीं होता, तो निश्चित कहता हूँ मैं पत्रकार होता।' गाँधीजी पत्रकारिता के खुलासा हैं, अगुवा या अग्रदूत हैं; यह सब कहना उनके योगदान का परिसीमन करना होगा। दरअसल, गाँधीजी जननायक की छवि में पत्रकारिता के असल योद्धा थे जिन्होंने कागज और कलम का डोर थामा, तो उनके पत्रकारीय ओज एवं हुंकार से तत्कालिन पत्र–पत्रिकाओं में नई स्फूर्ति का संचार हुआ, स्वाधीनता आन्दोलन की दिशा स्पष्ट हुई तथा जनमानस में वे सर्वस्वीकार्य सिद्ध हुए। वस्तुनिष्ठता और यथार्थता जो कि पत्रकारिता की आधारशिला है, उससे गाँधीजी कभी डिगे नहीं। उन्होंने हर विषय पर अपना मत रखते हुए जनमत–निर्माण की राह में नयी लकीर खींचने का सफल प्रयास किया।

हिन्दी पत्रकारिता

राष्ट्रीयता एवं संस्कृति

डॉ. सुरेश कुमार पाण्डेय

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साहित्य संचय

बी-1050, गली नं. 14, पहला पुस्ता,
सोनिया विहार, दिल्ली-110090
फोन नं. : 09871418244, 09136175560
ई-मेल - sahityasanchay@gmail.com
वेबसाइट - www.sahityasanchay.com

ब्रांच ऑफिस

ग्राम : बहुरार, पोस्ट : ददरी
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पटना (बिहार)

नेपाल ऑफिस

राम निकुंज, पुतलीसड़क
काठमांडौ, नेपाल-44600
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शिवपूजन सहाय की पत्रकारिता और मतवाला-मंडल
(विशेष सन्दर्भ : हिंदी नवजागरण)

डॉ. राजीव रंजन प्रसाद
सहायक प्रोफेसर, हिंदी विभाग
राजीव गांधी विश्वविद्यालय, रोनो हिल्स
दोईमुख, अरुणाचल प्रदेश

अपनी तरह का अनूठा आँचलिक उपन्यास है 'देहाती दुनिया' जिसे लिखने वाले शिवपूजन सहाय साहित्य के लाल बहादुर शास्त्री कहे जाते हैं। आचार्य शिवपूजन सहाय आधुनिक पत्रकारिता के उन्नायक-पुरुष के रूप में समादृत हैं जिनके सरल-सादगीपूर्ण व्यक्तित्व में बहुत कुछ ऐसा देखने को मिल जाता है जिसने आने वाली पीढ़ी को पत्रकारीय तेवर एवं लेखन में चेतस बनाया; उन्हें सम्पादन-कला में दक्ष-निपुण किया था। शिवपूजन सहाय 'मतवाला-मंडल' के गुणी सम्पादकों में से एक हैं। हिंदी पत्रकारिता में शिवपूजन सहाय कई अर्थों में मूल्य हैं। पहली बात तो यही कि वह आज के अधिसंख्य पत्रकारों की तरह बगैर गेट के नहीं थे जिनके पास न तो भाषा है और न उसे सम्यक् ढंग से बरतने की तमीज मालूम है। इतिहास-बोध और सांस्कृतिक-साहित्यिक विवेक-बुद्धि से च्युत ऐसे पत्रकारों ने भारतीय पत्रकारिता का बेड़ा गरक किया है। वर्तमान युगबोध से कटी और यथार्थ से छिटकी हुई पत्रकारिता न तो अपने पाठकों को अक्लमंद बनाती है और न ही उन्हें सेहतमंद। पूँजीपतियों के दबाव में संपादकों के अधिकारों पर होते कुठाराघात पर आचार्य शिवपूजन सहाय की चिंता गौरतलब है। वे कहते हैं–"लोग दैनिक पत्रों का साहित्यिक महत्व नहीं समझते, बल्कि वे उन्हें राजनीतिक जागरण का साधन मात्र समझते हैं। किंतु हमारे देश के दैनिक पत्रों ने जहाँ देश को उद्बुद्ध करने का अथक प्रयास किया है, वहीं हिंदी प्रेमी जनता में साहित्यिक चेतना जगाने

का श्रेय भी पाया है। आज प्रत्येक श्रेणी की जनता बड़ी लगन और [illegible]
दैनिक पत्रों को पढ़ती है। दैनिक पत्रों की दिनोंदिन बढ़ती हुई [illegible]
के हित साधन में बहुत सहायक हो रही है। आज हमें हर बात में [illegible]
की सहायता आवश्यक जान पड़ती है। भाषा और साहित्य की उन्नति में भी [illegible]
पत्रों से बहुत सहारा मिल सकता है।"[1]

पत्र-पत्रिकाओं की जवाबदेह भूमिका के लिए संभावित चुनौतियों [illegible]
हो सकती हैं। यह भान उस समय के दूरदर्शी सम्पादकों को बखूबी हो [illegible]
बाबू विष्णुराव पराड़कर ने प्रथम हिंदी सम्पादक सम्मेलन के अध्यक्ष पद [illegible]
कहा था उसकी निर्लज्ज परिणति आज हमारे सामने घटित हो रही है। करीब [illegible]
विष्णु पराड़कर, "पत्र निकालकर सफलतापूर्वक चलाना बड़े-बड़े धनियों [illegible]
सुसंगठित कंपनियों के लिए ही संभव होगा। पत्र सर्वांग सुन्दर होंगे। आकार [illegible]
होंगे। छपाई अच्छी होगी। पत्र मनोहर, मनोरंजक और ज्ञानवर्द्धक चित्रों से सुसज्जित [illegible]
होंगे, लेखों में विविधता होगी, कल्पना होगी, गंभीर गवेषणा की झलक होगी, [illegible]
मनोहारिणी शक्ति भी होगी। ग्राहकों की संख्या लाखों में गिनी जाएगी। [illegible]
कुछ होगा, पर पत्र प्राणहीन होंगे। पत्रों की नीति देशभक्त, धर्मभक्त अथवा [illegible]
के उपासक महाप्राण सम्पादकों की नीति न होगी। इन गुणों से सम्पन्न [illegible]
विकृत मस्तिष्क समझे जाएँगे। सम्पादक की कुर्सी तक उनकी पहुँच भी न होगी।

वास्तव में पत्रकारिता के कुछ निर्धारित मानदण्ड होते हैं, प्रचलित कर्तव्य [illegible]
जिनका उल्लंघन जनहित के विरुद्ध माना जाता है। इसका सिलसिलेवार उल्लेख [illegible]
किया जाना आवश्यक है। ताकि शिवपूजन सहाय और बाबू विष्णुराव पराड़कर [illegible]
चिंताओं को समझने में सुविधा हो सके। दरअसल, पत्रकारिता समाज को उचित [illegible]
सूचना, सुझाव और सत्य की सुचिंतित जानकारी देती है। यह समाज में [illegible]
लाने और जागरूकता फैलाने का काम करती है। संस्कृतिनिष्ठ एवं समाजोन्मुख [illegible]
पत्रकारिता सदैव राजनीतिक, साम्प्रदायिक, छुआछूत, जाति-प्रथा, दलित [illegible]
आदिवासी आदि मुद्दों के प्रति अपना संवेदनशील व्यवहार दिखाती है तथा इन [illegible]
में निष्पक्ष, पारदर्शी एवं वस्तुनिष्ठ बातचीत करती है। यह कृषि, व्यापार, [illegible]
शिक्षा, चिकित्सा से सम्बन्धित नीतियों के प्रति प्रगतिशील दृष्टिकोण रखती है [illegible]
इसका उचित विकास सुनिश्चित करने के लिए सकारात्मक पहल करती [illegible]
है। पत्रकारिता के दायित्व-बोध में यह भी शामिल है कि वह राष्ट्रीयता-बोध [illegible]
और देश के प्रति व्यक्ति के कर्तव्य को समय-समय पर सूचित करती है। यह [illegible]
को गलत ठहराने और सही को सही साबित करने के दिशा में निरन्तर प्रयास [illegible]

है। यह आम जनमानस को अधुनातन परिवर्तन, नवीन आचरणों, खोज, विज्ञान, साहित्य, कला, यात्रा, खेल, नवोन्मेष जैसे बहुविध विषयों की समसामयिक सूचना मुहैया कराती है, उन्हें शिक्षित करती है। जवाबदेह और निष्पक्ष पत्रकारिता गंभीर से गंभीर बात को सहज एवं सरल बनाकर प्रस्तुत करती है, ताकि वह सबकी समझ में आ जाए। वह किसी व्यक्ति-विशेष के लिए नहीं अपितु अपार जनसमूह के प्रहरी के रूप में चौबीसों घंटे काम करती है।

पत्रकारिता आज चाहे जितनी बदल गई है, पर उसके लिए संरचित प्रतिमान और निकष आज भी विचारणीय है। क्योंकि आवारा पूँजी ने पत्रकारीय मूल्यों की किस कदर अनदेखी की है, यह तथ्य अब किसी से छुपा नहीं है। पूर्व की पत्रकारिता में प्रतिबद्धता और जनपक्षधरता किस कोटि की रही है, जानने के लिए हिंदी नवजागरण से बेहतर परिप्रेक्ष्य और कोई दूसरा नहीं हो सकता है। भारतीय जनसमाज की मेधा और प्रतिभा को हिंदी नवजागरण ने माँजा। पश्चिमी आधुनिकीकरण को ठीक-ठीक पहचानने की चेष्टा की। इन्हीं दिनों नवजागरण के पुरस्कर्ता कहे जाने वाले भारतेन्दु हरिश्चन्द्र ने जनभाषाओं के एकीकरण पर बल दिया। उन्होंने राष्ट्रीयता के भूगोल को समझने हेतु मातृभाषाओं के महत्त्व को समझे जाने का आग्रह किया। साथ ही हिंदी की सर्वमान्यता और राष्ट्रीय स्वर बनने की अकूत क्षमता का प्रश्न भी उठाया। भारतेन्दु हरिश्चन्द्र ने मातृभाषाओं के महत्त्व को समझते हुए जहाँ यह कहा कि–'निज भाषा उन्नति अहै, सब भाषा को मूल/बिन निज भाषा ज्ञान के, मिटत न हिय को सूल'; वहीं यह भी कहना जरूरी समझा–'हिंदी नई चाल में ढली'। यह नई बनती हिंदी नागरी लिपि में अपनी देह-काया बलिष्ठ और मजबूत बनाने में जुटी थी। भारतेन्दु मंडली के पंडित प्रताप नारायण मिश्र ने हिंदी भाषा के विचार-प्रवाह को गति देने के उद्देश्य से कहा–'हिंदी, हिन्दू, हिन्दुस्तान'। बाद के मनस्वी सम्पादक आचार्य महावीर प्रसाद द्विवेदी ने हिंदी को अधिक रचनात्मक और वैचारिक बनाने में जिस तरह के सम्पादकीय मनीषा का प्रयोग किया, वह आज भी स्वर्ण-लकीर है।

नवजागरण का काल भारत में जनजागृति का अलख जगाने वाला ध्रुवकाल है। इस संक्रांति काल में ब्रिटिश शासन की गुलामगिरी करते सामंतों, जमींदारों, सेठ, साहूकारों, रैयतदारों आदि को सवाल के कठघरे में रखने की कोशिश हुई। यद्यपि ऐसे अभिजन भारतीय परतन्त्रता के हिमायती नहीं थे; लेकिन अंग्रेजों को जाने देना भी नहीं चाहते थे। उन्हें अपना एकाधिपत्य खत्म हो जाने का भय-डर सता रहा था जो उन्हें अंग्रेजों की चारण-भक्ति करने पर विवश किए हुए था। दरअसल,

समाज में जाति-विशेष के वर्चस्व का मिथ टूट रहा था। सामाजिक स्तरीकरण के नधायी भेदभाव आधारित अमानवीय व्यवस्था जबर्दस्त आलोचना का शिकार थे। इसी तरह सामाजिक कुरीतियाँ ही नहीं मानसिक विकृतियाँ भी अपनी पुरानी खोल-कवच हटाने पर विवश थीं। भारतेन्दु हरिश्चन्द्र और तत्कालीन साहित्यसेवी स्त्री-पुरुष के बीच बनी पीड़ादायी पितृसत्तात्मक दरो-दिवार और अन्यायपूर्ण सामाजिक व्यवस्था पर तीव्र प्रहार कर रहे थे। उनकी दृष्टि में 'नर-नारि सम हों हि' की अकुंठ भावना निहित थी। उनकी प्रबुद्ध और चेतस मंडली में जो कलमकार थे, उनकी दृष्टि साफ और सुस्पष्ट थीं। उनके वैचारिक लेखों और लिखे गद्य में अपने समय-समाज की वास्तविक समझ और यथार्थवादी दृष्टिकोण दिखलाई पड़ने लगा था। साहित्य और पत्रकारिता का तेवर घुलमिल जाने से कहन की अदायगी और कहे का प्रभाव केन्द्रित होना तय था। भारतीय साहित्य का पुराना कोठार खुल चुका था और उस ज्ञानराशि का सतत् प्रवाह समाचार-पत्र, अनुवाद और अन्यान्य वाचिक-लिखित माध्यमों के चहुँओर अपनी उपस्थिति दर्शाने लगा था। अपनी सीमाओं के बावजूद भारतेन्दु हरिश्चन्द्र हिंदी नवजागरण के पुरोधा साबित हुए थे और सांस्कृतिक-साहित्यिक पत्रकारिता के आधार स्तंभ भी। उन्होंने अपने युग की जमीनी सचाइयों को पहचानने की कोशिश की। उनकी भारतेन्दु मंडली में सहभागी बने साहित्यकारों ने भी इस समिधा में बहुत कुछ जोड़ा जो स्वाधीनता का राजनीतिक-बोध और सामाजिक चेतना को प्रसूत करने का प्रमुख कारण बना। फलतः अराजक सामाजिक जड़ताओं में जकड़ी मूक-बधिर जनता को साफ जबान में समझदार बात कहने वाले कुछ ऐसे लोग मिल गए, जो पहले के लोगों से भिन्न थे। उनकी कहनशैली हिंदी का नवभाषिक संस्कार ग्रहण किए हुए थी। स्वनामधन्य पत्रकारीय दृष्टि से लैस साहित्यकारों में राजा शिवप्रसाद 'सितारे हिंद', राजा रामपाल सिंह, बालकृष्ण भट्ट, बालमुकुन्द गुप्त, बदरी नारायण चौधरी 'प्रेमघन', दुर्गा प्रसाद मिश्र, अम्बिका प्रसाद वाजपेयी, गोपाल राम गहमनी, अमृतलाल चक्रवर्ती, रूद्रदत्त शर्मा, बाबू रामकृष्ण वर्मा, राधाचरण गोस्वामी जैसे तपस्वी साधकों का नाम अग्रगण्य है जो भारतेन्दु मंडली के महत्वपूर्ण स्तंभ कहे जा सकते हैं।

आचार्य शिवपूजन सहाय को जिन महानुभावों का वरदहस्त प्राप्त हुआ उनमें नवजागरणकालीन अंतः प्रेरणा और प्रदीप्त-भाव सर्वाधिक है। शिवपूजन सहाय अपने युगबोध की पहचान कर सकें याकि भारतेन्दुकालीन आधुनिक-चेतना से मार्गदर्शन पा सकें, तो इस कारण भी उनकी दृष्टि में भारतेन्दु तदनुकूल भाव-संवेदना एवं सामूहिकता-बोध के मानवीय-विस्तार (मानव-संचार) पर अधिक बल दे रहे थे।

जनसमूह के प्रति विशेष आग्रही तथा जनपक्षधर रचनाओं के जबर्दस्त पैरोकार होने के कारण हिंदी नवजागरण की नवचेतना विकसित करने में वे और उनकी मण्डली काफी हद तक सफल रही। वर्ण-व्यवस्था के कुंठित अवधारणा को प्रत्यक्ष-परोक्ष ढंग से बचाते हुए भारतेन्दु मण्डली ने कुलजातीय-चेतना को पहली बार राष्ट्रीय-संस्कृति से जोड़ा। औपनिवेषिक साम्राज्य से मुक्ति के ठोस आग्रह के बावजूद भारत की मूल-संवेदना, सरोकार, संस्कार, सामूहिकता, लोकचेतना, जनपक्षधरता, प्रतिबद्धता, त्याग, समर्पण, उत्सर्ग इत्यादि को सम्पूर्णतः शामिल न किया जाना भारतेन्दु मण्डली के हिन्दूवादी प्रवृत्तियों के कारण हुआ जबकि राष्ट्र-गौरव के निर्माण में जुटी भारतेन्दु-मण्डली के सदस्यों की स्पष्ट घोषणा थी– 'स्वाधीन मनोवृत्ति तथा अकुंठ चित्तवृत्ति'। अतएव, इसकी प्रतिपूर्ति में नई धारा को हिंदी नवजागरण का ध्वजावाहक बनना पड़ा जिसमें ज्योतिबा फूले एवं रमाबाई फूले का नाम बेहद महत्त्वपूर्ण है। यद्यपि "इन वर्षों में हिंदी की पत्रकारिता का अनेक स्तरों पर विकास हुआ। राष्ट्रीय चेतना, जागरण, देश प्रेम, समाज सुधार जैसे अनेक स्तरों पर पत्रकारिता समृद्ध हुई जिसमें भाषा के स्तर पर भी समृद्धि लक्षित की जा सकती है। इस दौर के प्रकाशनों में सहज ही देखा जा सकता है कि राजनीतिक प्रश्नाकुलता भी बढ़ी।"[3]

आचार्य शिवपूजन सहाय पत्रकारों, साहित्यकारों तथा सम्पादकों के आलोचकीय दृष्टि के हिमायती थे। उन्होंने नवजागरण की उन प्रवृत्तियों की खुलकर आलोचना की जो सत्तानुरागी या फिर समझौतापरस्त मालूम देती थीं। वजह कि हिंदी नवजागरण के अन्तर्गत हिंदी भाषा-भाषियों ने यूरोपीय शिक्षा से प्रभाव ग्रहण किया था। क्रांति और आन्दोलन के बीज तत्त्व तथा 'स्वतन्त्रता, समानता एवं बंधुत्व' की शब्दावली उन्हीं के यहाँ से मिले थे। लेकिन भारत में उभरी प्रवृत्तियाँ और मानुष चेतना मौलिक थी। यह सच है कि ब्रिटिश पद्धति से मिले ज्ञान ने तर्क-चिंतन-संज्ञान द्वारा वैज्ञानिक-विमर्श की नई परम्परा शुरू कर दी थी जिसे सामान्यतया आधुनिकता का पर्याय मान लिया गया है; परन्तु इसमें भारतीय आत्मा का स्वीकार-अस्वीकार पूर्णतया अपने विवेक-विक्षोभ के साथ समाहित था। अंग्रेजी-शिक्षण से जागरूक तथा शिक्षित बने भारतीयों ने बहुत कुछ सकारात्मक बातें सीखीं जिसमें से पत्र-संस्कृति स्वयं एक है। इसके अलावे हम देख सकते हैं कि, "इतिहास को धर्मों-सम्प्रदायों के अंदरूनी अंतर्विरोधों, परस्पर विरोधी विश्वासों और आर्थिक-सामाजिक स्थितियों के आधार पर होने वाले जातिगत-वर्गगत विभाजन को नकार कर एक 'यूनीफार्म और होमोजिनस' इकाई के रूप में प्रस्तुत करने की व्यवस्थित शुरूआत जेम्स मिल के इतिहास लेखन से हुई।"[4] इस तरह मान्य एवं स्वीकृत प्रचलन को प्रश्नांकित

करने का दमखम भारतेन्दु-मंडली ने दिखाया जिससे वर्तमान आधुनिक बना। बाद की सदियाँ सुलगते सवाल दागने की आदी हो गईं। राजा शिवप्रसाद 'सितारे हिंद' ने हिन्दू धर्म में प्रचलित बेसिर पैर की बातों का अपने तर्कों से न सिर्फ खंडन किया बल्कि उन्होंने यह भी कहने का साहस जुटाया कि भारतीयता को लेकर जितनी मुँह उतनी बेमतलब बातें प्रचलित हैं और भारत सम्बन्धी इतिहास-लेखन खुद इससे अछूता नहीं है। कहने को तो यह भी कहा जाता है कि भारतेन्दु हरिश्चन्द्र तक शिवप्रसाद की तल्ख टिप्पियों से आहत हो चुके थे। यह और बात है, भारतेन्दु और उनकी मंडली के अन्य सदस्यों में अपनी विचार-दृष्टि और सम्यक् दृष्टिकोण को लेकर आपस में ही भारी असहमति, अन्तर्विरोध, नकार-भाव रहे हैं। जैसे शिवप्रसाद 'सितारे हिन्द', बालकृष्ण भट्ट, प्रताप नारायण मिश्र, राधाकृष्ण दास, बालमुकुन्द गुप्त, बद्रीनारायण चौधरी 'प्रेमघन' आदि। ये सबलोग पश्चिमी चिंतकों यथा–विलियम जोन्स, कोलब्रुक, जेम्स प्रिंसेप और मैक्समूलर का अविवेकी-प्रस्तावक होने के कारण उनकी निराधार व्याख्याओं से अधिक प्रभावित थे। नतीजतन, बहुविध बुराइयों के चपेट में आकर बिल्कुल किताबी हो चुके हिंदू धर्म का वे तार्किक-विश्लेषण करने की जगह उसके गौरवशाली अतीत को लेकर अधिक मोहग्रस्त दिखाई देते हैं। मनीषी चिंतक श्यामाचरण दूबे किसी भी पूर्वाग्रह अथवा दुराग्रह को नकारते हुए कहते हैं–"भारत की सांस्कृतिक चेतना विशिष्ट प्रबुद्ध वर्ग के पूर्वाग्रह से पीड़ित है, जो धर्मशास्त्रों में चित्रित भारतीय संस्कृति के सार-तत्त्व तथा प्रधान विषयवस्तु को उभारते हैं। इस प्रकार से कुछ भी प्रदर्शित किया जाता है, वह बहुत अंशों में भारतीय संस्कृति का पुस्तकीय दृष्टिकोण होता है। यह वह आदर्श संस्कृति है जिसको नगरीय पढ़े-लिखे लोग कल्पना करते हैं, वह जनता की यथार्थ संस्कृति नहीं है।"[5] डी. डी. कोशांबी ने आत्म मोह ग्रस्तता से निकलने की सलाह देते हुए उचित ही कहा है कि–'अगर कहीं कोई स्वर्णकाल जैसी चीज है, तो वह अतीत में नहीं बल्कि भविष्य में मौजूद है।' भविष्य में असीम संभावनाएँ छिपी हैं। प्रो. अमरनाथ हिंदी भाषा के संदर्भ में यह बात पूरे दमखम से कहते हैं कि–"तमाम प्रतिकूल परिस्थितियों के बावजूद हिंदी ने अपना दायरा विस्तृत किया है। अपनी क्षमता में इजाफा किया है। विज्ञान एवं प्रौद्योगिकी की शिक्षा के लिए माध्यम भाषा के रूप में अपनी योग्यता प्रमाणित की है। निःसंदेह इस देश का भविष्य हिंदी के साथ जुड़ा है क्योंकि हिंदी, देश के उन मेहनतकशों की भाषा है, आने वाला भविष्य जिनकी मुट्ठी में होगा।"

इस प्रकार हिंदी नवजागरण ने वैचारिक बहस छेड़ने और प्रश्न उठाने की जो परिपाटी शुरू की, वह बेमिसाल साबित हुई। दायित्व-बोध से भरी-पूरी वह परम्परा

समालोचना भी वही करते थे। संपादकीय, चलती चक्की व अन्य विनोदपूर्ण टिप्पणियाँ लिखने तथा प्रूफ पढ़ने का जिम्मा शिवपूजन सहाय का था। मुंशी नवजादिक लाल भी हास्य विनोदपूर्ण टिप्पणियाँ लिखते थे।''[9] मतवाला-मंडल की चर्चा हो, तो आचार्य शिवपूजन सहाय की स्मृति स्वमेव अपने साथ जुड़ जाती है। लोक-प्रचलित कहावत है–'सबै सहायक सबल के, निर्बल ना केऊ सहाय' की रूढ़-धारणा को तोड़ने में शिवपूजन सहाय और उनकी मतवाला-मंडली की पत्रकारीय निष्ठा, जुनून और दृष्टि द्रष्टव्य है। शिवपूजन जी की यह मंडली अपने अतिरिक्त जिन-जिन मतवालों से मिलकर बनी थी उनके नाम हैं–मुंशी नवजादिक लाल श्रीवास्तव, श्री ईश्वरी प्रसाद शर्मा, श्री सूर्यकान्त त्रिपाठी 'निराला', पाण्डेय बेचन शर्मा 'उग्र'। उन दिनों की साहित्यिक पत्रों में इसकी धाक पूरी तरह जम चुकी थी। यही नहीं कई कारणों से मतवाला-मंडली लोकप्रिय थी। यूँ तो मतवाला कलकत्ता के बालकृष्ण प्रेस से निकलती थी, लेकिन उसके मालिक एवं संचालक श्री महादेव प्रसाद सेठ मिर्जापुर निवासी थे। सेठ जी का मतवाला के लिए फरमान था कि चाहे कोई कितना भी बड़ा हो, जरा भी लचे तो धरकर रगड़ डालो। उन दिनों 'मतवाला' की 10 हजार प्रतियाँ छपती थीं। उसके लिए कागज, स्याही, ब्लॉक तथा बिक्री आदि की सारी देखभाल मतवाला-मंडली ही संभालती थी। किन्तु मुंशी नवजादिक लाल इसमें विशेष निपुण थे। अपने हिसाब रखने की इस प्रवृत्ति के कारण ही उन्हें 'मुंशी' कहा जाता था। मुंशी साहब महादेव प्रसाद सेठ के सबसे निकट थे। इन्हीं के आश्वासन पर ही सेठ जी ने 'मतवाला' निकाला था। मतवाला-मंडल के सदस्य रूप में शामिल नवजादिक लाल लेखक भी जबर्दस्त थे। मतवाला में 'मतवाला की बहक' नामक जो स्तंभ निकलता था, उसे वे ही लिखा करते थे। मुंशी जी एक सफल पत्रकार होने के भी कई उदाहरण हैं। मुंशी जी ने 'लाला लाजपतराय' की ओजपूर्ण जीवनी लिखी थी। अन्य पुस्तकों में 'शान्ति-निकेतन', 'बेगमों के आँसू' और 'पराधीनों की विजय-यात्रा' नामक उपन्यास भी लिखे थे। मतवाला मंडली के श्री ईश्वरी प्रसाद शर्मा की शोहरत भी बेजोड़ थी। एक बार वह अपने पत्रकारीय लेखन की वजह से जेल गए और जल्द ही ससम्मान बरी हुए। इस पर उस समय के मशहूर कवि बिस्मिल ने लिखा–'ईश्वरी प्रसाद शर्मा छूट गए। ख़त में यह पढ़कर दिल हुआ बाग-बाग/लिख दिया 'बिस्मिल' ने बर्मन जी को 'अब जलाओ घर में, तुम घी के चिराग'। श्री ईश्वरी प्रसाद शर्मा अपने साप्ताहिक पत्र 'हिन्दू पंच' की वजह से भी जाने जाते हैं। इस पत्र का मुख्य उद्देश्य हिन्दू संगठन, शुद्ध संस्कार, अछूतोद्धार, समाज-सुधार और हिंदी-प्रचार था। ईश्वरी प्रसाद जी द्वारा मराठी से अनूदित 'इन्दुमति'

तथा 'रत्नदीप' नामक उपन्यास भी अपनी विशिष्टता के लिए विख्यात है। अंग्रेजी से अनूदित उपन्यासों में 'प्रेम गंगा' और 'प्रेमिका' नामक उपन्यास उल्लेख्य है।

मतवाला-मंडली के बतौर सदस्य सूर्यकान्त त्रिपाठी 'निराला' की तो बात ही निराली है। निराला बालकृष्ण प्रेस के ऊपरी तल्ले में रामकृष्ण मिशन के सन्यासियों के साथ रहते थे। एक नवोदित उर्जस्वित कवि के रूप में वह भी मतवाला से जुड़ गए। सेठ जी का निराला पर बहुत स्नेह था, यहाँ तक कि उनके लिए केश-रंजन और जावा कुसुम तेल लाकर रखते थे। निराला जब बाहर घूमने निकलते वह उनके जेब में रूपये-पैसे डाल देते थे। जेल जाने के लिए वे हमेशा तैयार रहते थे। मतवाला-मंडली में एक और शीर्षस्थ व्यक्ति रहे—पाण्डेय बेचन शर्मा 'उग्र'। उग्र जी ने 'मतवाला-मण्डल' के एक सदस्य की हैसियत से अपने साहित्यिक जीवन में प्रतिष्ठा प्राप्त करके हिंदी कथा साहित्य को जहाँ एक विशिष्ट भाव-भंगिमा प्रदान की, वहाँ उत्कृष्ट पत्रकार के रूप में भी उनकी देन कम महत्त्व नहीं रखती। 'मतवाला' में उनके लिखे चुटीले व्यंग्य जबर्दस्त लोकप्रिय थे। 'मतवाला' में कार्य करते हुए उग्र जी ने अपने को इतना माँजा और कहन को नुकदार बनाया कि इनकी व्यंग्य-लेखन प्रतिभा अत्यन्त प्रखर हो गई थी। क्षेमचन्द्र 'सुमन' श्री बेचन शर्मा 'उग्र' के बारे में ठोस किन्तु महीन टिप्पणी करते हैं—'आज कितने ऐसे पत्रकार हैं, जो मालिक को ठेंगे पर रखकर अपनी बात कहने की क्षमता रखते हों।' उन्होंने खुद ही पत्रकारिता के निकष सामने रखे—"मेरी राय में पत्रकार बनने से पूर्व आदमी को समझ लेना चाहिए कि यह मार्ग 'त्याग' का है 'संग्रह' का नहीं। जिस भाई या बहन को भोग-विलास की लालसा हो, वह और धन्धे करे, रहम करे इस राम-रोजगार पर। मेरा आदर्श पत्रकार ईमानदार पादरी, पीर, परमहंस-सा नजर आता है। व्यक्तिगत सुख-दुःख के बहुत ऊपर, किसी भी भीड़ में जिसे आसानी से पहचाना जा सके।"

मतवाला-मंडली के सान्निध्य में संघर्ष का सहयात्री बने आचार्य शिवपूजन सहाय का कर्म एवं व्यक्तित्व दोनों आदर्श है। डॉ. सिद्धिलाल माणिक ने उनके बारे में उपयुक्त ही कहा है कि—"उन्होंने एक पत्र-सम्पादक के रूप में जिस उत्साह से हिंदी-सेवा का व्रत लिया था, उसी उत्साह और दृढ़ता से उसे निभाया भी। हिंदी प्रेम उनकी धमनियों में लहू की तरह प्रभावित होता रहता था। वे आचार्य महावीरप्रसाद द्विवेदी जैसे सम्पादकाचार्य की परम्परा में अग्रणी कड़ी के रूप में हिंदी पत्रकारिता के क्षेत्र में आए थे और द्विवेदी जी के आदर्शों के अनुरूप ही अपने को ढालकर उन्होंने पूरी निष्ठा और दायित्व-चेतना के साथ समर्पित और स्तरीय सम्पादन-कार्य का एक प्रतिमान खड़ा कर दिया। अपने जीवन-काल में ही एक मर्मी कलाकार

होने के साथ-साथ एक विज्ञ समीक्षक के रूप में भी प्रतिष्ठित हो गए। शीघ्र ही हिंदी-जगत् ने सिर झुकाकर उनकी सम्पादन-क्षमता और अद्वितीय कला का लोहा मान लिया था।"[10] मतवाला-मंडली में कई जन शामिल थे किन्तु सभी एक से बढ़कर एक धुरन्धर थे। अतएव, सबका समान महत्त्व बनता है। आज यह परिपाटी खत्म होती जा रही है। अधिसंख्य पत्र-पत्रिकाओं में सम्पादक अथवा प्रधान सम्पादक का ही बखान होता है, जबकि सचाई कुछ और है। पंडित बनारसीदास चतुर्वेदी के शब्दों में कहें तो–'पत्रकार पेशे की यह एक विडम्बना है कि मुख्य काम करने वाले तो उसके सहायक सम्पादक होते हैं और सम्पूर्ण यश मिल जाता है उसके प्रधान सम्पादक को।'

यहाँ यह कहना आवश्यक जान पड़ता है कि चरित्र से साधु किन्तु पत्रकारीय शैली में प्रखर शिवपूजन सहाय व्यक्तिगत नाम-यश के आकांक्षी कभी नहीं रहे तभी तो उनकी पत्रकारीय-निष्ठा का अभिनन्दन करते हुए हरिवंश राय बच्चन ने कहा है–'हिंदी की शक्ति और क्षमता का, देना तुम्हें प्रणाम।' बड़े ही श्रद्धा एवं आत्मीय-भाव से संस्कृति-चिंतक फादर कामिल बुल्के ने लिखा है कि–'परलोक में जाकर जिससे मिलकर उन्हें अनिर्वचनीय खुशी होगी वह शिवपूजन सहाय हैं।' आचार्य शिवपूजन सहाय के कृतित्व एवं व्यक्तित्व के साक्षी एवं द्रष्टा रहे उनके सुपुत्र मंगलमूर्ति ने अपने पिता को याद करते हुए लिखा है–"हिंदी में अभिनन्दन ग्रन्थ निकालने की परम्परा हिंदी में सहाय जी ने ही शुरू की। आचार्य महावीर प्रसाद द्विवेदी अभिनन्दन ग्रन्थ के मूल में सहाय जी की ही प्रेरणा रही है और उसका एक तरह से संपादन भी उन्होंने ही किया।"[11] वह यहीं पर आचार्य नन्ददुलारे वाजपेई के हवाले से कहते हैं–"ऐसा अभिनंदन ग्रन्थ हिंदी में कोई दूसरा नहीं है। वैसे तो उनके गुरु ईश्वरी प्रसाद शर्मा थे लेकिन अपना आराध्य गुरु वे आचार्य द्विवेदी को मानते थे। वे द्विवेदी के ही पद चिन्हों पर आगे बढ़े। उनका गद्य 'ठेठ हिंदी का ठाठ' की परम्परा में है। शुरू में वह बहुत आलंकारिक भाषा लिखते थे बाद में ठेठ हिंदी की परम्परा में आए, फिर हिंदी-उर्दू की ओर गए। बिहार राष्ट्र भाषा का संचालन किया जो उस समय बहुत ही महत्पूर्ण संस्था बन गई थी। उनके समय में जो किताबें वहाँ से प्रकाशित हुई वे आपने आप में मानक हैं। उनके निर्देशन में वासुदेवशरण अग्रवाल का 'हर्ष-चरित : एक सांस्कृतिक अध्ययन', 'कादम्बरी : एक सांस्कृतिक अध्ययन', महापंडित राहुल सांकृत्यायन का 'सतमत कोश' जैसे ग्रंथों को तैयार करा कर प्रकाशित किया।"[12]

ऐसे महती और पुनीत कार्य की आवश्यकता आज की पीढ़ी को नवउदार

एवं नवशक्ति देने हेतु अत्यावश्यक है। पत्रकारीय पेशे से जुड़े लोगों को सुबुद्ध पत्रकार ऋषिकेश राय के इस आग्रह पर विचारना चाहिए जिसमें उन्होंने कहा है कि–"जन-संघर्षों से प्रेरणा लेकर ही हिंदी का धारदार एवं उर्जस्वित स्वरूप विकसित हो सकता है। इन आर्थिक परिवर्तनों की नकारात्मक भूमिकाओं के खिलाफ मोर्चा खड़ाकर हिंदी जन-संस्कृति के बुनियादी मूल्यों की अभिव्यक्ति तथा संरक्षण का माध्यम बन सकती है।"[13]

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Adaptability in Crisis

A Psychological Perspective

Dr. Dharmeshwari Lourembam
Dr. Kakali Goswami
Dr. Sandeep Panchal
Dr. Satchit Prasun Mandal

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This book is a compilation of empirical research and review papers, which focuses on pertinent issues in current situation. The articles have been contributed by different researchers and experienced academicians from all over the country. The articles are thoroughly based on their original research work presented during Two Day National Conference titled **"Adaptability In Crisis: Psychology, Education And Society"** organized by the Department of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh, India on the 17th& 18th of August 2021 through virtual mode.

The objective of the book is to highlight various issues related to the present COVID-19 pandemic to foster better preparedness and adaptability in crisis. The chapters delve on the themes of Physical &Mental Health, Health Care System, Work-Life Balance, Resilience, Coping Skills and Effects of COVID-19 on Mental Health. It consists of selected unpublished articles of diverse aspects of psychological and overall mental health highly relevant on both individual and community levels in every sphere of life. The findings will also contribute to public welfare and policy documentation for the Government.

Dr. Dharmeshwari Lourembam is working as an Assistant Professor in Department of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh. She is currently the Head in-charge of the Department. She has specialized in Clinical Psychology, Positive Psychology and Counseling. She has obtained her U.G., P.G. and Ph.D. Degree in Psychology from Panjab University, Chandigarh. She was a UGC-JRF and SRF after which she joined Sikkim University (A Central University) as a Guest Faculty in Department of Psychology. She is currently part of a research project sponsored by National Commission for Women and has published research articles in journals and book chapters in the field of psychology. Her area of research includes Health Psychology and Positive Psychology.

Dr. Kakali Goswami is working as an Assistant Professor in Department of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh. She was former Head in-charge of the Department. She has specialized in Organizational Psychology and Positive Psychology. She has obtained her PG from Jamia Milia Islamia, New Delhi and Ph.D. Degree in Psychology from Gauhati University, Assam. Her area of research is positive psychology and organizational psychology. She has published numerous research papers and book chapters in the field of psychology. She is currently carrying out research project sponsored by National Commission for Women.

Dr. Sandeep Panchal is an Assistant Professor in Dept. of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh. He has Specialization in Clinical Psychology, Health Psychology and Sports Psychology. He has obtained Ph.D. Degree in Psychology from Kurukshetra University, Kurukshetra, Haryana, India. Previously, he worked as Senior Research Fellow (SRF) in DIPR, DR&DO, DELHI & Sports Psychologist in Sports Authority of India, Delhi, & Assistant Professor (Guest) at Central University of Haryana & Teaching Faculty at Indira Gandhi University (State University), Meerpur Rewari, Haryana. He has published more than 26 publications in National and International Journal of repute.

Dr. Satchit Prasun Mandal is presently working as an assistant professor in the Department of Psychology, Rajiv Gandhi University, Arunachal Pradesh. Prior to his present occupation, he was employed as a Scientist in the Defence Research and Development Organization (DRDO). He obtained his Ph.D. and Master's degree in Psychology from Banaras Hindu University (BHU). He completed his graduation from University of Calcutta. His area of research includes Personality Psychology, Health and Well-being, Positive Psychology.

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Mental Health Problems and Associated Factors among Female Working Professionals

Sandeep Panchal

Abstract

The articles aimed at exploring the factors which are linked to the female working professionals. The article is based on the studies and review of literature related to female working professionals. As it is well understood that female are handling both family and professional work together therefore female working professionals are playing a good role at the professional setup as well as their house hold demands. Further, there are many factors which are linked altogether and certainly they affect the mental health of the female working professionals. The article is also highlighted the many factors which are directly and indirectly related to the mental health of the female working professionals. Several factors like, Negative Affect, Depression, Stress and their general health. So, the current article is very important in terms of current pandemic situation and the role of female working professional in this fast changing time.

Keywords: Mental Health Problems and Female Working Professionals

Assistant Professor, Dept. of Psychology, Rajiv Gandhi University(A Central University), Doimukh, Itanagar, Arunachal Pradesh, India

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This book is dedicated to all Mechanical, Production, Manufacturing, and Materials Engineers.

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Spirituality Can Help Alleviate Physical and Mental Health Problems Resulting From COVID-19 Pandemic

Mithilesh Kumar Tiwari[1], Sweta Pathak[2], Tushar Singh[3], Yogesh K Arya[3], Benkat Krishan Bharti[3] and Satchit Prasun Mandal[4]

Abstract

Covid-19 has posed a serious challenge to mankind. Unavailability of adequate knowledge about Covid-19 caused a lot of challenges in every aspect of human behavior. Professionals from across the disciplines attempted to understand present pandemic in variety of ways. To address the psychological issues emerging from such pandemic, various ways have been introduced by psychologist and mental health professionals. Spirituality is one of the core human values and having potential in determining behavior (Cognition as well as affect), in managing distressful situation, and in leading a positive & satisfied life. Despite its potential role in managing human psyche during such pandemic time, it is under explored in the current literature. Therefore, present article is a theoretical exploration of potential role of spiritual and religious based practices to address the current pandemic time.

Keywords: Covid-19, Pandemic, Spirituality, Human Behavior

[1]S. M. College, T. M. Bhagalpur University, Bihar.
[2]T. N. B. College, T. M. Bhagalpur University, Bihar, India.
[3]Department of Psychology, Banaras Hindu University, Varanasi, India.
[4]Department of Psychology, Rajiv Gandhi University, India.

Introduction

Covid-19 (Novel Corona Virus, SARS-CoV-2) has posed severe challenges to human health across the globe. As of now, a total of 1.76 Million people all over the world have lost their life due to covid-19 (WHO, 27th December 2020). The impact and consequences of covid-19 are limited to physical health problems and death; instead, it has significantly affected the psychological health of the entire populace. Besides, every sphere of human life (i.e., academic, economic, social) were ominously affected (Xiong et al., 2020) by the COVID-19 pandemic.

Due to its contagious nature and presence in various countries around the globe, and because of the unavailability of proper prognosis, shortage of resources such as testing kits, physical resources as well as human resources, treatment, and the vaccine against Coronavirus, various other precautionary measures such as social distancing, lockdown, and closure of all socio-economic activities were imposed by governments that have resulted in emotional distress and increased risks for psychological problems such as insomnia, denial, substance use, little physical exercise and activities, and other dependency disorders (Mohindra et al., 2020; Xiao et al., 2020b, Torales et al., 2020; Kaur, Singh, Arya & Mittal, 2020; Jurak et al., 2020) among the affected citizens. Also, some studies have shown increased suicide risks among various age groups across the world (Xiang et al., 2020; Wang et al., 2020). These countrywide restrictions and lockdown imposed due to the outbreak of Coronavirus have led to the feeling of uncertainty and helplessness (Serafini, 2020). Apart from the general public being affected due to this pandemic outbreak, healthcare facilities across continents become overloaded, and healthcare professionals were found to be highly stressed and suffered various psychological problems (Jaiswal, Singh & Arya, 2020; Philip & Cherian, 2020).

However, even though these uncertainty imposed problems, there was a section of the population, which did not capitulate to any disorder or health-related issues per se; instead, they are managing such adversities in a positive way (Pfefferbaum & North, 2020).

In their review, Jaiswal et al. (2020) suggested that various types of character strengths, which are collectively referred to as "Psychological Antibodies," are useful in dealing with such adversities in a very positive manner. A plethora of empirical investigations suggesting a positive impact of psychological capital on moderating health-related issues. These psychological capitals either work as a buffer or cushion against adverse events of life or provide inner support so that individuals can manage their life in a positive sense (Panchal et al., 2016; Conversano et al., 2010).

Among various other positive approaches to deal with such adversities, spirituality is one of the ways in which people develop resilience to manage their life in a better way during such a stressful situation. According to Southwick and Charney (2018), Spiritual or religious practice is a critical component of individual resilience.

Spirituality and Health

Addressing spiritual concerns becomes even more critical because such a biological crisis like Covid-19 poses a severe threat not only to human health but at the broader level of psychological, social, economic, or in other words, it becomes existential concerns. An empirical exploration of spirituality and religious beliefs on health-related concerns is a relatively nascent area; yet, researches suggested that these beliefs have positive impacts on the health, coping, and recovery from disease, death, and bereavement process (Albers et al. 2010; Puchalski, 2004, Phelps et al. 2009). There is an increasing trend in utilizing spiritual or religious beliefs in clinical practices (Best et al., 2015).

Drawing boundaries around spirituality and defining it is very hard; however, researchers have a common consensus that it is very personal. It is generally defined as "searching for greater meaning in the life, worthiness and transcendental way of life" (International Work Group on Death, Dying and Bereavement, 1990) or search for a "higher sense" with regards to religion or belief in God (Mishra et al. 2017).

Various empirical studies have found that religiosity/spirituality have a significant relationship with physical as well as mental health of the individual such as diabetes (Zaldıvar and Smolowitz, 1994; Fitchett et al., 2004), heart/cardiovascular diseases (Hughes et al., 2004; Ai et al., 2007), cancer (Yoshimoto, Ghorbani & Baer, 2006; Shaw, Han & Kim, 2007). Koenig (2009) and Boneli & Koenig (2013), in their exhaustive and elaborative review, have concluded that an inverse relationship between religiosity/spirituality and various mental health-related issues (i.e., depression, anxiety, suicide attempts) exists and it helps in fostering quality of life, better recovery. Koenig (2009) reviewed various empirical evidence about religiosity/spirituality and well-being or happiness and found a robust relationship between them. He found that about 82% of studies reported a positive relationship between spirituality and well-being. In the case of depression, 61% of studies reported a negative relationship between depression and spirituality, and 63% of clinical trials found that religiosity/spirituality based healthcare interventions have better outcomes than controlled conditions.

Explaining the mechanism through which religiosity/spirituality helps individuals deal with such adverse situations, Koenig (2009) summarized that spirituality makes available positive coping resources, optimistic worldview, sense of control, and religious doctrines that guide individuals' behavior, compassion, and altruism, etc. In other words, patients with stronger religious/spiritual beliefs have a better understanding of their illness, embrace adversities more positively and enjoy life despite sufferings and pain (Puchalski et al. 2014.). It is apparent from the above empirical evidence that religiosity/spirituality has a very promising impact on physical and mental health. Despite some methodological constraints, studies concluding that religiosity/spirituality have positive outcomes in preventing risky health behaviors, effective management of illness, and have a faster recovery process.

COVID-19 Pandemic, Spirituality and Health:

During pandemic situations, concerns for psychological health become secondary, especially in developing countries. Historical

evidence of pandemics and epidemics (like Ebola, SARS, etc.) were examples of when mental health got neglected (Roy et al., 2020), and the detrimental outcomes of such pandemics last even for a more extended period. Thus, in such grave times, a proper and comprehensive mechanism and strategies to address & protect the mental health of individuals are very necessary. Positive psychological capitals (i.e., optimism, hope, resiliency) play an essential role in moderating any health crisis's impact. Pandemic like Covid-19 presented a severe challenge to human health (Mohindra et al., 2020; Xiao et al., 2020b, Torales et al., 2020; Kaur, Singh, Arya & Mittal, 2020; Jurak et al., 2020) and psychological capitals (i.e., hope, optimism, resiliency) as well as religiosity/spirituality found to have a significant effect upon this health crisis and its effective management. It is seen as a promising factor that moderates onset, progression, and recovery of illness (Koenig, 2009; Puchalski et al., 2014).

Apart from the disease's physical aspect, individuals suffer a lot due to such existential questions, which shakes their deepest inner soul. Thus, incorporating the patients' spiritual needs into the modern treatment system becomes very necessary (Puchalski, 2001). Fostering spiritual needs-based treatment allows healthcare professionals to help the patients discover answers to their existential queries in more positive and satisfying ways. These spiritual or religious belief systems help the patients develop a positive attitude towards their suffering or illness, which in turn let them manage problems effectively. Through self-discipline or control, spiritual beliefs help individuals not indulging in specific negative and harmful behavior or faster recovery from particular illness (Siegel & Schrimshaw, 2002; Sephton, Koopman, Shaal, Thoresen, & Spiegel, 2001).

Religious or spirituality-based practices allow individuals to experience more positive emotions, enhancing their self-worth, which leads to developing resiliency and self-efficacy, which helps individuals maintain their health more positively. Self-acceptance and sense of meaning or worth of life components of spirituality

enable individuals to explore their existential questions of life and illness, and through this exploration, they can control over negativity due to illness or health crisis (Miller &Thoresen, 2003; Lin & Bauer-Wu, 2003; Olive, 2004; Stefanek, McDonald, & Hess, 2005).

Thus, addressing spiritual needs and beliefs in the health care system left a positive impact on the prognosis and recovery during a health crisis. Understanding patients' cultural, spiritual, and religious beliefs led healthcare professionals to provide their care and treatment up to a more satisfying level.

Various religious affiliations worldwide offer rich and fertile ground for exploring spirituality within that cultural and religious setting. Buddhism and Hinduism, particularly about the Indian sub-continent, have a detailed storehouse of rich knowledge about living life to reach transcendence or Moksha. The four noble truths (the existence of suffering, that specific causes produce suffering, that the cessation of suffering is possible, and that there is a Path or Way to end suffering) in Buddhism and the concept of Dharma, Karma, Moksha, and Samsara in Hinduism offer great insight about life and death and how to reach the ultimate goal of life, i.e., Transcendence or Moksha. Thus, incorporating learning from such religious knowledge to understand spirituality and deliver spirituality based healthcare becomes the need of the hour (Whitman, 2007; Shultz).

During the Covid-19 outbreak, people suffering from this unknown virus have debilitating existential questions very much, staying alone in healthcare facilities, their spirituality and religious beliefs often shattered. Thus, in such a crisis, healthcare providers' spiritual care becomes a necessity, not a luxury.

Conclusion & Further Suggestions

The present article aimed to explore the role of religiosity/spirituality in managing health crises and the time of the pandemic. Most individuals have some religious/Spiritual orientation, which functions as a safeguard against various obstacles of life and health crisis. Covid-19 being a pandemic like others in the past seriously

challenges humanity, human health, and health care resources (Xiong et al., 2020; Mohindra et al., 2020).

Since spirituality and religious beliefs based treatment and care are in a very nascent phase, we need a comprehensive theoretical model and intervention strategies, which are direly needed. Few instruments (FICA tool, Puchalski & Romer, 2000; and BELIEF, McEvoy, 2000) to assess spiritual needs and beliefs have been developed, and these instruments were found to be reliable in the assessment of patients' religious/spiritual orientation. However, there is a dearth of empirical approaches about spiritual needs and belief-based treatment, care, or intervention strategies, so that such concerns of patients and the general public may be addressed effectively during both normal and crisis time. Such spirituality based elements may also be incorporated into other established therapeutic intervention strategies such as Mindfulness-based intervention.

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This book is a compilation of empirical research and review papers, which focuses on pertinent issues of the current situation. The articles have been contributed by different researchers and experienced academicians from all over the country. The articles are thoroughly based on their original research work presented during the Two Day National Conference titled **"Adaptability In Crisis: Psychology, Education And Society"** organized by the Department of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh, India on the 17th& 18th of August 2021 through virtual mode.

The objective of the book is to highlight various issues related to the present COVID-19 pandemic to foster better preparedness and adaptability in crisis. The chapters delve on the themes of Physical &Mental Health, Health Care System, Work-Life Balance, Resilience, Coping Skills and Effects of COVID-19 on Mental Health. It consists of selected unpublished articles of diverse aspects of psychological and overall mental health highly relevant on both individual and community levels in every sphere of life. The findings will also contribute to public welfare and policy documentation for the Government.

Dr. Dharmeshwari Lourembam is working as an Assistant Professor in Department of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh. She is currently the Head in-charge of the Department. She has specialized in Clinical Psychology, Positive Psychology and Counseling. She has obtained her U.G., P.G. and Ph.D. Degree in Psychology from Panjab University, Chandigarh. She was a UGC-JRF and SRF after which she joined Sikkim University (A Central University) as a Guest Faculty in Department of Psychology. She is currently part of a research project sponsored by National Commission for Women and has published research articles in journals and book chapters in the field of psychology. Her area of research includes Health Psychology and Positive Psychology.

Dr. Kakali Goswami is working as an Assistant Professor in Department of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh. She was former Head in-charge of the Department. She has specialized in Organizational Psychology and Positive Psychology. She has obtained her PG from Jamia Milia Islamia, New Delhi and Ph.D. Degree in Psychology from Gauhati University, Assam. Her area of research is positive psychology and organizational psychology. She has published numerous research papers and book chapters in the field of psychology. She is currently carrying out research project sponsored by National Commission for Women.

Dr. Sandeep Panchal is an Assistant Professor in Dept. of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh. He has Specialization in Clinical Psychology, Health Psychology and Sports Psychology. He has obtained Ph.D. Degree in Psychology from Kurukshetra University, Kurukshetra, Haryana, India. Previously, he worked as Senior Research Fellow (SRF) in DIPR, DR&DO, DELHI & Sports Psychologist in Sports Authority of India, Delhi, & Assistant Professor (Guest) at Central University of Haryana & Teaching Faculty at Indira Gandhi University (State University), Meerpur Rewari, Haryana. He has published more than 26 publications in National and International Journal of repute.

Dr. Satchit Prasun Mandal is presently working as an assistant professor in the Department of Psychology, Rajiv Gandhi University, Arunachal Pradesh. Prior to his present occupation, he was employed as a Scientist in the Defence Research and Development Organization (DRDO). He obtained his Ph.D. and Master's degree in Psychology from Banaras Hindu University (BHU). He completed his graduation from University of Calcutta. His area of research includes Personality Psychology, Health and Well-being, Positive Psychology.

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Dr. Dharmeshwari Lourembam
Dr. Kakali Goswami
Dr. Sandeep Panchal
Dr. Satchit Prasun Mandal

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8

Digital Detoxification: A Way Forward to Deal with Digital Stress in Pandemic Scenario

Debasruti Ghosh[1], Saswati Bhattacharya[2], Kriti Vyas[3], Anuj Shukla[4], Saurabh Raj[5] and Satchit Prasun Mandal[6]

Abstract

The COVID-19 pandemic has boosted digitalisation, wherein, people are spending more time on digital platform for various purposes e.g. education, work, recreational activities. Research equates that excessive use of digital activities can induce digital stress, that may lead to increased levels of anxiety, sad mood, screen fatigue, uncertainty and negative emotions like irritability and aggression. There is a significant rise in school refusals, gaming addictions among children and adolescents. For working professionals, the new job settings 'work from home' was an invasion in their personal space and time that created a misbalance in the psychological homeostasis. The senior citizens adaptation to the digital demand posed new challenges. In the post pandemic era maintaining digital hygiene and

[1]Department of Psychology, MDDM College (Babasaheb Bhimrao Ambedkar Bihar University), Mithanpura, Muzaffarpur, Bihar.
[2]Consultant Psychologist, Tara Neuropsychiatry Clinic and Counseling Center, Ghaziabad, Uttar Pradesh.
[3]Department of Psychology, Vishwakarma University.
[4]IIT Hyderabad, Gachibowli, Hyderabad.
[5]Department of Psychology, Ram Dayalu Singh College (Babasaheb Bhimrao Ambedkar Bihar University), Ramdayalu Nagar, Muzaffarpur, Bihar.
[6]Department of Psychology, Rajiv Gandhi University, Itanagar, Arunachal Pradesh.

detoxification from digital stress is essential to achieve psychological and physical wellbeing.

Keywords: digital stress, digital detoxification, COVID-19, screen time, fatigue

Introduction

The "*New Normal*" during and after the COVID-19 scenario involved inculcating new habits to deal with uncertainties and challenges posed by the need for social distancing, quarantine and phased work schedules. One of the significant changes witnessed during the COVID-19 pandemic is the excessive dependency on digital medium for education, shopping, work settings and recreational purposes. Such digital dependency has become essential to survival in the technology age. Mobile phones initially served the purpose of calling 'on the go', but, with the technological advancement, it has become an alternative of a laptop (Deloitte's consumer survey, 2015). The use of tabloids, smartphones and laptops have witnessed a rapid surge with the sudden closure of educational institutions, offices and shopping hubs.

Given the restrictions, screen time spent on digital devices for working from home, online education, news, social media, home workout, lifestyle and shopping has increased. In the absence of in-person social connection, usage of social media apps has somewhat increased to stay connected with close ones. In a report by Bora (2020), indicated that by the October 2020, social media usage had increased by 12 per cent in the past year. In addition to this, the use of online platforms for entertainment and gaming purposes among children and youth to fill in the void of not meeting playmates physically is another huge change. In a report by Bora (2020), Indian gaming company *WinZo Games* witnessed a 35% surge in its usage. The report further mentioned a marginal increase in female users and noted that the majority of the users were in 25-35 years of age. On the working front, the work from home scenario also increased the screen time for professionals by 2.5 hours to 4.5 hours (Doval, 2020). Qin et al., (2020) found out that during

COVID 19 outbreak adults' screen time was more than four hours while staying at home.

The instances mentioned above are suggestive of how technology driven modalities have occupied our lives and also served as a boon during this pandemic. Nonetheless, it has also created space for physical and mental health problems. Previous studies have speculated links between blue spectrum light (from smartphone lights) and sleep problems due to suppressed melatonin response (Holzman, 2010). In the annual Stress in America survey (2017) conducted by American Psychological Associations, it was reported that about 18% of U.S adults identify technology use as a significant stressor in their life. Many people have developed an internal urgency to reply to all the incoming information, or else something important will be missed (*fear of missing out).* This tendency has also resulted in disruption in biological rhythms as people spend most of their time staying awake and being online (Sharma et al., 2020). The excess digital presence of people in pandemics has also boosted digital stress (Pandey and Pal 2020). According to Salanova et al. (2013), digital stress comprises fatigue, pressure, excessive demands that a person is not able to adequately handle modern and new digital technologies. The dependency on technological tools has not only perpetuated deep in people's lives but has also created lifestyle changes that need constant adaptation. This chapter attempts to explain the concept of digital stress in the post-pandemic phase, understanding its signs and symptoms further will help in managing it better and ultimately, one can achieve digital wellbeing from digital stress.

Impact of Digital Use during Covid: Evidence from Different Age Groups

The outbreak of the COVID-19 pandemic and prolonged period of restricted access to everything has created an explosion in the use of digital technology. As various operations changed from offline to online, the screen time or the exposure to digital means increased considerably. Cuello-Garcia (2020) referred to screen time as the amount of time spent and the various activities performed

online using digital devices. For example, screen time includes both using digital devices for work purposes (regulated work hours or educational purposes) as well as for leisure time and entertainment (non-regulated hours of gaming, viewing pornography or usage of social media). In the pandemic phase, digital technology came as a godsend in disguise. However, at the same time, it had a far-fetched impact on the physical and mental health of different populations in society.

Impact on Children and Adolescents

Implementation of lockdown by government authorities in different countries included a complete suspension (the closure) of educational institutions and digital portals were established to impart education in online mode. Despite a plethora of benefits, this came out to be a curse when mindful usages of digital exposure were not being done. The children reported having difficulty following in the classes. They had the option to mute themselves whenever they wished, which affected their ability to sustain attention and maintain emotional stability. A survey conducted by Beech and Anseel (2020) reported about 50–70 percent increase in internet use during the pandemic. The over-usage of digital platforms during the pandemic also gave rise to increased levels of anxiety, sad mood, screen fatigue, uncertainty and negative emotions like irritability and aggression (Rajkumar, 2020). However, anxiety and aggression also increased owing to cybercrimes and cyber-bullying (Lallie et al., 2021). Children and adolescents engaged themselves more in online games, social networking sites and other digital platforms to maintain social connectivity to alleviate boredom, loneliness and anxiety. Research also suggests that during COVID - 19 pandemic, caregivers faced many challenges like shifting to work from home set up, financial constraints, fear of getting infected, and closure of day-care canters. Due to these issues, they could not give full attention, and children were left unguarded during screen time (Montag & Elhai, 2020).

As the lockdown ended and the government is putting an effort to regularize into previous offline routines, the children

and adolescents are now facing difficulties to go back to the older routines. This could be due to the habituation to do the needful in the comfort of their homes. The boundary between the strict and structured environment of the school and the relatively informal and unstructured environment at their home was fused during the lockdown. According to the Save the Children Report (2021), children showed marked stress, anxiety, sleep difficulties, reluctance to engage in social interactions, emotional deregulation, temper tantrums followed by school refusals. Adolescents face considerable difficulty due to compulsive and impulsive use of the internet and having difficulty focusing on the studies, going back to a regularized routine, anger outbursts, irritability which is causing frequent absenteeism in colleges, avoidance to social interaction, procrastination, and other disruptions in social habits. Research suggests that compulsive and uncontrollable use of the internet and gaming apps led to reluctance to go back to previous routines. Increased screen time led to screen fatigue, procrastination, a refusal for activities (going out with friends, playing etc.), gradually regressing them to addiction disorders. (Dong et al., 2020; Kuss and Lopez-Fernandez, 2016)

Impact on Geriatric Population

Due to the pandemic, the geriatric population also was left with nothing but to use digital technologies. This proved to be a barrier for them as many older adults consider technology to be expensive and out of their reach (Greenhalgh et al., 2013) and often give preference to the "old-fashioned" ways of doing things (Peek et al., 2016). Prior research has also highlighted that older people can have trouble remembering how to use new technologies (Peek et al., 2016). A recent study by Lam et al. (2020) showed that about 40% of the elderly population in the United States were inexperienced in using tele-health resources, primarily due to a lack of skills to efficiently utilize the technology (Lam et al., 2020). Studies showed despite the elderly population had the highest number of doctors and hospital visits yearly, but the most access and adoption of tele-

medicine services were done by those aged 20-44 years (Lam et al., 2020). Peek et al. (2016) also found that older adults do not want to be a burden for anyone. As a result, the necessity to access digital services and inability or lack of necessary skills created a discrepancy which caused significant emotional problems including helplessness, loneliness, fear of missing out, fear who will help if they are ill, due to constant dependency for operations of digital platforms they tend to perceive themselves as being a burden followed by fear of being abandoned by their loved ones. All these cumulated to give rise to mental health issues like depression, anxiety and stress. Elderly with comorbidities faced more surge of anxiety and stress apprehending infections (Lam et al., 2020).

Impact on Working Professionals

As the lockdown was enforced, many organizations were compelled to shift to an online mode popularly called "remote working" or "work from home". As a result, many had difficulty maintaining a boundary between their private life and professional life. This caused extension of their working hours without any additional compensation. The overuse of technology and social media caused a threat to the employees' resources and well-being. For instance, using digital communication methods reduced the social support and connectedness received from the workplace. In addition, marathon online meetings proved to be draining, and multitasking between personal life and professional lives added to the injury leading to concentration problems, fatigue, exhaustion, stress, and burnout (Leonardi, 2020). Burnout is a psychological state where an employee experiences emotional fatigue, pessimism, and inefficacy, causing diminished work autonomy (Maslach, 2001; Alarcon, 2011; Aronsson et al., 2017; Hakanen et al., 2006). This can affect an employee's physical and mental well-being (Hakanen et al., 2008; Schaufeli et al., 2009). As the office reopens after a long period of lockdown and employees are expected to report to their onsite duties, they face difficulties in terms of fear of getting infected, maintaining attention, irritability, fatigue, getting habituated with

the continuous office hours and formal decorum to be maintained in the office. It can be speculated that the habituation to work in the comfort of the home contributed to the adjustment difficulties faced, which can create a barrier to adapt to this "new normal"

Managing and Way Forward

As it can be inferred from the above-mentioned account that dependency on technology has its own benefits, but it also comes with social, emotional and physical costs. Digital devices are inevitable in the current and future scenario; however, regulating its usage is extremely necessary to deal with digital stress. A routine based on digital detox practices can be helpful in this regard. In simpler words, digital detox means a disconnection from the digital devices for a certain period of time in the entire day, depending on the requirement of the individual. These practices may include having no smartphone/laptop in one's room during sleep hours or keeping gadgets off or silent during particular activities like lunch and dinner. It might also include defining no gadgets zone in one's home wherein one is supposed to stay away from devices in those particular areas (e.g. garden). Evidence suggests that apps based on digital detox programme have been successful in limiting smartphone use in adolescents during studying or having family dinner (Ko et al., 2016, Radtke et al., 2021). As mentioned in the previous sections problematic smartphone use and excessive online gaming has increased in the pandemic among children and adolescents, a digital detoxification routine can be structured for them as well. It is used in regulating the amount of time children and adolescents spend on their virtual gaming meetings and entertainment. Resistance from children and adolescents to refrain from using smartphones is commonly reported by parents. Some children also report finding it difficult to stay away from the devices and find it more convenient to pass their time. Schmuck (2020), in his research, stated that digital detox apps not only helped children to identify their problematic smartphone use but, also helped them develop self-regulation strategies. In addition to detox strategies, parents need

to communicate the physical and mental health impact of overuse of digital devices, and restructure offline activities to engage children/ adolescents in constructive ways.

With the changing scenario working professionals need to adjust their work from home environment as well. Rudnicka et al., (2020) reported that for these professionals to maintain work-life balance, managing productivity and digital self-control were difficult because of distractions and difficulty in setting boundaries. It is suggested that to avoid these stressors, some structural changes in work-home settings are required. A designated workstation at home, which one would use essentially for their professional purpose, can help avoid distractions and building work hygiene at home. In developing work hygiene routine, one must take care of post-work rituals, and set boundaries by avoiding watching videos or engaging in social media between work schedules. Such strategies can help individuals maintain productivity and, at the same time, create a proper work-life balance.

Conclusion

Technology is an inevitable part of our lives, hence developing digital hygiene is crucial for handling stress arising from digital use in post-pandemic scenarios. Besides mental health, the adverse effect of digital use on physical health can be taken care of by maintaining consistent sleep-wake schedules, exercise and having proper meals. It is imperative to understand that the use of the digital platform for everything was the need of the hour in the lockdown phase. Earlier, access to others via the digital world was a necessity, but now when the lockdown phases are over, it seems that a dependency on digital mediums has increased. Thus, effective strategies to counter this dependency and addictive tendencies are required through lifestyle changes.

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This book is a compilation of empirical research and review papers, which focuses on pertinent issues of the current situation. The articles have been contributed by different researchers and experienced academicians from all over the country. The articles are thoroughly based on their original research work presented during the Two Day National Conference titled **"Adaptability In Crisis: Psychology, Education And Society"** organized by the Department of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh, India on the 17th& 18th of August 2021 through virtual mode.

The objective of the book is to highlight various issues related to the present COVID-19 pandemic to foster better preparedness and adaptability in crisis. The chapters delve on the themes of Physical &Mental Health, Health Care System, Work-Life Balance, Resilience, Coping Skills and Effects of COVID-19 on Mental Health. It consists of selected unpublished articles of diverse aspects of psychological and overall mental health highly relevant on both individual and community levels in every sphere of life. The findings will also contribute to public welfare and policy documentation for the Government.

Dr. Dharmeshwari Lourembam is working as an Assistant Professor in Department of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh. She is currently the Head in-charge of the Department. She has specialized in Clinical Psychology, Positive Psychology and Counseling. She has obtained her U.G., P.G. and Ph.D. Degree in Psychology from Panjab University, Chandigarh. She was a UGC-JRF and SRF after which she joined Sikkim University (A Central University) as a Guest Faculty in Department of Psychology. She is currently part of a research project sponsored by National Commission for Women and has published research articles in journals and book chapters in the field of psychology. Her area of research includes Health Psychology and Positive Psychology.

Dr. Kakali Goswami is working as an Assistant Professor in Department of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh. She was former Head in-charge of the Department. She has specialized in Organizational Psychology and Positive Psychology. She has obtained her PG from Jamia Milia Islamia, New Delhi and Ph.D. Degree in Psychology from Gauhati University, Assam. Her area of research is positive psychology and organizational psychology. She has published numerous research papers and book chapters in the field of psychology. She is currently carrying out research project sponsored by National Commission for Women.

Dr. Sandeep Panchal is an Assistant Professor in Dept. of Psychology, Rajiv Gandhi University (A Central University), Arunachal Pradesh. He has Specialization in Clinical Psychology, Health Psychology and Sports Psychology. He has obtained Ph.D. Degree in Psychology from Kurukshetra University, Kurukshetra, Haryana, India. Previously, he worked as Senior Research Fellow (SRF) in DIPR, DR&DO, DELHI & Sports Psychologist in Sports Authority of India, Delhi, & Assistant Professor (Guest) at Central University of Haryana & Teaching Faculty at Indira Gandhi University (State University), Meerpur Rewari, Haryana. He has published more than 26 publications in National and International Journal of repute.

Dr. Satchit Prasun Mandal is presently working as an assistant professor in the Department of Psychology, Rajiv Gandhi University, Arunachal Pradesh. Prior to his present occupation, he was employed as a Scientist in the Defence Research and Development Organization (DRDO). He obtained his Ph.D. and Master's degree in Psychology from Banaras Hindu University (BHU). He completed his graduation from University of Calcutta. His area of research includes Personality Psychology, Health and Well-being, Positive Psychology.

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About the Editors

Dr. Prasanta Kumar Barik, an Assistant Professor at Rajiv Gandhi University, India was born in the district of Jharsuguda, Odisha in 1977.He has obtained his M.A. (Education), M.A.(History) and Ph.D. in Education from Sambalpur University. He qualified UGC-NET examination in Education. His areas of interest and specialization are Higher Education, Teacher Education, Secondary Education and Pedagogy of Social Sciences. Currently, Dr. Barik is associated with Post graduate teaching and research work. He is a teacher educator too. He has participated and presented in many national and international conferences, seminars, symposia, etc. He has published articles in journals, edited books at national and international repute. He acts a resource persons for various departments and colleges. He has completed a project work sponsored under ICSSR, New Delhi, India. He has also credited to publish a book titled "College Autonomy and Quality in Higher Education" along with his mentor Dr.Harihar Sarangi, Former Head, Department of Education, G.M. University, Sambalpur,Odisha.

Dr. Shisira Bapia is currently working as a Lecturer in Education (SSB, Department of Higher Education, Govt. of Odisha) in Birmaharajpur College under Sambalpur University, Odisha. He has done his Post Graduation in Education from G.M. Autonomous College (Now G.M. University) Sambalpur, Odisha; Post Graduation in Sociology from IGNOU, New Delhi and Post-Graduation in English from Odisha State Open University; M.Phil. in Education from Dr. P.M. Institute of Advanced Study in Education, Sambalpur, Odisha. He has qualified UGC NET and JRF in Education. He is awarded with Ph.D. degree in the subject Education from Sambalpur University, Odisha, India. He has more than 07 years of teaching experience. He has participated and presented many papers in National and International Seminars. He is the author of two Books. He has 18 research publications to his credit.

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Open Educational Resources (OER) – An Effective Tool for Enhancing Learning in Higher Education

Sushant Kumar Nayak* *and* Mihir Kumar Beura†

"When I see, I forget; when I hear, I remember but when I do, I understand."-Confucius)

INTRODUCTION

There are many advances in scientific knowledge and innovations in educational field that necessitates constant changes in course curricula. The world of knowledge is no longer limited to the text books and four corners of the classroom and library. Online and technology-based modes of study have been identified as a useful addition to classroom-based teaching methods. In the present era knowledge is in our finger tips. The emergence of OER (Open Educational Resources) is becoming a blessing to provide an instant and effective way of learning all across the world to reach the unreached learner through the use of advanced version of ICT. The primary objective of OER is to provide high quality educational material in free of cost for all the learners across the globe without any boundary **(Keller and Mossink, 2008)**. The idea of OER was put forwarded by UNESCO in 2002, by taking a holistic approach to make educational resources free from commercialization and user-friendly purpose so that knowledge and information can be easily accessible to all with the help of ICT **(UNESCO, 2002)**. **McAndrew, Santos et al. (2009)** believes that in spite of some terminological differences Open Educational Resources are fundamentally digital assets (music, video, images, words, animations) put

* *Assistant Professor in Education*, RGU, Arunachal Pradesh

† *Research Scholar*, RGU, Arunachal Pradesh

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Educational Status of Scheduled Tribes in India

Dr. Anga Padu
Ms. Tage Monju
Dr. Narender Singh

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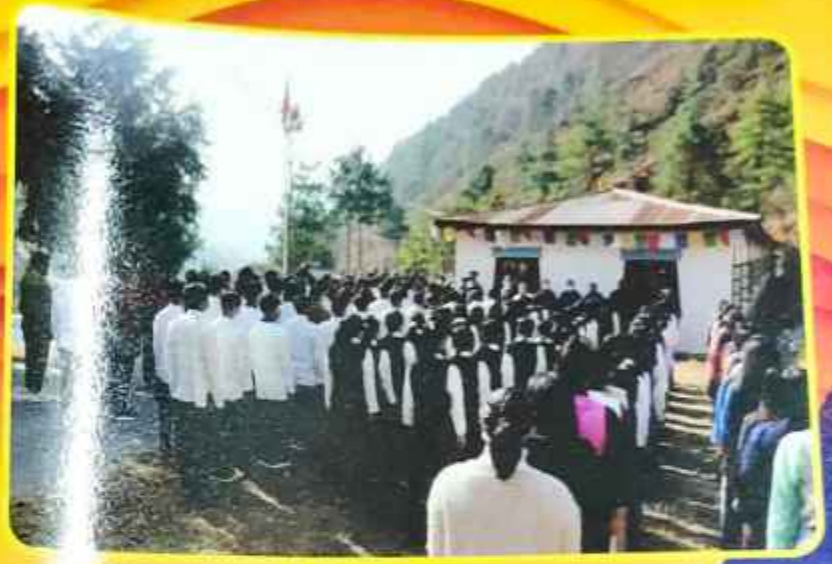

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Health Issues of School Going Tribal Children of Arunachal Pradesh

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[1]Assistant Professor, [2]Research Scholar, [3]Assistant Professor, [4]Assistant Professor,
Rajiv Gandhi University, Rono Hills Doimukh

Abstract

The aim of the study was to find out the Health Issues of School Going Tribal children of Arunachal Pradesh. It has been found that tribal students are facing many health problems. Tribal students with low literacy have poorer overall health. It has been found that low literacy leads to misuse of medication and misunderstanding of health information in tribal students. Students with low literacy skills often wait longer to seek medical help so health problems reach a crisis state. According to World Health Organization Health education is a social science that draws from the biological, environmental, psychological, physical and medical sciences to promote health and prevent disease, disability and premature death through education-driven voluntary behavior change activities. While there is great concern regarding health promotion and health literacy. Therefore, there is a great urgency to introduce Health and Physical education as a health literacy subjects in schools to aware and promote the health status of tribal students of Arunachal Pradesh.

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Overview of the School Education in Arunachal Pradesh with Special Reference to Samagra Shiksha Abhiyan

Tayum Saroh* and Elizabeth Mize**

Abstract

Education is a powerful tool for overall development of any society. In ancient time in India, it was primarily pursued by the students for self-realization, enlightenment, and also it has been widely used for religious propagation. But with the passage of time in this modern world the purpose of education changes drastically due to scientific invention, globalization, and industrialization. It becomes a weapon to bring rapid social development and progress of nation in the right direction. So, in order to cater the needs of the demand of the present age in education sector the government of India is gearing up to develop its education systems through its various programmes and policies right from its grassroots level of Elementary to Higher education section. Some of the latest educational programme initiated by the central and state government to enhance access, equity, and quality, in school education sector are SSA, RMSA, and very recently in 2018 -19, Samagra Shiksha which envisages school as continuum from pre-primary to senior secondary level. In case of Arunachal Pradesh being a late starter in the field of formal education system, it always lags behind the national scenario in term of literacy rate at national level. If we look at the historical prospective

*Assistant Professor, Department of Education, Rajiv Gandhi University, Arunachal Pradesh
**Research Scholar, Department of Education, Rajiv Gandhi University, Arunachal Pradesh
yumsaroh@gmail.com*, elizabethmize63@gmail.com**

About the Editors

Dr. Prasanta Kumar Barik, an Assistant Professor at Rajiv Gandhi University, India was born in the district of Jharsuguda, Odisha in 1977.He has obtained his M.A. (Education), M.A.(History) and Ph.D. in Education from Sambalpur University. He qualified UGC-NET examination in Education. His areas of interest and specialization are Higher Education, Teacher Education, Secondary Education and Pedagogy of Social Sciences. Currently, Dr. Barik is associated with Post graduate teaching and research work. He is a teacher educator too. He has participated and presented in many national and International conferences, seminars, symposia, etc. He has published articles in journals, edited books at national and international repute. He acts a resource persons for various departments and colleges. He has completed a project work sponsored under ICSSR, New Delhi, India. He has also credited to publish a book titled "College Autonomy and Quality in Higher Education" along with his mentor Dr.Harihar Sarangi, Former Head, Department of Education, G.M. University, Sambalpur, Odisha.

Dr. Shisira Bania is currently working as a Lecturer in Education (SSB, Department of Higher Education, Govt. of Odisha) in Birmaharajpur College under Sambalpur University, Odisha. He has done his Post Graduation in Education from G.M. Autonomous College (Now G.M. University) Sambalpur, Odisha; Post Graduation in Sociology from IGNOU, New Delhi and Post-Graduation in English from Odisha State Open University; M.Phil. in Education from Dr. P.M. Institute of Advanced Study in Education, Sambalpur, Odisha. He has qualified UGC NET and JRF in Education. He is awarded with Ph.D. degree in the subject Education from Sambalpur University, Odisha, India. He has more than 07 years of teaching experience. He has participated and presented many papers in National and International Seminars. He is the author of two Books. He has 18 research publications to his credit.

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Privatisation of Higher Education in India

Editors
Prasanta Kumar Barik, Shishira Bania

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Privatisation of Higher Education in India

Editors

Prasanta Kumar Barik

Shishira Bania

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6

Status of Private Higher Education in Arunachal Pradesh

Tayum Saroh*

Abstract

There is a rapid mushrooming of private higher education institution in the nation due to the ever increasing demand of higher education. The demand for higher education is not limited to single state but each and every state of the country is facing a shortage of government higher education institution, if we compare the same with the students demand for accessibility of higher education and numbers of government higher education institutions. In this context though the state of Arunachal Pradesh is late starter in the field of higher education in comparison to the other states of India, here also private higher educational institutions are mushrooming rapidly. There is no iota of doubt that the expansion of educational institution is a positive sign for the development of nation towards enlightenment of the society but at the same time the maintenance of quality education also become more challenging with the expansion of any existing system. In this paper the author has tried to analyze the existing private higher educational institution, enrolment of students, and also highlight some of the advantages and disadvantages of privatization of higher education in Arunachal Pradesh.

Keywords: *Quality, Privatization, Private Degree College, Mushrooming.*

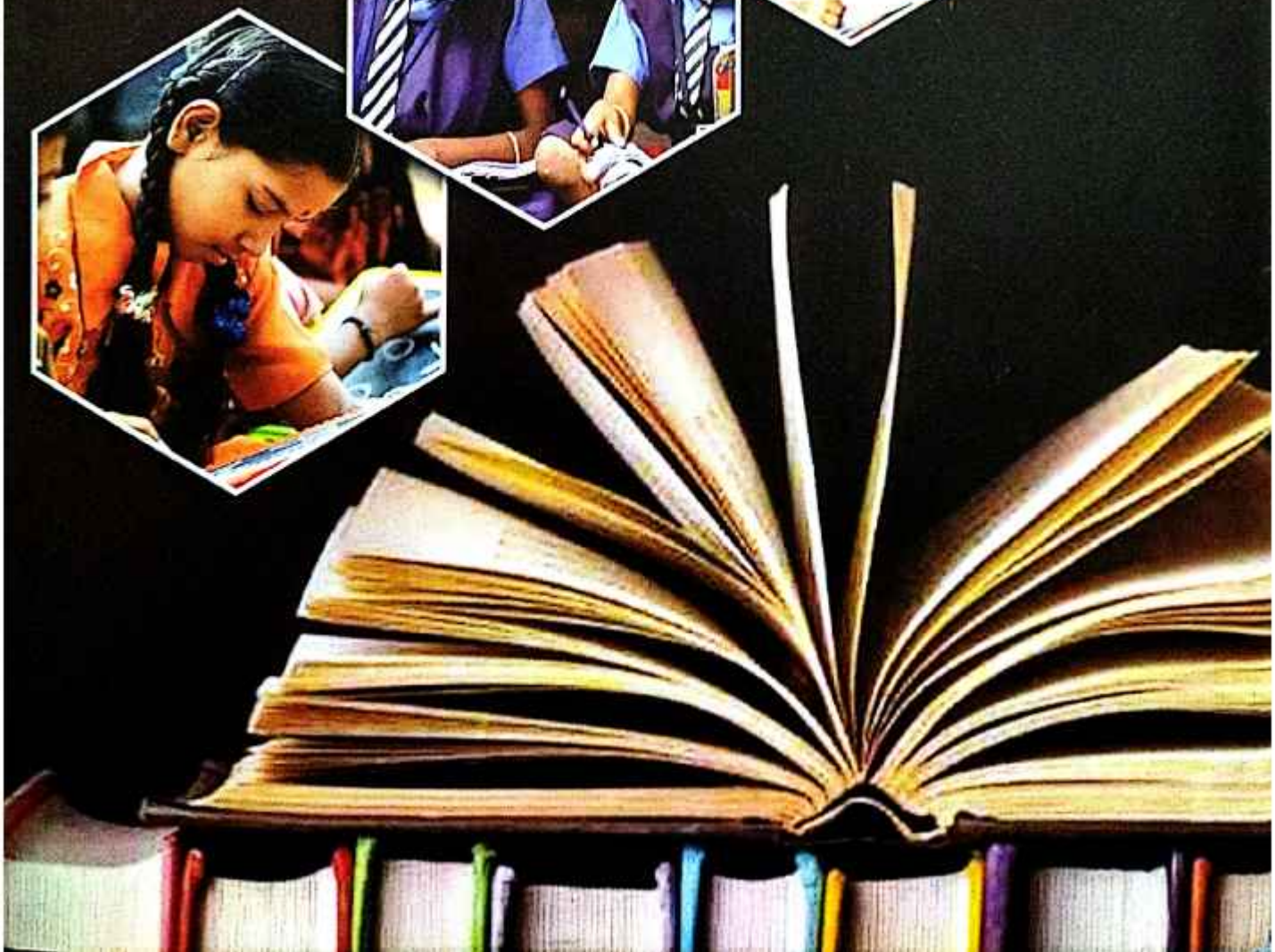
INTRODUCTION

The main backbone of any country is depending on the quality of education provided by that particular nation. The proper utilization of human resources could be achieved with the utmost utilization of educated masses of the

* Assistant Professor, Department of Education, RGU, Rono Hills, Doimukh, Arunachal Pradesh.

EDUCATION IN EMERGING INDIAN SOCIETY

DR. SUKANTA KUMAR PRADHAN
DR. TAGE YAMA



Education is a dynamic and changing concept. The edifice of education is mainly built with the bricks and mortars of Philosophical, Psychological , Sociological and Pedagogical foundations. With the change in time and advancement in Information and Communication Technology the gamut of education has faced widespread changes. The present book "*Education in Emerging Indian Society*" deals specifically with these issues and addresses the new developments and challenges in the 21st century. All possible efforts have been made to use simple and clear language, to reflect the current trends, developments and new thoughts to develop critical understanding among the readers . As this is the first edition of the text, despite of the best efforts, the book might have some lapses and limitations. Therefore, constructive suggestions and criticisms are welcomed from its readers on the basis of which the text will be revised and reviewed in further editions.

Dr. Sukanta Kumar Pradhan (b.1980) is presently working as Assistant Professor of Education (Selection Grade) at Indira Gandhi Government College, Tezu under Government of Arunachal Pradesh. He did his Graduation from Banki College (Autonomous), Banki under Utkal University, Odisha with Education (Hons), Post-graduation in Education from Ravenshaw (Autonomous) College, Cuttack(Utkal University, Odisha) (1st Class First), B.Ed. from IGNOU, New Delhi and PhD in Education from Rajiv Gandhi Central University, Doimukh, Itanagar, Arunachal Pradesh. He had previously worked at Maharishi College of Natural Law, Bhubaneswar, Odisha and Hills College of Teacher Education, Naharlagun, Arunachal Pradesh before qualifying APPSC Examination in 2009. So far Dr. Pradhan has 18 years of teaching experience in various capacities at the college level, 24 publications in international Journals, 8 books and 1 Minor research projects completed funded by UGC. Dr.Pradhan has delivered more than 15 invited lectures and participated in more than 50 seminars, conferences, workshops and webinars in the national and international level. . Besides, he has supervised more than 16 Dissertations at the M.Ed. and M.A in Education level under IGNOU,New Delhi. His thrust areas of research are Educational Measurement and Assessment, Human Rights Education, Curriculum Development, Educational and Vocational Guidance and Counselling, Educational Research, Educational Psychology, Educational Philosophy and Educational Technology.

Dr. Tage Yama (b.1980) is presently serving as Assistant Professor of Education at Indira Gandhi Government College, Tezu under Government of Arunachal Pradesh. She did her graduation from Jawaharlal Nehru College, Pasighat, B.Ed and Post Graduation from Rajiv Gandhi University the then Arunachal University and Ph.D from Rajiv Gandhi University, Rono Hills, Itanagar, Arunachal Pradesh. She qualified the Lecturership Examination conducted by APPSC, Itanagar in August 2007 and joined as an Assistant Professor of Education in Jawaharlal Nehru College, Pasighat, Arunachal Pradesh and later transferred to Indira Gandhi Government College, Tezu. So far, Dr. Yama has 13+ years of teaching experience in various capacities at college level and is the current Head of the Department, has 8 publications, including books and articles in National and International Journals, attended many National and International Seminars and is a visiting Professor at Denning College for Teacher Education, Tezu, Arunachal Pradesh.

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A Micro Study on the Problems Faced by Mathematics Teacher of Papum Pare District of Arunachal Pradesh

Dr. Tayum Saroh[1]

ABSTRACT

The infrastructure and educational facilities played a major role in providing best education to the students at any stage of education. The case becomes more complicated for elementary level mathematics teacher because at this stage most of the students are not matured mentally and physically. The teacher needs proper back up and supports not only from the concern authority but also from the parents whose children are attending schools to provide quality education. It is very important for a concern authority to provide proper infrastructure and academic support to the teachers teaching at elementary level of education. This paper deals with the problems faced by elementary level mathematics teacher of Papum pare district of Arunachal Pradesh in teaching mathematics.

Keywords: Mathematics Teacher, Elementary Education, Quality

Introduction

In the state of Arunachal Pradesh the medium of instruction in entire education system is English. Though, recently the government is encouraging to use local dialect as medium of instruction at the primary school stage. On the other hand

[1] Assistant Professor, Dept. of Education, Rajigv Gandhi University, Rono Hills, Doimukh, Arunachal Pradesh

History of Epidemics and Pandemics

Reverberations, Responses and Resilience

Edited by

Shreya Pathak

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22. **Dr. Tajen Dabi,** Assistant Professor, Department of History, Rajiv Gandhi University, Itanagar.
23. **Squadron Leader Ms. Toolika Rani (Retd.),** Research Scholar, Department of History, Babasaheb Bhimrao Ambedkar University, Lucknow.
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Epidemics and Diseases: Community Perspectives and Government Interventions in Arunachal Pradesh Till 1950

Tajen Dabi

ABSTRACT

Before modern medicine and healthcare facilities were made available through government initiatives, epidemics used to be a dreaded phenomenon among cultures in Arunachal Pradesh. Within the context of a broad animistic-shamanistic worldview, subsistence economy and a fluid tribal polity epidemics created a wider set of actions and ramifications within and beyond an affected group. Even state approaches to reach out to the tribes of the state were marked by use of medicines and vaccines as part of diplomacy. This process started in the pre-independence and was incorporated in the post-independence period's NEFA policy. Contemporary ideas on disease and epidemics amongst the tribes have since changed a lot due to various factors. This paper provides a brief outline of the indigenous perceptions related to diseases and epidemics and the nature of state interventions in mitigating diseases and epidemics in Arunachal Pradesh.

Keywords: Arunachal Pradesh, Epidemics, Indigenous Perceptions on Epidemics and Diseases, Medical Sociology.

Across cultures, famines and scarcities were often reported which were accompanied by the outbreak of epidemics. Smallpox, that is considered a medieval disease in origin, was for the first time recognized in China before AD 500, is reported to have ravaged France in AD 580, and entered medical literature in Sanskrit in the seventh century. In India also epidemics have been reported. Ibn Batuta described a dreadful epidemic resembling plague or cholera that raged Madurai in c. 1345. Jahangir is reported to have given a careful description of the plague which spread from Punjab to Kashmir, Delhi and Agra from 1615 to 1619 (Habib 2011, 84-87). That the disease attracted the attention of the Emperor reflects the gravity of danger posed by epidemics to general public health and safety of the empire. During the colonial rule in India diseases like smallpox, cholera, plague, influenza, malaria and tuberculosis were commonly reported. The climatic conditions and diseases in India posed a challenge to the English conquest of India. During the eighteenth century, diseases were sought to be explained through 'miasmatic' theories which were replaced by tropical medicine in the late nineteenth century (Kumar, 1998, 11). With the advancement of science, the germ theory of disease finally got established in the twentieth century. Cultural perception as well as technological advancement influenced the disease etiology and the curative methods.

Chronologically, the Portuguese were the first to introduce Western medicine in India. In 1510, Albuquerque founded the Royal Hospital in Goa which after being handed over to the Jesuits, was converted into a medical school in 1842 (Kumar, 1998, 17). But the French and later the British established and consolidated it in India widely and firmly (Keshwani, 17). The motive behind these developments is explained by Anil Kumar in these lines:

> Health concern has been an important feature of all

RECENT ADVANCES IN FOLK MEDICINE RESEARCH IN NORTH EAST INDIA

Editors:

Amal Bawri
Kenjum Bagra
Imlikumba
Robindra Teron

Amal Bawri, Kenjum Bagra, Imlikumba & Robindra Teron

Recent Advances in Folk Medicine Research in North East India

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Chapter 16

At the Cultural Crossroads: A Portrait of a Galo Shaman

Tajen Dabi
Department of History, Rajiv Gandhi University, Rono Hills, Doimukh, Papum Pare-791112, Arunachal Pradesh, India
E-mail: tdrguhist@gmail.com

Abstract

The Galo shamans belong to the fast disappearing traditional healers of the Eastern Himalayas. In an ideal traditional setting, the shaman is the performer of rites and rituals as alsoof social memory. Some shaman exhibit knowledge of herbal healing, an art not specialised by all the shamans and often practised by people other than shamans. Indigenous healing systems or folk medicine today faces a different scenario: coming of Western Biomedicine; neo-faith healing; re-organised indigenous faith, etc. This article is a short sketch of a performing shaman (*Nyibu*) through whose' experiences a brief exposition on the contemporary condition of the shamans would be made. It also raises the question about the place and future of the shaman in the context of the reformed indigenous religions.

Keywords: Shaman, Eastern Himalaya, Folk Medicine, Indigenous Faith, Arunachal Pradesh.

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Introduction

The art of curing ailments and diseases through indigenous methods is a very old tradition. Among the early societies, diseases were linked to 'possession by evil spirits' and spells and drugs were accordingly formulated (Childe, 1957). The term 'shaman' is variously used along with 'native healer,' 'medicine man' or 'medicine woman' depending on the cultural perspective of the writer. A performing Native American shaman and writer prefer the term 'native healer' since it represents the cultural perspective of the tradition the shaman is part of (Lake, 2007). Mircea Eliade, the noted Romanian historian of religion, defined Shamanism as 'an ancient technique of ecstasy, often considered a kind of mysticism or magic but in very broad terms also a religion' (Nishimura, 1987). Writing about Shamanism among the Tungus of eastern Siberia in S.M. Shirokogoroff described a shaman as 'persons of both sexes who have mastered spirits, who at their will can introduce these spirits into themselves and use their power over the spirits in their own interests, particularly helping other people, who suffer from the spirits' (Nishimura, 1987). These definitions were broadly summarized by Kokan Sasakiin *Shamanizumu no jinruigaku*(The Anthropology of Shamanism) as: 'shamanism is a form of religion which centers on a magico-religious specialist who has a special ability to enter into a trancelike state at will and in the abnormal psychological state can make direct contact with the supernatural being' (Nishimura 1987:59). Thus, a shaman was the link between the material and the spiritual world of the people- a function fulfilled by a Galo shaman also. It is argued by Mercea Eliade that '...because the properties and conditions of the soul are within his domain of knowledge, the shaman is a curer and healer of disease' (Jones, 1968).

These definitions of shaman and shamanism can be inferred to describe the shamans of various communities of Arunachal Pradesh also. The shamans are the bedrock of indigenous healing system. Forster and Anderson defined ethnomedicine as: 'Comprising those beliefs and practices relating to disease which are the products of indigenous cultural development and are not explicitly derived from the conceptual framework of modern medicine' (Anquandah, 1997). The ethno-medical practice or folk medicine of the people of Arunachal Pradesh is rooted in religious beliefs and shaped by the local ecology, physical environment and customs. In a sense, it is agreeable that the concept of illness is basically rooted in supernatural cosmology as argued by a noted anthropologist who studied the Arunachal tribes (Elwin, 1999). The idea of disease/ ailments, accidents, epidemics, and famine is construed as occurring as a result of 'breach' of the balance with natural and supernatural forces ('malevolent spirits') among the shamanistic communities of Arunachal Pradesh. For example, when a person meets with an accident the shaman negotiates (through rituals) with the spirits to safely 'retrieve' the *Yalo* (soul?) of the affected person from the offended spirits.

Objectives

From the 1950s Arunachal Pradesh was opened up for new impactful changes: expansion of government administrative machinery, roadways, introduction of Western Biomedicine (henceforth WBM), education, increasing population contact and powerful cultural influences. The degree of this process was described by Verrier Elwin as "creating the puzzle of the impact of the atomic age on a Stone Age" (Guha, 2000). Naturally, these influences were bound to have important, fundamental impacts. It has been a good seven decades since Elwin's time and this paper aims to discuss the nature of such impacts on the career of a shaman. The two immediate references for making this assessment are changing environment and the renewed interpretation and projection of indigenous religion itself.

Material and Methods

This quick essay is ethno-historical in orientation. A brief profile of a practicing shaman is being presented. The data has been collected through oral interview. The rites and ritual performances of the shaman are not being discussed. *Emic* perspective is inherent since the author is born and bred in the same cultural milieu as the shaman- reason why I have not provided any transcript of the interview with the shaman. For the same reason, survey of existing literature on Galo shamans has not been done. No special field-study was conducted on the reformed indigenous religion as family members of the author are directly involved in its practice and propagation.

Results and Discussion

Roughly equidistant from Tibet in the north, the Assam plains in the south, Siang River in the east and Subansiri River in the west layBipi village of Liromoba in the central West Siang District of Arunachal Pradesh. Born in c.1940, TamaMindoRomin is a *Nyibu* (shaman) and a propagator of the Donyi Polo faith (reformed indigenous religion)who no longer lives at his ancestral village Bipi. As is common for would-be Nyibu's, young Tama was 'kidnapped' by the *Yapom* (forest spirits believed to be of feminine gender) while asleep to be recovered by village folks from the nearby rivulet later on. Attracted to entrepreneurship and thus no interested in becoming a Nyibo, Tama left his ancestral village and started doing petty government contract works- a formative period of spiritual journey to shaman-hood later in life. In 1969, he adopted the Christian faith after coming into contact with Catholic Missionaries at Gandhigram in Vijaynagarin the Patkai Hills. Un-affected by his conversion, the Yapoms[1] again ventured to 'kidnap' Tama; this time the Yapom

[1] The Yapom is colloquially referred to in plural. The 's' here is a loose Anglicization. One of the earliest record of Yapom 'kidnapping' can be found in Elwin 1959:266. Such incidents are regularly reported till today.

were persistent. Circa. 1974, Tama was on a regular visit to the Shiva Mandir at Raneghat in Pasighat town. The temple premise hosted a huge banyan tree (locally called *sirek/ hirek*), a locally believed to be the favourite abode of the Yapoms. In the 'custody' of the relentless Yapoms, Tama had ecstatic experience of running across rivers and jumping over the mountains that divide the foothill town from hinterland Along (Aalo) headquarters - a distance the Yapoms helped him cover within a couple of hours in superman-style, literally. As expected, the Yapoms finally had the upper hand and a new poet stepped-in to a mystic world where the chosen few conversed with the spirits- as the plenipotentiary of the mortal beings. A shaman is born.

Tama specialises in what might be called 'prosperity' and 'cure' rituals (*GuminUyi*) as distinct from the types of rituals related to disputes, death, murder, etc. (*Yalu-YachuUyi*). Based on such specialisation, as well as the occult reputation, Galo shamans are viewed in loose hierarchical order at the pinnacle of which Tama considers himself to belong to. He is thus a *Gumin Nyibo* (indicating the type of rituals he performs) as well as a *Nyib-Buut* (suggestive of his position and reputation).As to whether his standing was equal to or above the *Tago-Nyigre* Nyibu, a shaman who can take the form of wild beasts, notably the tiger, like Kachi Yomcha (Riba, 2004) Tama avoided any comparison with the renowned late shaman who lived a generation before him in his home district.

Tama's long and ongoing career is dotted by many feats: curing a dysenteric (*Takw*) and a Yapom-infested patient each who would not get relief from medical treatment, for example. In the latter case, a Sikh engineer employed under the state government had incurred the wrath of the Yapoms while supervising jungle-clearing for a road project eventually found cure for his medically unexplained recurring vertigo after Tama checked the omen and negotiated a deal with the offended Yapoms.

At personal front, our shaman claims that he is a teetotaler since childhood and is quick to issue the disclaimer that he does not eat cattle-meat because of allergy. In 1987, he helped in organizing the Abotani Shaman Association as its first General Secretary. At the time of my interview, Tama headed the ecclesiastical wing of the Indigenous Faith and Cultural Society of Arunachal Pradesh (IFCSAP) asits president. The IFCSAP currently leads the indigenous faith movement in Arunachal Pradesh; the process has been described as 'reformist' in the 'contested domains of religious transformation…' (Chaudhari 2013:259-277).Under the aegis of the IFCSAP and other sister organisations, Tama occasionally attends training workshops in different places where he gets to meet shamans from other regions and cultures from across the diverse country.

When enquired about the future of the shamans and shamanistic rites and rituals, the enthusiasm in the room quickly dissipated and Tama responded with a disheartened tone citing factors for a bleak future of the shamans as well as reasons

why religious reform was necessary: coming of new ways of life; non-observance of indigenous ways of life and taboos; change in food habits; negligence of indigenous religion and its methods of healing; and adoption of new religious faiths. Food avoidance (of certain types, not only before and after performing rituals), according to Tama, was one of the strict discipline a shaman was supposed to keep thereby highlighting some universals shamans across cultures share; 'many abstentions may be interpreted as a type of primitive preventive medicine…Not only the individual, but also the whole community may derive psychological benefits from the avoidance of certain foods' (Ferro-Luzzi, 1975).

Conclusion

Tama's stress during the course of our extended interview was on two things: cure of many patients, who did not get relief from modern medical treatment, through the shaman's intervention and; the future of the shamans. The first case reinforces the idea and relevance of medical pluralism. The second aspect throws some light on the decline in the number of shamans and the changing role of shaman within the structure of the reformed indigenous religions. Until his generation, a Galo shaman like Tama was alien to the idea of a place of worship and congregation. Being a shaman and thus a key stakeholder of the indigenous religious life, Tama contributed to the efforts for re-organising the indigenous religions where the mode of worship[2] was different from the propitiatory rituals of the original shaman-hood. For example, *Ganggi* is a prayer hall where reformed indigenous faith believers meet weekly, offer prayers and seek cure from ailments and diseases also.

It can be visualised that within the confines of the Ganggi, shamans like Tama would be not be able to perform the shamanistic rituals. An irony stems from the genuine apprehensions and works of shaman cum religious reform workers like Tama: one of the results of religious reform is to uniquely put a shaman in a devotional-congregational environment where the shamanistic chants and rituals are no longer to be found. Unlike Tama and his colleagues in the indigenous religious reform movement, there are many shamans and people who do not attend the Ganggi considering the reformed practices to be equally 'alien'. This underlines the complexity and multi-positional nature of the religious reform movement in Arunachal Pradesh of which Tama is a part of.

Acknowledgement

The interview of the shaman was done as part of my recently award (2017) Ph.D. work titled "Development of Healthcare System in Arunachal Prade 1826-1987". A related paper named "A Priests' Chant: Healing Traditions amon

[2]For details on the types and nature of indigenous faith movements in Arunachal Pradesh see Chaudhur 2013.

the Galo tribe, Arunachal Pradesh, India" appears in the *Saudi Journal of Humanities and Social Science*, 2:11, Nov 2017: 1058-1061. While the data and methods remain same the organisation, focus and analysis of this article is different from the preceding two works. I received travel grants from the Indian Council of Historical Research (ICHR) for field-works during PhD study.

Note on Indigenous Terms

The vernaculars appearing in this article is in Galo language- a branch of Tani language cluster. The Tani languages (belonging to the Tibeto-Burman family), which share common roots and basic vocabulary, are spoken in central Arunachal and parts of upper Assam. There is no study on the archaic and shamanistic vocabulary of the Tani languages.

Interviews

Information about Tama Mindo was gathered through personal interview with the shaman at his residence at A-Sector, Naharlagun, Arunachal Pradesh on January 6, 2017.

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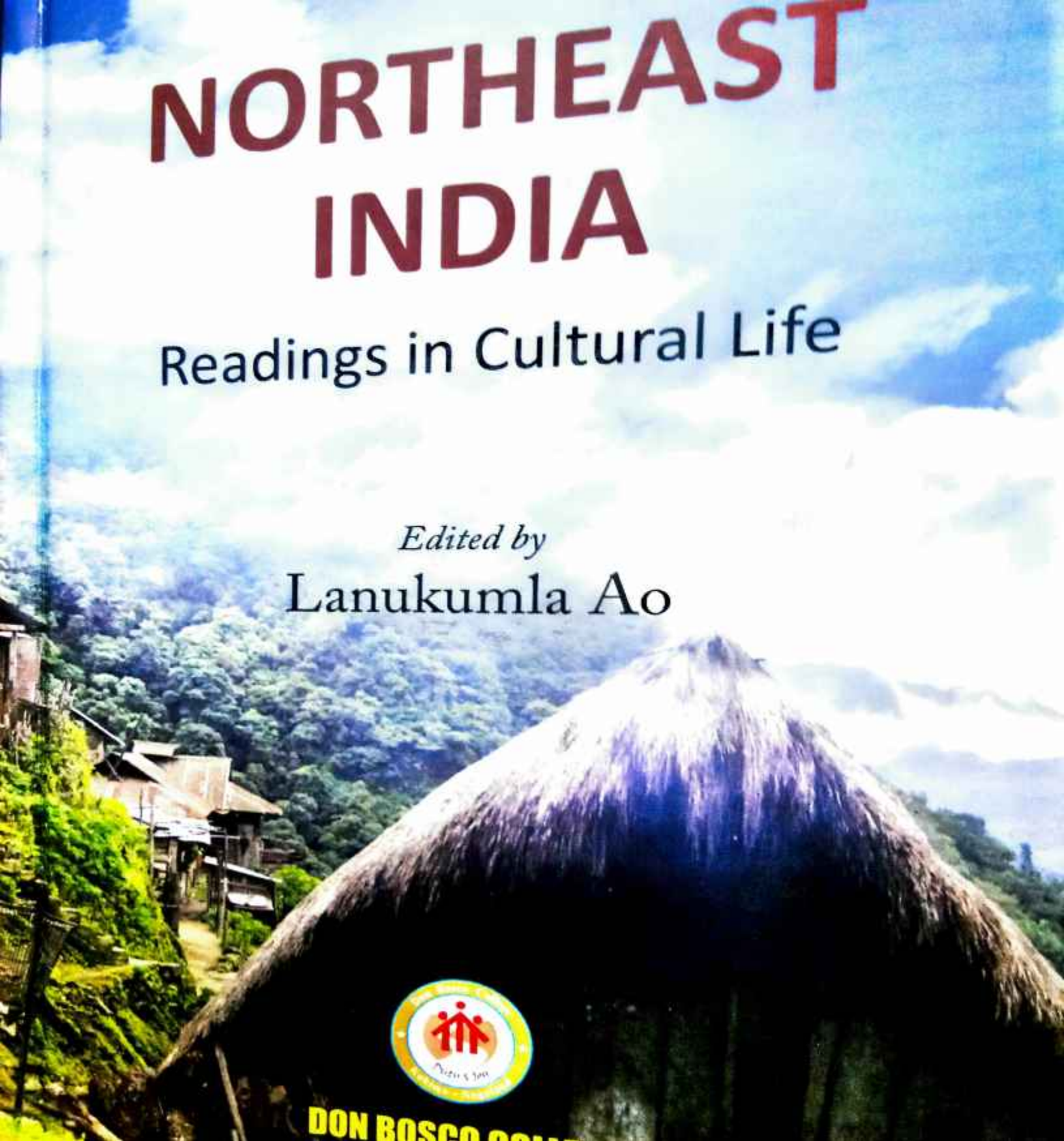
NORTHEAST INDIA

Readings in Cultural Life

Edited by

Lanukumla Ao



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Lanukumla Ao

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Tajen Dabi

Introduction

One of the most plural states in the northeast, religious forms in the mostly mountainous and tribal Arunachal indicates many things: migration of people from different places and cultures to where they are now (Mipun and Nayak, 1999: 17-28); peculiar historical past; hill-plains relations; relative laxity of indigenous tribal religions; competing mainstream religious dogmas at play; etc.

Political relations of the tribes of Arunachal with the Ahom state and later-on the British colonial state were at times hostile but always marked by a mutually beneficial and self-complimentary stance: no territorial annexation by the either state; sporadic military explorations and expeditions into the hills and grant of *Posa* (Jha, 1996 : 446-458; Thakur, 2016: 58); violent quelling of rebellions where the states' strategic interest was threatened (as in the case of the Khampti-Singpho Rebellions of 1839-43; Tani, 2018); exchange of local produce in the *Duar*s or the foothill-markets (Yania, 2018); employment of a class of native

interpreters known by various terms like *Dobashi*, *Kotoki* and to which was later-on added the government representatives cum local arbiters of disputes called *Jemadar* and *Gam/ Gaonbura*; no missionaries of any hue, etc. From the second decade of the twentieth century, due to strategic reasons, the colonial authorities started to politically define the hills north and east of the Brahmaputra Valley- a process revived during the Second World War crisis with the extension of "control area" up to the Mc Mahon Line (Reid, 1942: 263) within a broad "police-autocracy" (Stonor, 1957: 3) under ICS and military officer level appointees called Political Officers. This arrangement tallies well with a recent analysis according to which, in the Eastern Himalayas, the state agents prioritized the achievement of authority over people against territory (Guyot-Rechard, 2017: 263-4). The period from 1945-48 witnessed hectic official communication for administrative re-organisation and expanding dispensaries and hospitals (Dabi, 2018) - a process carried forward by the new government under Nehru-Elwin era of NEFA's history (roughly from 1950s to mid-1960s, the time when major policy changes were brought in the aftermath of the Chinese aggression). Such developments of pre-colonial and colonial periods clearly indicate that the people of Arunachal Pradesh had political and economic relations with the neighbouring Assam. The trade relations and cultural contacts of Arunachal Pradesh with its neighbours is a well established fact now (*see* Thakur, 2016). Hence, in the historical shaping of the socio-cultural life of the people of Arunachal Pradesh a plural life developed in which the differences were accommodated (Thakur, 2008: 336-358).

Experts have culturally mapped Arunachal, relevant to their times and this still provide introductory yardsticks when trying to comprehend the cultural geography of this

extensive and diverse state. Verrier Elwin identifies three cultural zones roughly corresponding to the three major religious groups- Buddhism, Animistic and the Vaishnavism (Elwin, 1958: xiii) while Parul Dutta and Syed Ishteaque Ahmad speaks of two cultural zones- the plains and the hills. Without elaborating this hills-plain binary, they classified the communities of the state into five major tribal groupings (Singh, 1995: xiii-xiv). The ecological variations run from the north to the south and the cultural variations run from east to west (Singh, 1995: 6) since the north-southerly hill ranges discouraged closer interactions between groups in a west-easterly fashion or vice-versa.

The Religions

Buddhism

Both the major doctrinal formats of Buddhism - Mahayana and Hinayana - are practised. In the western and northern parts of the state, the region bordering Tibet, Mahayana forms, variously also known as Tibetan or Lamaistic Buddhism, with further sectarian divisions like Nyigmapa and Gelugpa, is practised. The communities are: the Monpa and the Sherdukpen (in Tawang and West Kameng districts), the Nah (Upper Subansiri), the Memba (Mechuka and Gelling in the Shi-Yomi and Upper Siang districts), and the Khamba (in the Upper Siang district). Among the Monpas and Sherdukpens there is an undercurrent of their pre-Buddhist Bon religion (Dutta and Tripathy, 2008: 89-111) just as Bon deities and sacrificial rituals have been incorporated in the Nyigmapa tradition among the Membas (Tamak, 2016: 232). The pre-Buddhist elements have been integrated into the Buddhist pantheon of Arunachal

Pradesh and are reflected through the arts and paintings (Thakur, 2016: 26-42). Likewise the Nahs (Hiri, 2016: 146) and the Singphos (Geyi, 2015: 189-198) continue to practice parts of their shamanistic rites and rituals even after largely following Buddhism.

The Hinayana/Theravada is followed in the eastern part of the state by the Khamptis, the Singphos, and the Tikhak section of the Tangsas. From where these peoples migrated and brought the religion along with them, it is thus sometimes referred to as Burmese Buddhism. The Khamptis share close cultural affinity with the Thais (Thailand); a trans-continental cultural bonding that has recently found favour in the government for patronage. The Tikhak Tangsas, the earliest among the Tangsa groups to migrate from Burma, who now live in the plains of Miao, Bordumsa, Jairampur and Manmao and the Patkai ranges in Nampong and Namtok bordering Myanmar in the Changlang district, originally did not follow Buddhism. They adopted it after coming in contact with their neighbours, the Khamptis and the Singphos, after having migrated to Arunachal (personal comm.: J. Tikhak, June 6, 2020).

Animistic-Shamanistic Tribal Religion

An animistic religion, marked by a nearly "classic" shamanism (Jones, 1968:333), is the traditional religion of the majority of the people of the state. A visiting colonial military officer has described it as 'polydemonism' (Duff-Sutherland-Dunbar, 1915: 67). All the communities outside the fold of Buddhism as well as the erstwhile followers of Vaishnavism fall into this category. The majority of the people under this group live in what is now commonly referred to as "central Arunachal"- the region roughly from the Kameng in the west to the

Dibang in the east. Even in the 1950s, these communities were reported to be living in Neolithic stage of culture (Stonor, 1957: 2). Parul Dutta and Syed Ishteaque Ahmad (Singh, 1995: 42) describes the tribes like the Mishmis, the Adis and the Tangsas as having anthropomorphic view of nature. This quality may be attributed to all the animistic communities. The myth-origin narratives, lore, the ritual-chants and in day to day life elements of anthropomorphism is noticeable though the religion itself may not be termed anthropomorphic. Another study (Dutta and Tripathy, 2008: 32) has classified the religion of the Noctes and the Wanchos - the two eastern tribes living in the Patkai Hills bordering Nagaland and who are constitutionally recognised as the "other Naga tribes" - under animism while describing the rest of the fellow animist as "hereditary shamanism".

Vaishnavism

Vaishnavism entered Assam in sixteenth century (Eliot, 1910: 1169; Bora, 2017: 53). The process of the Hinduisation of the Ahom court completed towards the end of the eighteenth century (Baruah, 2004: 360). The propagation of Hinduism in areas or among peoples originally not Hindu was thereafter gradually effected - primarily among the tribes (Eliot, 1910: 1155). The history of Vaishnavism in Arunachal Pradesh draws from this ongoing cultural interaction; and it has been a short lived one as both the Akas as well as the Noctes no longer follow Vaishnavism.

Writing about the Aka religion in 1868, C.H. Hesselmeyer, a Christian missionary, said that the concept of *Hori Deo*, a Hindu deity, was introduced by Tagi Raja, the elusive Aka warlord, among his people after being released from imprisonment in the plains. As a captive Tagi became a

disciple of a Hindu *guru* who in turn obliged Tagi by giving security of the new convert's future good behaviour before the government (Elwin Ed., 1959: 441). Going by this account, it can be seen that a "civilizing" element was part of the conversion of the menacing warlord. Presently, there are hardly few practitioners of Vaishnavism among the Akas as most of them practice the ancestral animistic traditions (personal comm.: G. Nimasow, June 6, 2020).

The Noctes are believed to have embraced Vaishnavism some 250 years back, under the affiliation of the Shree Shree Chaliahl Bareghar Satra of Nazira in upper Assam, led by one of the Nocte chief, Khumbao, who later on came to be known as Naga Noruttam, abandoning beef and adopting the Sattriya hair-cut in the process (Dutta and Tripathy, 2008: 33). Khumbao's conversion appears slightly different from that of Thagi Raja: weary of inter-group killings, Khumbao, guided by a seminal dream, found his guru in one Shri Ram and was eventually christened as Narottam ("Narottam: A Nocte Saint", *The Arunachal Times*, May 16, 2012; Mishra, 2004: 265-273).

Some recent studies on the influence of Hinduism on the Mishmi (Miso, 2005: 69-70) and Apatani (Naku, 2006: 256, 264) speak about sects like *Jai-Guru* and *Gayatri* cult being followed by sections of the respective community members but these studies does not offer chronology of this process. Some factors suggested for adoption of the new faiths include "lack of spiritual fulfilment" in the indigenous religion and the belief that "if purification is done through practices of other communities, the result would be beneficial" (Miso, 2005: 69-70). Practices such as these are not an aberration as many people in Arunachal privately worship popular Hindu deities like Shiva, Laxmi, Saraswati, etc., in their own

convenience without identifying oneself as a member of the particular sect.

Christianity

At 30.2 % (4, 18,732) of the total population of the state as per the last census (2011), from a mere 0.79% (3,684) in 1971, Christianity is the single largest religion in the state. The church has also become "mainstreamed" with rival denominations vying for adherents (Lishi, 2019). One Delhi-based policy think-tank has called attention to the rise of Christian population in the state saying "Arunachal Pradesh joins the Christian northeast" (http://blog.cpsindia.org/2016/02/religion-data-of-census-2011-xiii.html).

The history of the church in Arunachal is recent. French missionary Father Nicholas Michael Krick, who had in 1853 visited Mebo in the Siang valley (Elwin Ed., 1959: 236-48), was on August 2, 1854 murdered, along with his colleague Augustine Etienne Bourri, in the Tibetan border by a Mishmi villager (Mackenzie, 1884: 49). Existing literature suggest the murder as incidental rather than anything to do with their faith; their journey was exploratory, not evangelical. In the 1830s and the 1840s the American Baptist Missionaries from Burma were pressed to work amongst the eastern tribes of the state like the Singphos, the Noctes, the Wanchos and the Khamptis (Bora, 2017: 314-342). After the Khampti Uprising (1839-40), the exercise was abandoned (Downs, 2003: 78).

From the last decade of the nineteenth century, missionary influence among the Adis, the Nyishis and the Mishings living near the foot hills is said to have begun though without much success. By 1950 some youths of the above tribes were converted into Christianity (Sangma,

1980: 271) mainly through the missionary schools in the neighbouring towns of Assam like Sadiya, Jorhat and North Lakhimpur. In July 1947, the Bishop of Shillong offered the services of their Sisters in the running of the hospital being improvised at Pasighat and proposed to open and run schools for the hill tribes of the frontier to work for their "intellectual, moral and social uplift" (Rev. Dr. S. Ferrando to the Governor of Assam dated July 29, 1947, *Medical-B, NEFA Branch*), a proposal declined by the government of the time.

Christianity in Arunachal did not contribute to spread of English education or in the process of unification of tribes neither is there a distinct Christian political identity; this is unlike the experiences in most of the hills of northeast where such developments were associated with the spread of Christianity (Webster, 2012: 93-94). The growth of church in the state has been happening in the absence of a colonial setting, minus missionaries' medical and educational works and it has no association with rebellious voices. Thus, while Christianity is identified as "anti-national" in the rest (Webster, 2012: 94), in Arunachal it currently holds the dignity of being an "alien" faith.

Reformed Religion or the Indigenous Faith Movement

Writing about the contemporary religious reform movement in Arunachal - the only detail scholarly work on the subject so far - anthropologist Sarit Kumar Chaudhuri relates the rapid expansion of Christianity to the awakening among the tribes "in order to protect and pre serve their indigenous religious beliefs and practices." The process has, writes Chaudhuri (2013), "generated new taxonomies, such as "Donyi-Poloism," "Intyaism," "Rangfraism,"... to institutionalize

tribal religion by inventing images of gods and goddesses, constructing temples, and textualizing religious chants or oral traditions in a manner very similar to that of Hinduism" (pp. 260-261), .

Religious reform in the sub-continent has one known element, that is, the employment of the tool and techniques of the religion perceived to be a threat in the revised format of the religion considered under threat. In the nineteenth-century, Ram Mohan Roy borrowed congregational worship from the Serampore missionaries (Davis, 1946: 119) and many Brahmo and Arya Samaj leaders, influenced by the idea of Christian piety and Islamic monotheism, re-interpreted and institutionalised their respective orders into a new shape (Panikkar, 1995). The nature of religious reform movement in Arunachal is no different: it has been started by the modern-educated elites who felt a sense of loss and threat; there is debate, exchange of ideas and acrimony- in seminars, workshops and informal settings where, often, the tone is unfriendly and the stance confrontational; there is intellectual and organisational links with similar pan-India organisations; there is production of an entirely new genre of devotional literature in vernacular; and there is this *Jai Donyi Polo* greeting, etc. Chaudhuri (2015) sums up the development crisply: "Many of the images invented are largely Hinduized idols, though an attempt has been made to assimilate some local traits into such images based on their mythical characters. Moreover, in the name of reviving indigenous tribal religion, the way it was institutionalized also reveals or supplements how Hinduized norms were imposed consciously or in disguised ways" (p. 275). The Hindi section of the BBC recently carried a news item titled (rendered in Roman script here), "Naye Bhagwan' ko Pujne ko Lekar

Kyon Asmanjas Mein Hain Arunachal ke Adivasi?" ("Why are the tribes of Arunachal confused about worshiping the 'new god'?") (https://www.bbc.com/hindi/india-51776394).

At least among a section of the followers of the reformed religion the result of institutionalisation has generated a sense of loss, and they are, ironically, the shamans. Some of the shamans, many of who I talked to, have apprehensions about the "survival" of their kind as the devotional element in the reformed religion dim the role of the shaman as the mediator between the mortal beings and the deities. Prayers in place of propitiation, devotional hymns in lieu of ritual-chants, idols in place of omen, healing not taboo/*genna* - the shamans' anxiety is not without valid reasons.

Innocuously placed by the wheels of time before waves of new things the desperation of the followers of the animistic religion is not misplaced. Their ancestral faith was originally not modelled to co-exist with this sort of complexity and competition. Thus, this urgency for reforms the course and results of which is going to be probed by anthropologists, sociologists and historians for a long time to come.

Discussion and Conclusion

A quick survey of religious pluralism in Arunachal generates the following observations. First, all established religions have exerted their influence on the animistic communities so as to recruit converts, irrespective of the means and goals of the conversion. In case of Buddhism, the examples are the Tikhak Tangsas and the Nahs (who, according to one version, embraced Buddhism at a monk's behest in order to escape a deadly epidemic; Hiri, 2016: 146); the Akas and the Noctes in the case of Vaishnavism; and all except the Buddhist communities with respect to Christianity.

Secondly, people from the animistic culture have a tendency to "relapse" to their old tradition. Most Buddhists continue to practice pre-Buddhist rituals; Vaishnavism failed to bring all the Aka and Nocte to its fold and its few early followers are nowhere to be found - only to be replaced by animism and Christianity respectively; and the Christian Church have its own 'backsliders' and returnees to the reformed religion. This interesting development brings back to memory a century-old characterisation about the followers of animistic faith: "The tribesmen have no special preference for their own forms of religion, and take fairly readily to Hinduism in the plains, and to Christianity in the hills. If not for their natural reluctance to abandon pork, liquor and freedom of intercourse between the sexes these tribes would have speedily converted to the either of the two religions" (Allen *et. al.*, 1909: 55).

A related issue is the question of the "alien-ness" of a religion vis-a-vis its indigenousness. Ideally, the animistic religions qualify the standards of being the indigenous religion (Harvey Ed. 2000 and 2002). Within this frame, the Buddhism and the Vaishnavism are established "world religions" without necessarily being "alien". From a protectionist, constitutional point of view Christianity becomes the "alien" religion of the state (the APFRA 1978 Section 2 (c) considers Vaishnavism - and obviously the Buddhism also - as one of the indigenous religions of the state). The standard for the categorisation of what constitutes an "alien" religion is anything but anthropological as much as the cited anti-conversion law was enacted to target spread of Christianity. This notion of an "alien" religion is being driven through a tunnel of animosity in the contemporary protection-of-indigenous-culture debate in Arunachal:

sometimes it assumes the form of posters and banners with insinuating slogans like "Imitation of Alien Faith is Slavery", "Loss of Indigenous Faith is Loss of Identity", "Rituals of Birth, Marriage and Death are Tripod of Your Identity", "Culture Without Indigenous Faith is a Body Without Soul", "Our Faith-Our Guide: Our Culture-Our Pride", etc. - a common sight for weeks during the month of December when the Indigenous Faith Day is celebrated across the state, strategically coinciding with the Christmas festivity. In the study of these complex cultural processes, the definition of what is "alien" about a religion and what "culture" is being supplanted in its wake to put a break to the "loss of identity" is going to attract more scholarly analysis in decades to come. Among such themes, semantic studies on the language and vocabulary being used by the Christian preachers, such as "devil", "evil", "repentance", etc. and its perception, and reactions, in the local animistic world-view; the peculiar appeal of the Gospel and the distinct Christian faith-healing among the animistic peoples of the state, etc. will generate deeper academic insights.

Dawar (2003) has, in detail, tried to understand the question of what he termed as "cultural regeneration" (instead of Chaudhuri's "religious reform") in Arunachal within the Gramscian framework of "cultural hegemony" (Gramsci, 1971), a model of analysis refreshingly and powerfully employed by K.N. Panikkar (1995) with respect to the nineteenth-century India socio-cultural processes. The idea of "hegemony" itself needs to be contextualised while analysing such cultural processes in Arunachal Pradesh. The import of what "hegemony" was in a nineteenth-century colonial metropolis may not fit the situation in a frontier about which the isolation-assimilation discourse was hotly

debated in policy circles right in the 1950s and whose administrative philosophy (Elwin, 1957) was initially guided by a sympathetic, protectionist regime.

The defining features of religious pluralism in Arunachal are two: one, the spectacular rise of Christianity and the extra-ordinary effort of the indigenous religious reform movement that has generated a powerful network of activists, intellectuals, temples and organisations (within and beyond the state). Good or bad, apt or misplaced the greatest contribution of the reform movement is in its ability to make the notion of the "loss of culture" popular and create an un-ending debate around it. The second important feature is the sweep of devotional element in the religions of Arunachal- Buddhist, Christian and the reformed religion's devotion; the animistic propitiatory rituals has become the casualty of this march of organised, worship-based religions. A detached observer might view the development as ominous: across all of tribal India, Arunachal, being the terrain where the contest of culture is intensely being fought, will enter the pages of history as India's most interesting cultural laboratory in the post-independent era.

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1st International Conference on

Evolving Materials and Nanotechnology for Sustainable Development (EMNSD-2020)

15-16 December 2020

Organised By

Department of Physics,
Central Institute of Technology Kokrajhar,
Deemed to be University (under MHRD, Govt. of India),
Kokrajhar, BTR, Assam-783370, India.

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Associate Professor, Department of Chemistry, CITK

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A TRIBUTE TO PROFESSOR INDRANI BANERJEE

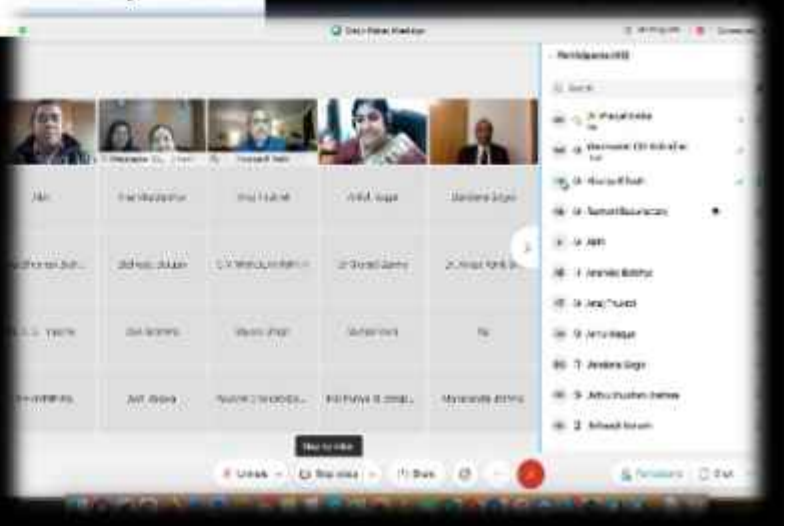
Professor Indrani Banerjee, Dean of School of Nanosciences at the Gujarat Central University, Gandhinagar, Gujarat, India, passed away on 11 April 2021 because of COVID-19 at the age of 48 years. The scientific fraternity including our institute Central Institute of Technology Kokrajhar along with the parent institute deeply mourn this sudden death. We pay our tribute to the great soul.

We were so fortunate to have Prof. Indrani Banerjee madam as one of the resource persons of the International Conference "*Evolving Materials and Nanotechnology for Sustainable Development" (EMNSD, 15-16 December 2020*).

Prof. Banerjee graced our event with spectacular lecture *on* ***Structure Function Relation of Microwave Synthesized Muga Silk Nanoparticles,*** where all the participants as well as speakers and all the members of the program greatly benefited. We glad to interact with Prof. Banerjee madam on screen and enthuses about madam's outstanding work.

A recipient of 'Better Opportunities for Young Scientists in Chosen Areas of Science and Technology' (Boyscast) fellowship and Commonwealth Academic Fellowship, UK, Prof Banerjee was a visiting scientist and postdoctoral research associate at Mechanical and Aerospace Engineering Department, University of California, Los Angeles, USA. She was also a visiting academician at Brunel University, London and a postdoctoral fellow at Bhabha Atomic Research Centre, Mumbai.
With a PhD (2007) from Bhabha Atomic Research Center, Pune University, Prof. Banerjee joined Birla Institute of Technology, Mesra as Assistant Professor in Physics, continued as Associate Professor in the same institute till 2017. Prof. Banerjee joined School of Nanoscience at Central University of Gujarat, Gandhinagar and continued there till her last day.

Prof. Banerjee was a great teacher and admirable researcher of the highest moral values, will be respectfully remembered by all who came in contact with madam as a person of highest integrity, honesty and sincerity.



Acknowledgement

We would like to extent our extreme gratefulness to the Director, Prof. Debkumar Chakraborty, Central Institute of Technology Kokrajhar (CITK) for the approval of organising the International Conference EMNSD-2020 and his stimulating support. We are very much grateful to the registrar Ms. Chaitali Brahma, CITK for her strong cooperation for grant success of the program. We are grateful to our management for their support, motivation and encouragement without which this event could not have been organized. We are very much thankful to each and all members who directly or indirectly extended their helping hand with moral support. Saying thank you is not enough but the individual and collective contribution of all speakers and participants mean a lot for the grand success of EMNSD-2020 followed by publication of conference proceeding with ISBN in form of E-Book. Special thanks to Mr. Biswajit Paul, (Library Information Assistant) for his continuous support for the success.

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MESSAGE FROM THE DESK OF DIRECTOR

It gives me immense pleasure to share with you that the Department of Physics, Central Institute of Technology Kokrajhar (Deemed to be University, MHRD, Govt. of India), Assam is organizing International Conference on "Evolving Materials and Nanotechnology for Sustainable Development (EMNSD)" 15- 16 December, 2020 in on line mode. The topic is quite relevant and significant which includes most prominent dimensions of the study in the field of materials and nanotechnologies. Taking this fact into consideration, the CITK is going to adopt a step to create a healthy academic horizon which is urgently needed for all-round development of the nation with global standard. I welcome all esteemed speakers and participants to deliver their interesting & valuable talks in the conference EMNSD 2020.

I acknowledge efforts put by all organizing members. I wish a grand success.

With Best Wishes

Debkumar Chakrabarti

Prof. Debkumar Chakrabarti
Director (Officiating) CIT Kokraj

MESSAGE FROM THE DESK OF REGISTRAR

Greetings from CITK…

I am happy to say that the Department of Physics of Central Institute of Technology Kokrajhar (Deemed to be University, MHRD, Govt of India) is going to organize the International Conference on "Evolving Materials and Nanotechnology for Sustainable Development (EMNSD)" 15- 16 December, 2020 in on line mode. This conference will bring the wave of knowledge from different fields across the world along with the platform to interact, discuss the challenges and exchange the expertise towards building a possible collaboration. With this message, I am honoured and delighted to welcome you to attend this conference. I welcome each and every participants of the conference to feel the learning environment of CIT Kokrajhar and to make the event grant success.

I appreciate the hard work of the entire team, as well bringing out a Book of Abstracts highlighting the recent research outcomes in the related field. I wish great success for the successful conduct of the delightful event EMNSD 2020 and hope this mission will be carried out with even more dynamism in the years ahead.

Ms. Chaitali Brahma

Registrar, CIT Kokrajhar, Assam

FROM THE DESK OF HEAD OF THE DEPARTMENT

It involves extraordinary delight to take note of that the Physics Department CITK will put together the first International conference Evolving Materials and Nanotechnology for Sustainable Development (EMNSD-2020). It involves incredible pride that the coordinator of the conference has been effective in making a gigantic effect on the target participant within short span of time. The conference has got a staggering response across the globe which is essentially stunning. It is an incredible accomplishment for the organiser to arrange the publication of Abstracts in the form of a book having ISBN status.

On behalf of the Department and also on my personal behalf I would like to thank the organisers of EEMNSD-2020 for their untiring efforts and constant endeavour to make the conference new heights.

I wish EMNSD-2020 a grand success!!

Dr. B N Parida
Assoc. Prof. & Head,
Department of Physics,
CIT Kokrajhar, Assam, India

FROM THE DESK OF CONVENOR

I am so honored and delighted to take the opportunity to convey my best of regards to you all who have given your valuable time towards fulfilment of the **International Conference on Evolving Materials and Nanotechnology for Sustainable Development (EMNSD-2020) on 15-16 December 2020 (Tuesday-Wednesday)** in online mode via Cisco WebEx. I would like to welcome you all respected persons to the glorious moment for our CIT Kokrajhar. We are so happy to receive to have very good response from Eminent Persons across the globe as well as the nation along with our native places.

The aim of the conference is to tie the thought of researchers working in academia and other professionals through their research presentations in current technological trends. EMNSD 2020 is providing an excellent forum for exchange of ideas, scientific interactions and potential for collaboration in materials science with nanotechnology.

We have received a very good number of participants for both oral and poster presentation from wide-ranging area of materials and nanotechnology based on the theme of Sustainable Development. We are very much delighted to publish all those as a conference abstract book and selected full papers in form of conference proceeding with ISBN. We hope, these publications will be valuable and memorable assets for the contributors, host institutes and other Academic and Research bodies.

On the behalf of organizing committee of EMNSD 2020. I would like to extend our gratefulness to Prof. Devkumar Chakrabarty, Director, CITK, for approval cum strong encouragement. I am also very much obliged to Ms. Chaitali Brahma, Registrar, CITK for the support and cooperation in all dimensions. I would like to extend my sincere gratitude to all members of advisory board and also appreciate Dr. Bichitra Nanda Parida, Head of Department of Physics, CITK for continues stimulating cooperation. The programme would not be up to the mark without the full contribution of members of organizing committee, staffs, research scholars, speakers, delegates, participants, students, and all who have joined their hands directly or indirectly to make the event grand success. So, I am very much thankful to them from bottom of heart.

I hope all of us will have a great time with peer groups in this conference and would receive many great tips to implement those in your works. On behalf of organising committee I would like to convey our best wishes to you all and appeal you to make our conference a great success.

Dr. Manasi Buzar Baruah,

Convener, EMNSD-2020
Assistant Professor, Department of Physics
CIT Kokrajhar, Assam, India
Email id: emnsd20@cit.ac.in

EMNSD 2020

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EMNSD 2020

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EMNSD 2020/OP/01

Challenge and Success in Synthesis of Quadruple Perovskite $A'A_3B_4O_{12}$ at Ambient Pressure

Ariful Haque*, Sudipa Bhattacharya and Md. Motin Seikh*
Department of Chemistry, Visva-Bharati University, Santiniketan-731235, West Bengal, India
Email: *haquearifulchem@gmail.com (A. Haque)*

ABSTRACT

Here we have described the genesis of real challenge in synthesizing $A'A_3B_4O_{12}$ quadruple perovskite at ambient pressure that largely hampers the exploration of this family of oxides. In this proceeding, we have reported two new compositions namely $BiCu_3Ti_3CrO_{12}$ and $LaCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$ synthesized at ambient pressure and compared their magnetic properties with our earlier reported results with the congener oxides. We observed highly contrasting magnetic feature by changing chemical compositions either in B-site $BiCu_3Ti_3MO_{12}$ (M=Cr, Mn & Fe) or in A-site $A'Cu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$ (A'=La and Bi). The ambient pressure synthesized compounds highlight the opportunity to explore the chemical effect on physical properties in this family of quadruple perovskite.

Keywords: Quadruple perovskite, Ambient pressure, Antiferromagnetic, Ferrimagnetic.

INTRODUCTION:

The quadruple perovskites of general formula $A'A_3B_4O_{12}$, where both the A and B-sites can be occupied by transition metal ions, provide excellent opportunities to discover exotic functionality due to widening the landscape of electronic and magnetic interactions between the metal ions [1]. Unlike the simple ABO_3 type perovskite oxides having only B-B interaction, $A'A_3B_4O_{12}$ exhibits all A-A, B-B, and A-B types of interactions inducing complexity and the possibility of a new phenomenon. Interestingly, the A-site cations in $A'A_3B_4O_{12}$ practically avail four coordinated square planar geometry. The remaining eight oxide ligands are at significantly larger distance, as the A-site cations in perovskite structure usually have twelve coordination numbers. This structural constraint restricts the metal ions to occupy the A-site only by the strongly Jahn-Teller active cations, such as Cu^{2+} or Mn^{3+}. Such fixation of metal ions in square

planar coordination usually requires high pressure for synthesis, and hampers exploring this series of oxides. Consequently, unlike simple perovskites, quadruple perovskites are much less studied. Developing a strategy for ambient pressure synthesis of quadruple perovskites will allow the investigation of such oxides overcoming the difficulty of high-pressure synthesis.

In this regard, the first ambient pressure synthesis of $CaCu_3Ti_4O_{12}$ about five decades ago provides a clue to progress in this direction [2]. Accordingly, several compositions of $(Ln/Ca)Cu_{3-x}Ti_{4-y}Mn_{x+y}O_{12}$ was successfully synthesized at ambient pressure via solid state route under sealed tube [3,4]. $CaCu_3Ti_4O_{12}$ exhibits antiferromagnetic ordering below 25 K where A-site Cu^{2+} ions are coupled antiferromagnetically through $Cu^{2+}\uparrow$—O—Ti—O—$Cu^{2+}\downarrow$ exchange pathway. The substitution of nonmagnetic Ti by a magnetic ion like Mn in the B-site gives rise to the dramatic evolution of electrical and magnetic properties. Here, $Cu^{2+}\uparrow$—O—Ti—O—$Cu^{2+}\downarrow$ exchange path gets transformed to $Cu^{2+}\uparrow$—O—Mn$\downarrow$—O—$Cu^{2+}\uparrow$ with two magnetic sublattice of parallel spins which are coupled antiferromagnetically eventually resulting in ferrimagnetic ground state [3]. However, the magnetic behavior of Fe doped $Bi_{2/3}Cu_3Ti_4O_{12}$ is rather complex [5]. Unlike the Mn substituted samples, upon 10% Fe doping in $Bi_{2/3}Cu_3Ti_4O_{12}$, the AFM interaction becomes weaker, and a further increase in Fe does not show any clear magnetic transition. Instead, a strong competition between ferromagnetic and antiferromagnetic interaction has been suggested to prevail [5]. The compound $BiCu_3Ti_3FeO_{12}$ shows spin glass behavior, whereas $BiCu_3Fe_4O_{12}$ is probably an antiferromagnet [6]. However, $BiCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$ has been realized to show strong competition between ferromagnetic and antiferromagnetic interactions leading to phase segregation [5]. This contrasting behavior of Mn and Fe doped samples must be related to the chemical nature of these two elements. To further substantiate such chemical effect on the magnetic property, we have performed ambient pressure synthesis of $BiCu_3Ti_3CrO_{12}$ and $LaCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$ and compared with $BiCu_3Ti_3(Mn/Fe)O_{12}$ and $BiCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$, respectively, to highlight the effect on both the A- and B-sites.

EXPERIMENTAL DETAILS:

$BiCu_3Ti_3CrO_{12}$ and $LaCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$ have been synthesized at ambient pressure by conventional citrate-gel method [7]. Stoichiometric amounts of required metal salts were dissolved in 80 mL of distilled water. Then 5 mL of concentrate nitric acid was poured into the reaction mixtures to prevent the hydrolysis of aquated metal ions. After that, the reaction mixture

was rotated by a magnetic stirrer to obtain a clear solution. Then citric acid was added to this solution in about four times the mole ratio of the metal ions. The resulting solution was rotated at 60 °C for 6 h by a magnetic stirrer and then evaporated at 100 °C to form the gel. Then the gel was dried into crude powder at 250 °C. The obtained crude was then treated in the air at 750 °C at a heating rate 5°C/minute for 16 h followed by 800 °C for 24 h with intermediate grindings to obtain the final products. The powder X-ray diffraction (PXRD) data were measured with a Bruker D8 Advance X-ray diffractometer using Cu Kα radiation (λ=1.5418 Å) working at 40 kV and 40 mA. The XRD patterns were collected in the 2θ range of 10°–80° using Lynxeye detector (1D mode) with a step size of 0.02° and a dwell time of 1 s per step. The d. c. magnetization measurements were carried using a superconducting quantum interference device (SQUID) magnetometer with a changeable temperature cryostat (Quantum Design, San Diego, USA). FE-SEM and EDX analyses were performed using a *Zeiss GeminiSEM 450* field emission scanning electron microscope at an accelerating voltage of 20 kV.

RESULTS AND DISCUSSION:

The PXRD patterns of $BiCu_3Ti_3CrO_{12}$ and $LaCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$, without any detectable impurity peak, have been shown in **Figure 1,** confirming the phase purity of the samples. Both the patterns refined using the Rietveld method can be properly indexed with cubic I-*m3* space group. The refinement parameters, cell constants, bond lengths, and bond angles are summarized in **Table -1**. The FE-SEM images of $BiCu_3Ti_3CrO_{12}$ and $LaCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$ (**Figure 2(a)-(b)**) reveal the larger agglomerated grains with irregular shape and size. The representative EDX spectra of the samples are shown in **Figure 2(c)-(d)**. The average cationic ratio appended on the spectrum obtained from the EDX spectra was recorded at different regions of the samples confirming the nominal composition of the compounds.

The temperature dependent magnetization of $BiCu_3Ti_3CrO_{12}$ measured under an applied field of 1000 Oe between 5-300 K in zero-field cooled (ZFC) and field cooled (FC) protocols are shown in **Figure 3(a)**. Unlike the parent $Bi_{2/3}Cu_3Ti_4O_{12}$, which shows a single magnetic transition around 25 K, $BiCu_3Ti_3CrO_{12}$ exhibits two anomalies around 22 K and 75 K, respectively. The first one corresponds to the parent phase. The second anomaly can be attributed to the local magnetic ordering around the dopant Cr center. These transitions are antiferromagnetic in nature, as suggested from the isothermal magnetization measured at 5 and 50 K (see inset in **Figure 3(a)**). There is a small jump in the magnetization near H=0 followed

by the gradual increase in moments with the applied field. The jump in magnetization can be related to the small ferromagnetic components arising out of spin canting. The canted antiferromagnetic state has also been reported in $CaMn_{6.5}Cr_{0.5}O_{12}$ [8]. The evolution of a new magnetic transition (75 K) in $BiCu_3Ti_3CrO_{12}$ with the retention of low temperature ordering (22 K) is remarkably different from the $BiCu_3Ti_3FeO_{12}$ and $BiCu_3Ti_3MnO_{12}$ [5]. For these latter two compounds, the low temperature ordering at 25 K corresponding to the parent $BiCu_3Ti_4O_{12}$ phase has completely been suppressed. $BiCu_3Ti_3FeO_{12}$ enters into spin glass state, whereas $BiCu_3Ti_3MnO_{12}$ becomes ferrimagnetic below 120 K with the several fold increase in magnetization (**Figure 3(c)**). To better visualize this remarkable change in magnetic properties in $BiCu_3Ti_3MO_{12}$ with M = Cr, Fe and Mn, we have plotted the data of Fe and Mn congeners in **Figures 3(b) & (c)**. In $BiCu_3Ti_3MnO_{12}$, the Mn is able to flip the antiparallel spins of the A-site Cu^{2+} like domino effect and eventually results in ferrimagnetic states by aligning its spin opposite to Cu^{2+} spins [3,4]. In this regard, the influence of Cr is likely to be localized. This result highlights the prominent chemical effect of B-site of substitution in $A'A_3B_4O_{12}$ quadruple perovskites.

To investigate the possibility of such a chemical effect for A′-site substitution, we have synthesized $LaCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$ at ambient pressure and compared its magnetic property with our previously reported data on $BiCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$ in Ref. 5. Accordingly, the magnetic data of $A'Cu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$ (A′ = La and Bi) are plotted in **Figure 4**. The isothermal magnetization measured at 5 K (see insets in **Figure 4**) revealed the comparable moments and similar features of M(H) curves for both the samples. The moments increase with the applied field without any signs of saturation even at ±5 T, which indicates the possible antiferromagnetic background. But the noticeable contrast is clear from the M(T)-curves. For the $BiCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$ sample, the transition is practically smeared up over a broad range of temperature, and only ZFC branch data shows humpy nature (**Figure 4(a)**). In contrast, $LaCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$ shows a clear transition below 50 K with a peak around 20 K in both the ZFC and FC data (**Figure 4(b)**). This differential behavior can be attributed to the local lattice distortion in the case of $BiCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$ which is instigated by the stereoactive $6s^2$-lone pair electrons of Bi^{3+} ions. We believe that $LaCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$ is also susceptible to electronic phase separation like $BiCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$ where the ferromagnetic and antiferromagnetic clusters coexist [5].

CONCLUSION:

We have synthesized two new members of the quadruple perovskites family, namely $BiCu_3Ti_3CrO_{12}$ and $LaCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$ at ambient pressure. Both the samples are crystallized in cubic I-*m3* space group. The samples are characterized by PXRD, FE-SEM and magnetization measurements. We have made a comprehensive analysis of magnetic data for two series $BiCu_3Ti_3MO_{12}$ (M = Cr, Fe and Mn) and $A'Cu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$ (A′ = La and Bi). We observed strong chemical effect on magnetic properties for substitution on either A′- or B-sites. We believe our findings will motivate the researchers to explore the possibility of ambient pressure synthesis of $A'A_3B_4O_{12}$ quadruple perovskites and to examine their novel properties.

ACKNOWLEDGEMENTS

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Table-1: The refinement parameters, cell constant, bond length and bond angles of $BiCu_3Ti_3CrO_{12}$ and $LaCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$.

Parameters	**$BiCu_3Ti_3CrO_{12}$**	**$LaCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$**
Fitting parameters (S. G.: I-*m3*)	a = 7.431(3) Å R_b = 8.12 R_f = 7.95 χ^2 = 3.21	a = 7.453(1) Å R_b = 2.35 R_f = 1.58 χ^2 = 5.42
Bond length	Cu–O : 1.898 Å Cr/Ti–O : 1.999 Å	Cu/Mn–O : 1.973Å Fe/Ti–O : 1.978Å
Bond-angel	Cu—O—Cu :102° Cu—O—Cr : ~111° Cr/Ti—O—Cr/Ti: ~138°	Cu—O—Cu :103° Cu/Mn—O—Fe/Ti : ~109° Fe/Ti—O—Fe/Ti : ~141°

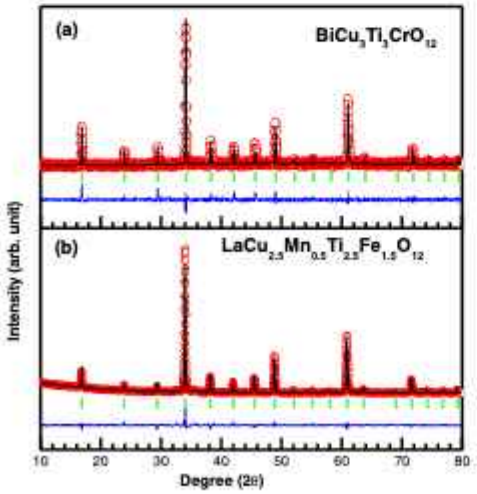

Figure 1: PXRD pattern of (a) $BiCu_3Ti_3CrO_{12}$ and (b) $LaCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$. The open red circles, black lines, the bottom blue lines and green vertical bars represent the experimental data, calculated pattern, difference curve and Bragg position, respectively.

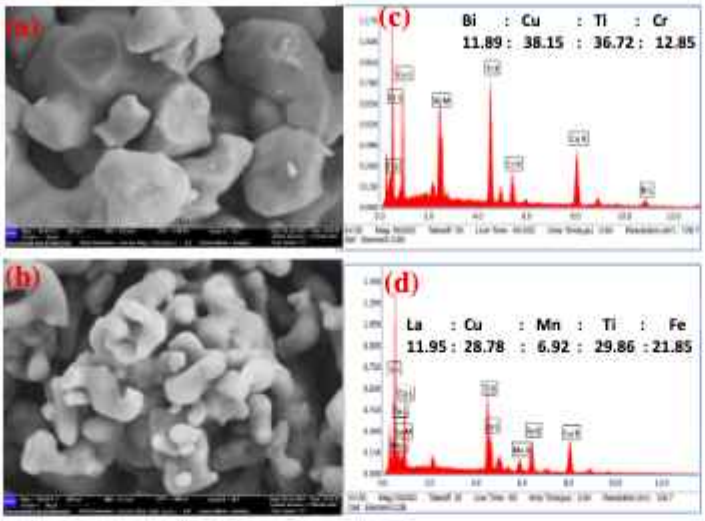

Figure 2: The FE-SEM images for (a) $BiCu_3Ti_3CrO_{12}$ and (b) $LaCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$. representative EDX spectra elemental ratio of (c) $BiCu_3Ti_3CrO_{12}$ and (d) $LaCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$.

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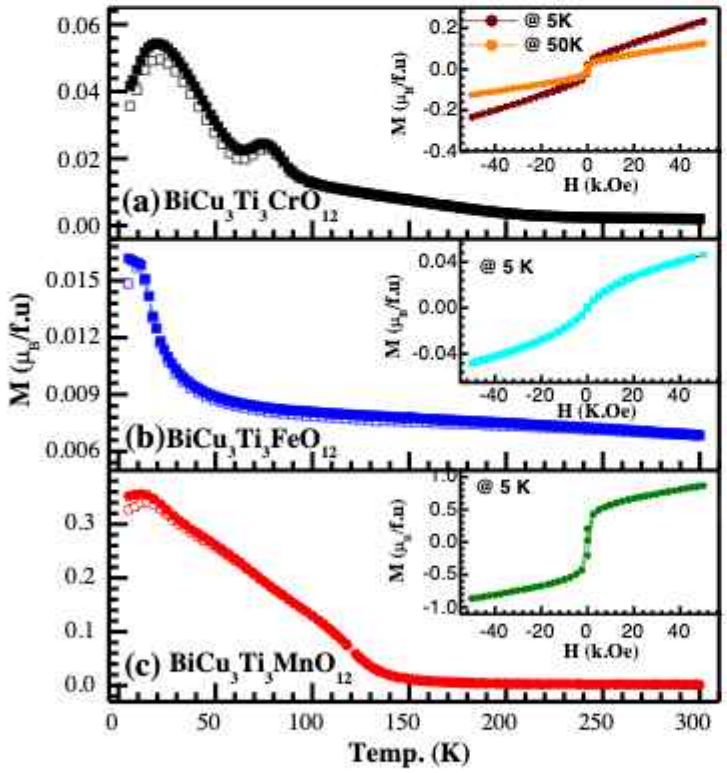

Figure 3: Temperature dependent magnetization of (a) $BiCu_3Ti_3CrO_{12}$, (b) $BiCu_3Ti_3FeO_{12}$ and (c) $BiCu_3Ti_3MnO_{12}$. The open and filled symbols correspond to ZFC and FC data set, respectively. Inset shows the corresponding isothermal magnetization plots. Magnetic data of (b) $BiCu_3Ti_3FeO_{12}$ and (c) $BiCu_3Ti_3MnO_{12}$ are adapted from Ref. [5].

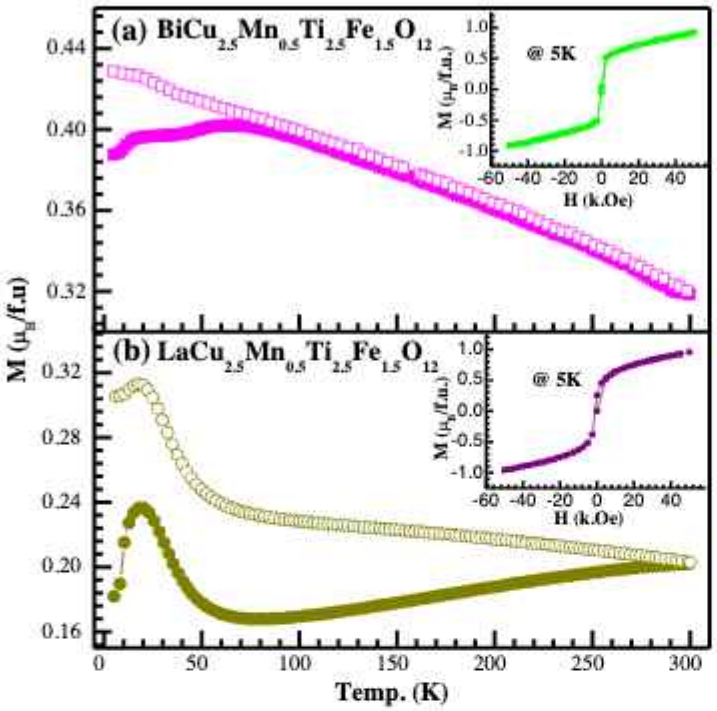

Figure 4: Temperature dependent magnetization of (a) $BiCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$ and (b) $LaCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$. The open and filled symbols correspond to ZFC and FC data set, respectively. Inset shows the corresponding isothermal magnetization plot. Magnetic data of (a) $BiCu_{2.5}Mn_{0.5}Ti_{2.5}Fe_{1.5}O_{12}$ is taken from reference [5].

EMNSD 2020/OP/04

All-Optical Binary to Quaternary Radix Converters Using Soa-Prs

A. Raja*[1,2], K. Mukherjee[2,3] and J. N. Roy[1,3]
[1] Department of Physics, Kazi Nazrul University, Asansol, INDIA.
[2] Department of Physics, B.B.College, Asansol, INDIA.
[3] COSOD, Kazi Nazrul University, Asansol, INDIA.
Email: *ashifphysics@gmail.com*

ABSTRACT

In this paper, we have designed a quaternary logic-based all-optical "binary to quaternary" radix converter. The semiconductor optical amplifier-based polarization rotation switches (SOA-PRS) have been used as the basic switching element in the design. The design is very simple, needs only two SOA. The circuit performance has been analyzed and some performance-related matrices like the Quality factor (QF) and Extinction Ratio (ER) have been calculated. The circuit can operate at an ultra-high speed (100 Gb/s). The SOA-based designs are always simple, compact, and less power-consuming than other switches and structures. The SOA-PRS works in the principle of non-linear polarization rotation (NPR) or cross-polarization modulation (XpolM) effect in SOA.

Keywords: Semiconductor Optical Amplifier, Cross-polarization Modulation, Radix Converter

INTRODUCTION:

The optical circuits already established their superiority over the electrical and electronic information processing circuits after the invention of optical fibers and optical amplifiers. In the last decade, multivalued circuits are becoming one of the interesting fields of research [1, 2]. Multivalued circuits are always better than binary circuits for dealing with a wide range of data using minimum hardware complexity. Some works based on the multivalued ternary and quaternary optical circuits have been designed and analyzed by few research groups [3, 4]. Most of these works are based on interferometric switches where the signal interferes in external optical couplers and the mode of interference depends on the optical path traversed by the signals. So the signal handling is difficult. On the other hand, the SOA-PRS switches or NPR switches works based on XpolM and all the interaction between the signal happens within the cavity of the switches internally [5-7]. So the signal handling is easy and the switch is less power consuming (optical power <1mW, injection current <200mA)[8, 9]. In this communication, we have designed a quaternary logic-based all-optical "binary to quaternary" radix converter [4] using SOA-PRS. The SOA's are very famous for operational speed, wide gain bandwidth, moderate noise, and fast gain recovery [10-12]. The design of the radix converter is simple and compact made of only two SOA's.

The circuit can operate at an ultra-high speed (~100 Gb/s). The circuit operation is expressed with a quaternary polarization encoding scheme (where 0, 1, 2 & 3 represents no light, horizontally polarized light, vertically polarized light, and mixed polarized light respectively) [9].

THEORY

The switching operation of the SOA-PRS is based on the intensity-dependent birefringence and gain saturation effect in SOA. The phenomenon is known as XpolM and is also known as NPR [8, 9]. In this effect, the intensity and state of polarization of the weak probe signal are affected by the higher intensity control signal. The mathematical model is described in the papers of H.J.S. Dorren et al [5] and S. Zhang et al [6]. We have already implemented SOA-PRS switches to designed some binary [8] and multivalued [9] circuits in our previous communications. The numerical values of the parameters used for the best performance of the switch are also described there. The simulation works have been done, solving the "rate equations" of the SOA using the MATLAB computational program. Non-inverting ports are used to show the polarization rotation effects of the circuit. The output signal coming out from the non-inverting port (Y1, Y2) will be high when the input control signal is present (high) and vice versa.

The output signal intensity (I_Y) of the circuit can be expressed as the sum of the output signal intensity of SOA-PRS1 (I_{Y1}), SOA-PRS 2 (I_{Y2}) and is given by,

$$I_Y = I_{Y1} + I_{Y2}$$

$$= a\left(I_1 + I_2 + 2\sqrt{I_1 I_2}\cos\phi\right)_{SOA-PRS1} + b\left(I_1 + I_2 + 2\sqrt{I_1 I_2}\cos\phi\right)_{SOA-PRS2} \qquad (1)$$

Where, a, b represents the coefficients corresponding to the binary numbers A and B respectively. I_1, I_2 are the intensity corresponding to the transverse electric and magnetic components of the output probe signal. ϕ is the phase difference between the TE and TM components imposed by the control signal.

Circuit operation: The circuit of our all-optical binary to quaternary radix converter is shown in Fig.1. A and B inputs represent the Most Significant Bit (MSB) and Least Significant Bit (LSB) of the binary number. Y is the output representing the quaternary number.

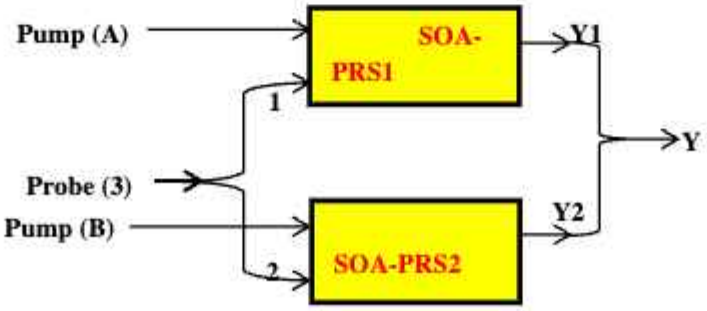

Figure 1. Design of the Radix Converter

Case 1: When binary number 0 enters the circuit, we have A=B=0. In this case, both the pump signal of SOA-PRS 1 and SOA-PRS 2 is absent. So the non-inverting output ports emit no signal (Y1=Y2=0). Then the final output is Y=0+0=0 (no light). Then we have quaternary number 0 for the binary input 0.

Case 2: When binary number 1 enters the circuit, we have A=0, B=1. In this case, the pump signal for the SOA-PRS 1 is absent, and that for the SOA-PRS 2 is present. The non-inverting output of SOA-PRS 1 will emit no signal. The vertically polarized probe signal of SOA-PRS 2 will be rotated to a horizontally polarized signal. So Y1=0 and Y2=1. Then the final output will be Y=0+1=1 (horizontally polarized light). So we get quaternary number 1 for the binary input 1.

Case 3: When binary number 10 enters the circuit, we have A=1, B=0. In this case, the pump signal for the SOA-PRS 1 is present, and that for the SOA-PRS 2 is absent. The horizontally polarized probe signal of SOA-PRS 1 will be rotated to a vertically polarized signal. The non-inverting output of SOA-PRS 2 will emit no signal. So Y1=2 and Y2=0. Then the final output will be Y=2+0=2 (vertically polarized light). Then we have quaternary number 2 for the binary input 10.

Case 4: When binary number 11 enters the circuit, we have A=B=1. In this case pump signals for both the SOA-PRS 1 and SOA-PRS 2 are present. The horizontally polarized probe signal of SOA-PRS 1 will be rotated to a vertically polarized signal. The vertically polarized probe signal of SOA-PRS 2 will be rotated to a horizontally polarized signal. So Y1=2 and Y2=1. Then the final output will be Y=2+1=3 (mixed polarized light). So we have quaternary number 3 for the binary input 11.

The truth table for the operation of the circuit is shown in table 1.

Table 1. The truth table of the Radix Converter

Binary Input		**Y1**	**Y2**	**Quaternary Output**
Pump(A)	**Pump(B)**			**Y=Y1+Y2**
MSB	**LSB**			
0	**0**	**0**	**0**	**0**
0	**1**	**0**	**1**	**1**
1	**0**	**2**	**0**	**2**
1	**1**	**2**	**1**	**3**

RESULTS & DISCUSSION

The QF [8] of the proposed radix converter can be calculated using Eq. (2).

$$QF = [(P_m^1 - P_m^0)/(\sigma^1 + \sigma^0)] \quad (2)$$

Where, P_m^1: average power of the high state, P_m^0: average power of the low state, σ^1: standard deviation of high state, σ^0: standard deviation of low state.

The variation of the QF of the circuit with the change in control power is shown in Fig.2.

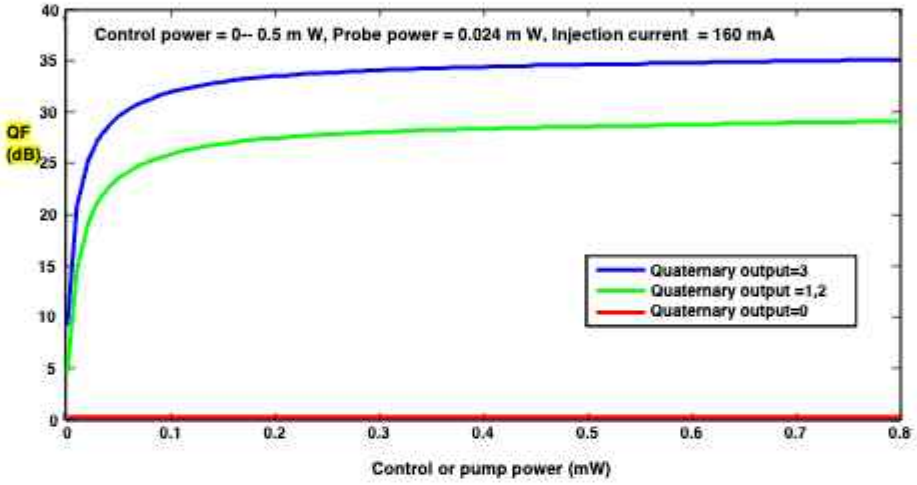

Figure 2. The QF versus control power graph

The ER [8] can be calculated using Eq. (3)

$$ER = 10\log\left(P_{min}^1/P_{max}^0\right) \quad (3)$$

Where, P_{min}^1 and P_{max}^0 are the maximum and minimum levels of output power respectively.

The variation of the ER of the circuit with the change in control power is shown in Fig.3.

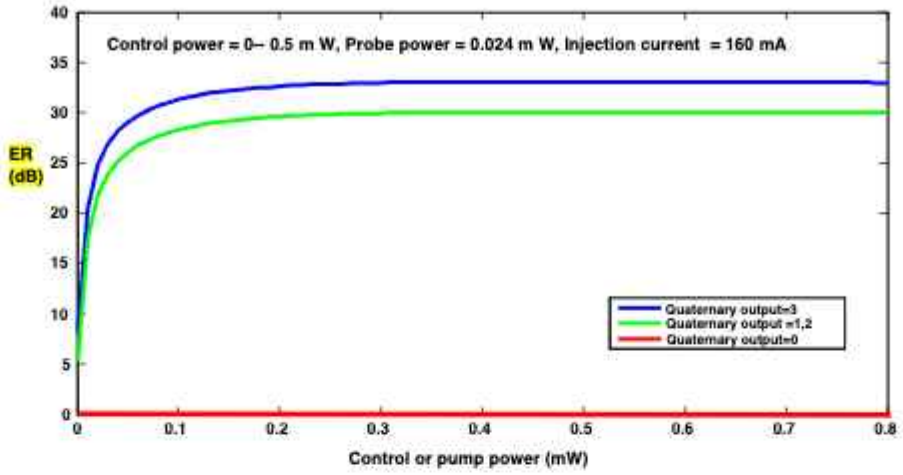

Figure 3. The ER versus control power graph

The QF and ER of the radix converter both increase with the increase in control power. In absence of the control signal, we get nothing but a small amount of power due to the amplified spontaneous emission (ASE) noise effect [8, 9]. Then we have a very small amount of QF and ER and are shown in Fig.2 and Fig.3 using the red line.

The pseudo-eye diagram of the binary to quaternary radix converter circuit is shown in Fig.4.

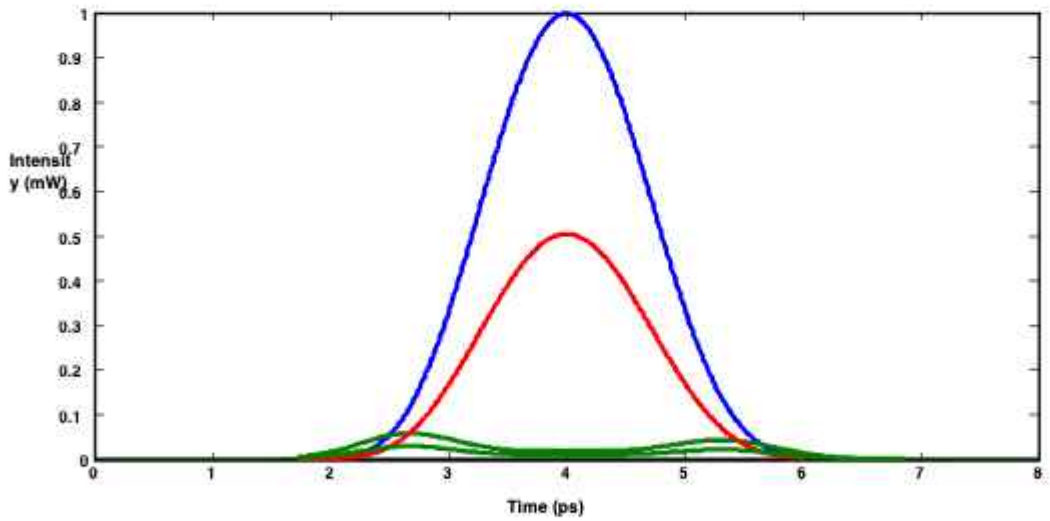

Figure 4. Pseudo Eye Diagram for the Radix converter

The Relative Eye Opening (REO) [8] of the circuit can be measured using Eq.(4)

$$REO = \left(\frac{P^1_{min} - P^0_{max}}{P^1_{min}}\right) \sim 86\% \qquad (4)$$

CONCLUSION

In this paper, all-optical polarization encoded binary to quaternary radix converter is designed to exploit the XpolM effect of SOA. Some performance-related matrices like QF and ER have also been calculated. The main advantage of this scheme is having a good QF (>10dB) and less bit error rate ($<10^{-20}$). The NPR switches work efficiently in the low input (pump) power region (≤ 0.5mW). High power levels reduce the conversion efficiency in the SOA because of the gain saturation effect. Any change in polarization of input signals can be controlled using some additional polarization controllers (PC). This technique can also be used to design some higher-order multi-valued all-optical circuits [9]. For better speed, Quantum Dot SOA can be used in the designs [13].

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A Study on Iron Oxide (Γ- Fe_2O_3) Nanoparticles Synthesized Using Precipitation Method and its Possible Applications

Bandana Gogoi*[1] and Upamanyu Das[2]
[1, 2] Department of Physics, Rajiv Gandhi University, Doimukh, AP, INDIA.
1 Department of Physics, D.N.Govt. College, Itanagar, A.P, INDIA.
Email: bandana.gogoi12@gmail.com

ABSTRACT

The recent nanotechnological impact has been observed greatly in society as well as in environment. Magnetic Nanomaterials showing unique novel magnetic behaviour show great potential applications. Iron oxide nanomaterials have drawn considerable attention and interest have been developed for unique properties they show at extremely small size like high surface to volume ratio, surface modification property, excellent magnetic property with better biocompatibility. Therefore more efforts have been devoted for the synthesis of ecofriendly, biocompatible Iron Oxide NPs. Magnetite (Fe_3O_4) and Maghemite (γ- Fe_2O_3) and Hematite (α-Fe_2O_3) are promising member of Iron oxide family. Promising qualities of these nanoparticles can be applicable in the field of specific technical and biomedical applications. Nanostructuring can result a new magnetic state called superparamagnetism. In this study an experimental setup is designed to observe the size effect in magnetic properties of the material with the preparation of Magnetite (Fe_3O_4) and Maghemite (γ- Fe_2O_3) as magnetic sample and observed that ensemble of particles together show superparamagnetism at elevated temperatures. The morphology of the particles has also been studied. Theoretical analysis on superparamagnetism where there is an unusual change in shape of hysteresis loop showing state of zero magnetization has also been discussed.

Keywords: Nanomagnetism, Superparamagnetic, Nanoparticle, Ferromagnetism.

INTRODUCTION:

Various studies have been done on different metal oxide particles. Among the different metal oxide studies, iron oxides (Fe_xO_y) NPs can offer unique advantages over others. The promising contributions towards many technological applications like targeted drug delivery, magnetic resonance imaging (MRI), bio sensing, bio separation etc increases the attention of researchers towards this engineered material. The inexpensive production, biocompatibility and safety to environment and other living being, made great contribution to develop interest to investigate this noble material [1-5]. Among the other properties Iron oxide NPs are physically and chemically stable that can be manipulated under the influence of an external magnetic field. Due to the reduction in size, magnetic ordering inside the particle changes, at the same

time surface property also changes remarkably [6]. Magnetic behaviour shown by many NPs can be attributed to many factors like chemical composition, structural distribution, amount of defectiveness and type of defectiveness present in crystal lattice. The size, shape and morphology of the particle and its interaction with the surrounding matrix and neighbouring particles provide major contribution in deciding magnetic nature of the particles. Among various magnetic metal oxides iron oxides (Fe_xO_y) NPs are considered to be technologically more important, eco-friendly and comparatively less hazardous.

Iron oxides are found to be exists in nature in many forms. Magnetite (Fe_3O_4) and Maghemite (γ-Fe_2O_3) and Hematite (α-Fe_2O_3) are most commonly found iron oxide forms in nature [11]. Among these commonly available iron oxides Magnetite and Maghemite has got more attention and investigation on its application in the field of biomedical. Both Magnetite (Fe_3O_4) and Maghemite(γ- Fe_2O_3) shows their biocompatibility and low toxic nature towards human health and other living world.

Magnetite (Fe_3O_4) and Maghemite (γ- Fe_2O_3) generally found to contain single domain of about 5–20 nm in diameter and therefore possess large surface area as compared to volume. The quantum size effects at nanodimension also lead to some dramatic change in magnetic behaviour of the iron oxide material resulting in superparamagnetic behaviour and quantum tunnelling of magnetisation as well. The Fe_3O_4 nanocrystal shows spinal structure where Fe^{3+} ions are distributed randomly between octahedral and tetrahedral sites. Fe^{2+} ion occupies solely the octahedral sites having six oxide ions as the nearest neighbours [7]. Basically they are ferromagnetic and show the properties of spontaneous magnetisation in bulk state.

Synthetic route is one of the various factors that can affect the magnetic properties of a material. A synthetic route can affect strongly in determining the magnetic properties of Iron Oxide NPs also. Further it is reported by Margulies et al. that magnetic behaviour of magnetite nanoparticle changes with crystal morphology. The coercivity of the magnetite NPs are observed to be changed as sphere < cubes < octahedral [8,9]. The routes followed during preparation and the coating medium used may play key role in determining the size distribution, morphology, magnetic behaviour and surface chemistry of the magnetic nanoparticles. Hence the preparation method is one of the responsible factors for determining the intrinsic properties as well as the applications of iron oxide nanomaterials. A large variety of synthetic routes have been reported in the literature for the preparation of iron oxides (Fe_xO_y) NPs which includes chemical co-precipitation method, hydrolysis, thermal decomposition, sol-gel method, microemulsion, sonochemical etc. [3,4,10].These routes may be distinguished as aqueous routes and non -aqueous routes. Aqueous routes could draw more attention in the sense of their low cost high productivity side and are highly sustainable. Chemical co-precipitation method is the most commonly used versatile method for the production of Fe_3O_4 or γ-Fe_2O_3 NPs. This method critically affects the physical and chemical behaviour of nanoscopic iron oxide particles and generates wide variety of particles with wide size distributions.

Moreover it is observed that Fe $_3O_4$/γ-Fe_2O_3 NPs without coating or naked are highly reactive and shows high tendency of aggregation. This high tendency towards aggregation can result poor magnetism, reactivity and mobility of NPs produced. Hence to avoid aggregation, chemical stability of the NPs is highly desirable and surface modification is very much necessary. To achieve chemically stable and less aggressive NPs the following methods may be adopted to stabilize nanoparticles as desired (a) Surface coating of NPs by using appropriate polymer stabilizers/surfactants (eg; carboxylates, phospates) (b) By deposition of a layer of inorganic metals (e.g., gold) or nonmetals (e.g., graphite), or oxides (e.g. SiO_2) (c) By the generation polymeric shells that avoid cluster growth after nucleation (composite particles, nanocapsule). (d) Forming lipid-like coatings (e.g., liposomes/ lipid NPs) around the magnetic core. Surface coating can result with improved quality of the nanoparticles in terms of chemical stability in the solvent. Particles with Surface coating reduce the particles aggregation remarkably hence this approach is very much popular in the field of biotechnology and medical science applications. [11, 12]. In the present work, our basic objective is to design ecofriendly co-precipitation method to synthesize magnetic iron oxide NPs with low cost additives and to analyse the results by studying morphological as well as enhanced magnetic properties due to size effect.

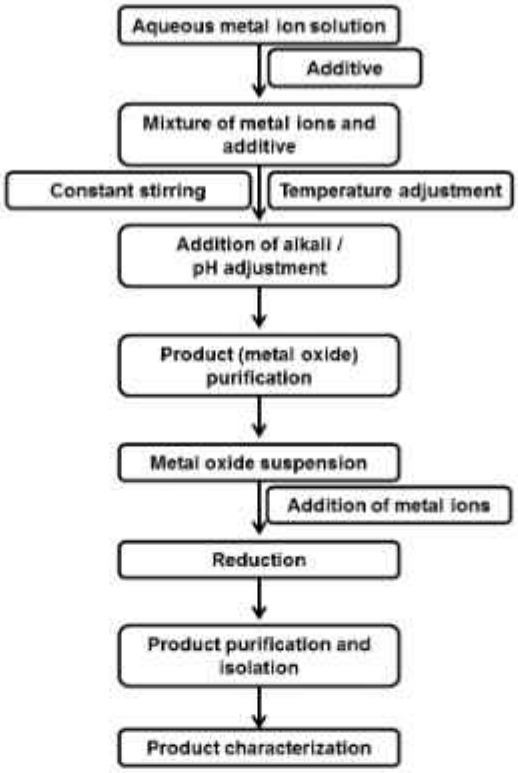
1. MATERIALS AND METHODS

1.1 Synthesis method

wet chemical method has been designed to synthesize the magnetic iron oxide NPs, as template based wet chemistry methods is reported to be the most appropriate, efficient and low cost method for the preparation of metal oxide NPs. The conventionally used co-precipitation method comprises the mixing of ferric and ferrous ions in 1: 2 molar ratios in high concentration of basic solutions at room temperature or at high temperature. The size and shape of the iron oxide NPs produced depends on the type of salt used, ion ratio of ferric and ferrous salt , temperature of the reaction, value of pH, stirring rate and speed of dropping of basic solution to the mixture of salts [13,14,15]. The reaction mechanism may be represented as

$$Fe^{2+} + 2Fe^{3+} + 8OH^- = Fe(OH)_2 + 2Fe(OH)_3 = Fe_3O_4 + 4H_2O$$

A schematic synthesis procedure opted in this present study is presented by **Scheme 1.**



Scheme 1. Schematic representation of co-precipitation synthetic route

1.2 Sample preparation

Fe_3O_4 nanoparticles were prepared in the lab using the conventional co-precipitation method. Sample preparation has been done using anhydrous iron chloride ($FeCl_3$, 98% purity) and Iron Sulphate heptahydrate (FeSO4 $7H_2O$, 98.5% purity) from Merck and. NaOH as the basic solution. Methyl cellulose is used to give polymer coating to stabilize the nanoparticles and to avoid aggregation. Ferric and ferrous ions were mixed in the ratio1:2 molar units in basic solution at different elevated temperatures. The reaction took place under the constant stirring of three hours duration using magnetic stirrer. A wide variety of factors has been adjusted to tune the size and morphology as well as to set the magnetic behaviour and surface properties of the produced iron oxide NPs. The temperatures were set at 50^0 C, 60^0C,70^0 C etc; The size and shape of nanoparticles were monitored controlling the pH value, adjusting the strength and nature of ion and salt and ion ratio of Fe (II) /Fe (III). The black precipitations produced after reaction were collected and were isolated to do the further treatment. The produced products were washed and centrifuged at 10000- 15000 rpm for three times and were dried. This conventional procedure is cheap and suitable for large scale production.

1.3 Characterisation of samples

1.3.1 TEM image study

The products obtained were prepared for analytical treatment. The TEM images of the samples have been taken to study the morphology and the size distribution of nanoparticles. TEM image shows that the particles are almost uniform and cubical in shape and are poorly mono-disperse.

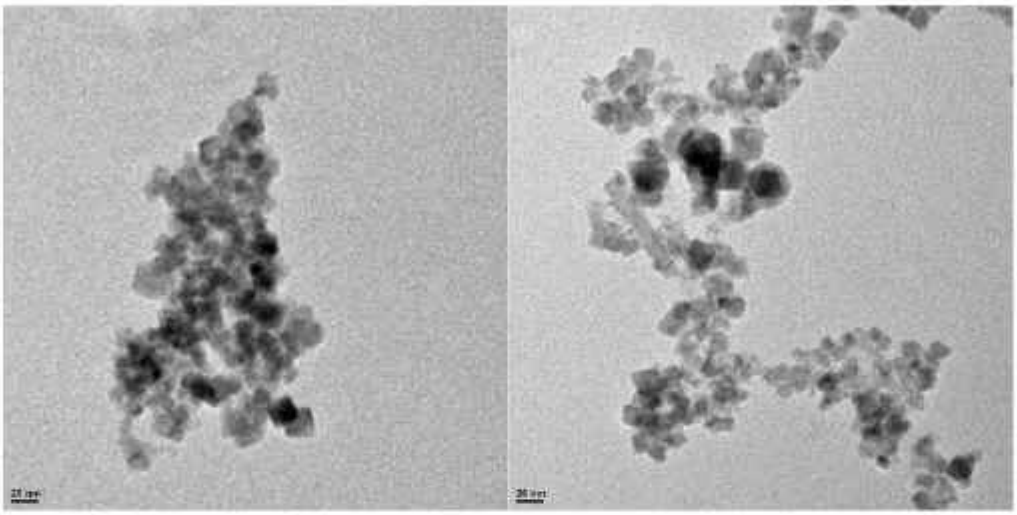


Figure 1. TEM image of IONP at 50^0 C.

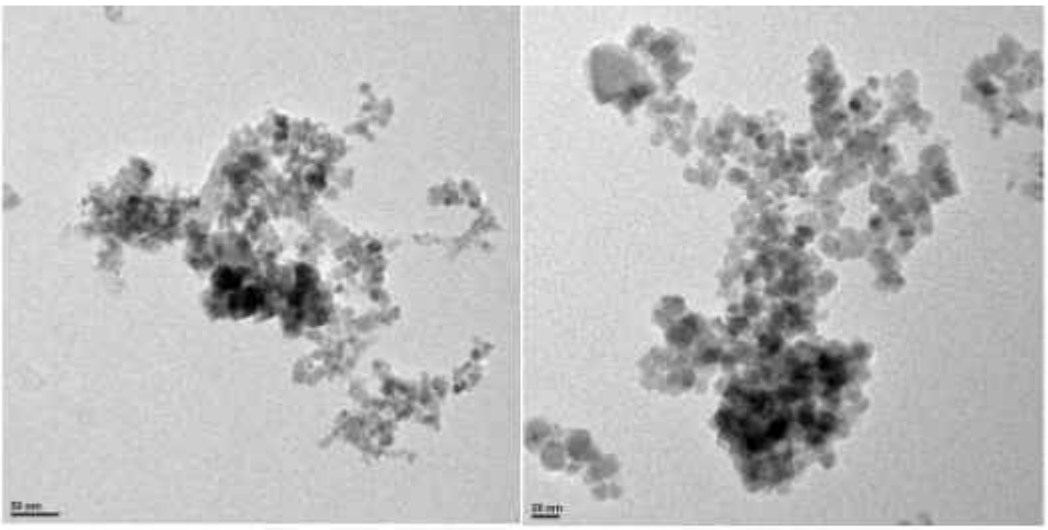


Figure 2. TEM image of IONP at 60^0 C.

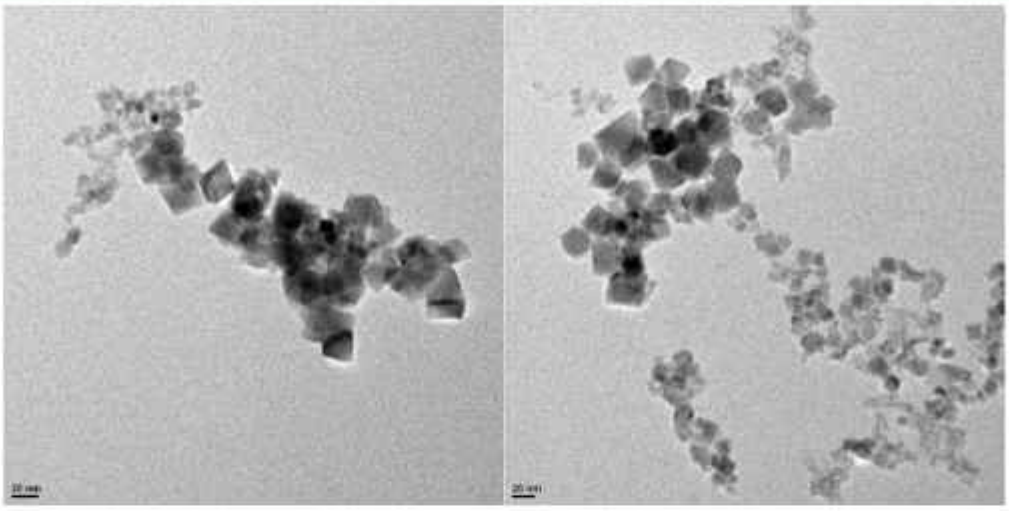


Figure 3. TEM image of IONP at 70^0 C

Figure 1, figure 2 and figure 3 show the TEM images at temperatures 50^0 C, 60^0 C and 70^0 C respectively. The ensemble shows well separated particle variation and cubical shape structure.

1.3.2 VSM study

In order to study the magnetic behaviour of Fe_3O_4 NPs, the magnetization measurement of NPs were done with VSM. VSM is being the commonly used versatile method of measuring magnetic properties which determines the magnetic moment by vibrating the sample perpendicular to the uniform magnetic field in between a set of coils. The results have been analysed to study the Hysteresis loop of the sample.

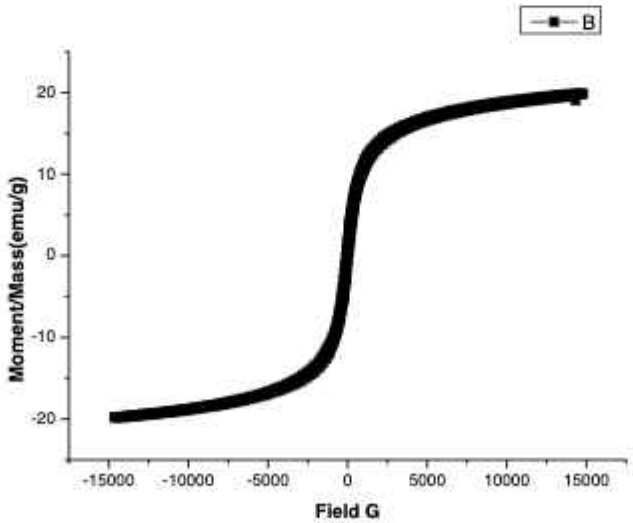


Figure 4. Hysteresis Curve of IONP at 60^0 C

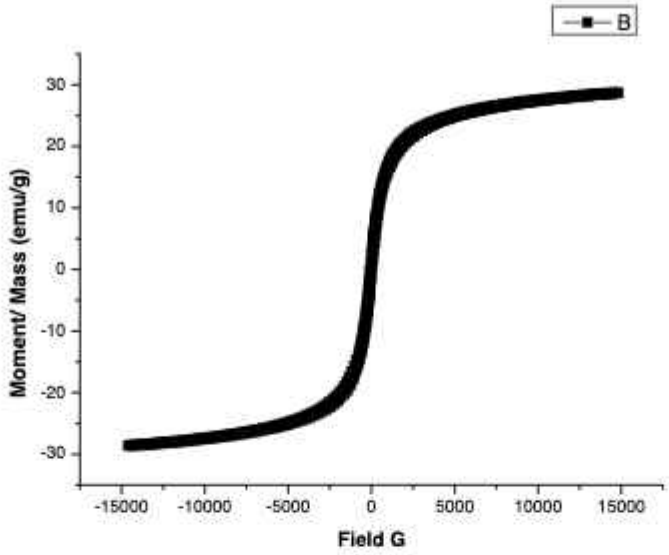


Figure 5. Hysteresis Curve of IONP at 70^0 C

Figure 4 and figure 5 show the Hysteresis curves of Fe_3O_4 NPs at 60^0 C and 70^0 C. A plot has been drawn with Magnetic field Vs Magnetic moment and the Hysteresis curves of Fe_3O_4 NPs were prepared. The resulted hysteresis loops are seen to be appeared like S shape or sigmoid shape. The thin curve shows no remanence and negligible coercivity.

2. RESULTS & DISCUSSION

TEM analysis shows that sizes of the particles are uneven and indicates agglomeration. Agglomeration is observed in all the prepared samples, but with rise in temperature magnetite particles becomes more uniform in size distribution. Although alglomeration is very difficult to avoid in magnetite nanoparticle, high centrifuge rate and surface coating by polymer can help to some extent.

VSM analysis results show that hysteresis loops obtained possess no particular area but they shows a curve passing through origin. This is a kind of typical paramagnetic behavior. This particular behaviour of hysteresis curve indicates the superparamagnetic properties of cubical shape Fe_3O_4 NPs. It shows a very sharp and steep rise in magnetisation in the initial state following a gradual and smooth change of magnetisation with increasing magnetic field and finally reaching the saturation.

The term superparamagnetism refers to the physical description of non- interacting magnetic particle ensemble when particle size is reduced below a critical dimension in ferromagnetic or ferrimagnetic materials. Below critical size nanoparticles show unstable magnetization. This particular behaviour is due to quantum size effects and increased surface area of nano sized particles. At nano size, spin wave energy becomes comparable to thermal energy, hence spin-spin interaction becomes more prominent over

thermal energy hence energy barrier potential becomes in sufficient to control spin exchange. The exchange coupling that exist between the magnetic dipoles at room temperature or elevated temperature can result in random orientations of magnetic spins inside the particles which can result in zero remnant magnetisation and zero coercivity. This particular phenomenon is observed in magnetic nanoparticles if the thermal energy k_BT is of the same order of magnitude of anisotropy energy of the particles. This condition effectively leads to zero measured magnetic moment of the sample. The magnetization inverts spontaneously, as thermal enegy k_BT is comparable to the anisotropy energy. Nanoscopic magnetic particles showing the phenomenon of superparamagnetism, thermal fluctuations play an important role in the magnetization process. This behaviour seems to be similar to paramagnetic behaviour but with a much steeper increase of susceptibility (higher susceptibility). The saturation magnetization which represents the spin alignments of the magnetic sample decreases with particle size [16-20].

The prepared sample of Fe_3O_4 NPs shows superparamagnetism by flipping the magnetic moments resulting paramagnetic behavior. This is one of the important aspects of magnetic properties of Fe_3O_4 NPs, at nanodimension.The saturation magnetisation Ms value for magnetic iron oxide NPs prepared have been observed to be around 20-30 emu/g which is smaller than the bulk saturation magnetisation value i.e. around 100 emu/g.

3. CONCLUSION

Transition metals are the most abundantly studied magnetic material because they are more relevant to the application in various fields. Scientific interest has been developed to study the basic and fundamental properties of Magnetic iron oxides in a more profound way. In the present work cubical shape Fe_3O_4 / γ-Fe_2O_3 NPs were prepared using precipitation method. Particle system displays superparamagnetic behaviour at elevated temperature with the reduction of particle size at nanolevel. Saturation Magnetization value observed to be decreases compared to bulk value. Magnetite or Maghemite particles truly show the size effect when dimension is reduced to nearly atomic scale. Near future it is going to prove its great potentiality in the field of medical science.

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EMNSD-2020/OP/06

Plasmon Resonances in Interacting Ni Nanoparticles Embedded in Dielectric

Jayanta Kumar Majhi
Post Graduate Department of Physics, Banwarilal Bhalotia College, Asansol, India.
Email:*devmajhi794@gmail.com*

ABSTRACT

The optical absorption (OA) properties of interacting Ni nanoparticles (NPs) of radius 10 nm embedded in dielectric have been studied theoretically, using modified Maxwell-Garnett (MG) model. The OA spectra for non-interacting NPs exhibit two broad absorption bands corresponding to 3.69 eV and 6.06 eV in lower and higher energy region. These absorption bands come from surface plasmon resonance (SPR) in Ni NPs. Here, we have considered interacting Ni NPs and the interaction is represented by a parameter K. For our calculation we have varied the value of K from 0 to 50. Interestingly, the plasmon resonance peak shift towards lower energy with increase of K. This can be explained on the basis of driven damped harmonic oscillator model. It is well known that Ni is a strong ferromagnetic material. Therefore, the simultaneous existence of ferromagnetic and plasmonic properties make the Ni NPs more superior and can be used as optical nano-antennas for magnetic manipulation and also in different optoelectronic and photonic devices.

Keywords: Ni nanoparticles, surface plasmon resonance, interparticle interaction, redshift

INTRODUCTION:

The studies of optical absorption (OA) properties of interacting metal nanoparticles (NPs) and their assemblies attracted a lot of attention due to their transport and guiding ability to the electromagnetic wave in nano-optics [1]. The most of the research work have been focused on the surface plasmon resonance (SPR) in noble metal NPs and their assemblies. For interacting noble metal NPs, the plasmon mode has been demonstrated for interparticle separation much less than the wavelength of exciting electromagnetic radiation [2-4]. Although, several works have been done in this direction, but the less attention has been paid to transition metal like Ni, Co and Fe. Due to much higher SPR energies, the Ni NPs could also be of technological interest for UV photonic applications than those of noble metals. However, the application of SPR in Ni NPs is

not limited to UV regime rather; it finds applications in photonics, non-linear optics, optoelectronics [5], biosensors [6] and others. The SPR is very important phenomenon of the optical properties of metal. The theory of SPR depends on the Drude free electron model of metal. For free electron like metals this model is highly applicable, although, some departures from the model can be found in case of few metals for their SPR energies lying very close to the d-band and hence the interaction between them cannot be neglected [7].

Recently, multiple SPR absorption bands corresponding to non-interacting Zn [8, 9] and Ni NPs [10, 11] embedded in dielectric (silica) has been reported [12]. In both the cases the OA bands were recognized as SPR [8, 10, 11, 12]. A considerable peak shift with interaction in case of noble metals has also been observed [13].

In this article, the interparticle interaction is taken into account to calculate the OA spectra of Ni NPs using the modified MG model [14]. Here, we have varied the parameter K from 0 to 50 for a particle of radius 10 nm. Interestingly the both SPR peaks show redshift with increase of the parameter K and arise due to the SPR of the surface electrons in Ni NPs. This property of interacting transition metal NPs can be used to tune the plasmon resonance from UV to visible region of electromagnetic spectrum.

CALCULATION METHOD

The SPR properties of the small spherical metal particles have been generally studied using Mie theory in the "quasi-static limit". In this limit, extinction can be regarded as absorption. But in a relatively denser medium one uses the MG type effective medium theory [14]. The details of the theory can be found in the reference [15]. In the calculation the concept of effective dielectric function has been used and we have considered the interacting Ni NPs. The interaction is regarded as a parameter designated by K whose values were taken from 0 to 50 with a fixed particle size (R = 10 nm). The volume fraction (f = 0.1) and dielectric function (DF) of the surrounding medium were kept fixed.

RESULTS & DISCUSSION

In Fig. 1(a) we have shown the calculated OA spectra of spherical non-interacting Ni NPs, of radius 10 nm embedded in silica glass. The spectra show two broad absorption bands at around 3.69 and 6.06 eV which are believed to be appeared due to surface plasmon resonance [1]. The OA spectra corresponding to interacting Ni NPs also exhibit the two SPR absorption peaks as shown in the Fig. 1(b). The SPR peaks are found to become prominent and shift towards lower energy side with increase in the values of the parameter K. The observation of the shift of plasmon absorption peak clearly indicates that there is a substantial redshift in both the bands with increase of K.

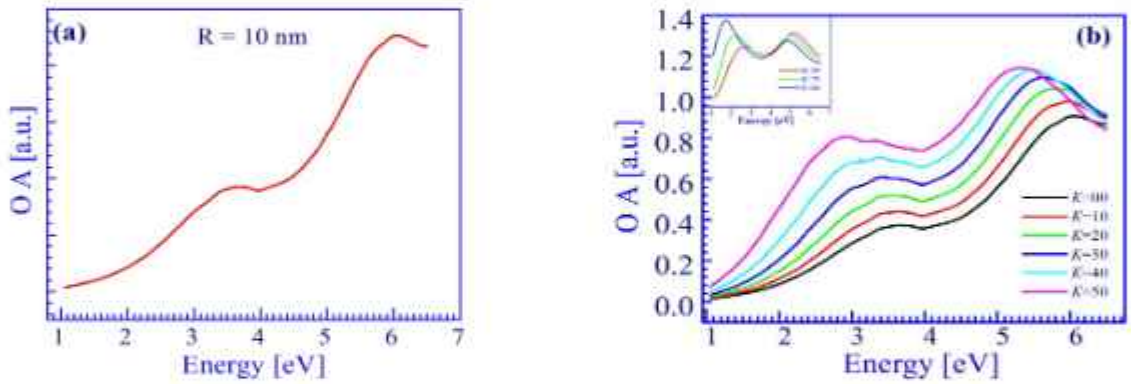

Fig. 1: The OA spectra as function of energy for (a) non- interacting and (b) interacting Ni NPs of radius 10 nm embedded in silica. Inset shows the spectra for some other particle size.

Further, the intensity of the absorption peaks has been found to increase with increase in the interaction with corresponding reduction in its full width at half maximum (FWHM). The existence of such SPR bands has also been observed experimentally in Ni NPs embedded in silica matrix with peak positions around 3.3 eV and 6.0 eV respectively [10]. Although, there are some differences between the experimental and theoretical results due to inconsistency in the available literature data for the dielectric constants of Ni. The effect of this interaction on the SPR absorption for Ni is as strong as that of SPR absorption in noble metal NPs [14]. For transition metal NPs the size dependent SPR energy is determined using the following condition [5, 10, 16] given by the equation

$$[\{\varepsilon_1(\omega)+2\varepsilon_m(\omega)\}^2+\varepsilon_2^2(\omega)]=\text{Minimum}, \quad (1)$$

where $\mathcal{E}_1$ and $\mathcal{E}_2$ are the real and imaginary parts of the DF of the metal NPs, and $\mathcal{E}_m$ is the dielectric constant of the medium. All the parameters are frequency dependent. In most of the cases, for simplicity the following condition is used to find the SPR criterion [12],

$$\{\varepsilon_1(\omega)+2\varepsilon_m(\omega)\}=0 \quad (2)$$

instead of Eq.(1). Although, it is derived and found by neglecting $\mathcal{E}_2$ (ω) from Eq.(1). We can make such assumption for small values of $\mathcal{E}_2$ (ω) but for larger values Eq. (2) cannot be used. The actual mechanism of SPR absorption of Ni has been explained clearly in the ref.[13] and one can confirm that both the bands appeared due to SPR [12]. For interacting Ni NPs the SPR frequency can be estimated by considering the point dipole approximation. However, the SPR energy may be changed with the size but such change for interacting NPs is weaker in comparison to the change due to dipole-dipole interaction. When the particles come close to each other, the electromagnetic interaction comes into play and the electric field get distorted [17]. The amount of distortion depends on the separation between the particles and hence the interaction. Such changes lead to splitting of the SPR energy due to two types of polarization modes namely transverse and longitudinal [18]. The higher energy peak is associated with the transverse polarization while the lower energy peak is with the longitudinal polarization mode [19]. The SPR peak energy decreases linearly with the increase of K as shown in Fig. 2(a)-(b).

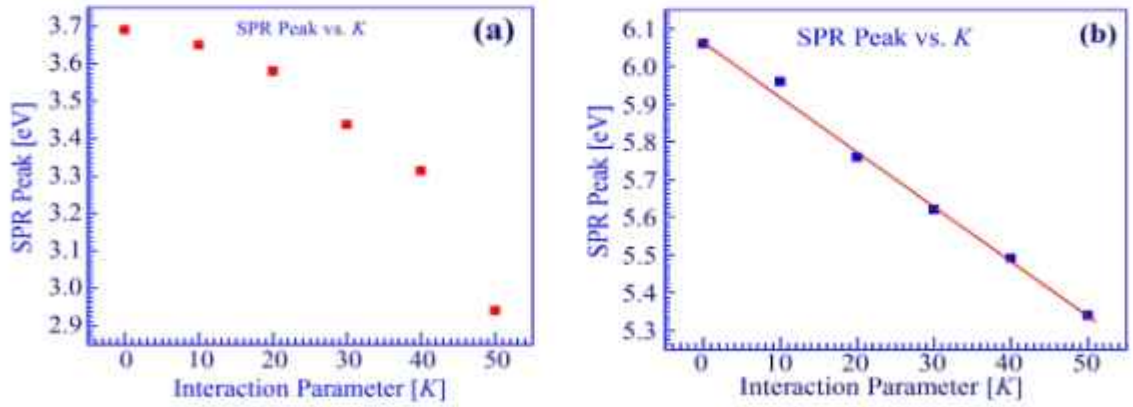

Fig. 2 The variation of the (a) lower and (b) higher energy SPR Peak with the parameter K

Thus the range of tunability of the SPR absorption is greatly enhanced by considering interaction between the particles. Although, in case of the lower energy peak, the variation is nonlinear but more or less the trend of the shift is the same i.e. both the peak show redshift. It is also seen that the shift of both the SPR peak for interacting particles is more pronounced than the corresponding **shift of SPR peak** for non-interacting **nanoparticles (i.e. K=0),that means** the effect of interparticle interaction on the SPR absorption is more than that of the effect of particle size on the SPR in case of Ni NPs. Actually the plasmon peak shift is associated with the materials intrinsic plasmon damping which can be explained on the basis of driven damped harmonic oscillator model in which the oscillator amplitude is associated with near field amplitude and the energy dissipation is associated with far field extinction [19]. Although, the damping is not only the reason of the spectral shift, rather in nanostructure the size effect and larger value of the imaginary part of the dielectric function also play an important role [19].

CONCLUSION

The OA spectra of interacting Ni NPs of radius 10 nm embedded in silica have been calculated theoretically using modified MG model. The calculated spectra exhibit two absorption bands, one in the higher energy side and other in the lower energy region. The positions of both the absorption band have been found to shift towards lower energy side with increase in the value of K. Such observation is mainly due to the dipole-dipole interaction. The higher energy peak is stronger than that of the lower energy peak. In addition due to the large spectral shift between the lower and higher energy peaks, and simultaneous ferromagnetic and plasmonic properties, the Ni NPs is suitable material for use of plasmonic antenna and in nanophotonic devices etc.

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Tera-Hertz Optical Asymmetric Demultiplexer (Toad) Using Quantum Dot Semiconductor Optical Amplifier

Kousik Mukherjee

Physics Department, B B College, Asansol, West Bengal India
Centre of Organic Spintronics and Optoelectronic Devices, Kazi Nazrul University, Asansol, West Bengal India

ABSTRACT

TOAD is an important all-optical switch having various applications in all-optical logic gates and processors. It also finds applications in designing different types of processors for optical networking like code converters, parity checkers, generators etc. Most of the TOAD based designed so far reported used Semiconductor Optical Amplifier (SOA) for designing the TOAD, but in this communication, conventional SOA is replaced by quantum dot SOA or QDSOA. This enables the device to operate with a high speed as demanded by modern-day optoelectronic communication systems. QDSOA has a higher operating speed due to its lower gain recovery time compared to conventional SOA. This paper investigates TOAD based on QDSOA as an optical switch..

Keywords: TOAD; Quantum dot SOA; Optical Switch; Extinction ratio

INTRODUCTION:

Tera-Hertz Optical Asymmetric Demultiplexer (TOAD) is an important device for all-optical signal processing [1-5]. These TOADs use single Semiconductor Optical Amplifier (SOA) for its operation. Another variant of TOAD is found in the works [6-10] is called dual control dual SOA TOAD or DCTOAD. The application of DCDSTOAD makes the system hardware less complex. However, most of these TOADs use conventional SOAs with bulk semiconductor materials. Semiconductor optical amplifiers also use quantum dots in place of bulk materials to show improvements in the performance of the devices [11]. Quantum dot SOA (QDSOA) has advantages over its bulk counterparts as they show higher saturation power, larger gain bandwidth, pattern effect free nonlinearities like cross gain modulation (XGM), cross-phase modulation (XPM), and four-wave mixing. Moreover, QDSOAs have a slower population and polarization relaxations are the reason for these improved nonlinearities. Therefore, QDSOA

based devices will show improved performance [12]. The work [12] describes a 4bit digital to analog converter (DAC) using quantum dot SOA based TOAD (QDSTOAD). This motivates to use QDSOA in TOAD and see the effects as optical switch. In Figure 1, self-assembled InGaAs quantum dots on GaAs substrate is used to design the QDSOA, in which the wetting layer is grown with Stranski- Kranstanow mode[11].

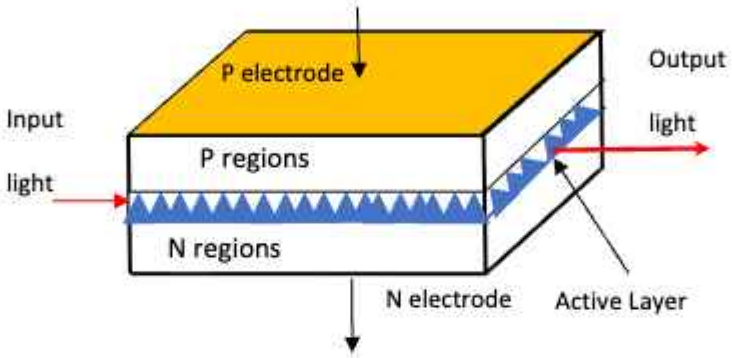

Figure 1. Quantum dot SOA

TOAD based on QDSOA is shown in figure 2. It consists of a fiber loop with a QDSOA placed asymmetrically acts as a nonlinear element. The control power changes the gain and phase of the data signal which after circulating the loop from opposite direction interfere and gives two outputs at destructive and constructive ports.

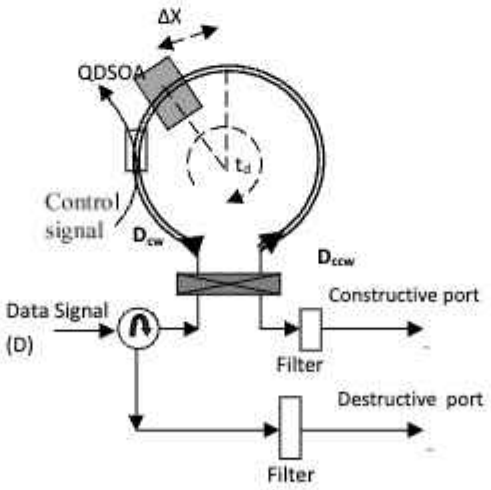

Fig 2. TOAD based on QDSOA

The outputs of constructive port and destructive ports are given by

$$P_{T,R} = 0.25P_{in}[G_0 + G(t) \pm 2\sqrt{G_0 \mathrm{G(t)}}\cos(\Delta\theta) \qquad (1),$$

where G_0 is the unsaturated gain and G(t) is the time-dependent gain and $\Delta\theta$ is the phase difference between interfering co and counter-propagating data signals D_{cw} and Dccw as shown in figure 2.

MATHEMATICAL MODELING:

To investigate dynamics of the QDSOA, rate equation model described in [12, 13] is considered. The following equations (2) to (5) are numerically solved to calculate extinction ratio(ER):

$$\frac{\partial N}{\partial t} = \frac{J}{eL_w} - \frac{N(1-h)}{\tau_{w2}} + \frac{N_Q}{\tau_{2w}L_w} - \frac{N}{\tau_{wR}} \qquad (2)$$

$$\frac{\partial h}{\partial t} = -\frac{h}{\tau_{2w}} - \frac{N(1-h)L_w}{\tau_{w2}N_Q} + \frac{(1-f)h}{\tau_{21}} - \frac{f(1-h)}{\tau_{12}} \qquad (3)$$

$$\frac{\partial f}{\partial t} = \frac{(1-f)h}{\tau_{21}} - \frac{f(1-h)}{\tau_{12}} + \frac{f^2}{\tau_{1R}} - \frac{L_w g_{max}(2f-1)P}{N_Q A_{eff} h\nu} \qquad (4)$$

Here N,h, and f are the occupation probabilities of wetting layer, excited state, and ground-state respectively. Signal propagation along the length (z-direction) of the QSDSOA is given by[13],

$$\frac{\partial P}{\partial z} = \frac{[g_{max}(2f-1) - \alpha_{int}]P}{A_{eff} h\nu} \qquad (5)$$

Where P is the total input power injected into the QDSOA.

SIMULATION RESULTS AND OPERATION:

Table 1 shows the parameters for the simulation used in this paper. These parameters (except the universal constants) are optimized for the performance of the device TOAD. The extinction ratio is defined as ER= $10\log_{10}(P_1^{min}/P_0^{max})$, where P_1^{min}, and P_0^{max} are minimum power of output '1' and a maximum power of output bit '0' respectively.

Table 2. Parameters used for simulations[12]
Spontaneous lifetime(radiative) in the WL(τ_{wR}) = 0.2 ns
Relaxation time of electron from the WL to ES(τ_{w2}) = 3 ps
Relaxation time of electron from ES to GS(τ_{21}) = 0.16 ps
Group velocity(V_g) = 8.3 x10^7m/s
Escape time of electron from ES to WL(τ_{2w}) = 1 ns,
Escape time of electron from GS to ES(τ_{12}) = 1.2 ps
Radiative lifetime(spontaneous) in Quantum Dot(τ_{1R}) = 0.4 ns
Material gain coefficient, g_{max} = 14 cm^{-1}
internal loss α_{int} = 2 cm^{-1}
Injection current density, J = 1kA/cm^2
L_w = 250nm
Transparent current density, N_Q = 5.0 x 10^{10}
Effective area, A_{eff} = 0.75 μm^2.

We have first optimized the QDSTOAD for the control power. It is found that an ER value of 3.86dB, and 28.5dB are calculated for 1.5mW of control power for transmitted port and reflected port respectively (Figures 3 and 4). This shows that the reflected port has better ER than the transmitted port and has better switching operation.

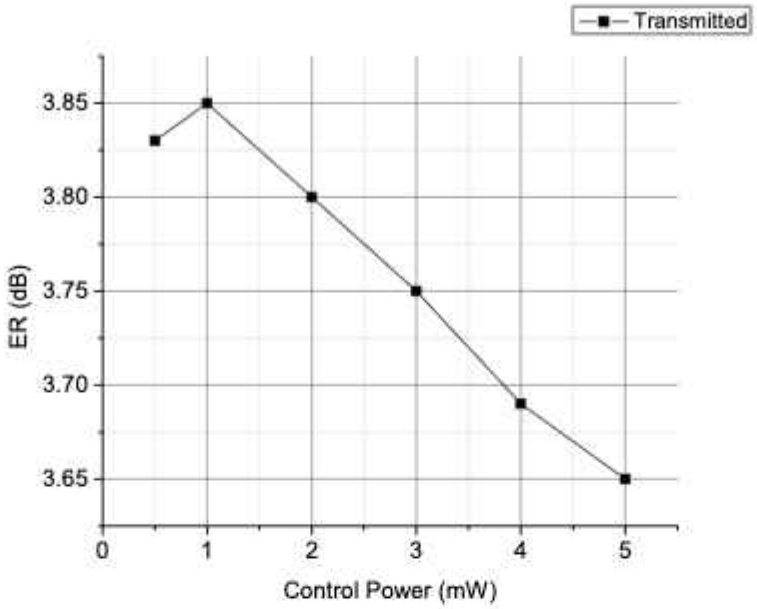

Figure 3. Variation of ER of transmitted port with control power

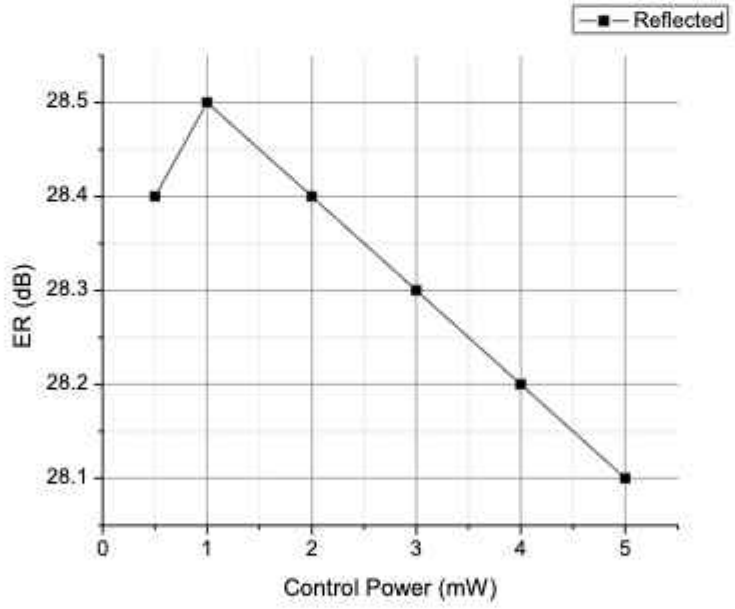

Figure 4. Variation of ER of reflected port with control power

Figure 5 optimizes ER for line-width enhancement factor (LEF) and it is found that a maximum ER of 3.86dB is for LEF equals to 5 for the transmitted port. However, ER values decrease with LEF for the reflected port as clear from figure 5.

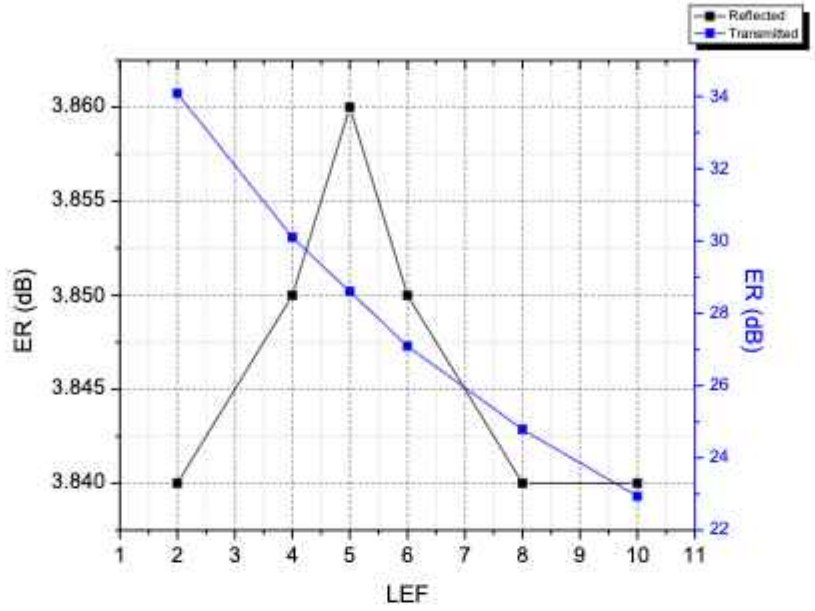

Figure 5. Variation of ER with LEF

CONCLUSIONS: In this paper, QDSOA based TOAD is designed and investigated theoretically using numerical modeling and ER is calculated for both the ports. The reflected port shows ER value as high as 28.5dB. In the future, the TOAD needs further investigation in terms of different parameters like amplitude modulation(AM), contrast ratio(CR), Quality factor(Q), etc.

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Direct Synthesis of Co_3O_4 Nanomaterials By Carbonate Precursor

Arnab Kanti Giri*[1] and Jong-Sung Yu[2]

[1]Department of Chemistry, Karim City College, Jamshedpur, Jharkhand, India
[2]Department of Energy Science and Engineering, Daegu Gyeongbuk Institute of Science and Technology, South Korea.
Email: *giri.arnabkanti54@gmail.com*

ABSTRACT

Herein, the monodisperse Co_3O_4 with various morphology is reported. Within this demonstration, a series of Co_3O_4 with different morphology was synthesized using cobalt ammonium carbonate as precursor by hydrothermal method. In the present work we successfully synthesize pure phase of Co_3O_4 microcube by direct (one step) hydrothermal process by carbonate-based precursor. The materials were characterized by XRD, SEM, TEM, EDX, TGA analysis. The kinetics have been studied for the formation mechanism of the materials. The materials were used for the post synthesis of core-shell type materials for different task specific applications.

Keywords: Co_3O_4, Nanostructure, Cube, Hydrothermal

INTRODUCTION:

Co_3O_4 has been widely considered as an efficient electrocatalyst [1-4]. Co_3O_4 with spinel crystal structure is beneficial for the electron transport between Co^{2+} and Co^{3+} ions and considered an effective catalyst for OER processes [5-8]. But due to its low electrical conductivity and dissolution, short active site density and agglomeration nature during electrocatalytic processes, the electrocatalytic activity is not superior [8]. To overcome this problem research on faceted Co_3O_4 nanostructure materials has been explored extensively [9-13]. Among the various faceted Co_3O_4, cubelike structure is one of the major morphology due its exposed {100} facet [14-17]. There are few reports for the synthesis of cubes like template assisted synthesis [14, 15], solution based hydrothermal process [16-17]. In some cases, the reaction time is longer by using urea as a reagent [16]. In these literatures strong base like NaOH was used [17]. For the synthesis of metal oxides using carbonates yields metal carbonate as an intermediate which upon heating produce the metal oxide. So, an additional step is required to synthesize the metal oxides. Direct synthesis of Co_3O_4 nanoparticles without calcination process is a promising technique for the

development of Co_3O_4-based functional nanomaterials [17]. So, direct synthesis of faceted Co_3O_4 nanostructures is the main focus of the present work.

In the present work, we report the direct hydrothermal synthesis of pure phase of Co_3O_4 nanomaterials by carbonates. Elimination of strong hydroxide base or any organic or inorganic template for the synthesis of Co_3O_4 cubes. Co_3O_4 is used as a template for core shell void Co_3O_4@ CoS_2. The OER performances of the synthesized materials are quite good and expected to be a good energy material.

MATERIALS & METHODS

Chemicals.

Cobalt (II) Chloride, Hexahydrate was procured from Oriental Chemical Industry, South Korea; ammonium carbonate was purchased from Samchun Chemicals, South Korea. Potassium ethyl xanthogenate was purchased from Sigma Aldrich. All the chemicals were used as-obtained without any further purification. Water with a resistivity of 18 MΩ cm^{-1}, obtained from a Millipore water purifier, was used for all the performed experiment.

Synthesis of Cube like Co_3O_4

11 g of Cobalt (II) Chloride, Hexahydrate dissolved in 500 mL of water. 40 ml of the solution was taken and 1.8 g of solid ammonium carbonate was added with continuous stirring (500 rpm). Within 2–3 min the solution became clear. Then, 160 ml of water was added to the clear solution and stirred (500 rpm) for 5 min. 50 ml of the resultant solution was diluted to 200 ml and then 50 ml transferred to Teflon lined stainless steel autoclave and kept in a pre-heated oven at 200°C for 2h. The resultant black materials were collected through centrifugation and washed with water for several times. The materials were dried at 70–80 °C for 6 h.

Synthesis of Cube like Co_3O_4@CoS_2

In typical procedure, 0.5 gm Co_3O_4 was dispersed in 40 ml water. Then 1 gm of Potassium ethyl xanthogenate was added to the solution and stirred for 5 min and transferred to Teflon lined stainless steel autoclave and kept in a pre-heated oven at 200°C for 4h. The resultant black materials were collected through centrifugation and washed with water for several times. The materials were dried at 70–80 °C for 6 h. This synthesized Co_3O_4@CoS_2 treated with different temperatures in N_2, N_2/H_2 atmosphere.

RESULTS & DISCUSSION

Synthesis and characterization

From the XRD data it is confirmed that the pure Co_3O_4 phase is obtained after hydrothermal treatment (**Fig. 1a**). JCPDS card No. 43-1003) and confirmed the formation of phase pure Co_3O_4. **Fig. 1b** represents the phase of Co_3O_4 and CoS_2. The XRD pattern of the Co_3O_4 nanoparticles present diffraction peaks at 19° (111), 31° (220), 37° (311), 39° (222), 45° (400), 55° (422), 60° (511) and 65° (440), which are indexed to the cubic phase of Co_3O_4 spinel structure. The XRD pattern (Fig. 1b) of the CoS_2 at 27° (111), 32° (200), 39° (211), 46° (220), which are index to CoS_2 phase [18].

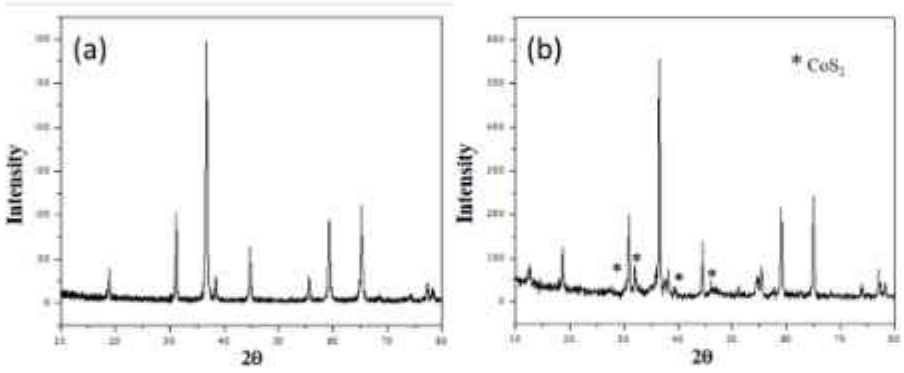

Fig. 1 (a) XRD pattern of Co_3O_4 and (b) Co_3O_4@CoS_2

In the TG analysis (**Fig. 2**), a very little weight loss (~1%) is observed. No distinct weight loss indicates the pure Co_3O_4 phase in asynthesize product.

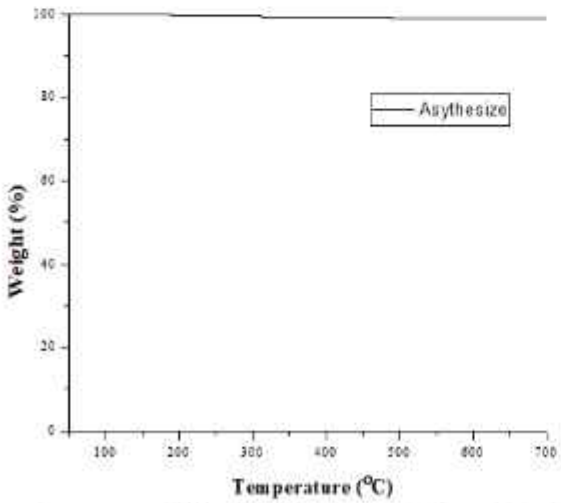

Fig. 2 TGA analysis of asynthesized Co_3O_4.

Low-magnified SEM image (**Fig. 3a**) of Co_3O_4 shows a cube like structure. From the SEM analysis it is also confirmed that the synthesized materials are monodisperse (~ 95%). The

individual cubes are around 200-300 nm. TEM images of the hydrozincite also confirmed the cube like structure of Co_3O_4 nanoparticles (**Fig. 3b**). All the TEM observations also support the SEM observations. The EDX mapping shows the Co and O (Red and Blue colour) in cubes and indicates the pure phase of Co_3O_4 (**Fig. 4**).

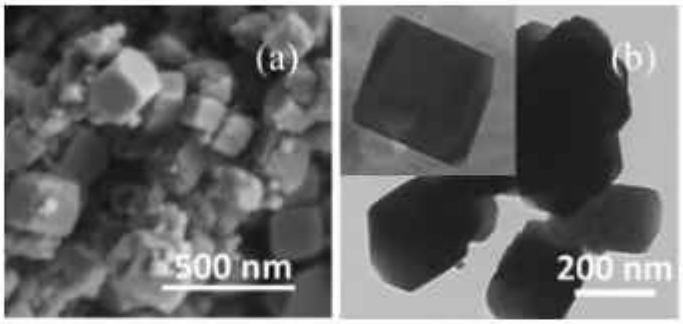

Fig. 3 (a) SEM images and (b) TEM images of asynthesized Cube like Co_3O_4.

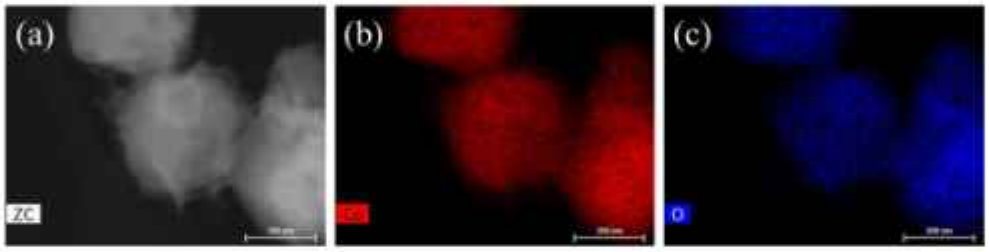

Fig. 4 (a), (b) & (c) EDX mapping of Cube like Co_3O_4 structure.

Formation mechanism:

The formation mechanism of Co_3O_4 is interesting and still a scope of research. Major focus was given to understand the core-shell formation mechanism. But the formation mechanism of Co_3O_4@CoS_2 is well understood by the controlled experiments (**Table 1**). From the TEM analysis it is observed that when the Co_3O_4:Xanthate ratio is increased then the coating occurs effctively (**Fig. 5**). **Fig. 6** represents the mechanism of Void core-shell formation [19, 20]. In our case kirkendall difussion is the most probable mechanism as per the experimental observation.

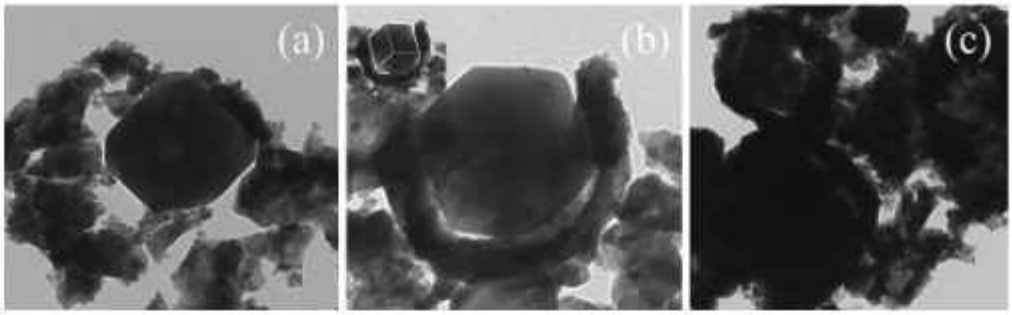

Fig. 5 Controlled experiments (a) No coating, (b) partial coating and (c) full coating of CoS_2 on Co_3O_4.

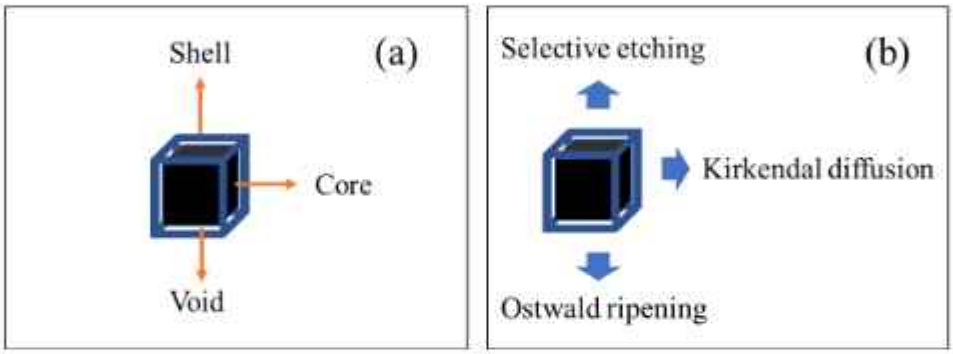

Fig. 6 (a) & (b) Schematic representation of Void core-shell mechanism

From the controlled experiments the following equation can be predicted. The previous literatures also support the following reaction [20, 21]. Initially, xanthate decompsed to carbon disulphide (**Eq. 1**), CS_2 in presence of wáter and CS_2 reacts with Co_3O_4 to form core-shell structure (**Eq. 2**).

$$C_2H_5OCSS^-K^+ + H_2O = C_2H_5OH + CS_2 + KOH \quad \text{(Eq. 1)}$$

$$Co_3O_4 + CS_2 = Co_3O_4@\,CoS_2 \quad \text{(Eq. 2)}$$

Table 1 Phase and morphology controlled by Potassium ethyl xanthate

Co_3O_4 :X X= Potassium ethyl xanthate (mol ratio)	Phase	Morphology
1:0.5	Co_3O_4@CoS_2	No coating
1:1	Co_3O_4@CoS_2	Partial coating
1:1.5	Co_3O_4@CoS_2	Full coating

OER Performances:

The OER performaces of Co_3O_4 and Co_3O_4@CoS_2 was performed. The Co_3O_4@CoS_2 -H-500 C showed best perfomances amoung other synthesized catalyst. (**Fig. 7**) Co_3O_4@CoS_2 -H-500 C shoed the OER perfomances at 1.75 V (Vs. RHE) at O.1 M KOH. This catalyst showed the lower overvoltage among the synthesized catalysts. The effect of calcinature temperature with different gaseous environment on OER performances can be explained by increased crystallinity for better electron transport. But from the data it is shown that the OER performances of Co_3O_4@CoS_2 is better than Co_3O_4. This is due to the fast electron transfer between heterojunction of core-shell structure.

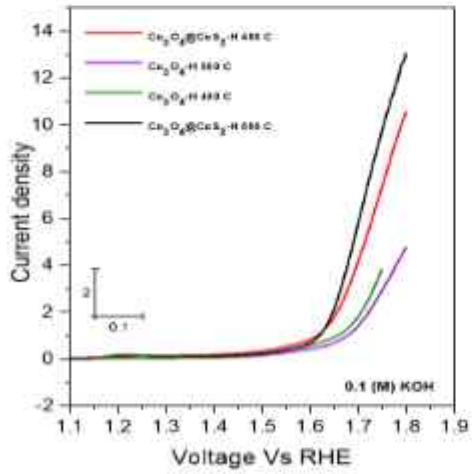

Fig. 7OER performaces of Co_3O_4 and Co_3O_4@CoS_2.

CONCLUSION

Monodisperse nanostructured Co_3O_4 with different morphology was synthesized using cobalt ammonium carbonate as precursor by hydrothermal method. In the present work we successfully synthesize pure phase of Co_3O_4 microcube by direct (one step) hydrothermal process by carbonate-based precursor. The materials were used for the post synthesis of core-shell type materials for different task specific applications. The kinetics have been studied for the formation mechanism of the materials and xanthate concentration play an important role for formation of void in core shell structure. The synthesis of this material requires simple laboratory instruments. The Co_3O_4@CoS_2. core-shell material showed quite good OER performances and expected to be a useful energy material.

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Design of a Power Inverter Using Solar Cell as a Source of Charger

***H C Medhi**

Department of Electronics, St. Edmund's College, Shillong-793003, Meghalaya, India

***Email:** *hemenmedhi1984@gmail.com*

ABSTRACT:

The increasing demand and depletion of fossil fuels in India lead us to shift our focus to renewable sources which are not only the future unlimited source of energy but also ecofriendly and viable for environment. Solar energy is a form of renewable energy and is a very efficient method of saving electricity which does the same functioning as the electricity but the main difference is that the major source is solar energy. This paper focuses on the design of solar modules serve as a source of charger through solar charge controller to the battery and inverter for converting the direct current into an alternating current for house hold application. It has more advantages because it needs less maintenance, no use of fuel, light in weight, rugged, noiseless and does not require an alternating current for charging.

Keywords: Solar cell, Inverter Circuit, MOSFET

INTRODUCTION:

It is evident that solar energy is renewable source of all. It is a process in which solar energy is converted into electrical energy using solar panel. Solar energy is the radiant energy. The earth receives 174 watts of solar radiation at the upper atmosphere 30% reflected back to space and rest is observed by clouds, ocean, and mass. Human harness solar energy in many different ways space heating and cooling, lighting, hot water, cooking etc. the solar energy are only limited by human ingenuity.

Solar technologies are characterized as either passive or active depending on the way the energy captured converts and distributed [1]. Active solar techniques use photovoltaic panel which we are going to use this type of solar panel in circuit, as we all know that solar energy is a renewable source of energy and is inexhaustible. Using sun's energy we can charge a 12V battery through

charger circuit, we can even charge our cell phones with the help of mobile charger circuit and a CFL bulb can be glown with the designed inverter circuit.

1. EXPERIMENTAL WORK

The block diagram demonstrates about solar inverter which converts the solar energy in to electrical energy for house hold application. Hence it is renewable source of energy and more efficient. Through this process we can consume solar energy for our daily life requirement. As its energy in the form of electrical energy is used to charge the mobiles and batteries too.

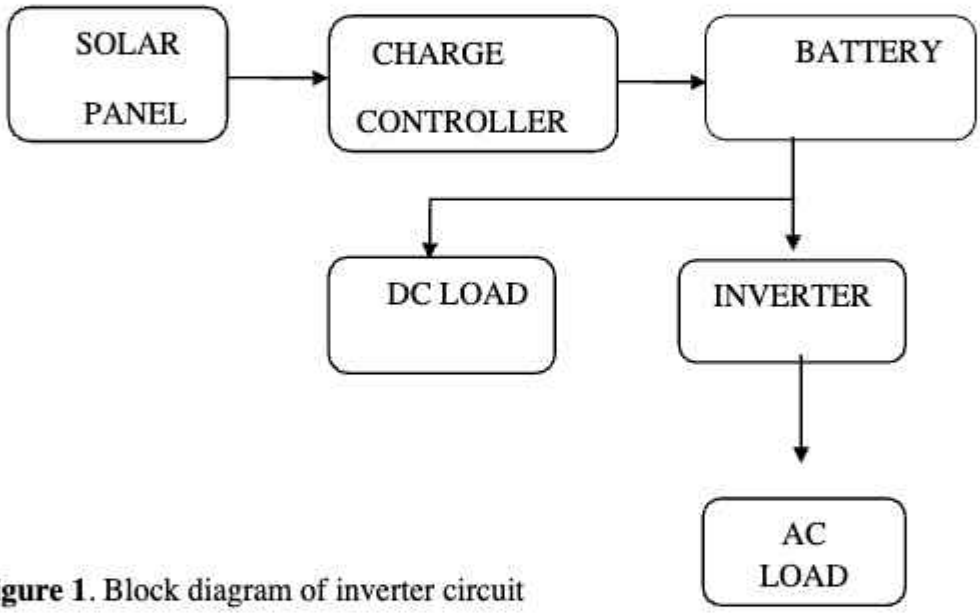

Figure 1. Block diagram of inverter circuit

i. SOLAR PANEL

Collection of solar cells is known as solar panel. Combinations of small solar cells together can be used for generating power that can be used over a large area. The electricity produced by a solar cell depends upon the mount of light that hits a cell. The principle on which solar panel works is photo voltaic effect is a physical and chemical phenomenon in which voltage or current created in a material when sunlight falls on it [2, 3].

ii. SOLAR CHARGER CIRCUIT

When solar radiation falls on solar plate then it absorbs sun rays as a source for generating electricity. These sun rays are the light energy (photon) directly coming from the sun. In this

circuit a diode of series In 4001 is placed which is used to give a unidirectional flow of current in the circuit i.e., current could only flow from solar panel to battery and not from battery to solar panel. After the battery an IC of series LM317 is used as voltage controlling device [4].

iii. BATTERY

A battery is a device that stores the charge for further application. In this circuit the main function is to store power and during storage of AC power supplied it acts as a beneficial source of power via inverter to AC load. Lead acid battery or Ni – Cd battery banks can be charged with the help of solar charger circuit. For this at stationary locations series of solar Cells are installed. These solar cells can be directly connected to battery banks to store energy for off peak hours. They can also be used in peak hours for saving energy during day time. The range of charging voltage produced from solar panel depends upon the intensity of the Sun. Thus to protect the solar charger circuit [5] from over charging or over voltages a voltage regulator must be used along with the solar charger circuit.

iv. AC LOAD

It is the output of the inverter circuit. The inverter circuit converts the DC source into 220V AC which is consumable for appliances.

v. DC LOAD

It is the output power which we can directly obtain from the battery. It is efficient in supplying the power to gadgets operating on low DC voltage.

4. Inverter

Inverter is a device that converts Direct current (or DC) to Alternating Current (or AC) using transformers, switching circuits and control circuits. Home inverters or home UPS takes the DC power from the batteries and converts it into AC power used by the load connected at home. Similarly, an off grid solar inverter operates. In case of grid connected, solar inverter the DC power is generated from the solar panels and AC power is given to the grid. In case of "grid connected" solar inverter when the power is coming from the grid , the UPS and Inverter system charges the batteries using the power coming from the grid . When the power coming from the grid is off, then the inverter takes the DC power from the batteries and converts it into AC to

appliances. An automatic switch is used to sense whether the power is coming from the grid and if not then it switches the UPS into battery mode.

i. IC CD4047

It is a CMOS low power mono stable / a stable multivibrator with logic techniques incorporated to permit positive or negative – edge triggered 14 - lead hermetic dual – in-line ceramic packages. It can operate in only one mode at a time. It requires an external capacitor (between pin 1 & 3) and an external resistor (between pin 2&3) to determine the output pulse width in the mono stable mode, and the output frequency in the a stable mode. Its various features are wide supply voltage range: 3V to 15 V, high noise immunity, true and complemented buffered out puts, low power compatibility, low power consumption and only one external R and C is required.

ii. MOSFET IRFZ44

MOSFET IRFZ44 [6] is an N-channel enhancement mode standard level field –effect power transistor in a plastic envelope using trench technology which is used for both amplifying and switching purpose. MOSFETS are the most common transistors used because of its main advantage that it requires lesser amount of current to turn on while it delivers much higher amount of current to load. The device features very low on-state resistance and has integral zener diodes giving ESD protection up to 2KV, maximum V_{DS} (Drain source voltage) as 55 V and can handle continuous drain current up to 49A.

iii. TRANSFORMER (12-0-12)

A transformer is a static device that transfers electrical energy from one circuit to another through electromagnetic induction at constant frequency. Transformers are used in circuits to increase or decrease the voltages value. In this paper the transformer used is of 12-0-12 Volt and 5A. It has 230V primary windings and centre tapped secondary winding.

iv. RESISTORS

In this circuit the resistors of different ratings are used. Those are resistors of 100ohm, 1 K ohm and 100 K ohm variable resistor.

v. CAPACITOR (0.22uf)

In this circuit the capacitor used is of 0.22μF.

5. WORKING OF INVERTER CIRCUIT

DC supply to the inverter circuit is provided by 12V battery. In this a combination of 'R' & 'C' is used which works as an oscillating circuit. This circuit endows the frequency of oscillation. Through this oscillation circuit capacitor gets fully charged and thus triggers the IC when it reaches at threshold voltage. Once the capacitor is completely charged, it starts discharging through the resistor and the common line. At pin 4, 5, 6 & 14 of IC positive supply comes and at pin 7,8,9 & 12 of IC negative supply comes . IC used in the circuit is such that one time we get out put at IC pin number 10 and second time we get out put at IC pin number 11. Thus due to the output of IC, MOSFET get triggered.

When we get output at IC pin number 10 at that time MOSFET 1 gets triggered. It act as a closed switch. Thus the primary circuit of transformer will get completed due to which voltages would be induced in the secondary of the transformer. When MOSFET 1 acts as closed switch at that time the direction of flow of current in the primary winding would be clockwise and at the same time the direction of flow of current in the primary winding would be clockwise and at the same time the direction of flow of current in the secondary would be anti-clockwise. The output obtained from secondary winding of transformer would be square wave. This wave would be positive in nature.

When we get out put at IC pin number 11 at that time MOSFET 2 gets triggered [7]. It will now act as a closed switch. Thus the primary circuit of transformer will get completed due to which voltages would be induced in the secondary of the transformer. When MOSFET 2 acts as closed switch at that time the direction of flow current in the primary winding would be anticlockwise and at same time the direction of flow of current in the secondary would be clockwise. The output obtained from secondary winding of transformer would be square wave. This wave would be negative in nature. Thus the net output obtained would be complete square wave.

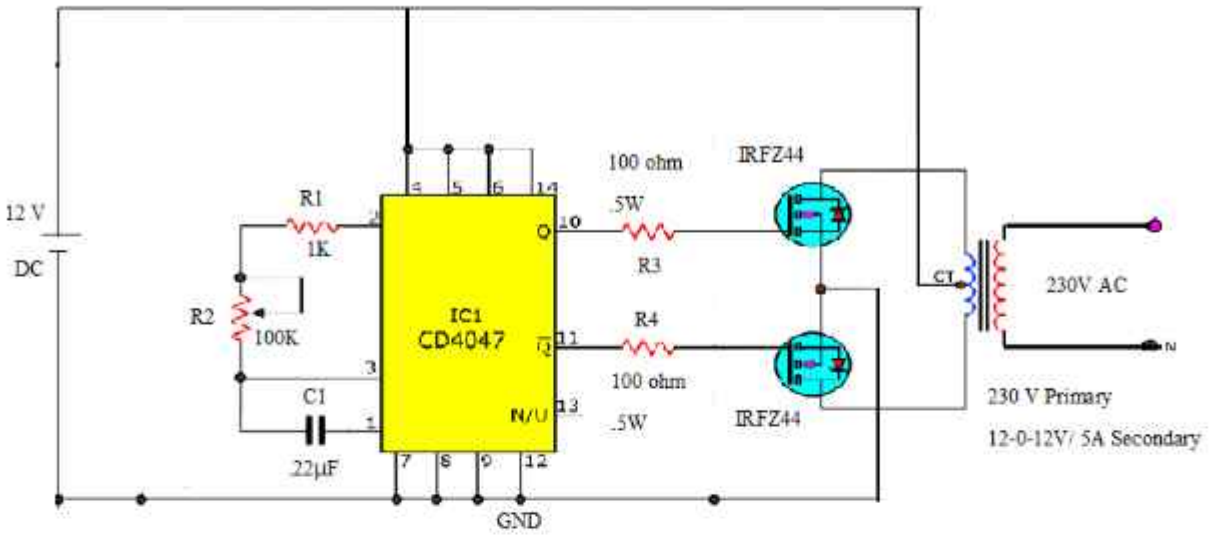

Figure 2. Circuit diagram of inverter

6. PROTECTIVE FUNCTIONS OF THE SOLAR INVERTER

i. OVERLOAD PROTECTION

When the power consumption of the appliance /appliances exceeds the total power of the solar inverter, it will then revert to the protection state within 20 seconds until you reduce the load.

ii. SHORT CIRCUIT PROTECTION

If an appliance short circuits, the solar inverter will revert to the protection state until the appliance is removed.

iii. THERMAL PROTECTION

As inverter is semiconductor-based equipment, sensitive to overheating and operate best at cooler temperatures. If the temperature of the solar inverter gets too hot it will protect with automatic temperature controlled section developed by front end electronics.

iv. REVERSE POLARITY PROTECTION

If connected incorrectly no current will pass through the solar inverter. For that purpose a diode (IN5408) is connected to the positive terminal of the inverter.

7. CONCLUSION

A solar panel using inverter with charger and charge controller had successfully been designed and developed. Solar charger was used to store DC power which was generated by photovoltaic effect of solar panel. To protect from over charging of the battery simple auto cut off circuit is designed and tested. The output of charger circuit is fed to auto cut off circuit using relay which is completely automatic which protects the battery from over charging. Inverter circuit is used to convert DC power into AC power which is used to drive the loads. Level indicator circuit helps to determine the amount of charge left in the circuit which can easily be implemented in real life to increase the efficiency of solar inverter. Using microcontroller instead of relay the system of solar inverter circuit will be made more attractive and reliable.

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Structural and Optical Properties of Green Synthesized Copper Oxide Nanoparticles

Sanjib Baglari[a], Riu Riu Wary[b], Pranjal Kalita[c], Manasi Buzar Baruah[b]*

[a]Department of Physics, Birjhora Mahavidyalaya, Bongaigaon, Assam:783380, India
[b]Department of Physics, Central Institute of Technology, Kokrajhar, Assam:783370, India
[c]Department of Chemistry, Central Institute of Technology, Kokrajhar, Assam:783370, India
*Coresponding author: Email: mbbaruah@cit.ac.in

ABSTRACT

Discarded fruit peels create various environmental pollutions, the reuse of such waste peels reduces pollution, waste as and it also sustains environmental balance. In this communication, we have reported the synthesis of copper oxide nanoparticles using aqueous extract of citrus maxima peel and copper nitrate as precursor. The prepared CuO NPs were characterized by XRD, SEM, EDS, FTIR, PL and UV-visible spectroscopy. The obtained result revealed that the synthesized CuO nanoparticles were spherical in shape with monoclinic crystal structure. UV-visible diffuse reflectance spectroscopy was used to estimate the direct and indirect band gap energy of CuO nanoparticles. Photoluminescence (PL) was carried out to investigate materials imperfection and recombination mechanism.

INTRODUCTION:

In recent year, the green synthesis becomes an alternative method for material fabrications because of various environmental issues. The method utilizes green chemistry for the synthesis of nanoscale materials for various potential applications and attracted the attention of researcher in contrast to the traditional method which produces harmful waste product for the environment. In general, the traditional method employed organic solvent, harsh reducing agent, flammable, toxic and corrosive chemical compounds and required sophisticated instruments and time consuming. However, green technology utilizes the only environmentally available natural product and reduces the usages of chemical reagents with improvement in crystal quality along with the efficiency of method.

Nanomaterials have various applications in the field of science and technology and biomedical applications because of its unique and remarkable properties as compare to the bulk counterparts [1]. Due to the large surface area and high surface energy of nanoparticles, metal oxide nanoparticles are used broadly in the form of nanoscale [2-4]. Electronic, magnetic, antibacterial, catalysis, sensing and optical properties made the nanomaterials superior in nanoscale. Among various type of nanomaterials, Copper Oxide (CuO) is another p-type semiconductor with narrow indirect band gap energy ~1.2 eV [5,82] with

excellent superconducting properties and widely used in the field of catalysis [7], gas sensor [8], dye-sensitized solar cell [4] etc. due to its low cost, non-toxicity and thermal stability.

The various method has been employed for the synthesis of CuO nanoparticles (NPs) such as microwave-assisted [9], Hydrothermal [10], sol-gel [11], thermal decomposition [12], and chemical precipitation [13]. Recently, different kind of plant, peel and root extract has been used for the synthesis of NPs as a stabilizing or capping agent [14,15]. Plant extract contains various biological compounds such as flavonoids, alkaloids, phenolic compounds, quinol, amino acid, and chlorophyll pigments which acts as a reducing agent and itself act as a stabilizing agent to reduce metal ions to nanoparticles and eliminates the use of any other stabilizing agent [14]. Different kind of plants and peels extract like Calotropis gigantean [4], Punica granatum [16], Thymus vulgaris [17], Cassia auriculata [18] has been used for the synthesis of CuO NPs. Along with plant extract, fruit peels extract was also useable for green synthesis of NPs. Citrus maxima is a fruit of citrus family, its peel contains polysaccharide, essential oil, pectin, and flavonoids, and so on [19,20]. Iron NPs were synthesized using an aqueous solution of citrus maxima peel as a reducing agent [21]. A thorough literature review suggested that none have reported aqueous solution of citrus maxima peel for the synthesis of CuO NPs using copper nitrate precursors. However, these peels are discarded in an environment which causes environmental issues. Re-use of such waste products avoids pollutions in an environment. Concerning all these, current work reports the use of citrus maxima peel extract as a reducing and stabilizing agent for the production of CuO NPs using copper nitrate precursor and structural, morphological and optical properties were carried out.

MATERIALS AND METHODS:

Synthesis of CuO nanoparticles

Fresh Citrus maxima fruit was peeled and washed several times with distilled water and then cut into pieces and air-dried. 50 gm of said peel pieces were then boiled in 150 ml distilled water at 70-80°C for 1 hour. A light yellow solution was formed which was cooled at room temperature and filtered several times using Whatmann No. 1 filter paper. 30 ml extract was taken from the stock solution and stirred. Afterward, 1 gm of copper nitrate trihydrate [$Cu(NO_3)_2.3H_2O$)] was added into the extract and then the solution was heated slowly until the temperatures reaches to 80°C. The solution was heated until it changed to brown colored paste and then cooled. The paste was transferred to the ceramic crucible and sintered at 400°C for 1 hour. Black powder was collected and ground in mortar pestles and stored in vacuum desiccators for further characterizations.

Characterization of CuO NPs

Different techniques were used for the characterization of the materials. The phase purity of the material was characterized by powder X-Ray diffraction (PANAlytical E'XPERT, Netherlands) with CuKα as a incident beam (λ=1.54 Å) in the range of 30-80^0 at scanning rate of 1^0/min. The morphology, particle size and elemental composition were analyzed using Scanning Electron Microscopy (SEM) and Energy Dispersive X-Ray Spectroscopy (EDS). Optical properties and band energy were evaluated using UV-Vis

NIR spectroscopy with diffuse reflectance. Function group of the material was studied by Fourier Transform Infrared (FTIR) Spectrometer, Shimadzu FTIR 8201. The room temperature photoluminescence (PL) was carried out using spectrophotometer, RF 6000 for the identification of defect state.

RESULTS AND DISCUSSION

The crystal structure, crystallite size was examined using powder X-Ray diffraction spectroscopy. Figure 1. shows the powder XRD diffraction pattern of the synthesized sample. All the diffraction peaks of XRD patterns are well matched with JCPDS Card No. : 45-0937 of CuO with a monoclinic crystal structure. The sharp and intense peaks indicate the high crystallanity of CuO NPs. No other diffraction peaks from Cu_2O, $Cu(OH)_2$ and impurity were observed which confirms the pure monoclinic phase formation of grown product. From the figure-1 it is clear that (-111) and (111) have a stronger intense peak than others, indicates that the strong preferential orientation in the (-111) and (111) direction. The average crystallite size (D) of the CuO NPs was determined using Debye-Scherrer's formula -

$$D = \frac{k\lambda}{\beta_{hkl}\cos\theta} \qquad (1)$$

where k and λ represents shape factor (0.9) and wavelength of incident radiation (1.5406Å). β_{hkl} and θ are full width half maxima (FWHM) and scattering angle. The average crystallite size was 18.32 nm.

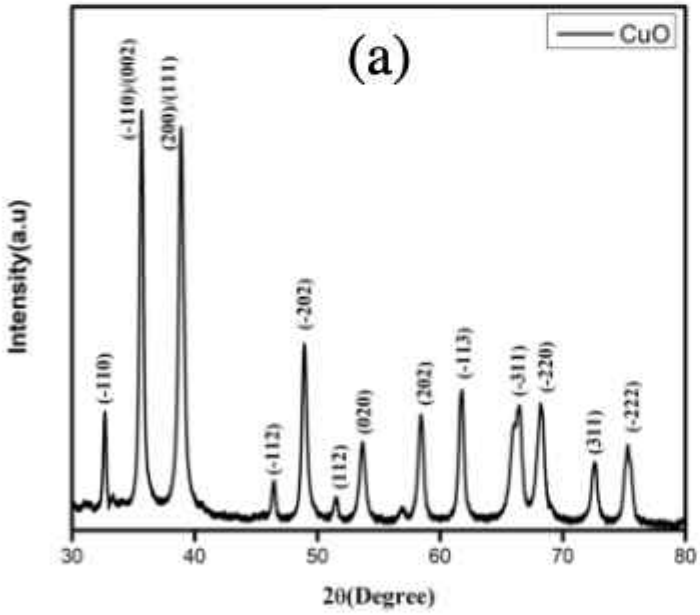

Figure 1. (a) XRD pattern of sample of CuO NPs

Fourier transform- infrared (FTIR) spectroscopy was used to analyze the functional group present in the material and the spectrum is shown in Figure 2. The presence of broad band in the region of 3540-2800 cm^{-1} may be due to the stretching vibration of O-H and C-H [21,23]. The peak positioned at 2358.07 cm^{-1} indicates the presence of CO_2 molecules. The band at 1639 cm^{-1} indicates the stretching vibration of C=O in aldehydes and ketones which confirms the presence of phenolic acid and terpenoid on the surface of NPs. In addition to it, the stretching vibration of C-N at 1206 cm^{-1} indicates the presence of aliphatic amines [21]. The absorption band at around 1389.79 cm^{-1} can be attributed to the C-C stretching of the aromatic ring. The sharp and intense peak at around 531.39 cm^{-1} is due to the characteristic stretching

vibration of Cu-O along the [101] direction on the monoclinic crystal structure of CuO, which confirms the formation of CuO. Moreover, the absence of band at 610 cm^{-1} indicates that there is no phase formation of Cu_2O and confirms the phase purity of CuO [24]. FTIR spectroscopy suggested the presence of phenolic acid, terpenoid, aliphatic amines, and aromatic ring on the surface of CuO NPs which were thought to act as capping or stabilizing agents for the formation of CuO NPs.

The Scanning electron microscopy (SEM) and energy dispersive x-ray spectroscopy (EDS) of CuO NPs were carried out to evaluate morphology and elemental composition and it is shown in Figure 3 (a-b). The SEM image reveals the distinguishable spherical morphology of CuO NPs with an average size of about 33.44 nm and it is in good agreement with the size computed from XRD patterns. It is clear from the SEM image that CuO NPs synthesized using citrus maxima peel aqueous extract produce uniform spherical morphology. The peaks of Cu and O in EDX spectrum display that NPs are composed of Cu and O only and the absence of extra peak indicates the purity of synthesized CuO NPs and this result supports the XRD spectra of CuO NPs. However, an extra peak is observed from the substrate used. CuO NPs are constituted with 75.04 and 24.96 wt% of Cu and O respectively. The overall result suggested the pure phase formation of CuO NPs using aqueous citrus maxima peel extract.

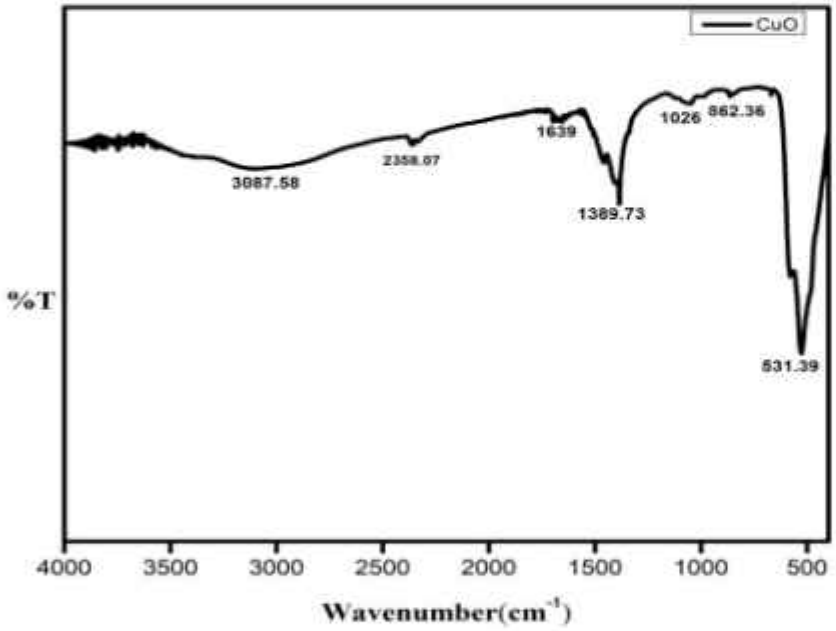

Figure 2. FTIR spectra of CuO NPs synthesized using aqueous peel extract.

UV-Vis NIR spectroscopy in diffuse reflectance mode was carried to analyze the spectral response of the sample as shown in Figure 4(a). Kubelka-Munk formula [22] was employed to estimate the band gap energy of the material. F(R) was derived from $F(R) = \frac{(1-R)^2}{2R}$, here F(R) is equivalent to the absorbance coefficient, and R is the absolute reflectance. From the spectrum, it was clear that sample exhibit absorption peak at 256 nm associated with Cu^{2+} ion in the zeolite structure. Also, the absorption band at 427 nm attributed to the Cu^{2+} was also observed which is related to the electron transmission of d orbitals [25,26]. This confirms the presence of copper (II) ion in the material. Moreover, peak around 550 nm belongs to Cu_2O resulting from the decomposition of CuO [27]. The optical band-gap of indirect and direct band-gap was calculated using Tauc's plot by plotting [F(R)×hυ]^0.5 and [F(R)×hυ]^2 versus photon energy (Figure 4(b)&4(c)) and the energy was observed by extrapolating liner portion to the energy axis and the observed value was 1.4 eV and 3.17 eV respectively and the result is in accordance

to other reported literature [5].The higher direct band gap energy to that of indirect indicates the crystallanity of the materials [28]. However, the observed indirect band gap energy is greater than the bulk counterparts of CuO (~1.2 eV) which could be attributed to the quantum confinement effect for the small individual crystal size observed in SEM analyses. When the size of the materials decreases to the nanoscale, the wavelength of light becomes large with respect to the size of the materials and the low coordination atoms with lower atomic interaction increases on the surface of the materials. As the size of the particle becomes smaller than Bohr radius the electrons are become more confined in the particle. Due to this confinement effect the band gap energy increases [29].

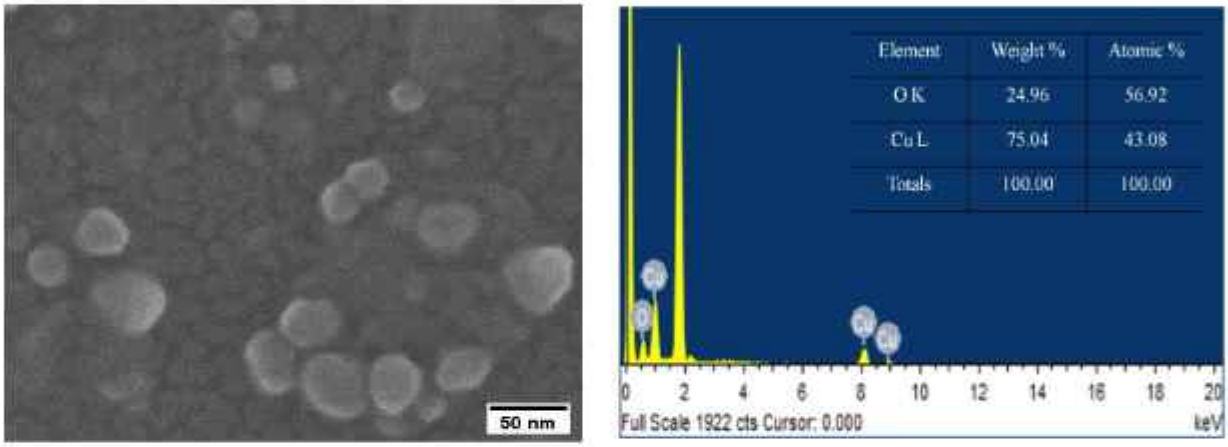

Figure 3 (a) SEM micrograph of CuO and (b) Elemental composition spectra of the sample

Figure 5. corresponds to room temperature photoluminescence (PL) spectra of CuO NPs. The spectra consist of four peaks located at 380, 402, 426, and 524 nm. A strong UV emission band known as near band edge (NBE) emission is observed at 380 nm attributed to the recombination of electron-hole pair in free excitons [30]. Violet and blue emission at 402 and 426 nm was also observed in the visible region attributed to the oxygen vacancy and interstitial oxygen [22] and this result is consistent with the luminescence band of CuO reported by other literature [31,32]. In addition to it, the broad small hump which is known to be green emission band around 528 nm could be associated with singly ionized oxygen vacancy originated from the recombination of electrons with holes [33,34]. However, the origin of luminescence in CuO is still in contradiction and only few reports are available. S. Dagher et al. reported different NBE emission peak depending upon the size of colloidal CuO nanoparticles [35]. The different PL emission peaks suggests that depending upon the morphology, particle size, CuO exhibit different emission peaks.

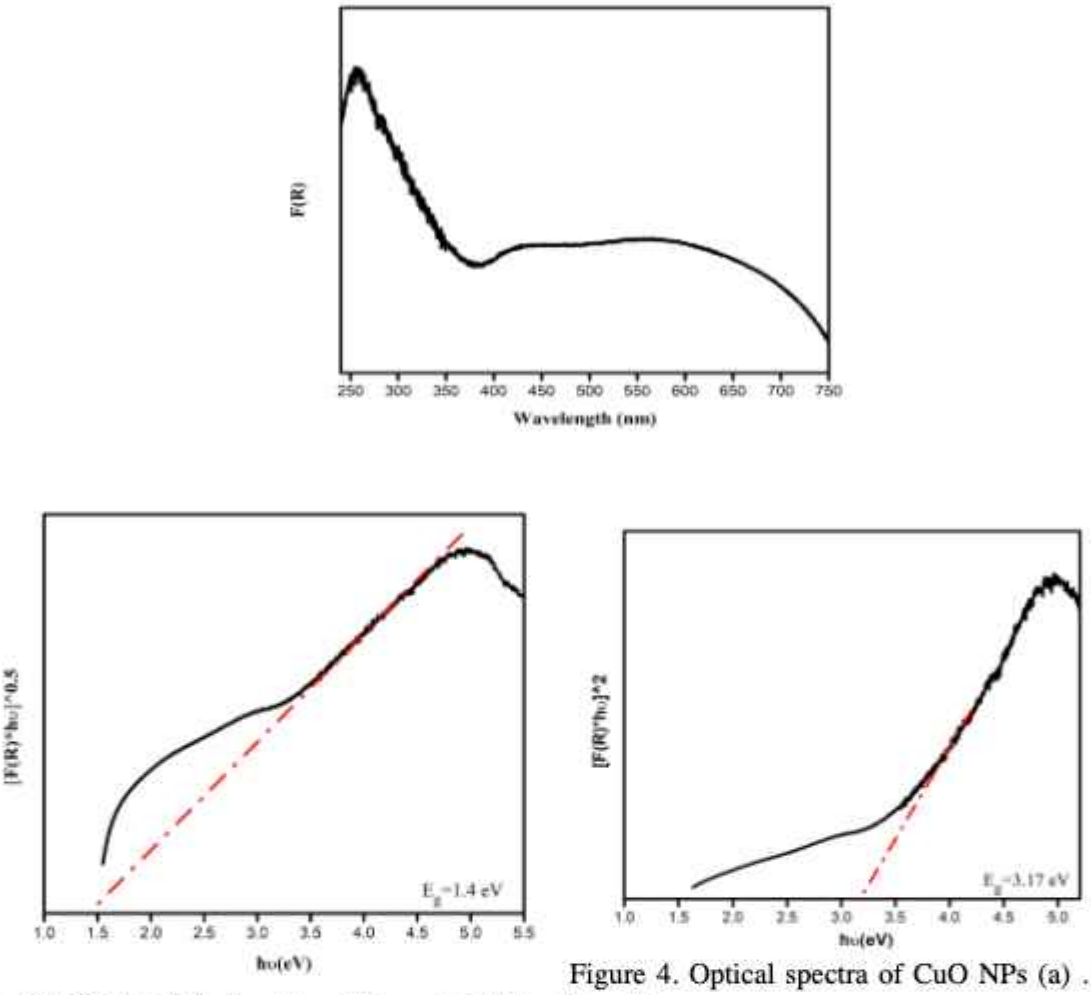

Figure 4. Optical spectra of CuO NPs (a) . Tauc's plot of CuO NPs (b) Indirect transition and (c) direct transition.

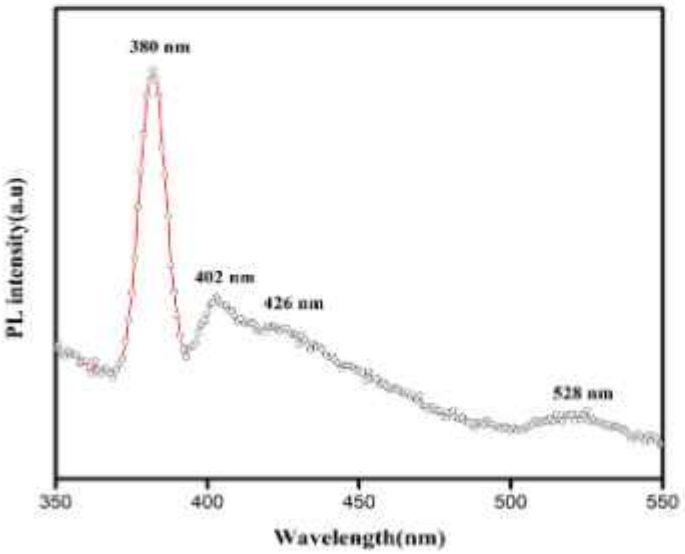

Figure 5. Photoluminescence spectra of CuO NPs.

CONCLUSIONS:

In this work, we have reported the synthesis of CuO through environmentally friendly method using aqueous extract of citrus maxima. XRD result showed the pure monoclinic phase of the materials supported by FTIR and EDS analysis. FTIR result indicated the presence of phenolic acid, terpenoid, aliphatic amines and aromatic ring which acts as reducing or capping agent.SEM result showed spherical morphology of particles with an average particle size of 33.44 nm. The indirect optical band gap energy was evaluated from Tauc's plot and found to be 1.4 eV which suggested that the materials will be useful for photocatalytic applications. PL spectra showed both UV and Visible emission peaks with dominant NBE emission peak at about 380 nm. The green synthesis method using aqueous peel extract will contribute to environmental issues and create economic benefits. Finally, while recognizing our limitation of analysis, the work presented in this paper leave avenues for further study of present materials. In view of application, we propose further study may be carried out in future for application of the synthesized materials.

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EMNSD-2020/PP/03

Frequency encoded All optical single bit memory unit using Tera Hertz Optical Asymmetric Demultiplexer(TOAD)

Kajal Maji[1,2], Kousik Mukherjee*[2], Mrinal Kanti Mandal[1]

[1] Department of Physics, National Institute of Technology Durgapur, Durgapur, India
[2] Department of Physics, Banwarilal Bhalotia College ,Asansol, India
Email: kajalmaji200@gmail.com

Abstract:

The frequency encoded all-optical single bit memory unit operation is described using Tera Hartz Optical Asymmetric Demultiplexer (TOAD) based interferometric switch. Terahertz Optical Asymmetric Demultiplexer (TOAD) is a fundamental optical switch in an optical communication system. In the frequency encoding scheme, the states of information '0' and '1' are denoted by signals of frequency υ_1 and υ_2, respectively. This single-bit memory unit's output shows in the form of a truth table in terms of wavelengths.

Keywords: TOAD; Frequency encoding; SOA; Memory unit.

1. Introduction:

All-optical signal processing has emerged as an alternative to an electronic system[1]. The demand of high-speed logic gates and processing units boosted the research in semiconductor optical amplifier based devices to implement different types of all-optical processors [2-7]. This includes all-optical logic gates, two's complement generator, comparator, and many others. Tera hertz optical asymmetric demultiplexer or TOAD is an all-optical switch uses SOA in such a way that the speed is increased considerably compared to simple SOA and many proposals for all-optical logic gates and processors have been designed using TOAD and its variant dual control TOAD(DCTOAD)[7-13]. Frequency encoding for states of information has many advantages[1-4,7,10], and hence TOAD based designs with frequency encoding are very much attractive for future optical technologies. In this communication, a frequency encoded single bit memory unit using TOAD is designed and analyzed and shows improved performance compared to our earlier work described in[1]. In this communication, frequency encoded memory using TOAD is developed and interpreted for the first time as far as the author's knowledge goes.

2. TOAD based optical switch:

Tera Hartz Optical Asymmetric Demultiplexer (TOAD) is an interferometric switch. It is consists of a loop mirror with one Semiconductor Optical Amplifier (SOA), circulator, 2×2 coupler, and filters. It has one control input, one data signal input, and two outputs one is called output port 1, and the other is output port 2. When there is no control signal present only data signal enter into the TOAD, data signal break into two components one is the clockwise component, and the other is the counterclockwise component, which propagates around the loop and reaches the SOA at a different time. These components experience the same unsaturated SOA gain and recombine at the coupler. As no phase difference is introduced between them, and data signal comes from the output port 2. If the control signal is present, due to the gain saturation of the SOA and refractive index change, the two components will experience a different phase shift. If the phase difference is π, they recombine in the coupler, and the data signal will exit through output port 1. TOAD-based optical switch as shown in figure 1.

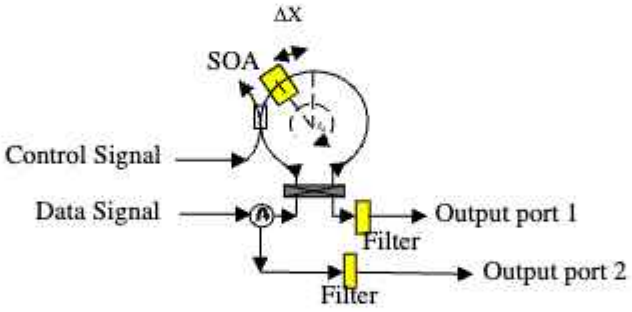

Figure1. TOAD based optical switch

3. Frequency encoded single bit memory unit:

Frequency encoded TOAD-based single bit memory unit as shown in figure2. It is consists of four TOAD-based switches, filters (υ_1 pass and υ_2 pass), beam splitters (BS), and mirrors. It has one input A and two outputs Y_1 and Y_2.

3.1 Working Principle of single bit memory unit:

We have used the data signal, and the control signal has different frequencies.

Case 1: When the input A is a signal of frequency υ_1, i.e.'0', it passes through the υ1 pass filter. So the TOAD T_1 output generates a signal of frequency υ_2, i.e., '1'. So the output of Y_1 is υ_2, i.e., '1'. A part of this output frequency υ_2, i.e., '1', is applied in the input of TOAD T_4 through the υ_2 pass filter and generates a signal of frequency υ_1, i.e.'0'.So the output of Y_2 is υ_1, i.e.,'0'. Now let

us explain what happens when the input is made off. In this condition, TOAD T_1 still receives a signal of frequency υ_1 from the output Y_2 and generates an output signal of frequency υ_2, i.e., '1'. So the output of Y_1 is υ_2, i.e., '1'. A part of this output of frequency υ_2, i.e., '1' is applied in the input of TOAD T_4 through the υ_2 pass filter and generates a signal of frequency υ_1, i.e.'0' as Y_2 as output. So the previous condition is verified when the input is made off. Thus the device has a memory. So the memory unit is stored a high state signal even if the input signal made off because of feedback. When storing the new information into the memory, first erase the previously stored memory. This is called clearing memory. To clear the memory data signal frequency remains made off. There are no output exits from any TOAD T_1 and TOAD T_4, i.e., there is nothing at the outputs Y_1 and Y_2. This is the memory unit' clear state, and now the memory unit is ready to store new information.

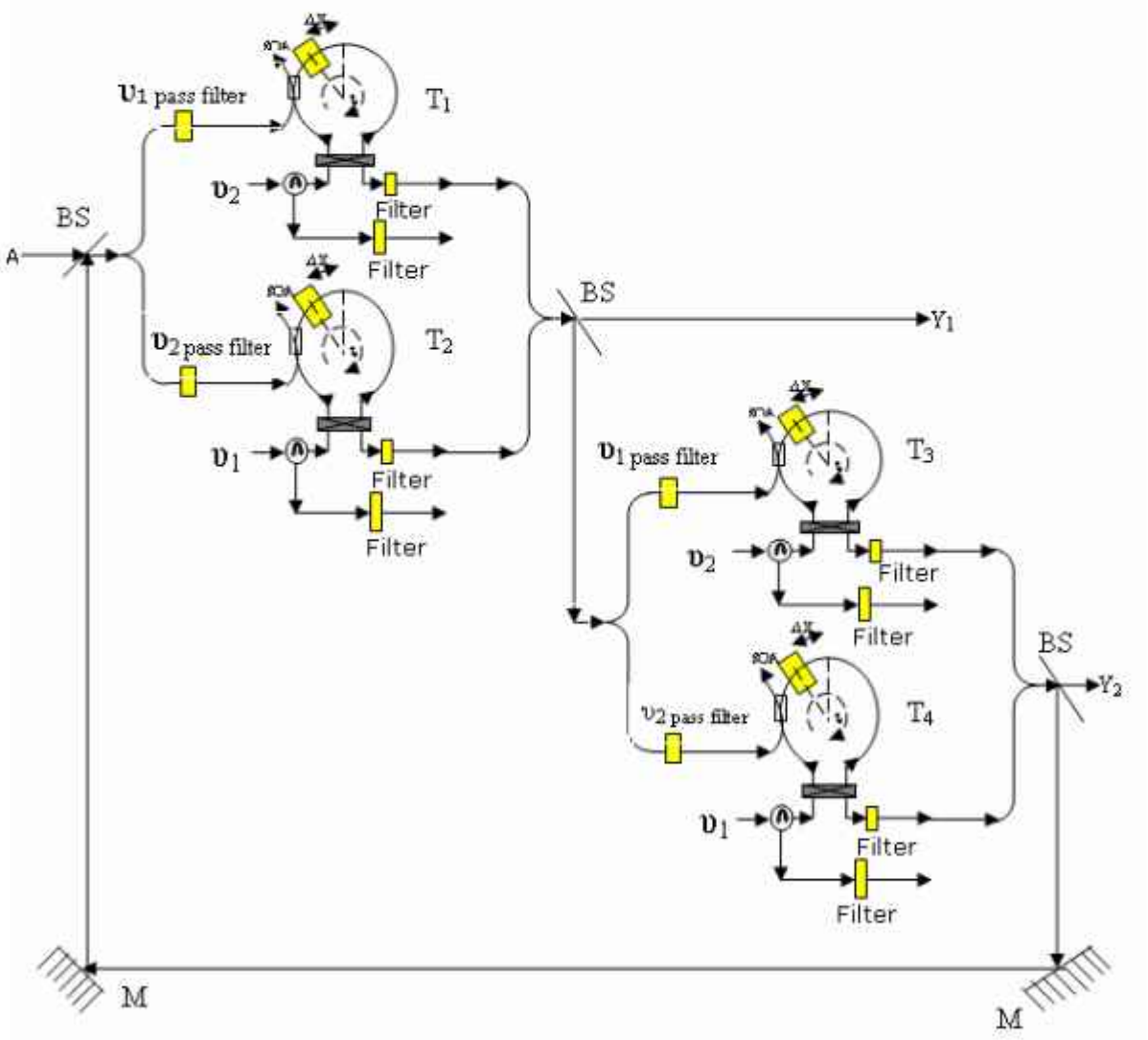

Figure2. Frequency encoded single bit memory unit circuit using TOAD

Case2: When the input A is a signal of frequency υ_2, i.e., '1', it passes through the υ_2 pass filter. So the TOAD T_2 output generates a signal of frequency υ_1, i.e. '0'. So the output of Y_1 is υ_1, i.e., '0'. A part of this output frequency υ_1, i.e. '0', is applied in the input of TOAD T_3 through the υ_1 pass filter and generates a signal of frequency υ_2, i.e., '1'.So the output of Y_2 is υ_2, i.e., '1'. Now let us explain what happens when the input is made off. In this condition, TOAD T_2 still receives a signal of frequency υ_2 from the output Y_2 and generates an output signal of frequency υ_1, i.e., '0'. So the output of Y_1 is υ_1, i.e., '0'. A part of this output of frequency υ_1, i.e. '0', is applied in the input of TOAD T_3 through the υ_1 pass filter and generates a signal of frequency υ_2, i.e., '1' as output Y_2. So the previous condition is verified when the input is made off. Thus the device has a memory. So the memory unit is stored low state signal even if the input signal is made off because of feedback. When storing the new information into the memory, first erase the previously stored memory again. To clear the memory data signal frequency is made off again. So the figure 2 can store single bit optical information in terms of frequency. This single-bit memory unit's output is shown in the truth table1.

Table1. Truth table of single bit memory unit

Input	Output	
A	Y_1	Y_2
$\upsilon_1(0)$ λ_1=1550 nm	$\upsilon_2(1)$ λ_2=1560 nm	$\upsilon_1(0)$ λ_1=1550 nm
$\upsilon_2(1)$ λ_2=1560 nm	$\upsilon_1(0)$ λ_1=1550 nm	$\upsilon_2(1)$ λ_2=1560 nm

4. Simulation and Result:

Simulated input and output of the TOAD based single bit memory unit are shown in figure 3 and figure 4. Figure 3 shows the optical power spectrum when the input A is a signal frequency υ_1 and outputs Y_1= υ_2 and Y_2= υ_1. Figure 4 shows the optical power spectrum when the input A is a signal frequency υ_2 and outputs Y_1= υ_1 and Y_2= υ_2. We have used control signal and data signal pulse as gaussian pulse[3], and we choose the two wavelengths λ_1=1550 nm for the frequency υ_1 and λ_2=1560 nm for the frequency υ_2. In [4], SOA parameters are use for this simulation.

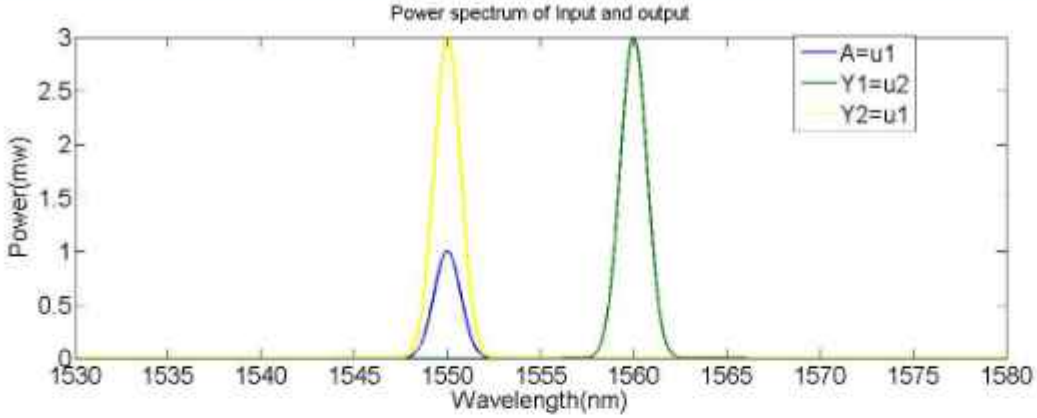

Figure3. Simulated optical power spectrum of the TOAD based single bit memory unit when input A is a signal frequency $\upsilon_1(\lambda_1=1550$ nm) and outputs $Y_1= \upsilon_2(\lambda_2=1560$ nm)and $Y_2= \upsilon_1(\lambda_1=1550$ nm).

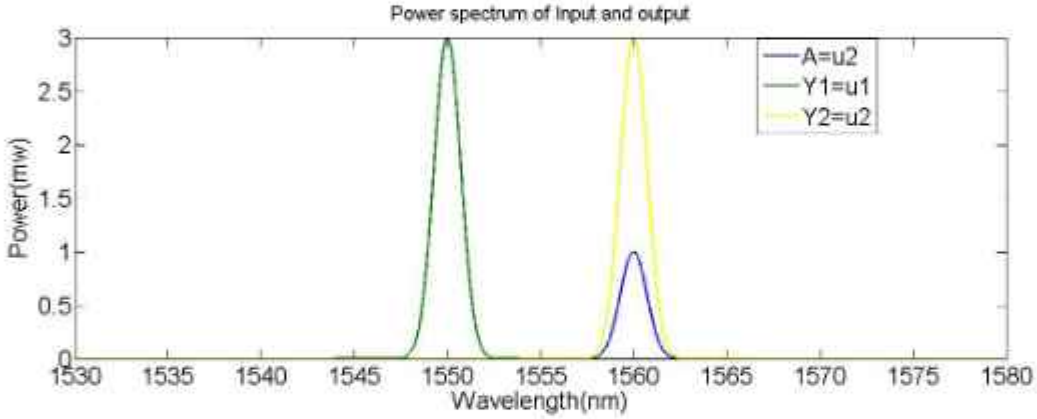

Figure4. Simulated optical power spectrum of the TOAD based single bit memory unit when input A is a signal frequency $\upsilon_2(\lambda_2=1560$ nm) and outputs $Y_1= \upsilon_1(\lambda_1=1550$ nm) and $Y_2= \upsilon_2(\lambda_2=1560$ nm).

Conclusion:

Frequency encoded all-optical single bit memory unit using TOAD is successfully analyzed and characterized. This single-bit memory unit's operation is based on frequency conversion and simulated by MATLAB. We have shown the output optical spectrums of the single-bit memory unit. The output of a single-bit memory unit shows the possibility of various applications in optical and electrical communication systems.

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Effect of Fe Substitution on the Magnetic Properties Of $MnCo_2O_4$

Junmoni Barman*[1] and S. Ravi[2]

[1] Department of Physics, Rajiv Gandhi University, Arunachal Pradesh-791112, India
[2] Department of Physics, Indian Institute of Technology Guwahati, Guwahati-781039, Assam, India
Email: barmanjunmoni@gmail.com

ABSTRACT

Single phase samples of $Mn(Co_{1-x}Fe_x)_2O_4$ ($x = 0 - 0.5$) were synthesized by using sol-gel route. Rietveld refinement of the room temperature X-ray diffraction patterns reveal cubic spinel structure of the samples with $Fd\bar{3}m$ space group. The lattice parameter is found to increase systematically with increase in the Fe concentration. Magnetization measurements show ferrimagnetic transition in all the samples and the transition temperature is found to increase with increase in Fe concentration, *i.e.* from 176 K for $x = 0$ to 446 K for $x = 0.5$. From the Curie-Weiss fit of the susceptibility data in the paramagnetic region, the possible cationic distribution in this compound is found to be of the type $Co^{2+}[Co^{3+}_{1-2x}Fe^{3+}_{2x}Mn^{3+}]O_4$ with Co^{3+} in low spin state. The saturation magnetization and the theoretical as well as the experimental effective magnetic moment are found to increase with increasing Fe concentration. Both parent and Fe doped samples show an unusual hysteresis behavior below a certain temperature. This unusual hysteresis behavior is attributed to the domain wall pinning effect which is found to decrease with increasing Fe concentration.

Keywords: Spinel Cobaltite; MCo_2O_4; Ferrimagnetic

INTRODUCTION:

Spinel compounds with general chemical formula AB_2O_4, containing two or more types of cations in tetrahedral A and octahedral B sites, have been studied for decades owing to their interesting electric, magnetic, optical and catalytic properties [1-10]. Out of several spinel compounds, transition metal cobaltite MCo_2O_4 (M = Mn, Ni, Zn, Cu, Mg etc.) have attracted significant interest for fundamental research and also for technological applications in many areas such as colossal magnetoresistance (CMR), magnetic sensors, fuel cell electrodes, electrical

catalysts, microwave absorption, *etc*. [3-10]. Among these cobaltite, spinel $MnCo_2O_4$ has been studied widely due to its promising applications as a magnetic material and its unusual hysteresis behavior [9-12]. $MnCo_2O_4$ is in general described as an inverse spinel oxide with $Fd\bar{3}m$ space group in which the manganese cations show preference for octahedral sites [3]. However, the cationic distribution of $MnCo_2O_4$ is still not well established. Several cationic distribution have been proposed for stoichiometric $MnCo_2O_4$ and non-stoichiometric $Mn_xCo_{3-x}O_{4+\delta}$ on the basis of (i) electrical conductivity: $Co^{2+}[Co^{2+}Mn^{4+}]O_4$ or $Co^{3+}[Co^{3+}Mn^{2+}]O_4$ [3, 13], and (ii) neutron diffraction and magnetic measurements: $Co^{2+}[Co^{3+}_{2-x}Mn^{3+}_x]O_4$ [3, 13,14] and $Co^{2+}[Co^{2+}Mn^{4+}]O_4$ [3, 13]. Bulk $MnCo_2O_4$ is a long range ferrimagnetic (FIM) oxide with the transition temperature, $T_C \approx 185$ K [9-11]. Also a peak at $T_P \approx 177$ K is observed in the temperature dependent zero field cooled magnetization curve due to Hopkinson effect [10]. An unusual magnetic hysteresis behavior at temperatures below 130 K is observed by Joy and Date [9, 10]. In this temperature range, the initial magnetization curve lies outside the main loop while for $T > 130$ K, normal hysteresis loops are observed. This unusual behavior of magnetic hysteresis loop is explained in terms of irreversible domain wall movements. An evolution of such unusual magnetic properties is studied by Borges *et al*. [11] for different crystallite size of $MnCo_2O_4$. Philip and Kutty have reported a change in the temperature coefficient of resistivity of $MnCo_2O_4$ from negative to positive value below 100 K and this temperature is compared to the T_C of the material [7]. According to them the conduction in $MnCo_2O_4$ is mainly due to hole hopping between Mn^{3+} and Mn^{4+}. In this present work, we have substituted Fe^{3+} ions with relatively larger magnetic moment, in place of Co^{3+} ions and carried out the study of structural and their interesting magnetic properties.

MATERIALS & METHODS

$Mn(Co_{1-x}Fe_x)_2O_4$ ($x = 0 - 0.5$) samples were synthesized by using sol–gel method. Stoichiometric ratio of $C_4H_6MnO_4.4H_2O$, $Co(NO_3)_2.6H_2O$ and $Fe(NO_3)_3.9H_2O$ of 99 % were weighed, dissolved in distilled water and mixed in a beaker. Citric acid and ethylene glycol were added to the solution and then the solution was heated slowly to evaporate the solvent, leaving a precipitate. The precipitate was grinded and calcined at 600 °C and 800 °C for 12 hours followed by final sintering in pellet form at 1000 °C for 24 hours. Powder X-ray diffraction pattern at room temperature was recorded by using Rigaku make X-ray diffractometer of model TTRAX III with Cu-Kα radiation.

Magnetization measurement both as a function of temperature and magnetic field were performed by using Lakeshore make Vibrating Sample Magnetometer (VSM) of model no. 7410.

RESULTS & DISCUSSION

The X-ray diffraction (XRD) patterns obtained for all the samples at room temperature are found to be in single phase form. The XRD patterns were analyzed by Rietveld refinement technique by using Fullprof program. Refinement shows that all the samples crystallize in cubic spinel structure with $Fd\bar{3}m$ space group. Figure1 shows the XRD pattern of $x = 0$ and 0.5 samples along with the Rietveld refinement data. For $x = 0$ sample the lattice parameter is found to be $a = 8.2753$ Å which is comparable to those reported in literatures [11, 12]. The lattice parameter is found to increase systematically with increase in Fe concentration. It can be easily explained in terms of Fe^{3+} ions having larger ionic radius (0.645 Å) replacing the Co^{3+} ions (0.61 Å) in the octahedral site. Thus the doped Fe^{3+} ions indeed get substituted in Co site. The lattice parameters and the reliability factors related to Rietveld refinement of the samples are listed in table I. The occupancy value of Fe is found to be comparable to the nominal starting composition.

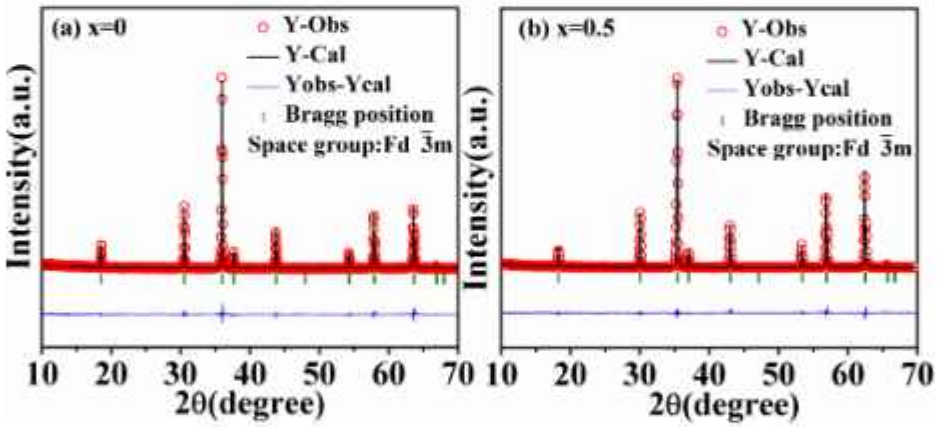

Figure 1. XRD patterns along with Rietveld refinement data for (a) $x = 0$ and (b) $x = 0.5$. Y-Obs and Y-Cal represent the experimental and refined data respectively.

Magnetization as a function of temperature is measured for all the samples under zero field cooled (ZFC) and field cooled (FC) conditions for the applied field $H = 500$ Oe. ZFC and FC curves for $x = 0, 0.2, 0.3$ and 0.5 samples are shown in Figure. 2. Sharp magnetic transitions at the Curie temperature highlights the FIM behavior of the samples. The transition temperature determined from dM/dT versus T plot is found to be $T_C = 175$ K for $x = 0$ sample and is comparable to that reported in literatures [11, 12]. The FIM T_C is found to increase with increase

in Fe concentration. This increase in T_C is due to the substitution of Fe^{3+} ions with higher magnetic moment (5 μ_B) in place of the Co^{3+} ions in low spin state as such substitution strengthens the superexchange interactions between A and B site ions [14]. The overall shape of the ZFC curve is almost similar for all the samples. Strong irreversibility of magnetization is observed between ZFC and the FC curve at $T < T_C$ due to the presence of large magnetocrystalline anisotropy. Such irreversibility is similar to the earlier reports for $MnCo_2O_4$ [10] and also to some ferromagnetic (FM) and FIM oxides [15, 16]. Moreover, for each samples a maximum magnetization (T_P) is observed just below the transition temperature in the M-T plot under ZFC condition and then it drops off to a very low value. This peak is observed due to Hopkinson effect. It is a competition effect between the applied magnetic field and the magnetocrystalline anisotropy which changes with temperature. The domain wall pinning effect is also responsible for the shape of the ZFC curve. When the sample is heated in a small applied magnetic field the mobility of the domain walls may be increased i.e. the pinning of the domain wall is reduced as the temperature increases and the walls may be displaced easily along the direction of the applied field and this leads to a slight increase in the magnetization. When the sample is heated further, the magnetocrystalline anisotropy is reduced and this reduction may make the magnetization of the grains to orient easily in the direction of the magnetic field leading to an increase in magnetization. On the other hand, with increasing temperature the thermal agitation increases which leads to a decrease in magnetization. However, in the temperature range just below T_C, the easy magnetization rotation may dominant over the thermal agitation which leads to overall increase in magnetization. After this temperature the sample become demagnetized and the magnetization falls off to zero at T_C. Therefore, a peak is observed in the ZFC curve just below the T_C [17]. With increase in Fe concentration, along with T_C, the T_P value also increases and become enlarged. However, the T_P value decreases with increase in the applied magnetic field as shown in Figure 3 for $x = 0$ and $x = 0.1$. Since the magnetocrystalline anisotropy decreases with increase in temperature and applied field, in case of high applied field it may be much easier to rotate the spins in the field direction relatively at low temperature. This is the reason of shifting of T_P towards low temperature with increase in the applied field.

In order to determine the valence state of Co, Mn and Fe and their distribution in tetrahedral and the octahedral sites, we have compared the experimental effective magnetic moment, μ_{eff} with the theoretical effective magnetic moment, μ_{th}. For this purpose, the susceptibility data in the paramagnetic region were fitted to the Curie-Weiss (CW) law $\chi = C/(T - \Theta_C)$. The values of

effective magnetic moment, μ_{eff} determined from the above fit are found to be 6.29 μ_B for $x = 0$ sample and this value increases with increase in Fe^{3+} ($3d^5$) concentration as expected. The Curie-Weiss fit for four of the samples are shown in the inset of Figure 2. The estimated theoretical values of magnetic moment μ_{th} are determined by considering spin only contribution of Mn^{3+} and Co^{2+} and considering Co^{3+} in low spin state (S = 0) and also considering the cationic distribution of the type $Co^{2+}[Co^{3+}_{1-2x}Fe^{3+}_{2x}Mn^{3+}]O_4$. The values of μ_{th} are found to be comparable to the experimental values. Thus the cationic distribution obtained here is in accordance with that given by Wickham and Croft [14]. However, a slightly smaller value of μ_{eff} than μ_{th} for $x = 0.4$ and 0.5 samples are due to the possibility that some of the Mn^{3+} ions in the samples may be in higher valence state, say Mn^{4+}. However, we have not determined the actual valence state of the ions. Also the μ_{eff} increases with increasing Fe concentration as expected.

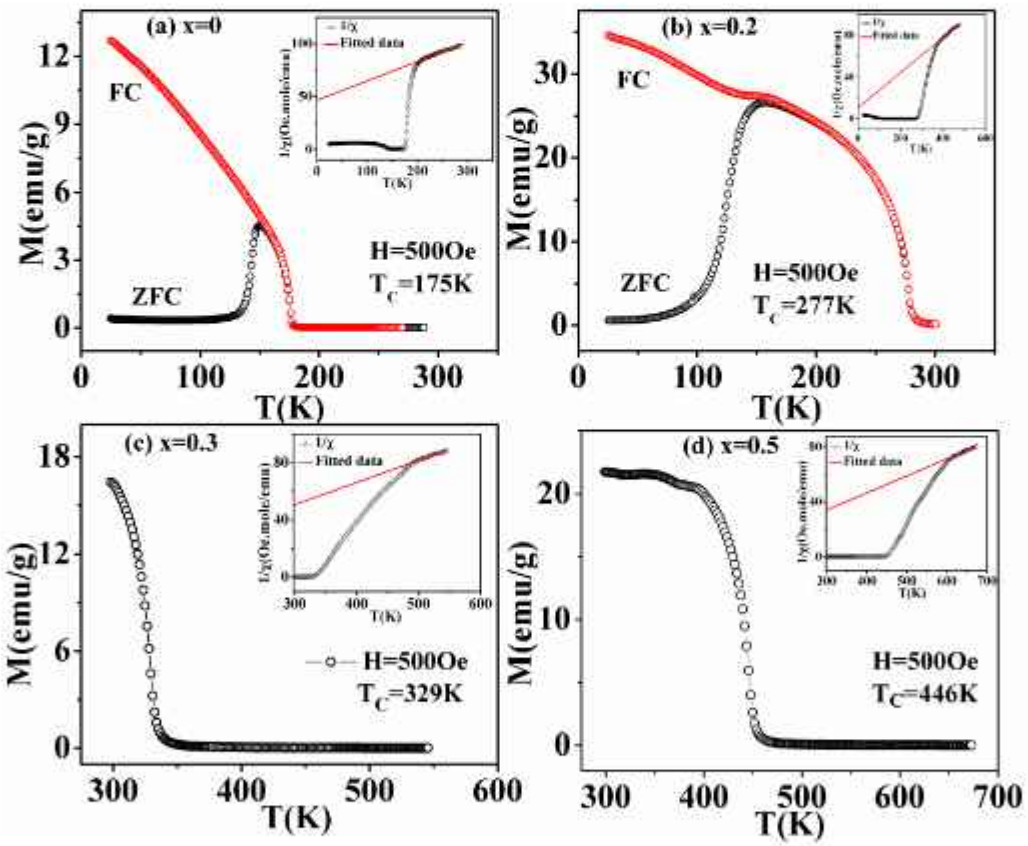

Figure 2. Temperature dependence of ZFC and FC magnetization for (a) $x = 0$ and (b) $x = 0.2$ and that of (c) $x = 0.3$ and (d) $x = 0.5$ samples at high temperatures. Insets show the Curie-Weiss fit for the respective samples.

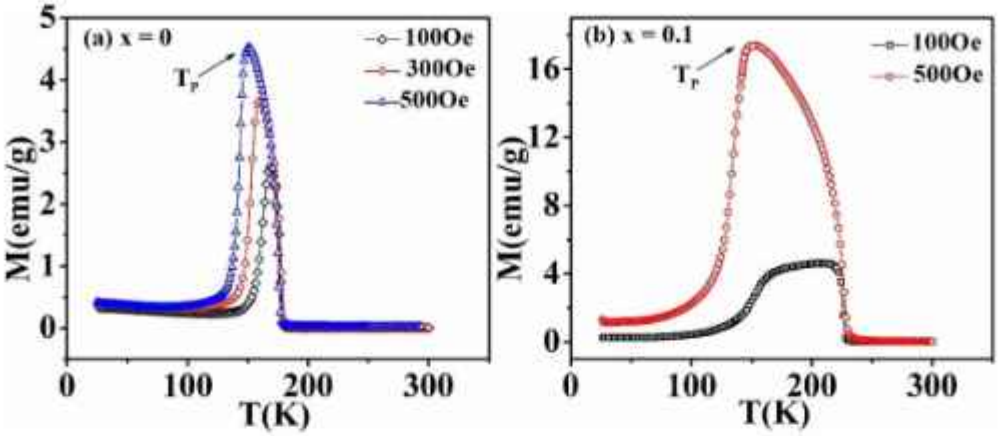

Figure 3. Temperature dependence of ZFC magnetization at different fields for (a) $x = 0$ and (b) $x = 0.1$ samples.

Table 1. The lattice parameter a, goodness of fit χ^2, R_P, R_{Brag}, R_F, T_C, μ_{eff}, μ_{th} and M_s of $Mn(Co_{1-x}Fe_x)_2O_4$.

x	a (Å)	χ^2	R_P	R_{Brag}(%)	R_F(%)	T_C	μ_{eff}	μ_{th}	M_s
0	8.2753	3.84	9.68	3.63	3.32	175	6.29	6.25	0.34
0.1	8.3110	3.88	10.80	2.54	2.36	226	6.79	6.78	1.24
0.2	8.3450	4.82	8.99	3.66	3.81	277	7.18	7.28	1.93
0.3	8.3737	3.74	8.06	2.95	3.02	329	7.67	7.74	2.33
0.4	8.3927	4.35	7.41	2.67	2.75	388	7.87	8.18	2.73
0.5	8.4125	3.72	7.50	3.07	2.90	446	8.02	8.60	3.45

Typical *M-H* loops recorded at 25 K for all the samples are shown in Figure 4(a). The Fe doped sample shows enhanced saturation magnetization, M_s compared to the parent compound and it gradually increases with increasing Fe concentration as expected. The values of M_s obtained after subtracting the linear contribution are listed in table I. The coercivity, H_C decreases first with Fe concentration up to $x = 0.2$ but starts increasing again as shown in Figure 4(b).

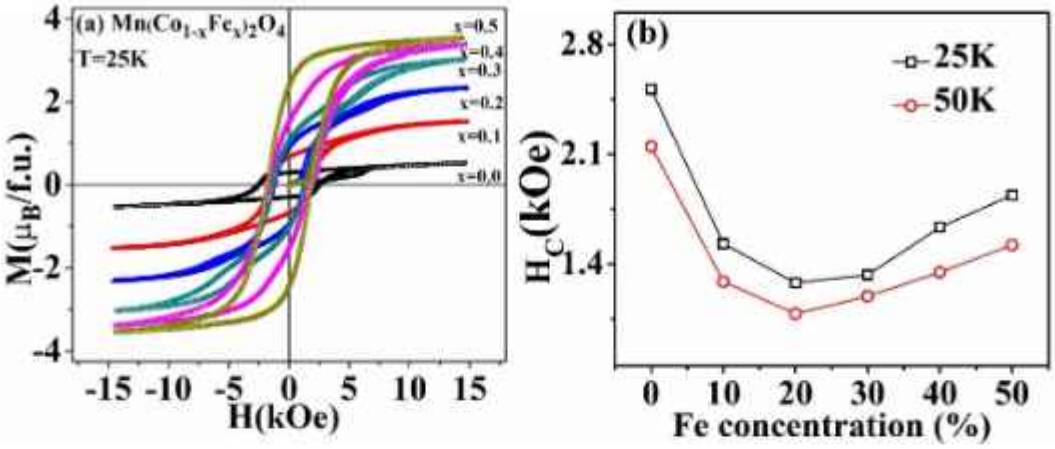

Figure 4. (a) *M-H* loops of $Mn(Co_{1-x}Fe_x)_2O_4$ at 25 K and (b) variation of H_C with Fe concentration at 25 K and 50 K.

The *M-H* loops recorded for both parent and Fe doped samples show unusual hysteresis behavior below a certain temperature. The initial magnetization curve lies outside the main hysteresis loop. In order to clearly display this phenomenon, the *M-H* loops for $x = 0, 0.2$ and 0.5 at some certain temperatures are shown in expanded scale in Figure 5. It is found that for $x = 0$ and $x = 0.2$ samples up to 125 K such unusual behavior is observed but at 150 K the initial curve lies completely inside the loop. However, for $x = 0.5$ sample the unusual hysteresis behavior is observed only at 25 K and after that normal hysteresis behavior is observed. For $x = 0.1, 0.3$ and 0.4 this unusual hysteresis behavior is observed up to 125 K, 100 K and 75 K respectively (not shown). Thus with increase in Fe concentration this behavior is gradually shifted towards lower temperatures and may be disappeared if the Fe concentration is increased above 50 %. Such unusual hysteresis behavior is earlier observed for $MnCo_2O_4$ [9, 10] and for some other compounds also [18-21]. Since the shape of the initial curve at low applied field is controlled by the domain wall motion, such unusual behavior is associated with irreversible domain wall motion which indicates the presence of domain wall pinning effect. In this case may be the domains are in minimum energy states by increasing the number of domains and thus bringing the domain walls to interact with pinning sites. Therefore, to move or to unpin the domain walls a higher magnetic field is required and because of this at small applied fields the domain walls move slowly and the initial magnetization curve lies outside the hysteresis loop. As the field is increased sufficiently, the pinning of the domain wall is overcome by the applied field and a normal initial curve is observed at higher field.

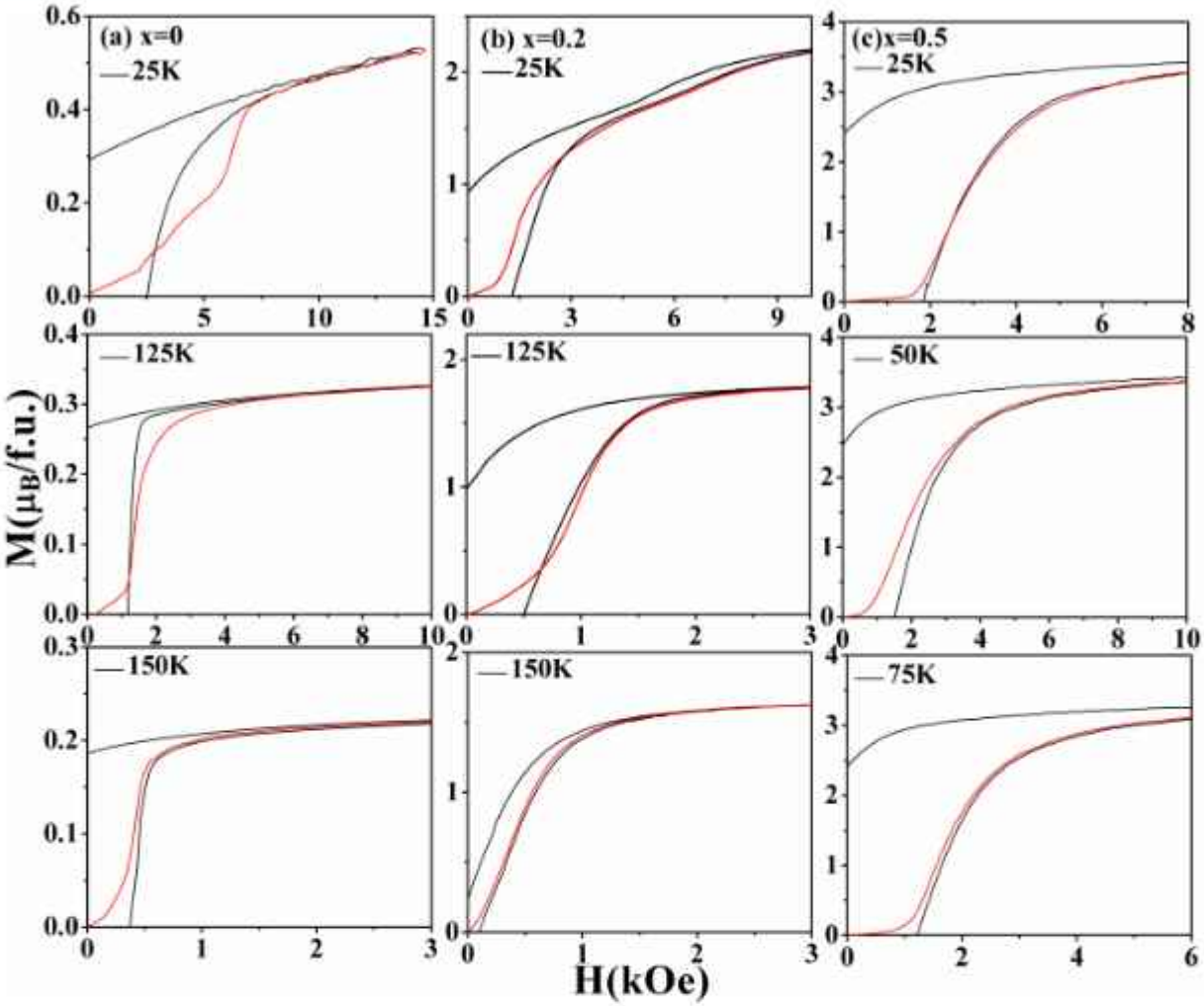

Figure 5. Initial magnetization (red line) and part of the hysteresis loop (black line) of (a) $x = 0$, (b) $x = 0.2$ and (c) $x = 0.5$.

However, the initial curve lies outside the loop only up to a certain temperature as mentioned above. Since the samples are cooled through the T_C for both the ZFC curve and the hysteresis loop measurements, the ZFC curve and the initial magnetization curve can be compared to understand this behavior. Figure 6 shows the ZFC magnetization curves (solid lines) recorded at 500 Oe and the initial magnetization values (open circles) at the corresponding field strength at different temperatures for x = 0, 0.1, 0.2 and 0.5 samples. Both are found to be identical as expected. Upon ZFC, the domain walls are pinned into random orientations and thus when a low field is applied, there is a competition between the random local magnetization orientation of the individual domain and the applied magnetic field, and the former one dominates at low temperature resulting in a magnetization lower than the expected. As discussed earlier, when the temperature increases the pinned domain walls become activated and slow motion of the domain

walls takes place resulting in a slow increase in magnetization. When temperature is further increased this pinning effect is completely overcome by the magnetic field energy and the increasing thermal activation energy, and the magnetization value reaches a maximum in the ZFC curve. This temperature is found to be about 150 K for $x = 0$, 0.1 and 0.2 samples which corresponds to the temperature at which the initial curve lies completely inside the hysteresis loop and below this temperature it lies outside. For $x = 0.5$ sample, though the complete peak in the ZFC curve is not observed but the increase in the magnetization occurs from about 30 K which means that the domain wall pinning effect become weaker at lower temperatures compared to the others and this is the reason for the initial curve to lie inside the hysteresis loop even at 50 K for this sample. Similar behavior is observed for the $x = 0.3$ and 0.4 samples which are not shown here. Similar unusual hysteresis behavior at low applied field and temperature is also likely to occur if competing antiferromagnetic interactions are present in the samples. Although the presence of such antiferromagnetic interactions at low temperature was not reported yet on $MnCo_2O_4$ based samples, further investigation is required to eliminate it in the present samples.

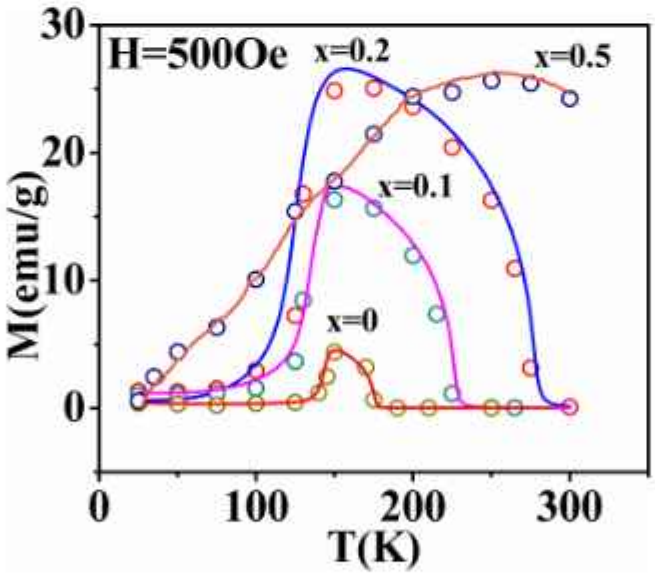

Figure 6. ZFC magnetization curve (Solid lines) for $x = 0, 0.1, 0.2$ and 0.5 at $H = 500$ Oe. The open circles correspond to magnetization values at 500 Oe taken from *M-H* loop at different temperatures.

CONCLUSION

$Mn(Co_{1-x}Fe_x)_2O_4$ ($x = 0 - 0.5$) samples were prepared by sol-gel route and all the samples were found to be crystallized in cubic spinel structure with $Fd\bar{3}m$ space group. The lattice parameter is found to increase systematically with increase in the Fe concentration. All the samples show FIM behavior and the T_C is found to increase with increase in Fe concentration. From the Curie-Weiss fit of the susceptibility data in paramagnetic region, the possible cationic distribution in this compound is found to be of the type $Co^{2+}[Co^{3+}_{1-2x}Fe^{3+}_{2x}Mn^{3+}]O_4$ with Co^{3+} in low spin state. The *M-H* loops recorded for both parent and Fe doped samples show unusual hysteresis behavior below a certain temperature which can be compared with the ZFC curve of each sample. Both the shape of ZFC curve and the unusual hysteresis behavior is attributed to the domain wall pinning effect which is found to decrease with increasing Fe concentration. However, further investigation is needed to confirm the absence of any competing antiferromagnetic interaction at low temperature.

ACKNOWLEDGEMENT

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Review 0n Metal Nanoparticles Embedded in Molybdenum Disulfide Nanosheets: Synthesis and Properties

Upama Das*[1], Dr.Sulochana Deb[2]
[1,2]Department of Physics, Gauhati University, Guwahati-781014, Assam, India
Email: upama.das96@gmail.com

ABSTRACT

Study of transition metal dichalcogenides (TDMCs) has become very crucial due to their wide range of applications in various fields such as sensors, supercapacitors, biological imaging, etc. Molybdenum Disulfide (MoS_2) nanosheet is a 2D TMDCs semiconductor, which is considered to be an ideal substrate as it gets easily hybridized in presence of functional group and results in formation of MoS_2-based nanocomposites. Amongst the different types of MoS_2-based nanocomposites, Metal-MoS_2 nanocomposite are unique due to their unusual and extraordinary properties. In this review, we will be focussing on the various techniques of synthesis and properties displayed by Ag-MoS_2, Au-MoS_2, Pd-MoS_2 and Pt-MoS_2 nanocomposites.

Keywords: Molybdenum Disulfide, Metal-Molybdenum Disulfide, Surface plasmon resonance (SPR).

1. INTRODUCTION:

The study of Molybdenum Disulfide (MoS_2) plays an important role due to their wide range of applications in lubricants, catalysis, sensors, supercapacitors, etc, [1-8]. MoS_2 nanosheets are 2D semiconductor which possess great chemical and thermal stability, large active surface area, high reactivity, and exhibit increased adsorption capacity [9-11]. Multi-layered MoS_2 nanosheets have indirect bandgap whereas monolayered MoS_2 nanosheets possess direct bandgap structure due to hybridization between the d orbitals of Mo atoms and p_z orbitals of S [12]. Various methods such as spin coating, metal organic chemical vapour deposition, sputtering technique, etc. are used for the synthesis of the MoS_2 nanosheets [13-20]. Deposition of metal nanoparticles such as silver NPs, gold NPs, palladium NPs and platinum NPs on the surface of the MoS_2 nanosheets enhances its properties due to the surface plasmon resonance (SPR) effect displayed by these NPs [21,22].

2. SYNTHESIS OF METAL-MOLYBDENUM DISULFIDE NANOCOMPOSITE

Embedding metal nanoparticles on the surface of MoS_2 nanosheets results in enhancement of properties displayed by the nanocomposite along with it the intrinsic properties of the nanosheet are also maintained [1].

Here, we have reviewed some of the popularly used techniques by the researchers present in literature for the synthesis of the Metal-MoS_2 nanocomposite.

2.1. Self-Assembly / Hierarchical Assembly method

For the preparation of Gold-Molybdenum Disulfide (Au-MoS_2) nanocomposite, Onur Parlak et al. dispersed MoS_2 nanosheets in phosphate buffer solution (PBS) and added AuNPs solution to it [20,23,24]. For synthesis of Silver-Molybdenum Disulfide (Ag-MoS_2) nanocomposite, Xiao-Dong Zhu et al. dissolved silver nitrate ($AgNO_3$), mercaptosuccinic acid (MSA) and sodium borohydride ($NaBH_4$) solution together and to it MoS_2 powder, Ag–MSA NPs and dehydrated copper dichloride ($CuCl_2$) was added [25-27].

2.2. Chemical synthesis method

Shao Su et al. prepared Au-MoS_2 nanocomposite, for which MoS_2 powder was dissolved in n-butyllithium solution in presence of argon (Ar), to it carboxymethyl cellulose (CMC) and $HAuCl_4 \cdot 3H_2O$ was added and the solution was heated in a microwave reactor [28]. A. J. Cheah et al. prepared Ag-MoS_2 nanocomposite, for which 2.0 mmol Na_2MoO_5 and 10.0 mmol L-cysteine (HO_2CCHCH_2SH) were mixed together and kept in an autoclave, and then to it hydrazine and the $AgNO_3$ solution were added dropwise [29].

2.3. Hydrothermal Method

M. Sookhakian et al. prepared Ag-MoS_2 nanocomposite for which ammonium heptamolybdate ($(NH_4)_6Mo_7O_{24}$) and thioacetamide (C_2H_5NS) were dissolved together and transferred to an autoclave. And then finally, silver-ammonia ($Ag(NH_3)_2OH$) solution was added to it [30].

2.4. Laser beam and Microwave assisted method

Chorng Haur Sow et al. prepared Au-MoS_2 nanocomposite by the laser assisted method for which initially a beam of laser was focused on the MoS_2 nanosheets which converted it into micropatterns containing active nucleation sites and then the nanosheets were dipped into auric chloride ($AuCl_3$) solution [31]. Lihui Yuwen et al. also prepared Au–MoS_2 nanocomposite by microwave assisted method for which MoS_2 nanosheet solution was dissolved in a mixture of

ascorbic acid (AA) aqueous solution, CMC aqueous solution and $HAuCl_4$ aqueous solution under microwave irradiation [32,33].

3. PROPERTIES OF METAL-MOLYBDENUM DISULFIDE NANOCOMPOSITES

3.1. Structural studies by X-Ray Diffraction method (XRD)

Structural properties of Ag-MoS_2 were determined by X. Wu et al. by using powder XRD method as shown in figure.3.1.(I). From the XRD data they have obtained it can be observed that the diffraction peaks at (002), (100), (103), and (110) refers to the MoS_2 nanosheets and additional diffraction peaks obtained at (111), (200), (220) and (311) are for the nanocomposite due to the contribution of the characteristic peaks of the AgNPs [34]. The XRD patterns of Au-MoS_2 nanocomposite obtained by Prianka Sharma et al. shown in figure 3.1.(II), displays diffraction peaks at (111), (200) and (220), which suggests that AuNPs on the surface of MoS_2 nanosheets are face centred cubic. Further, it can also be found that the intensity of the diffraction peaks obtained due to AuNPs increases with increase in concentration of AuNPs but it also decreases the diffraction peaks which are obtained due to MoS_2 as the AuNPs creates an obstruction for MoS_2 nanosheets and as a result it hinders its exposure area [35-37]. Eunjik Lee et al. characterised Pd-MoS_2 nanocomposite with XRD as shown in figure 3.1.(III). The peak of PdNPs at (111) indicates expansion of the lattice due to uptake of hydrogen and epitaxial relationship between Pd on MoS_2 which provides extra stability to the structure [38-44]. Lihui Yuwen et al. studied the XRD plots for Au-MoS_2, Ag-MoS_2, Pd-MoS_2 and Pt-MoS_2 nanocomposite. The XRD pattern obtained by them as shown in figure 3.1.(IV), reveals emergence of strong diffraction peaks at 38.5, 38.1, 40.3, and 40.0 upon deposition of AuNPs, AgNPs, PdNPs and Pt NPs, respectively on the surface nanosheets for the (111) cubic lattice planes of the NPs. The diffraction peak for MoS_2 becomes weaker as a result of surface modification of the nanosheets by metal NPs as they decrease the ordered restacking process of the MoS_2 nanosheets [33].

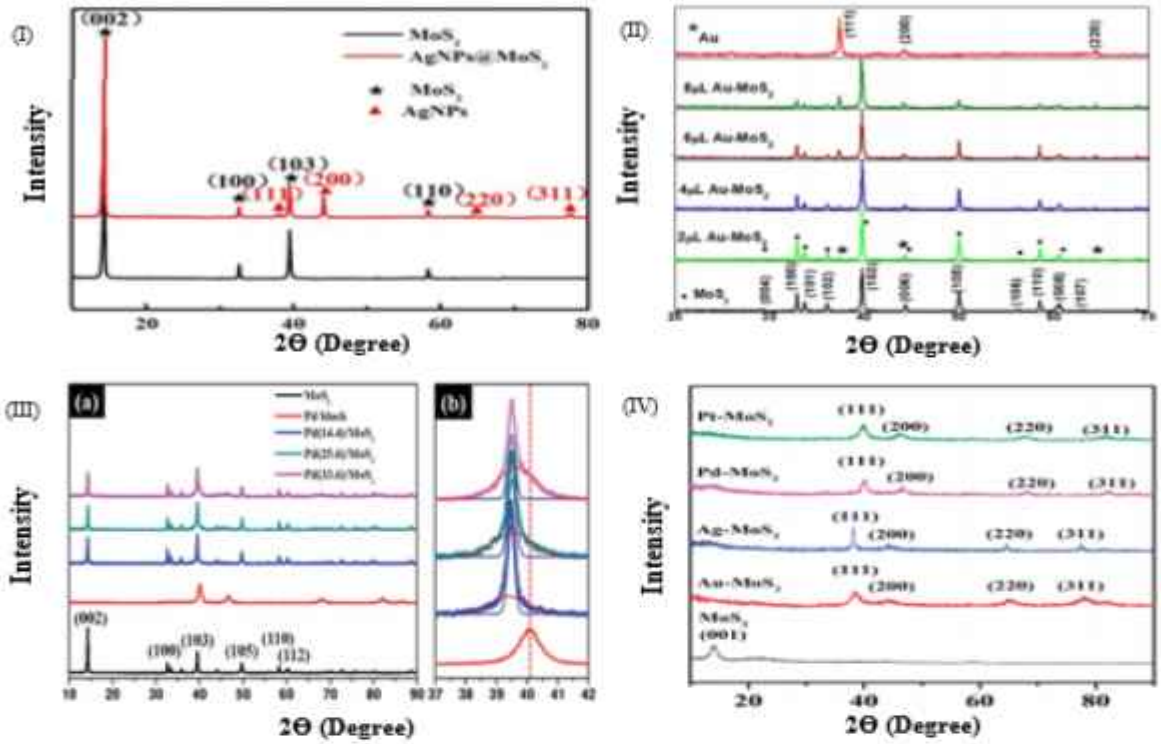

Figure 3.1 *XRD patterns of (I) MoS_2 nanosheets and Ag-MoS_2 nanocomposite [34], (II) MoS_2 and Au-MoS_2 nanocomposite with different concentration of AuNPs [35], (III) (a) MoS_2 and Pd-MoS_2 nanocomposite and (b) magnified view of deconvolution between Pd (111) indicated by red lines and MoS_2 (103) peaks by blue lines [38], (IV) MoS_2, Au-MoS_2, Ag-MoS_2, Pd-MoS_2 and Pt-MoS_2 nanocomposite [33].*

3.2. Morphological Properties

3.2.1. Morphological studies by using Transmission Electron Microscopy (TEM)

The TEM images for Ag-MoS_2 nanocomposite obtained by A. J. Cheah et al. shown in figure 3.2.1.(I) displays slight structural change in the MoS_2 nanosheets upon deposition of AgNPs as a result of partial removal of the S^{2-} ions by the use of the reducing agent, further the AgNPs also did not diffuse into the lattice of MoS_2 hence, no alloy was formed [29,45,46]. The TEM analysis for Au-MoS_2 nanocomposite was performed by Shao Su et al. as shown in figure 3.2.1.(II) depicts slight amount of change in the structure of nanosheets upon deposition of the AuNPs as the presence of NPs results in high density of energetic defects near the edges of MoS_2 nanosheets [47-49]. The TEM images for Pd-MoS_2 studied by Eunjik Lee et al. as shown in figure 3.2.1.(III) displays only horizontal interconnection between the PdNPs on the surface of nanosheet for low concentration of PdNPs, but when there is increase in concentration of PdNPs, one PdNPs gets

stacked over another, due to increase in electron density caused by thickening of the PdNPs layers on surface of MoS_2 nanosheets [38]. The TEM images obtained by Sagar H. Patil et al. as shown in figure 3.2.1.(IV), depicts that the spacing between lattice fringes of PtNPs was 0.22 nm which corresponds to the face centred cubic (111) planes of Pt NPs [50,51].

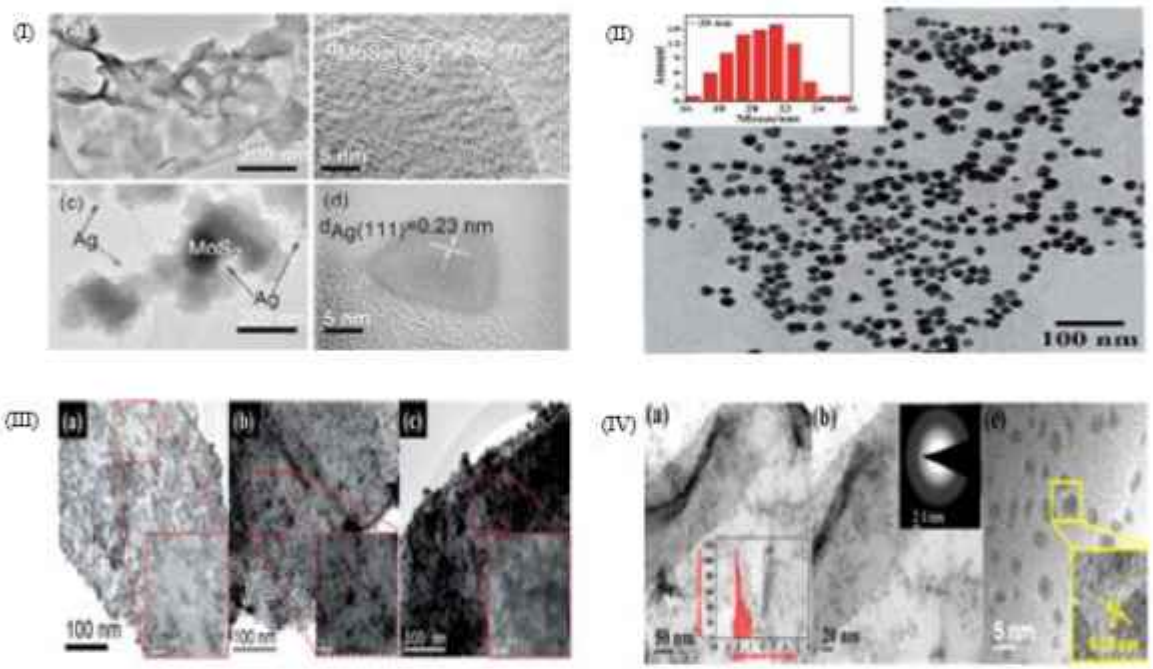

Figure 3.2.1. *TEM image of (I)(a) MoS_2 nanosheets, (b) MoS_2 nanosheet depicting defect-rich active edges, (c) 20 wt% Ag-MoS_2 nanocomposite, (d) AgNPs embedded on the MoS_2 nanosheet [29], (II) Au-MoS_2 nanocomposite [47], (III) (a) Pd (14.4)-MoS_2, (b) Pd (25.6)-MoS_2 and (c) Pd (33.6)-MoS_2. (Insets: enlarged images of marked area) [38], (IV) (a) PtNPs on MoS_2 nanosheets (Inset: histogram of Pt particle size distribution), (b) higher magnification of the nanocomposite, (Inset: electron diffraction pattern for Pt-MoS_2), (c) HRTEM image of Pt-MoS_2 (Inset: lattice fringe distance corresponding to (111) plane of Pt) [51].*

3.2.2. Morphological studies by Scanning Electron Microscopy (SEM)

Ameena Nazneen et al. used the SEM analysis to study the morphology of Ag-MoS_2 nanocomposite as shown in figure 3.2.2.(I), the images depict that on depositing AgNPs on the surface of MoS_2 nanosheet the sheet-like MoS_2 nanostructures change to particle like form, it occurred due to the presence of the AgNPs which increases the number of active sites and structural defects on the surface of MoS_2 nanosheet [52]. According to the SEM data of Au-MoS_2

obtained by Haofan Sun et al. as shown in figure 3.2.2.(II), the MoS_2 nanosheets were very thin and were highly exfoliated and the AuNPs were homogeneously dispersed on the surface the nanosheets [53]. Cihan Kuru et al. studied the morphological properties of Pd-MoS_2 as shown in figure 3.2.2.(III) it reveals that Pd-MoS_2 nanocomposite forms a continuous film in a self-assembled manner and the MoS_2 nanosheets were highly exfoliated as they appeared to be transparent [54]. From SEM images obtained by Sha Li et al. for Pt-MoS_2 nanocomposite shown in figure 3.2.2.(IV) reveals that PtNPs helps in maintaining the high edge defects in MoS_2 nanosheet and it also benefits by providing a real surface area to the active edges to the nanosheets [55].

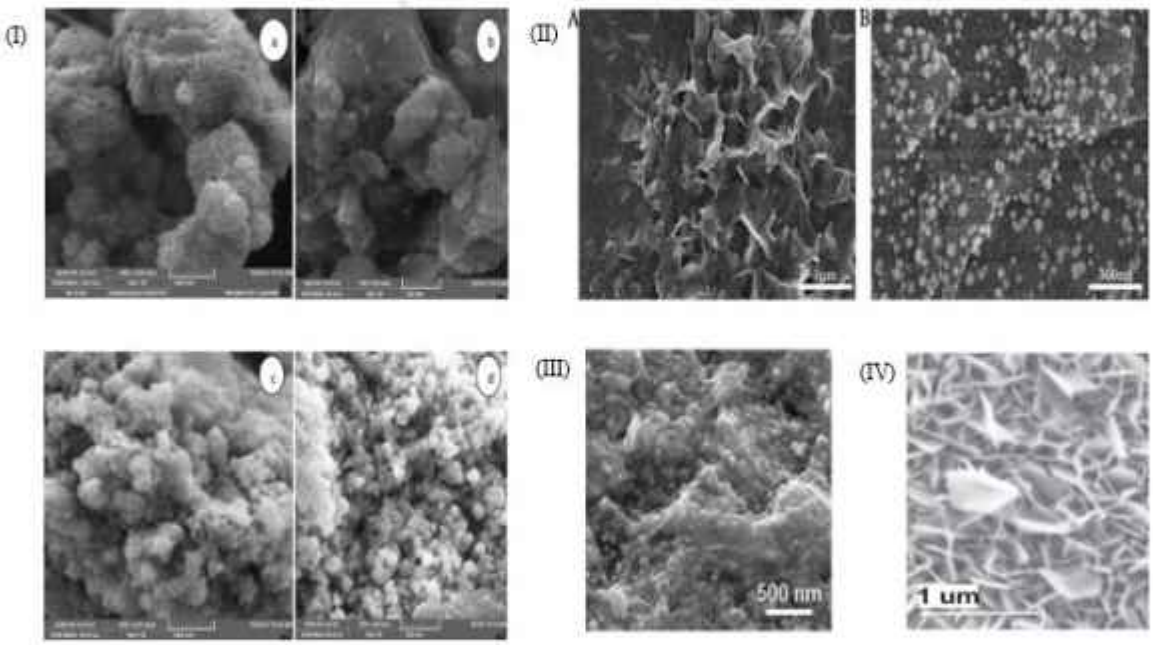

Figure 3.2.2. *SEM images of (I) (a) pure MoS_2, (b) 1% Ag-MoS_2, (c) 2% Ag-MoS_2 and (d) 3% Ag-MoS_2 nanocomposites [52], (II) (A) MoS_2 and (B) Au-MoS_2 nanocomposites [53], (III) High magnification SEM image of Pd-MoS_2 nanocomposite [54], (IV) Pt decorated on MoS_2 nanosheets (Pt-MoS_2) [55].*

3.3. Optical Properties

3.3.1. Optical studies by UV-Vis Spectroscopy

A.J. Cheah et al. used the UV-Vis spectroscopy to study the optical characteristics of the Ag-MoS_2 nanocomposite. The spectral data obtained by them is shown in figure 3.3.1.(I) which displays a broad absorption spectrum with peak centred at about 635 nm for MoS_2 nanosheets as

a result of excitation from the occupied to unoccupied 4d orbital of Mo, the absorption peak of Ag-MoS_2 nanocomposites also shows slight amount of blue shift and the presence of AgNPs on the surface of the nanosheet enhances the absorbance peak of the nanocomposites. At 400 nm and 438 nm, two small bumps or peaks were formed due to the localized surface plasmon resonance (SPR) of the AgNPs which occurs as a result of collective oscillation of the electrons in the conduction band, when the AgNPs interact with the incoming visible-light [29,56-60]. Shao Su et al. obtained two absorption peaks as shown in figure 3.3.1.(II), one intense peak was observed at around 260 nm and another at 320 nm for MoS_2, on addition of AuNPs the absorption peak which was earlier at 260 nm got blue shifted to 210 nm and another new peak was formed at around 550nm, which corresponds to the characteristic SPR peak for AuNPs. As the concentration of $HAuCl_4$ was increased, initially the absorption peak got red shifted but later on further increase in concentration of $HAuCl_4$ a blue shift of the absorption peak was observed which is due to plasmon coupling and refractive index effects displayed by the AuNPs [28,61-64]. Lihui Yuwen et al. studied the optical properties of Ag-MoS_2, Au-MoS_2, Pd-MoS_2 and Pt-MoS_2 as shown in figure 3.3.1.(III). In case of Au–MoS_2 nanocomposite, along with slight shift in position of absorption peak significant enhancement of the absorbance peak at 500 nm to 1200 nm can also be observed, which is due to the of coupling of the SPR of the AuNPs. For Ag-MoS_2 a wide absorption peak was formed beyond 400 nm which corresponds to the SPR peak of the AgNPs. For both Pd-MoS_2 and Pt-MoS_2 no new peaks were observed but the absorbance peak starting from 300 nm to 1200 nm increased to a great extent, which is due to a wide absorption range but no distinct absorption peaks in the UV-Vis or in the near infrared region for the case of PdNPs and PtNPs [33,65-67].

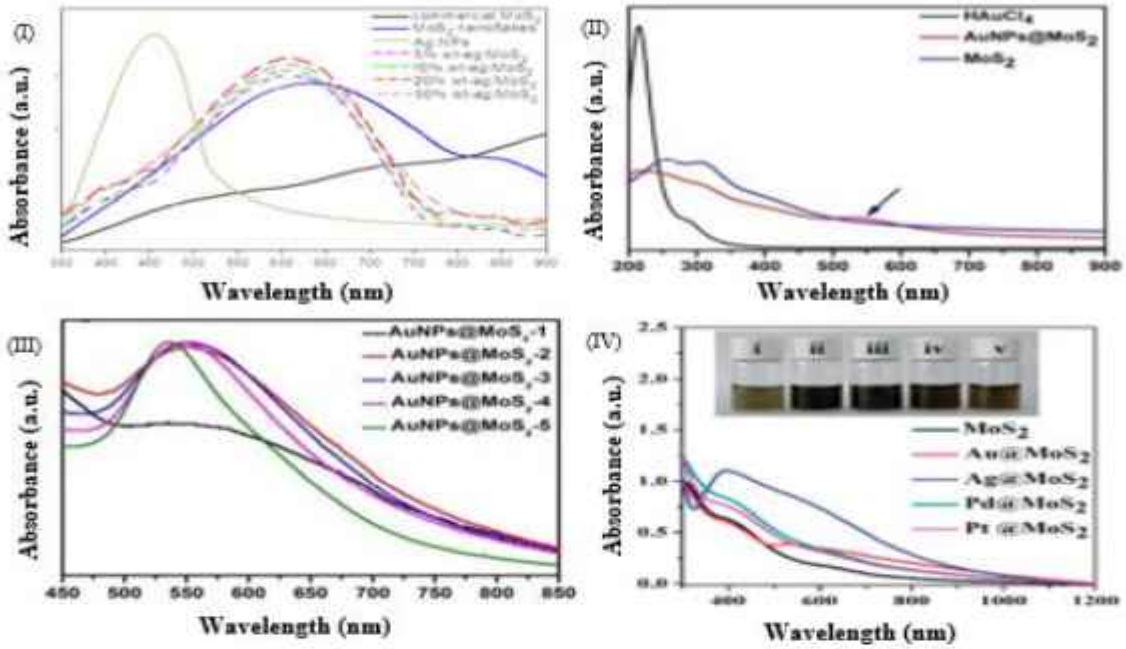

Figure 3.3.1 *UV-vis absorption spectra of (I) Bulk MoS_2, MoS_2 nanosheets and Ag-MoS_2 nanocomposite [29], (II) MoS_2 nanosheets and Au-MoS_2 nanocomposite, (III) Different concentrations of Au-MoS_2 nanocomposite [28], (IV) MoS_2, Au–MoS_2, Ag–MoS_2, Pd–MoS_2, and Pt–MoS_2 nanocomposite [33].*

3.3.2. Optical studies by Raman Analysis

X. Wu et al. used the Raman analysis to study the optical properties of Ag-MoS_2 nanocomposite as shown in figure 3.3.2.(I). From the figure, it can be observed that the characteristic peak of the 20wt.% Ag-MoS_2 nanocomposites was stronger compared to the low concentrations of the NPs on the nanocomposite samples, as higher concentration of AgNPs is responsible for large local intense electromagnetic fields due to surface plasmon resonance effect which is significantly localized at the nanoscale junctions [34,68]. Ameena Nazneen et al. investigated the molecular vibrations in Ag-MoS_2 nanocomposite. They observed that the active modes of the Raman bands of MoS_2 nanosheet are located at the peaks of 280 cm^{-1} (E_{1g}) and 381 cm^{-1} (E_{2g}). The band formed at 381cm^{-1} was formed as a result of antipodal vibration of two S atoms with a Mo atom. For low concentration of AgNPs, a low frequency vibrational mode (A_{1g}) was observed at 366 cm^{-1}, which occurs due to the distortion in structure due to the addition of AgNPs into the MoS_2 lattice. On further increasing the concentration of AgNPs, the low-frequency vibrational mode (A_{1g}) got shifted to 315 cm^{-1}. For higher concentration of AgNPs, many low-frequency vibrational modes appeared at 354 cm^{-1} (A_{1g}), 364 cm^{-1} (A_{1g}), 343 cm^{-1} (A_{1g}), 333 cm^{-1} (A_{1g}), and 323 cm^{-1} (A_{1g}).

Upon comparing these peaks with that of the MoS_2 nanosheets it can be justified that on increasing the concentration of AgNPs, slight shifts and variation in the peaks at 280 cm^{-1} and 380 cm^{-1} were observed, which depict increase in structural defects [52,69-77]. Prianka Sharma et al. investigated the vibrational modes of Au-MoS_2 nanocomposite as shown in figure 3.3.2.(II). When AuNPs was added to the nanocomposite to form Au-MoS_2, a red shift of the E^1_{2g} and A_{1g} modes can be observed and the new frequency difference between E^1_{2g} and A_{1g} modes came out to be about 25 cm^{-1}. This shifting of the peak occurs as the lattice sites gets strained due to presence of AuNPs on the MoS_2 nanosheets. Increasing the concentration of AuNPs enhances the intensity peaks of the Raman spectra due to localized surface plasmon resonance (LSPR) displayed by AuNPs. Presence of AuNPs increases the electric field near the surface of AuNPs and thus, a peak of sharp intensity was obtained. This phenomenon is termed as Surface Enhanced Raman Scattering (SERS) [35,78,79]. L. Z. Hao et al. studied the properties of Pd-MoS_2 nanocomposite as shown in figure 3.3.2.(III). It was observed that the MoS_2 film exhibits two characteristic Raman peaks one of E^1_{2g} mode at 376 cm^{-1} due to the S and Mo atoms as they were oscillating in the antiphase parallel to the crystal plane and another of the A_{1g} mode at 410 cm^{-1} due to the S atoms oscillating in the antiphase out-of-plane. When the PdNPs were decorated on the surface of the MoS_2 nanosheet, red shift of about 6.0 cm^{-1} of the A_{1g} peak was observed whereas, there was no change in position of the E^1_{2g} peak, due to which the separation between the E^1_{2g} and A_{1g} peaks decreases, which is due to the fact that for Pd-MoS_2 the A_{1g} phonons couple more tightly with electrons than E^1_{2g} phonons, which causes a significant change in the electronic structure and semiconductor characteristics of the nanocomposite [41,80].

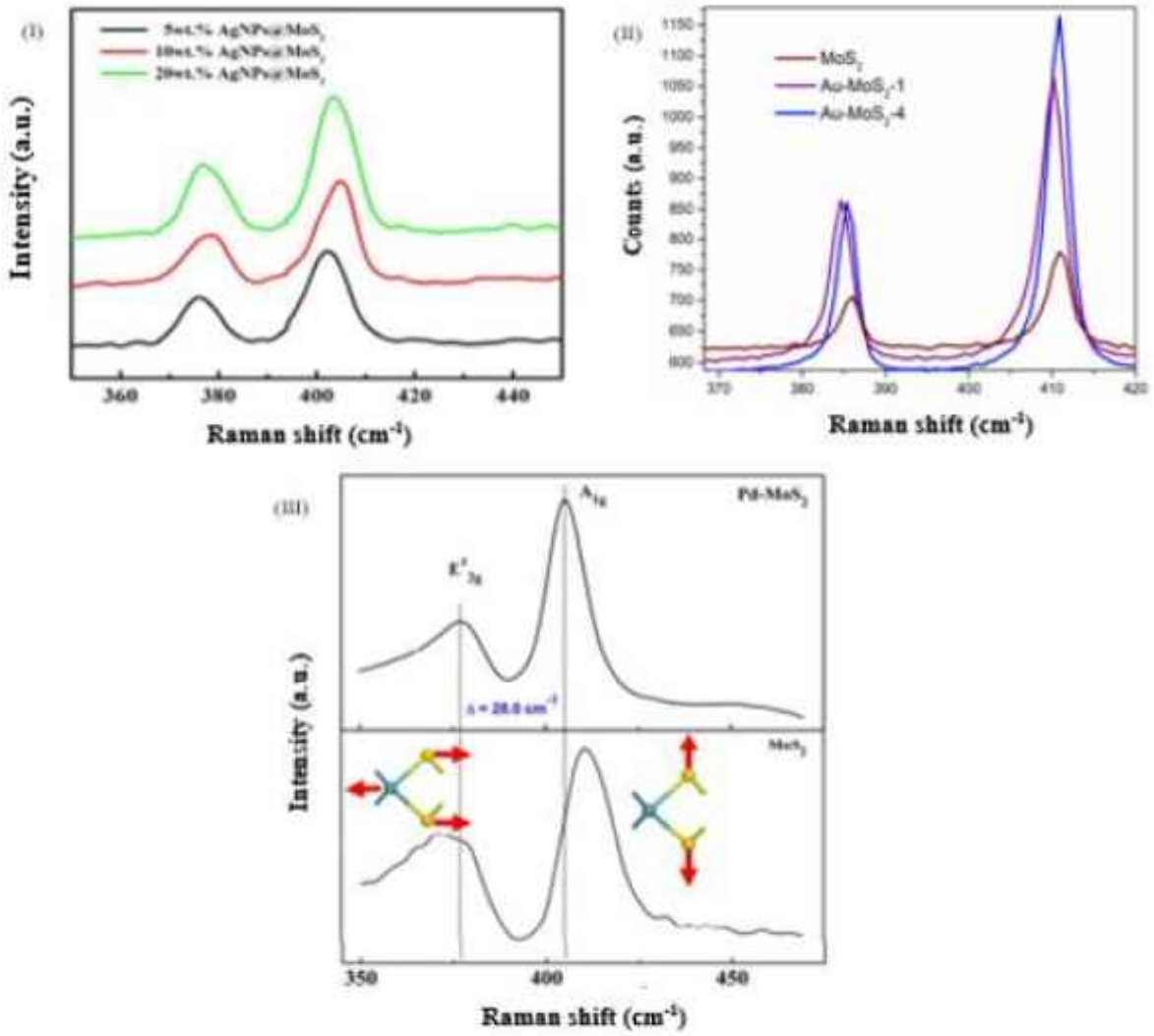

Figure 3.3.2. *Raman characterization of (I) 5wt.%, 10wt.%, and 20wt.% Ag-MoS_2 nanocomposites [34], (II) MoS_2 and Au-MoS_2 nanocomposite, [35], (III) Pd-MoS_2 film (top) and MoS_2 film (bottom) (inset: oscillation of E^1_{2g} (left) and A_{1g} (right) modes) [41].*

CONCLUSION

Among the different types of Metal-MoS_2 nanocomposites, the Ag-MoS_2 nanocomposites are most useful due to their tuneable optical (PL) properties, excellent electrical conductivity and extraordinary magnetic properties. The type of the band gap displayed by the MoS_2 nanosheets depends on the number of layers of the nanosheet. Occurrence of blue or red shift in the absorption peak of MoS_2 depends upon the size of metal NPs deposited on the surface of MoS_2 nanosheets. In case of Au-MoS_2, the peak obtained at 210 nm got blue shifted due to the small size of the nanoparticles embedded on the nanosheets. For both Ag-MoS_2 and Au-MoS_2 nanocomposite another characteristic peak at 430nm and 550 nm, respectively was observed due

to the SPR phenomenon displayed by these noble metals NPs, but for Pd-MoS_2 and Pt-MoS_2 no new peaks were formed but a huge increase in the existing absorbance peak was observed, as both PdNPs and PtNPs do not display any distinct absorption peaks due to SPR phenomenon in the UV-Vis or in the near infrared region. The XRD diffraction peaks suggest that the Metal-Molybdenum Disulphide nanocomposites are hetero crystalline in structure. The intensity of the peaks for Raman spectra has also been enhanced by embedding the NPs on the surface of the nanosheets due to the increase in structural defects which resulted in formation of new peaks. In case of Pd-MoS_2 the A_{1g} phonons couple more tightly with electrons than E_{2g}^1 phonons which results in significant change in the electronic structure and semiconductor characteristics of the nanocomposite. Analysing the morphological properties, it was found that certain nanocomposite which were prepared by using the chemical reduction process displayed structural defect due to the partial removal of the S^{2-} ions by the use of reducing agent.

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High Power Analysis of a Junctionless Field Effect Transistor With High K Spacer and Low Work Function Gate Material

A. Baro*[1], K.C.D. Sarma[2]

[1, 2]Department of Instrumentation Engineering, Central Institute of Technology Kokrajhar, Kokrajhar, INDIA

Email: *anganju1992@gmail.com*

ABSTRACT

This paper presents a high power analysis of Junctionless field effect transistor (JLFET) with High K Spacer and Low Work Function Gate Material. The structure consists of Hafnium Oxide (HfO_2) as spacer. The work function of the gate material is selected in such a way that the device is Normally off in the absence of externally applied gate field. The high K spacer helps in reducing off-state leakage while low work function gate material results reduction of on-state loss making the device suitable for high power applications. Various performance parameters such as off current, on-state resistance etc of the proposed structure are compared with conventional JLFET and Power Metal oxide semiconductor field effect transistor (MOSFET) on Cogenda VisualTCAD 1.8.2 simulation platform. The simulation results shown that the device exhibits lower off current, lower on-state resistance and lower subthreshold swing compared to that of conventional JLFET and Power MOSFET.

Keywords: High power, JLFET; Low work function; High K Spacer`

INTRODUCTION:

Power semiconductor devices are unavoidable part of almost all modern industries. Power MOSFET is one of the most widely used power devices as it possesses very low switching loss and handle very high power. However the on-state resistance of Power MOSFET is comparatively higher which causes a significant increase in on-state loss in small dimensions. A Junctionless Field Effect Transistor (JLFET) exhibits much lower on-state resistance compared to Power MOSFET. But it posses higher off state loss. Therefore a novel technique to reduce the off-state loss while keeping

the on-state loss to a minimum is proposed in the paper. The structure uses a high K spacer and low work function gate material which improves the performance of the device by a fringing field.

DEVICE STRUCTURE AND SIMULATION:

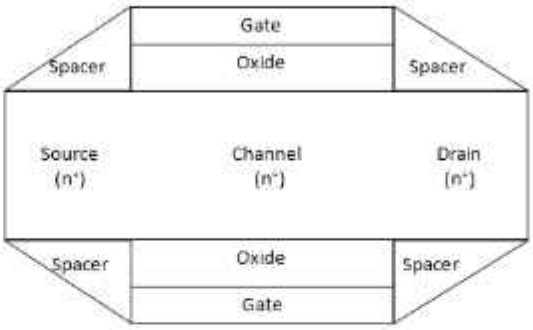

Figure 1. Symmetric Double gate JLFET with high K spacer

The simulation work is performed in COGENDA VisualTCAD platform. Carrier statistics used for the study is Fermi-Dirac statistics without impact ionization.

RESULTS AND DISSCUSSIONS

Variations of on current and off current for different values of drain voltages, gate oxide thicknesses, channel thicknesses, doping concentration and gate dielectric materials are shown in table 1 to table 5.

Higher drain voltage results in higher current (both on and off) as it is the biasing voltage and Drain induced barrier lowering effect is more for higher drain voltage.

Thinner gate oxide implies higher gate capacitance and higher gate controllability. Therefore off current is lower while on current is higher for thinner gate oxide.

Thicker channel results in lower channel resistance causing both on and off current to rise. Higher doping concentration results in higher current due to increase in total charge in the channel.

Gate dielectric material with higher dielectric constant results in higher gate capacitance. Therefore off current is lower while on current is higher for a high K dielectric such as HfO_2.

From all the tables it can be seen that proposed structure exhibits better characteristics with reduced off current and larger on current because fringing field resulting from the spacer.

Table1. On-current and Off-current for various drain voltages

Drain Voltage(V)	Off-current (A)		On Current (A)	
	Proposed Structure	Conventional Structure	Proposed Structure	Conventional Structure
100	$0.57x10^{-6}$	$0.835 x10^{-6}$	11.2	8.35
140	$1.04 x10^{-6}$	$1.38 x10^{-6}$	15.4	10.8
180	$1.17 x10^{-6}$	$1.52 x10^{-6}$	16.64	11.3

Table2. On-current and Off-current for various gate oxide thicknesses

Gate oxide thickness (nm)	Off-current (A)		On Current (A)	
	Proposed Structure	Conventional Structure	Proposed Structure	Conventional Structure
2	$0.57x10^{-6}$	$0.835 x10^{-6}$	11.2	8.35
4	$6.15 x10^{-6}$	$3.28 x10^{-6}$	7.41	6.62
6	$10.72 x10^{-6}$	$8.23 x10^{-6}$	4.64	3.31

Table3. On-current and Off-current for various channel thicknesses

Channel thickness (nm)	Off-current (A)		On Current (A)	
	Proposed Structure	Conventional Structure	Proposed Structure	Conventional Structure
10	$0.57x10^{-6}$	$0.835 x10^{-6}$	11.2	8.35
20	$9.3 x10^{-6}$	$12.38 x10^{-6}$	25.4	15.8
30	$16.7 x10^{-6}$	$18.2 x10^{-6}$	44.64	21.2

Table4. On-current and Off-current for various doping concentration

Doping Concentration ($/cm^3$)	Off-current (A)		On Current (A)	
	Proposed Structure	Conventional Structure	Proposed Structure	Conventional Structure
10^{19}	$0.57x10^{-6}$	$0.835 x10^{-6}$	11.2	8.35
10^{18}	$0.18 x10^{-6}$	$0.27 x10^{-6}$	9.52	7.6
10^{17}	$0.023 x10^{-6}$	$0.036 x10^{-6}$	7.61	5.3

Table5. On-current and Off-current for various gate dielectric

Gate Dielectric	Off-current (A)		On Current (A)	
	Proposed Structure	Conventional Structure	Proposed Structure	Conventional Structure
SiO_2	$0.57x10^{-6}$	$0.835 x10^{-6}$	11.2	8.35
Si_3N_4	$0.43 x10^{-6}$	$0.58 x10^{-6}$	12.2	9.7
HfO_2	$0.19 x10^{-6}$	$0.32 x10^{-6}$	21.16	13.2

CONCLUSIONS

High power analysis has been done for a JLFET with high K spacer with low work function gate. Off current and on current of the proposed structure of the proposed structure has been compared with conventional structure. The simulation study shows that the proposed structure exhibits higher on current and lower off current compared to that of conventional structure.

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A Review on Layered Graphene Oxide and Transition Metal Dichalcogenides Material: Synthesis and Application in Memory Devices

Nipom Sekhar Das[1] and Avijit Chowdhury[1,]

[1]Organic Electronics and Sensor Laboratory, Department of Physics, National Institute of Technology Silchar, Cachar, Assam-788010, India.
E-mail: avijitiacs@gmail.com

ABSTRACT

Two-dimensional (2D) layered materials such as graphene oxide (GO) and transition metal dichalcogenides (TMDs) have drawn growing attention due to their excellent physical and structural properties and have been considered as a promising candidate in photonics, electronic, energy storage, sensing, optoelectronic devices. Here, different synthesis processes of layered materials have been reviewed. Recent progresses of non-volatile memory devices based on these materials with and without polymer have been discussed and trying to focus on memory characteristics such as I_{on}/I_{off} ratio, switching voltages, endurance, retention which are very important parameter for designing next generation electronic devices.

Keywords: Graphene oxide, transition metal dichalcogenide, layered, endurance, retention

INTRODUCTION:

During the past few years, a wide research is going on in the field of 2D layered materials such as graphene, TMDs etc. Graphene was first introduced as a wonder material with 2D sheet of carbon atoms [1]. Prof A. K. Geim and K.S. Novoselov was awarded Nobel prize for their groundbreaking discovery of graphene [2]. The schematic diagram of graphene has been presented in Fig.1.

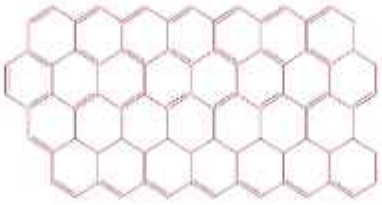


Figure 1. Schematic diagram of graphene.

The term graphene emanates from the prefix graph from graphite and the suffix ene from polycyclic aromatic hydrocarbons as for e.g., naphthalene, anthracene etc. It is a two-dimensional layer of sp^2 hybridized carbon atoms with π electrons. Graphene have grabbed increasing attention because of their outstanding physical, chemical and structural characteristics which include high intrinsic strength of 136 GPa, specific area of 2620 m^2/g, Young's modulus of 1 TPa, high electrical and thermal conductivity [3] and have perceived promising applications in various modern technologies such as electronic devices, sensors, energy storage devices etc. [4,5]. Despite of all these properties it has major drawback of low dispersibility in water which limits its applications. Moreover, due to zero band gap in graphene causes major limitations in data storage applications. On the other hand, GO shows increased band gap, improved solubility, and also displays considerable mechanical and electrical properties. To overcome this drawback, oxygen functional groups are introduced on the graphene sheets by chemical oxidation. Oxidation of graphite-to-graphite oxide was discovered by Schafhaeutl and Brodie in 1840 and 1855, respectively [6-8]. The method of synthesizing graphene oxide (GO) had already been developed by Brodie in 1859 where he accomplished a reaction between graphite and $KClO_3$ [9]. After that Staudenmaier increased the acidity of the mixture by adding H_2SO_4 and chlorate during the whole process in 1898. Later Hummer and Offeman enhanced the procedure by oxidation using $NaNO_3$, $KMnO_4$ and Concentrated H_2SO_4 [10]. Hummers' formulated the experimental method where graphite was oxidized by taking $KMnO_4$, $NaNO_3$ in concentrated H_2SO_4 in 1958 [11]. It is schematically presented in Fig.2.

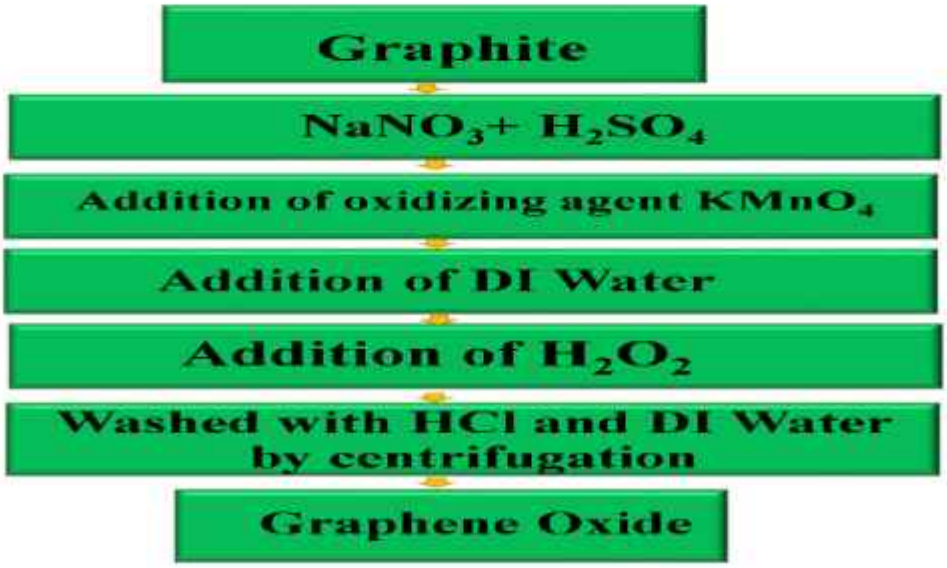
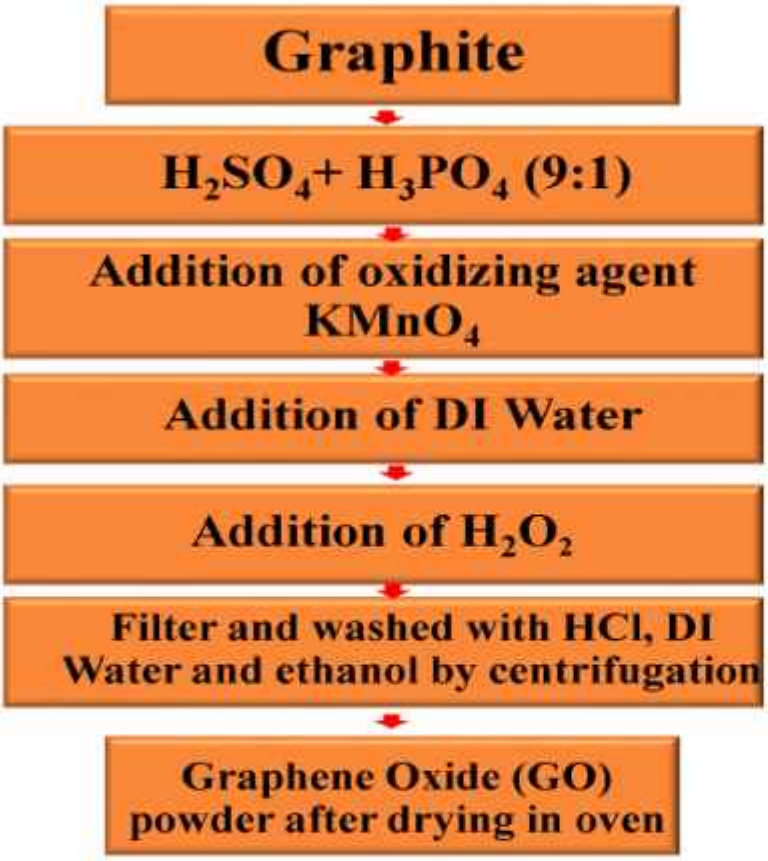


Figure 2. Schematic diagram of synthesis of GO by conventional Hummers' method.

GO can be synthesized by ultrasound assisted modified Hummer's method from expanded graphite [12]. This method is highly productive, less energy consuming and time saving. Use of $NaNO_3$ emit toxic gases therefore, in improved Hummers' method $NaNO_3$ is replaced by H_2SO_4 and H_3PO_4 which gives the advantages such as equivalent conductivity, emission of no toxic gas, hydrophilic carbon nanomaterials as shown in Fig 3.



GO is a single thick layer of graphite oxide which contains oxygen functional groups such as carboxylic (-COOH), carbonyl (-C=O), hydroxyl (-OH), epoxy (-O-) at the edges and the basal planes respectively [13, 14]. A diagram of graphene oxide is schematically presented in Fig. 4.

Figure 3. Schematic diagram of synthesis of GO by improved Hummers' method.

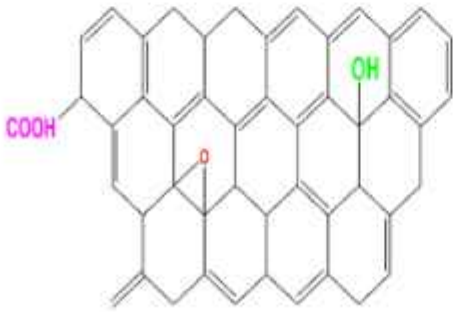


Figure 4. Schematic diagram of graphene oxide (GO).

It can be exploited for memory application because of their outstanding electrical and structural properties [15]. Due to the existence of energy gap and defect states in graphene oxide, it becomes an outstanding charge trapping layers in resistive memory devices [16]. Classification of memory is schematically shown in Fig. 5.

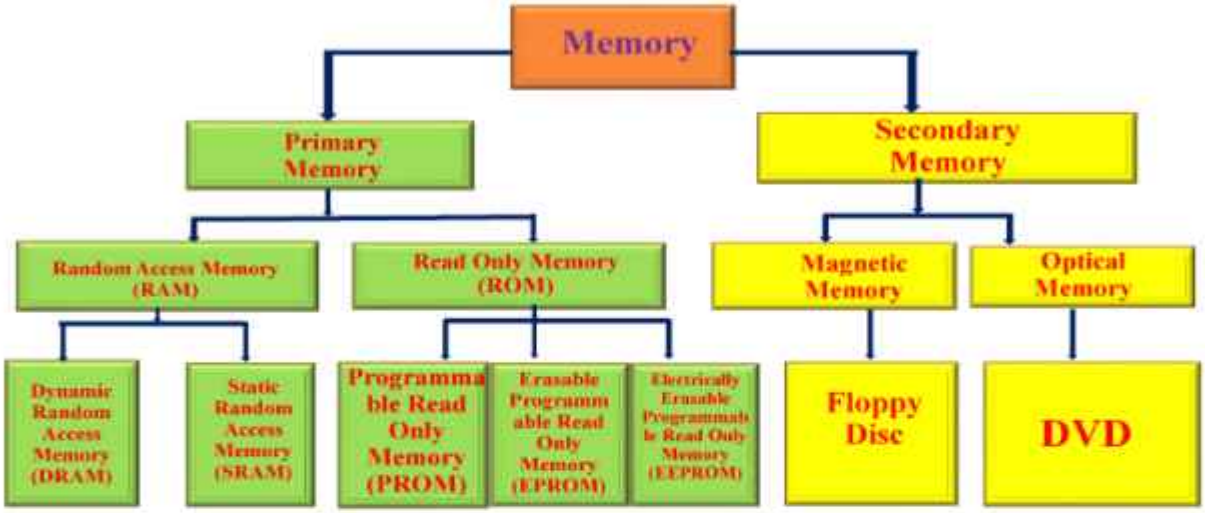


Figure 5. Schematic diagram of classification of memory

Alongside, 2D layered transition metal dichalcogenides (TMDs) (MX_2 where M corresponds to Sn, Mo, W etc. and X corresponds to S, Se etc.) have drawn immense attention due to their distinctive electronic and optical properties [17,18]. Diagram of TMDs is schematically presented in Fig. 6.

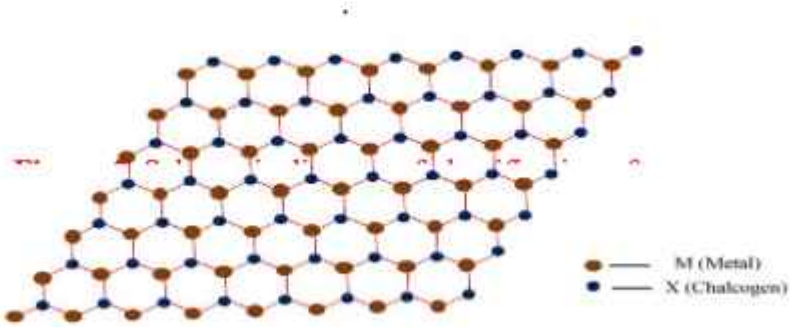


Figure 6. Schematic diagram of MX_2 (Metal dichalcogenide).

Among different TMDs, MoS_2 is one of the promising 2D layered material after graphene and having direct band gap of about 1.9 eV [19]. In MoS_2, Mo layer has been sandwiched between two sulfur layers via van der Walls forces similar to graphite [20] and have potential application

in electronics after conventional silicon. MoS_2 nanostructure can be synthesized through simple hydrothermal method [21] schematically shown in Fig.7.

Figure 7. Schematic diagram of synthesis of MoS_2.

Resistive switching in organic/ inorganic nanofillers have drawn promising attention because of their considerable physical and structural characteristics. Recently, carbon-based material particularly GO and TMDs have been under comprehensive investigation due to their broad exploitation in resistive memory devices because of their outstanding charge transport properties. Recently, Jeong *et al*. fabricated the device Al/GOs/Al which showed bipolar resistive switching with retention time more than 10^5 sec and I_{on}/I_{off} 10^2 [22]. Wu *et al*. fabricated the multistacking layered device PS/SLG/PMMA/SLG/PMMA and observed the tristable resistive memory characteristics with current on/ off (I_{on}/I_{off}) ratio of about 10^4 [23]. He *et al*. fabricated the Cu/GO/Pt device and observed that the device showed bipolar resistive switching nature with a retention time longer than 10^4 s and I_{on}/I_{off} about 20 [24]. Liu *et al*. fabricated the device Al/GO-PVK/ITO and the device showed bistable electrical conductivity switching with endurance up to 10^8 [25]. Rehman *et al*. fabricated the device Ag/WS_2/Ag and observed the bipolar resistive switching behavior with retention 10^5 s and I_{on}/I_{off} 10^3 [26]. Lee *et al*. fabricated the Al/ WS_2 NSs: PMMA/ITO/PEN device, which exhibited bipolar switching nature and I_{on}/I_{off} ratio up to 10^4 [27]. Deepak *et al*. fabricated the Al/MoS_2(PVDF-HFP)/ITO device and the device showed the bipolar resistive switching with I_{on}/I_{off} 10^4 [28]. Memory device structure is schematically presented in Fig.8.

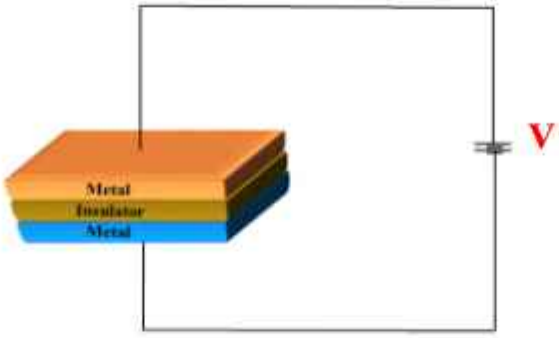


Figure 8. Schematic diagram of memory device structure.

DIFFERENT SYNTHESIS PROCESSES OF 2D LAYERED MATERIALS

Various approaches have been followed over the years for the production of low cost, high quality and highly efficient 2D layered materials. The methods include hydrothermal method, sol gel technique, top-down approach, bottom-up approach etc.

Hydrothermal Method: It is one of the very well-known and suitable methods for the synthesis of nanomaterial. In this process the production of nanomaterial can occur in a temperature that ranges from room temperature to very high temperatures. The desirability of the method is its capability to produce crystalline phases that are not steady at the melting point.

It is an efficient method for the synthesis of GO based material which is carried out in high vapour pressure and temperature. Moreover, this method is very environmentally friendly, cost effective. Hydrothermal method can also be regarded as solvothermal method which is performed in a teflon lined stainless steel autoclave and where the temperature ranges from 160°C to180°C [29-31].

Sol gel technique: Sol gel process is a very known method. It is a wet chemical process use for the synthesis of solid materials from small molecules. The sol gel derived inorganic compounds need very low temperature for the synthesis [32].

Top-down approach: It involves the breakdown of bulk materials into small nanomaterials schematically shown in Fig. 9 (a). This method implies that the nanostructured materials are synthesized after removing the crystal planes which are present in the substrate. It has the

advantage of large-scale production, moreover, chemical purification is not required in this method. This approach includes liquid phase exfoliation method, micromechanical exfoliation.

Liquid phase exfoliation method is widely used for synthesizing cost effective two-dimensional nanosheet. It is one of the largely acceptable procedure for the large-scale production of few layered 2D nanomaterial which is cost effective [33].

Micromechanical exfoliation is a method for producing low defects, high quality, and thin materials. It is a widely used method that offers high quality 2D nanostructured materials, allowing to study the properties, and outstanding device performances [34].

Bottom-up approach: It involves physical or chemical process for constructing larger compounds from basic units' atom by atom, molecule by molecule, schematically shown in Fig. 9(b). It has many advantages such as high accuracy, less wastages etc. Ultra-fine nanoparticles can be produced, but in this method large-scale production is very difficult, and chemical purification is needed. This method includes physical vapour deposition, chemical vapour deposition etc. [35].

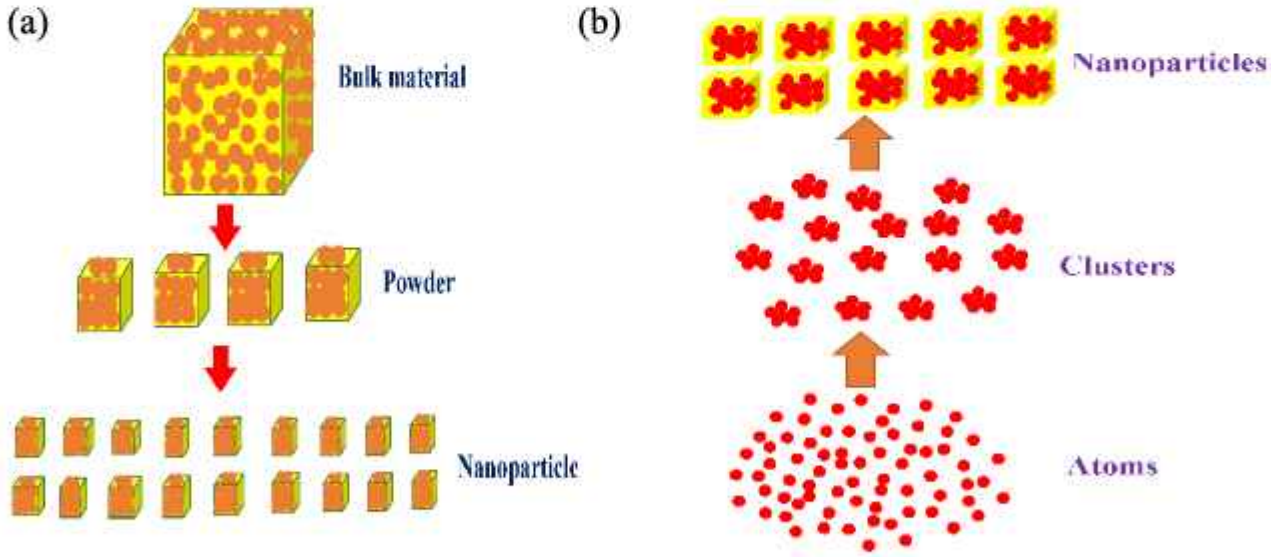


Figure 9. Schematic diagram of (a) Top-down approach (b) Bottom-up approach.

2D LAYERED MATERIAL BASED NON-VOLATILE MEMORY DEVICES

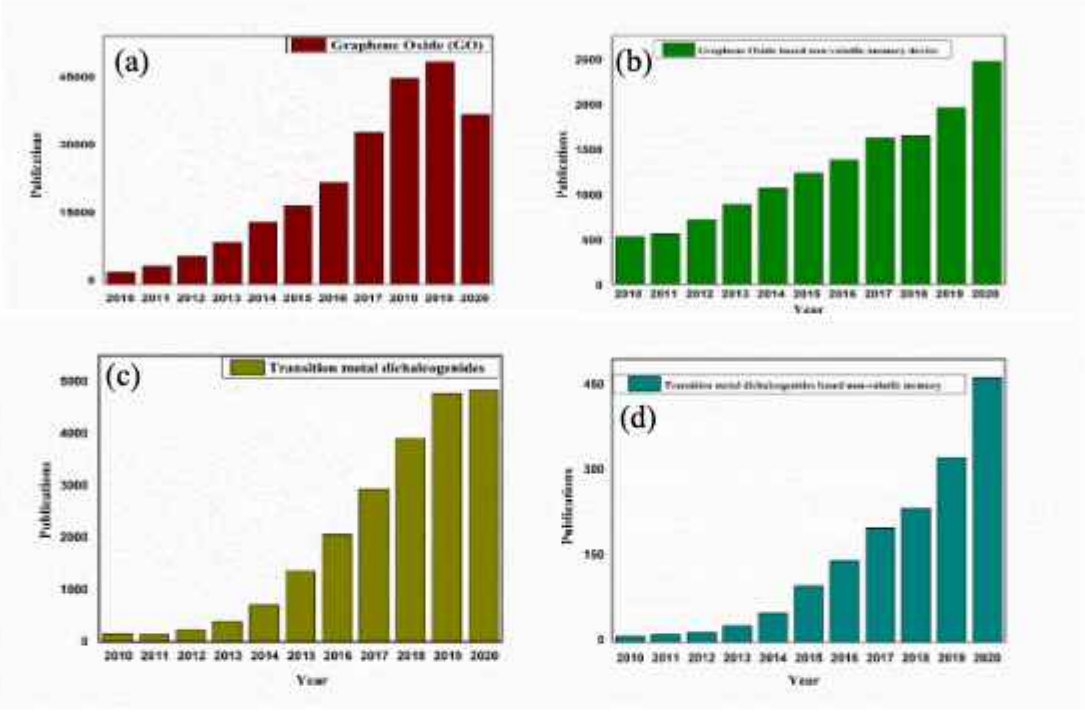


Figure 10. Publication vs Year graph of (a) Graphene oxide (GO) nanomaterials (b) GO based non-volatile memory devices (c)Transition metal dichalcogenides (TMDs) (d) TMDs based non-volatile memory devices (Data obtained from Google Scholar).

Fig.10 shows the publications of layered material-based memory devices over the past few years. Functionalized layered nanohybrid materials have been exploited in various applications such as sensor, supercapacitor, and resistive random access memory devices. Recently, researcher have been focussing on the fabrication of memory devices with simple structure and easy fabrication technique. The important parameters for designing high performance memory devices are high density, high I_{on}/I_{off} ratio, long retention time, good endurance property, reproducibility, and high switching speed. To achieve such memory properties various semiconducting and insulating materials are explored to exhibit the resistive memory properties. Among the different known organic-inorganic layered nanohybrid materials two-dimensional layered carbon-based materials and transition metal dichalcogenides with or without polymeric materials have drawn immense attention because of their outstanding performances in modern electronic devices. Various 2D layered material-based memory devices and their memory characteristics is shown in Table 1.

Table 1. Two-dimensional layered material-based memory device

DEVICE STRUCTURE	V_{SET} (VOLT)	V_{RESET} (VOLT)	I_{ON}/I_{OFF}	ENDURANCE CYCLES	RETENTION TIME (SEC)	MEMORY EFFECT	PUBLICATION YEAR	REFERENCES
RGO/MOS_2 - PVP/AL	-	-	10^2	-	-	THE DEVICE EXHIBITED THE ELECTRICALLY BISTABLE BEHAVIOR.	2012	36
AG/MOS_2 + PVA/AG	-	-	10^2	10^3	10^5	BISTABLE, NON-VOLATILE AND REWRITABLE RESISTIVE SWITCHING BEHAVIOR.	2016	37
RGO/ MOS_2- P123/ RGO/PET	-	-	10^2	-	10^3	IT SHOWED THE NON-VOLATILE FLASH	2015	38

						MEMORY DIODE BEHAVIOR.		
RGO/ MOS_2-ZIF8/ RGO/PET	-	-	10^4	-	10^3	IT SHOWED THE WRITE-ONCE-READ-MANY-TIMES (WORM) MEMORY CHARACTERISTICS.	2014	39
AL/GOS+PMMA/ITO	-1.87	-	10^4	-	10^4	THE DEVICE EXHIBITED THE WORM CHARACTERISTICS.	2019	40
ITO/PMMA/ RGO-CDS/PMMA/ AL	-0.48	2.88	10^6	10^3	10^4	THE DEVICE EXHIBITED BIPOLAR RESISTIVE SWITCHING CHARACTERISTICS.	2020	41
ITO/ GRAPHENE -MOS_2 + PMMA/CU	-1.0	1.0	$>10^4$	10^4	10 DAYS	THE DEVICE EXHIBITED NON-VOLATILE RRAM.	2018	42

ITO/PS+GO/AL	-0.80 TO -1.55	3.7 TO 5.2	10^3	10^4	10^5	THE DEVICE EXHIBITED REWRITABLE, NON-VOLATILE TERNARY MEMORY PROPERTY.	2017	43

RRAM: Resistive Random-Access Memory; PS: Polystyrene; PVA: Polyvinyl Alcohol; PVP: Polyvinyl pyrrolidone; P123: Poly (ethylene glycol)- poly (propylene glycol)-poly (ethylene glycol); ZIF8: Zeolitic imidazolate framework; PMMA: Poly (methyl methacrylate).

CONCLUSION

In summary, different methods have been investigated for the synthesis of low cost, environmentally friendly, high quality and highly efficient two-dimensional layered materials in this review article. Micromechanical exfoliation and liquid phase exfoliation provide the highest material quality and compatible for modern research and large-scale industrial production. Recent progresses of non-volatile resistive memory devices based on various organic/inorganic layered material such as GO, TMDs e.g., MoS_2 are discussed thoroughly. From the review it can be summarized that layered materials hold promising attention as active layers in next generation electronic devices. Different electrical switching behaviors such as current on/off (I_{ON}/I_{OFF}) ratio, retention time, switching voltages are investigated here to compare the reliability of the memory devices. Current research on 2D layered materials and their nanocomposites are highly appreciated because of their outstanding physical and electronic properties in non-volatile memory devices.

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Estimation of Radon Exhalation Rate in Soil Samples of Oil Field Area of Tinsukia District of Assam and its Possible Correlation with Radium Content in Soil Using Can Technique Method

Sonali Dutta [1] , Hiranya Kr. Sarma[2] Ranjan Kr. Kakati[3]

[1]Department of Physics, Assam Down Town University, Guwahati, Assam, India
[2]Principal, Suren Das College Hajo,Kamrup,Assam,India
[3]Director, Students' Welfare, Gauhati University,Assam,India
Email: *sonaliphysics1@gmail.com*

ABSTRACT

Radon activities and radon exhalation rates have been measured in soil samples collected from different locations of oil field area of Tinsukia District (Digboi) of Assam, India. 'Can Technique' using LR115 (type II) detectors, has been used for the estimation of radium concentration & radon exhalation rate. Radium concentration observed for soil samples has been found to be varying from 1.33 Bq/Kg to 1.6 Bq/Kg .The Radon exhalation rate in these samples has been found to be varying from 0.834 to 0.998 $mBqm^{-2}\ h^{-1}$.A positive correlations with (R^2 =0.99) have been found between radon exhalation rate and radium concentration in the samples for the investigated area. The obtained results indicate normal levels of indoor radon concentration and effective radium content in all locations of the studied area. Life threats to the dwellings in the particular area.In the importance of a study of radon has been recognized globally. So we have taken up a study to compare the radon datas with respect to our present study. Institutions like EPA, WHO, ICRP and many more world recognized organizations have taken up the study of radon and its importance. So,a qualitative analysis and comparison is highly essential in context to world concern.

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Keywords: Can technique, radon exhalation, emanation, effective radium content

INTRODUCTION:

Radon is produced in the soil due to the presence of ^{238}U and is transported to atmosphere by turbulent diffusion (J.E.Tanner). Once formed by the decay of the parent ^{226}Ra, the ^{222}Rn atoms are free to diffuse through the interstices between mineral or soil particles where they become a minor constituent of soil. The processes effective in transporting ^{222}Rn from soil to the surface are related directly to the size and configuration of the space occupied by the soil gas. Radon

concentrations in soil pores (J.Porstendorfer) at depth are dependent directly upon the radium content of the soil, emanating power for radium and soil moisture content. Exhalation of ^{222}Rn, a radioactive inert gas, is associated with the presence of ^{226}Ra and its ultimate precursor uranium in the earth crust. Although these elements occur in virtually all types of rocks and soils, their concentration varies with specific sites and geological formation of materials. The rate at which radon escapes or emanates from solid into the surrounding air is known as radon exhalation rate of the solid. This may be measured by either per unit mass or per unit surface area of the solid. Measurement of radon exhalation rate of soils and rocks are helpful to study radon health hazards. Radon exhalation is the amount of radon (radon activity) as obtained from a given layer (geological material on the surface/surface exposure) mainly the outer thinner part of the crust. On the other hand, emanation dependents on the nature of uranium and/or thorium. Radon enters into buildings through the soil or building materials. So radon exhalation rate from the soil or building material is an important parameter for estimating local environmental radon level. On the basis of epidemiological studies it has been established that the enhanced levels of indoor radon in dwellings can cause health hazards and may cause serious deceases like lung cancer in human beings (F.Bichichi, R.W.Field). A number of studies of exhalation rates of radon/thoron from soil and building materials are available which are same as observed by (F.W.Wilkening,M.Folkerts,Singh, R.Prasad). Threfore, it is also necessary to check the correlation between the radium concentration and radon exhalation rate of the source material. In the present study we have applied solid state nuclear track detectors (LR-115,TYPE II) for the analysis of radium and radon exhalation rate measurements in the soil samples taken from wide range of areas of oil field areas of Assam, India.

MATERIALS & METHODS

The 'Can technique' is used for the measurement of radium and radon exhalation rates in some soil samples collected from different study areas. The dried samples collected from different places are finely powdered and sieved through a 200 mesh sieve. The fine powder (250g) of samples from each site is placed in different glass bottles and scaled with thin polyethylene sheets for 30 days so as to attain the equilibrium. After one month, LR-115 (type II) plastic track detectors are fixed on the lower side of cork lids, which are then gently pressed against the polyethylene sheets on the glass bottles (acting as emanation chambers) as shown in Fig1. so that

the equilibrium is not disturbed or there is minimum possible disturbance, if any. The bottles are then sealed and left as such for 90 days so that the detectors can record tracks produced by the decay of radon. The exposed detectors are etched in 2.5N, NaOH solution at $(60 \pm 1)^0$C for 90 minutes . The tracks are counted using an (Olympus) optical microscope at 400X magnification.

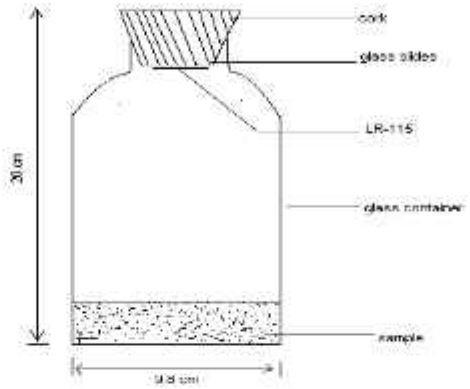


Fig 1: The Can technique used for the study of radium content and radon exhalation rate of soil samples

The track density ρ (tracks.cm^{-2}) so obtained was converted into the units of (Bq m^{-3}) of radon concentration C_{Rn} using the following equation (F.Saad, H.A.Hend, &N.A. Hussein;M.A. Ayman & A.Ali; I.Tayseer & M.A.Ayman):

$$C_{Rn} = \rho / kt \qquad \text{.....(1)}$$

where t is the exposure time of distributed LR-115 detector in (days) and k is the calibration factor tracks of CR-39 in (tracks.cm^{-2}. day^{-1}/Bqm^{-3}) (F.Saad; M.A.Ayman &A. Ali; I.Tayseer & M.A.Ayman) The effective radium content C_{Ra} (Bq/Kg) can be calculated from the relation

$$C_{Ra} = \rho hA / kT M \qquad \text{..... (2)}$$

where ρ.is the counted track density (tracks.cm^{-2}), h is the distance between the detector and the top of the sample (m), A is the area of cross section of the can (m^2), K is the calibration factor of the detector, M is the mass of the sample (Kg) and Te is The effective exposure time (in hour) which can be determined using the following equation.

$$T_e = T - (1-e^{-\lambda RnT})/ \lambda \text{.....} \qquad (3)$$

where T is the exposure time, and λ_{Rn} the decay constant for radon. The radon exhalation rate in terms of area, E_A ($mBqm^{-2}\ h^{-1}$) can be calculated from the (F.Saad, M.A. Ayman &A. Ali; I.Tayseer & M.A.Ayman):

$$E_A = C_{Rn} V\lambda / A[T + 1/\lambda\ (e^{-\lambda T} - 1) \quad \text{.....(4)}$$

Where A, V, λ and T are the area of the can in (m^2), the effective volume of the can in (m^3), decay constant for radon in (h^{-1}), and the exposure time in hours, respectively. The radon exhalation rates in terms of mass, E_M ($mBqm^{-2}\ h^{-1}$) can be calculated by the following formula

$$E_M = C_{Rn} V\lambda / M[T + 1/\lambda\ (e^{-\lambda T} - 1) \quad \text{.....(5)}$$

Where M is the mass of the sample (250 gm)

The risk of lung cancer from domestic exposure due to radon and its daughters can be computed directly from the equivalent effective dose. The annual effective dose, D ($mSvy^{-1}$) was computed from the integrated radon concentration using the following formula (Gupta, Mahur, Sonkawade, & Verma, 2010):

$$D = C_{Rn}\ 0.4 \times 3.88 \times 7000 / 170\ 3700 \quad \text{..... (6)}$$

Where D and C_{Rn} are the annual effective dose in ($mSvy^{-1}$) and the integrated radon concentration in ($Bq.m^{-3}$) respectively. The equilibrium factor and the ICRP conversion factor (ICRP, 1993) are 0.4 and 3.88 mSv.WLM, respectively. 7000 is the number of hours per year, and 170 is the number of hours per working month

RESULTS & DISCUSSION

Table 1 represents the activity concentrations of indoor Radon-222, effective Radium content (Bq/kg) and radon exhalation rate ($mBqm^{-2}\ h^{-1}$) were measured at different locations in oil field areas of Digboi, Assam.The soil samples are collected from different locations near oil industry within the range 2 – 4 Kms. The values of radium content at Digboi varies from 1.33 Bq/Kg to 1.6 Bq/Kg and radon exhalation rate varies from 29.37 $mBqm^{-2}h^{-1}$ to 31.18 $mBqm^{-2}h^{-1}$.From these data, a good positive correlation have been observed between radium content and radon exhalation rate in soil samples. The results show that there is a variation in radon exhalation rate from one location to other which depends on the geological formation. The variation in values

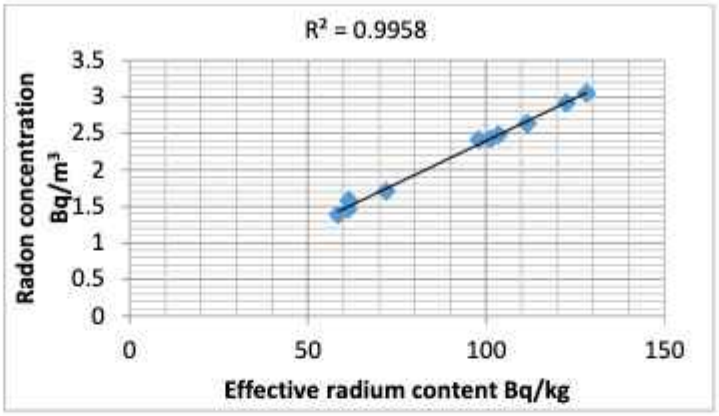
of radon exhalation rate may be due to the differences in radium content (T.V.Ramachandran and M.C.Subba Ramu) and porosity (M.Folkerts) of the soil. The values of effective radium content are less than the permissible value of 370 Bq kg^{-1} as recommended by Organization for Economic Cooperation and Development (OECD 1979). Hence, the result shows that these study areas are safe as far as the health hazards of radium are concerned.

Table1: Values of Radon Exhalation Rates and Radium Content in Soil Samples Collected From Different areas of Digboi

Location	GPS locations	Track Density (Tracks cm^{-2})	Radon Concentration(Bq m^{-3})	Radium content Bq/ kg	Mean Bq/ kg	Radon exhalation rates in terms of area(E_A)in mBq$m^{-2}h^{-1}$	Mean E_A in mBq m^{-2} h^{-1}	Radon exhalation rates interms of mass,(E_M) mBqm^{-2} h^{-1}	Mean E_M mBq m^{-2} h^{-1}
Digboi	**$27^0$23´41.0´´N &$95^0$36´10.6´´E**	210	95.23	1.33	1.43± 0.07	29.37	31.71±0.03	0.834	0.898 ±0.06
	$27^0$23´40.6´´N &$95^0$36´14.8´´E	220	99.97	1.39		30.76		0.871	
	$27^0$23´40.9´´N &$95^0$36´11.2´´E	222	100.68	1.41		31.04		0.879	
	$27^0$24´17.7´´N	250	113.37	1.58		34.96		0.990	

	&95⁰36´ 14.4´´E							
	27⁰36´18 .3´´N &95⁰31´ 16.5´´E	215	97.50	1.36		30.06		0.852
	27⁰36´15 .4´´N &95⁰36´ 17.2´´E	223	103.40	1.44		31.89		0.903
	27⁰36´14 .16´´N &95⁰37´ 03.1´´E	230	104.30	1.46		32.16		0.911
	26⁰ 90´14.5´´ N &94⁰72´ 10.6´´E	252	114.28	1.6		35.24		0.998
	26⁰90´41 .0´´N &94⁰66´ 16.1´´E	218	98.86	1.38		30.48		0.864
	26⁰90´11	223	101.1	1.41		31.18		0.883

Fig2: Co-relation co-efficient between radium content and rad. Exhalation rate in area at Digbo



CONCLUDING OBSERVATIONS:

Based on the results obtained in this study the following concluding observations may be drawn as follows:

1. With increase of radium content of soil samples the radon exhalation rate also increases in the studied locations.

2. The average values of effective radium content at the locations of the studied area are lower than the OECD recommended value.

3. A good positive correlation have been observed between effective radium content with radon exhalation rate of soil samples.

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Effect of Endophytic Fungus *Fusarium oxysporum* on Crystallographic Properties of PdO: Nanoparticles Synthesis, Characterization and Evaluation of Anti-oxidant Activity

Sk Najrul Islam, Syed Mohd Adnan Naqvi, Sadia Parveen and Absar Ahmad*

Interdisciplinary Nanotechnology Centre (INC), Faculty of Engineering and Technology, Aligarh Muslim University, AMU, Aligarh 202002, India
***Email:** *aahmad786in@gmail.com*

ABSTRACT

In recent times, semiconductor transition metal-oxide nanoparticles have gained a lot of attention because of their unique physio-chemical properties which mainly depend on size, shape, crystallographic phase and routes of synthesis. Palladium Oxide Nanoparticles (PdO NPs) belonging to the platinum group metal oxide possesses potential application in catalytic conversion of organic molecules and gas sensing application. Different methods have been reported for the synthesis and low-pressure phase transition of PdO NPs. Herein we report a simple endophytic fungus *Fusarium oxysporum* assisted novel approach for the biofabrication of face-centered cubic PdO NPs (f-PdO NPs) from tetragonal PdO (t-PdO) powder. The change in crystallographic properties under fungal stress was confirmed by XRD analysis while TEM images show biotransformed PdO NPs of average particles of size 6-8 nm. FTIR spectrum confirmed the presence of capping protein which made PdO NPs water dispersible with very high shelf-life. Anti-oxidant activity and optical band gap energy (1.9 eV) have also been estimated using UV-VIS-NIR spectrophotometry.

Keywords: Anti-oxidant activity, crystallographic phase transition, Endophytic, *Fusarium oxysporum*, PdO NPs.

INTRODUCTION:

The increased multidisciplinary applications of nano-size materials and their unique properties have drawn researchers toward the field of nanotechnology research. Although different methods have been employed for the fabrication of nanomaterials, biological routes of nanoparticle synthesis using plants and micro-organisms have gained much more attention as they provide highly stable, naturally protein-capped nanoparticles with very high shelf-life. A range of nanoparticles like metal, metal oxide, metal chalcogenide, quantum dots and biomineral

nanoparticles have been successfully synthesized using biological routes and some of them are in use in commercial and industrial products. Various types of biofabricated nanoparticles with different physiochemical properties have also been reported by our group [1-5]. These novel physicochemical properties mainly depend on particle size, chemical composition, surface-to-volume ratio, morphology and crystalline structure of NPs. It was also known that the thermodynamic stability of NPs is highly dependent on their crystallographic phase. High-temperature annealing methods for the phase transition of barium titanate NPs, Fe_2O_3 NPs and TiO_2 NPs have been reported previously [5-8]. Fungus base phase, size and shape transformation of TiO_2 were also reported by our group [9]. Arora K., Sandil D. et al studied the effect of a low-pressure hydrogen environment on crystallographic properties of PdO nanoparticles [10].

Antioxidants are substances that inhibit the production of reactive oxygen species or reduce oxidative stress by scavenging free radicals. Reactive oxygen species which are the byproduct of metabolic processes cause serious diseases including Alzheimer's disease, Parkinson's disease, Cancer, etc [11]. As many antioxidant exhibits anticancer activity, the antioxidant activity of different metal and metal oxides nanoparticles were evaluated [12-14]. It was also established that ultra-sonication enhances the antioxidant activity of metal oxide nanoparticles by increasing reaction feasibility [15].

Palladium oxide nanoparticles, a transition metal oxide, belong to the platinum oxide group has been widely used in organic reaction catalysis [16-18], formic acid oxidation [19] and gas sensing applications [20]. DNA binding properties of PdO NPs and anticancer activity of many palladium complexes have also been studied as palladium complexes show structural similarity with platinum-based drugs [21]. As PdO NPs become an important candidate for selective catalysis of various organic reactions, various methods have been reported for the synthesis of PdO NPs from the precursor salt of palladium [22-26]. Herein we have investigated the effect of fungal stress on t- PdO powder and evaluated the antioxidant activity of biotransformed f-PdO nanoparticles.

MATERIALS & METHODS

Isolation, purification and maintenance of endophytic fungus *Fusarium oxysporum*

The endophytic fungus *Fusarium oxysporum* was isolated from the plant parts such as leaves. Then isolated and purified strains of *Fusarium oxysporum* were transferred on potato dextrose agar (PDA) slants and these slants were incubated in B.O.D incubator at 25°C. After 96 h incubation of the freshly prepared slant, fungal mycelia were inoculated from stock PDA slant to 500 ml Erlenmeyer flask containing 100 ml of MGYP medium which is composed of 0.3% Malt extract, 1% Glucose, 0.3% Yeast extract and 0.1% Peptone. The mycelia-containing MGYP medium was then placed on a rotary shaker (200 rpm) at 25°C and it was kept under systematic review. After 96 h of fermentation at pH 7, the fungal biomass was separated from the culture broth by centrifugation (7000 rpm) which was performed at 15°C for 20 min. The obtained biomass was then washed thrice with sterile distilled water. All the processes were performed under sterile conditions.

Investigation of fungal stress on t-PdO powder and f-PdO NPs formation

The investigation of the stress of fungus *Fusarium oxysporum* on t-PdO powder was accomplished by adding 20 gram of fungal biomass in a 500 ml Erlenmeyer flask having 100 ml aqueous suspension of 0.1% t-PdO powder. The reaction mixture was then kept on a rotary shaker (200 rpm) at 25°C and was monitored for 96 h. After 96 h, the reaction product was filtered out by using a simple filtration method. The filtrate solution containing f-PdO NPs was then lyophilized to powder for further characterization and investigation.

CHARACTERIZATION

UV-Vis- NIR Spectroscopy

After completion of reaction, the aliquots of biotransformed f-PdO NPs (3.5 ml) was subjected to double beam Cary 5000 UV-Vis-NIR spectrophotometer (Agilent, USA) for the measurement of optical absorption and band gap. The spectrum was recorded at a resolution of 1 nm and wavelength range of 350-500 nm.

Transmission electron microscopy (TEM)

TEM images of biotransformed f-PdO NPs were captured by transmission electron microscopy (JEM-JEOL, JAPAN) operated at the magnification of 100,000X to explore the shape, size and particle size distribution of nanoparticles. For TEM analysis, the biotransformed f-PdO NPs

were loaded onto the carbon coated copper grids by drop casting. These grid was also used for the recording of Selected Area Electron Diffraction (SAED) pattern at an angular magnification of 0.001 nm per degree.

X-ray diffraction (XRD)

XRD (Rigaku, Tokyo, Japan) measurement was carried out to investigate the effect of fungal stress on crystallographic properties of PdO powders and establish the crystallographic structure of f-PdO NPs. XRD patterns of both t-PdO powder and lyophilized f-PdO NPs were recorded in the 2θ range of 20–80° with a step size of 0.04° and a time of 5 seconds per step at 40 kV voltage and a current of 30 mA.

Fourier transform infrared spectroscopy (FTIR)

The FTIR spectrum of t-PdO powder and f-PdO NPs were recorded using Perkin Elmer (USA) Fourier transform infrared spectrophotometer to examine the characteristic metal-oxide bond vibration and confirm the presence of capping biomolecules (proteins) onto the surface of nanoparticles. For FTIR study, thin pellets of KBr containing nanoparticles were analyzed while a pure KBr pellet was used for background scan.

Antioxidant activity evaluation

Antioxidant activity of biofabricated f-PdO NPs was evaluated using 2,2-Diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay [27]. To execute the experiment, 50 ml methanolic solution (0.01 mM) of DPPH and different concentration (0.05 mg/ml, 0.1 mg/ml, 0.15 mg/ml, 0.2 mg/ml, 0.25mg/ml) of aqueous test solution of f-PdO NPs were prepared while aqueous solution of ascorbic acid with 0.05 mg/ml concentration was used as control. 1 ml of each NPs solution and standard solution were added with 3 ml of DPPH solution separately. The obtained mixtures were then incubated for 10 min at room temperature. The antioxidant activity of f-PdO NPs was evaluated by measuring the absorbance of all mixtures at 513 nm against methanol as blank.

RESULTS & DISCUSSION

UV-Vis-NIR spectrum of biotransformed f-PdO NPs was recorded in the wavelength range 350-500 nm (Fig. 1a.) and the appeared absorption band at 407 nm confirms the existence of PdO NPs [23]. Using UV-Vis-NIR data direct bandgap energy was estimated from tauc plot (Fig. 1b.) as 1.9 eV which is approximately the same as the reported band gap energy 1.8 eV for PdO NPs [10].

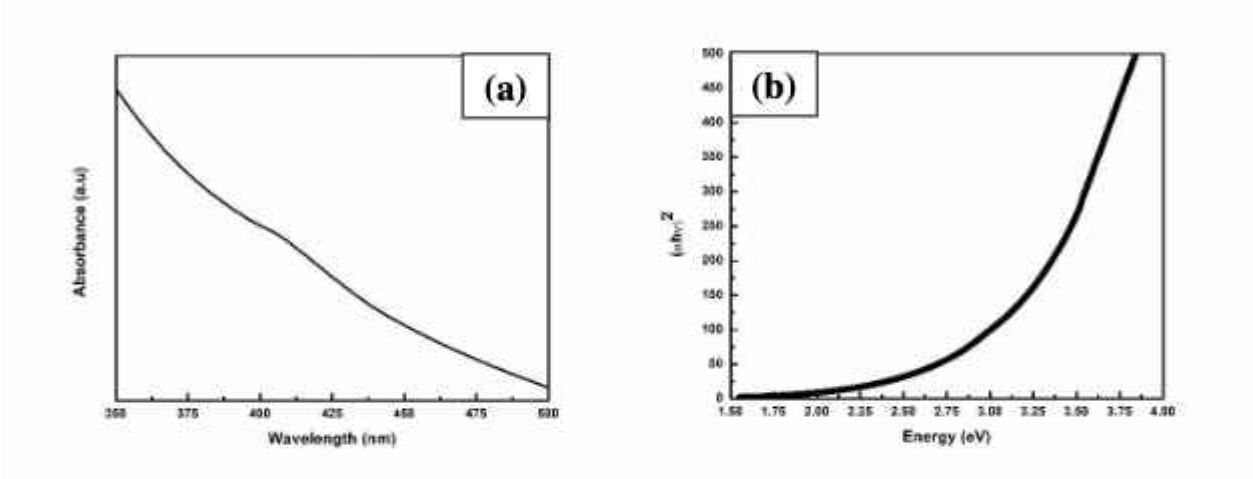
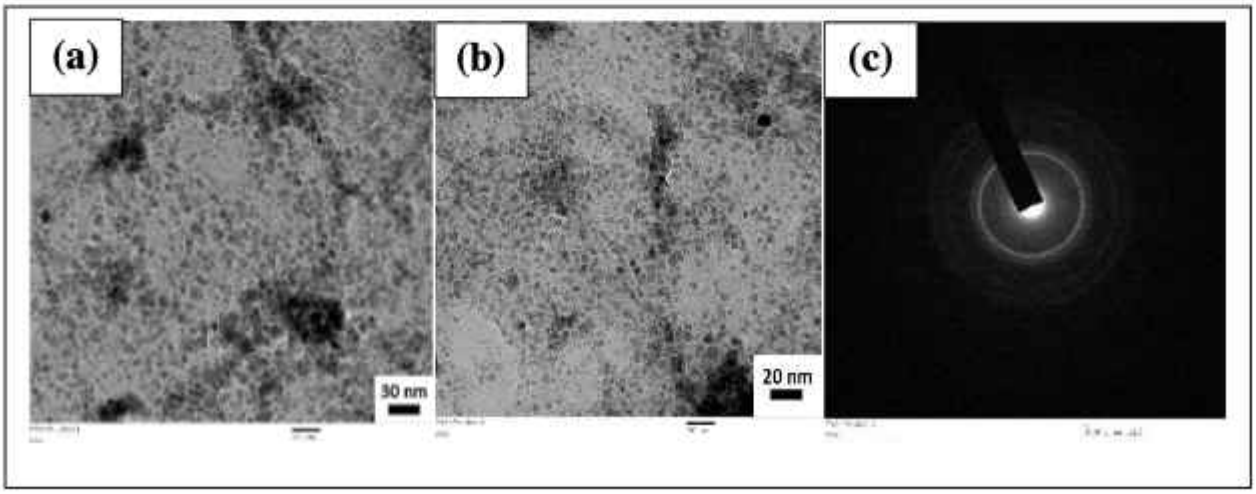


Figure 1. (a) UV-Visible spectrum of an aqueous solution of f-PdO NPs. (b) Optical band gap estimation using Tauc plot.

Figure 2. (a,b) TEM images and (c) SAED pattern of biofabricated f-PdO NPs.

Fig. 2a. and Fig. 2b. shows the TEM images of biotransformed f-PdO NPs. These TEM images indicate the formation of f-PdO NPs having an average particle size of 6-8 nm. Selected Area



Electron Diffraction (SAED) pattern (Fig. 2c) was also captured during TEM analysis which confirmed the crystalline nature of biotransformed f-PdO NPs.

XRD diffraction pattern of PdO, before (Fig. 3a.) and after (Fig. 3b.) treatment with fungus *Fusarium oxysporum*, was recorded to investigate the effect of fungus stress on the crystallography phase. Diffraction peak appeared (Fig. 3a.) at 2θ angle of 33.82°, 40.47°, 54.7°, 59.16° and 73.12° correspond to the planes (002), (110), (112), (103) and (202) ensure the tetragonal phase of precursor PdO powder (JCPDS file No. 043- 1024) [10],[28]. After biotransformation of t-PdO powder, the relative intensity of the peak at 40.47° (110) get increased and four new diffraction peaks were indexed (Fig. 3b.) at 28.03° (111), 31.25° (200), 44.78° (220) and 66.17° (400) which confirm the PdO nanoparticles with a face-centered cubic structure having lattice parameters 5.642A° (JCPDS file No. 046-1211) [22].The increased intensity of the diffraction peak and newly appeared peaks established the biotransformation of the crystallographic phase during nanoparticles formation.

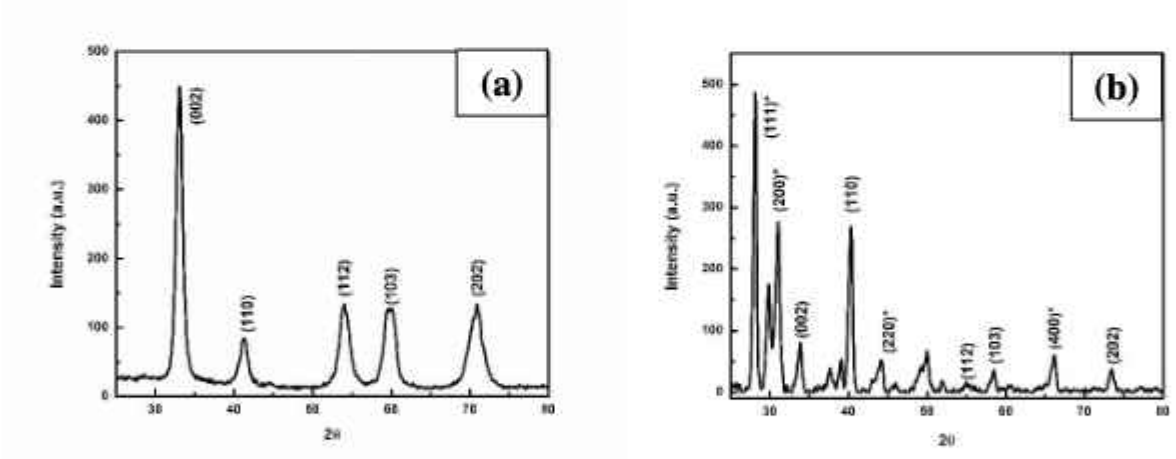


Figure 3. XRD pattern of (a) t-PdO powder and (b) biotransformed f-PdO NPs.

The FTIR spectrum of t-PdO powder and biotransformed f-PdO NPs was recorded in the wavenumber range of 400-2000 cm^{-1} at room temperature (Fig. 4.). The recorded spectrum of control t-PdO powder shows two characteristic absorption peak at 590 and 650 cm^{-1} corrospond to stretching vibration of Pd-O bond [21]. In case of f-PdO NPs, these absorption bands were shifted towards lower wavenuber (545 and 614 cm^{-1}) along with two new additional peaks were appeared at 1554 cm^{-1} (N–H bending, amide II), and 1645 cm^{-1} (N–C=O stretching, amide I). The change in peak positions and newly appeared amide bands demonstrated that the biofabricated f-PdO NPs were capped by protein molecules [24, 29].

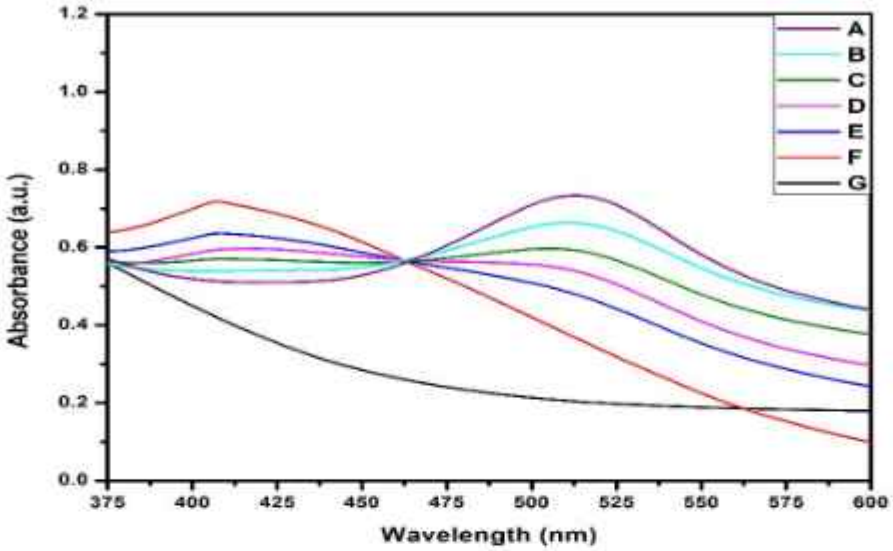


Figure 4. FTIR spectra of t-PdO powder and f-PdO nanoparticles

Antioxidant activity of biotransformed, protein-capped f-PdO NPs was performed where ascorbic acid was used as a positive control. The UV-VIS absorption study (Fig. 5.) shows the DPPH radical scavenging activity of biotransformed f-PdO NPs. The absorption peak appeared at 514 nm correspond to DPPH decreases with increasing concentration of f-PdO NPs while the absorption at 407 nm associated with f-PdO NPs increases. The change in color and the gradual decrease in absorption maxima at 514 nm with increasing concentration of f-PdO NPs indicates its good potential to act as an antioxidant agent.

Figure 5. UV-VIS absorption spectra of (A) Pure DPPH, (B-F) DPPH with increasing concentration of t-PdO NPs, (G) DPPH with ascorbic acid.

Conclusion

At the flourishing time of green nanoscience and nanotechnology, crystallographic phase transitions of different materials are being carried out using harsh chemicals and extreme heating conditions. However, we have developed a simple fungus-based green approach to obtain f-PdO NPs with an average particle size of 6-8 nm from t-PdO powder. The biosynthesized NPs were characterized by well-recognized techniques and antioxidant activity has been investigated using

DPPH radical scavenging assay. The experimental result demonstrated significant antioxidant activity of biotransformed f-PdO NPs.

Acknowledgments

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BEST POSTER PRESENTATION AWARD

Paper Code: EMNSD-2020/PP/04

Title: Effect of Fe Substitution on the Magnetic Properties of $MnCo_2O_4$

Corresponding Author: Junmoni Barman

Department of Physics, Rajiv Gandhi University, Arunachal Pradesh-791112, India

Paper Code: EMNSD-2020/PP/29

Title: Recycling of E-Waste Derived Printed Circuit Boards

Corresponding Author: Anuj Thukral

CSIR-National Physical Laboratory, Dr. K. S. Krishnan Marg, Pusa, New Delhi-110012, India

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(Online Mode)

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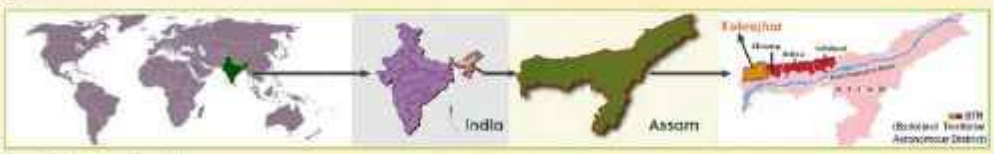

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PROGRAMME

DAY 1, 15 December 2020, TUESDAY

TIME	
	9:30-1.00 PM (Day 1, 1st Session) Session Co-ordinator: Dr. Anamika Kalita Deka
9.30-10.00AM	***INAUGURATION*** **Convener Speech:** Dr. Manasi Buzar Baruah, Asstt. Professor, Dept. of Physics, CITK **Welcome Speech:** Ms. Chiatali Bramha, Registrar, CITK **Welcome Speech and Opening of e-Abstract Volume:** Prof. Debkumar Chakrabarti, Director, CITK Photo Session
10.00-10.45AM	***KEYNOTE SPEAKER*** **Prof. Madan K Bhattacharyya** Department of Agronomy, Iowa State University, Ames, Iowa, USA **Title: Genetic modification of a soybean gene for enhancing broad-spectrum disease and pest resistance in soybean** **Department of Agronomy, Iowa State University, Ames, Iowa, USA**
10.45-11:15AM	***INVITED SPEAKER*** **Prof. Hiranya K Nath** Department of Economics International Business, Sam Houston University, Texas, USA **Title: Information and Communications Technology (ICT) and Economy**
11:30-12.00 NOON	***INVITED SPEAKER*** **Dr. Indrani Banerjee** **Associate Professor and Dean, School of Nano Sciences, Central University of Gujarat, Gandhinagar, Gujarat, India** **Title: Structure Function Relation of Microwave Synthesized Muga Silk Nanoparticles**

EMNSD 2020

	ORAL PRESENTATION **(Day 1, 1st Session)** **Chairman: Dr. Indrani Banerjee** **Associate Professor and Dean, School of Nano Sciences,** **Central University of Gujarat, Gandhinagar, Gujarat, India**
OP1 **12.00-12.10PM**	Challenge and Success In Synthesis Of Quadruple Perovskites At Ambient Condition Ariful Haque Department of Chemistry, Visva-Bharati university, Santiniketan, Pin – 731235, India
OP27 **12.10-12.20PM**	Optical and Electrical Properties of CuO Nanoparticles Synthesized Using Citrus Maxima Peels Sanjib Baglari Department of Physics, Birjhora Mahavidyalaya, Bongaigaon, Assam:783380, India
OP3 **12.20-12.30PM**	Waste Sesamum indicum Plant: An Efficient Heterogeneous Catalyst for Biodiesel Production Sanjay Basumatary Department of Chemistry, Bodoland University, Kokrajhar-783370, Assam, India
OP4 **12.30-12.40PM**	All-optical Binary to Quaternary Radix Converter using SOA-PRS Ashif Raja COSOD, Department of Physics, Kazi Nazrul University, Asansol-713340, West Bengal, India
OP5 **12.40-12.50PM**	A study on Iron Oxide (γ- Fe_2O_3) Nanoparticles synthesised using precipitation method and its possible applications Bandana Gogoi Department of Physics, D.N.Govt College, Itanagar-791113, Arunachal Pradesh, India
OP6 **12.50-1.00PM**	Plasmon Resonances in Interacting Ni Nanoparticles Embedded in Dielectric Jayanta Kumar Majhi Post Graduate Department of Physics, Banowarilal Bhalotia College, Asansol – 713303, West Bengal
1.00-2.00 PM	**LUNCH BREAK:**

ICNSD 2020

	POSTER SESSION: 2.00-3.30PM **Group 1: PP1-PP16: Google Meet Link: https://meet.google.com/giw-ncsv-okg** **Group 2: PP17-33: Google Meet Link: https://meet.google.com/cpb-trxe-cft**
	(Day1, Session 2, 3.30-6.00 PM) **Co-ordinator: Dr. Sahalad Borgoyary & Mr. Bikramjit Choudhury**
3.30-4.00PM	***INVITED SPEAKER*** **Dr. Chris Holland** **Senior Lecturer** **Department of Material Science & Engineering** **The University of Sheffield, S. Yorks, UK** **Title: Sustainable Polymer Processing Inspired by Silk**
	ORAL PRESENTATION **Chairman: Dr. Chris Holland** **Senior Lecturer** **Department of Material Science & Engineering,** **The University of Sheffield, S. Yorks, UK**
OP7 **4.00-4.10PM**	Biocompatible Nanocarrier For Effective Delivery Of Antimicrobial To Agricultural Crop Gunjan Harshadkumar Vyas School of Nano Sciences, Central University of Gujarat, Gandhinagar, India.
OP8 **4.10-4.20PM**	Preparation of carotenoid Loaded BSA Nanoparticle Stabilized by Biosurfactant Jyoti Jaiswal School of Nano Sciences, Central University of Gujarat, Gandhinagar 382030, India.
OP9 **4.200-4.30PM**	Microstructure and Abnormal Coalescence Behavior of Ion Beam Sputter Deposited Silver and Gold Thin Films Rajeeb Brahma Department of Physics, Bodoland University, Kokrajhar, BTAD, Assam – 783370, India.

ENVSP-2020

OP12 **4.30-4.40PM**	Study on Electrical Characteristics of Normally On Junctionless Field Effect Transistor Angshumala Talukdar Department of Instrumentation Engineering Central Institute of Technology Kokrajhar, Kokrajhar, India.
OP16 **4.40-4.50PM**	Investigation of the Spin Speed Variation on the Performance of PEDOT:PSS/Si Hybrid Solar Cells Avritti Srivastava CSIR-National Physical Laboratory, New Delhi-110012, India
OP25 **4.50-5.00PM**	Application of Musa paradisiaca derived ashes as heterogeneous base catalyst for Cross-Aldol reactions at room temperature Dulu Brahma Department of Chemistry, Central Institute of Technology Kokrajhar (Deemed to be University, MHRD, Govt. of India), Kokrajhar-783370, Assam, India.
5.00-5.30PM	***INVITED SPEAKER*** **Dr. Bharat Baruah** Department of Chemistry and Biochemistry, Kennesaw State University, GA, 30144, USA **Title: Fabrication of Flexible Transparent Wood Infiltrating Natural Polymer**

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DAY 2, 16 December 2020, WEDNESDAY

10:00-1.00PM (Day 2, 1st Session) Co-ordinators: Mr. Mahananda Brahma & Mr. Sanjib Narzary; Mr. Bipin Brahma	
10:00-10:45AM	**KEYNOTE SPEAKER** **Prof. Absar Ahmed** Director, Interdisciplinary Nanotechnology Centre (INC), Aligarh Muslim University, Aligargh, Uttar Pradesh, India. **Title: Green Fabrication of Nanomaterials, and their applications in healthcare, agriculture, environment, energy and life sciences**
10:45-11:15AM	**INVITED SPEAKER** **Dr. Pranjal Kalita** Associate professor, Department of Chemistry, CIT Kokrajhar, Assam, India **Title: Recovery of Waste into Value-Added Compounds**
	ORAL PRESENTATION (Day2, Session 1, 11.15AM-1.00PM) **Chairman: Dr. Pranjal Kalita** Associate Professor, Department of Chemistry, CIT Kokrajhar, Assam, India
OP10 **11:15-11:25AM**	Synthesis and Ultrasound-assisted Extraction of Polyhydroxybutyrate (PHB) from Invasive Weeds Sushobhan Pradhan School of Chemical Engineering, Oklahoma State University, Stillwater, Oklahoma, USA.
OP11 **11:25-11:35AM**	Biodiesel production from waste cooking oil using a novel heterogeneous catalyst based on calcium oxide nanoparticles Gaurav Singh St. Peter's Engineering College, Hyderabad, India.
OP13 **11:35-11:45AM**	Depletion Width Determination of Double gate Junctionless Field Effect Transistor With Triangle Shaped Spacer Anjanmani Baro Department of Instrumentation Engineering, Central Institute of Technology Kokrajhar, Kokrajhar, India

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OP14 **11:45-11:55AM**	Tera-Hertz Optical Asymmetric Demultiplexer(TOAD) using quantum dot Semiconductor Optical Amplifier **Kousik Mukherjee** Physics Department, B B College, Asansol, West Bengal, India
OP15 **11:55-12:05PM**	Effect of Annealing Temperature on the Structural and Optical Properties of ZnO Nanoparticles Synthesised by Colloidal Route **Premshila Kumari** CSIR-National Physical Laboratory (NPL), New Delhi-12, India
OP22 **12:05-12:15PM**	Design of a Power Inverter Using Solar Cell As A Source Of Charger **HEMEN CH MEDHI** Department of Electronics, St. Edmund's College, Shillong-793003, India
OP17 **12:15-12:25PM**	Hydrogen Adsorption on $TMMg_3$(TM=Ni, Pd, Pt) Clusters: First Principles Study **Bishwajit Boruah** Department of Physics, Dibrugarh University, Dibrugarh, Assam, India-786004
OP18 **12:25-12:35PM**	Effect of the Ligands PPIA and TOPO on the spectroscopic behaviour of Sm^{3+} ions in sol-gel silica matrix **Navaneeta Rajkonwar** Department of Physics, Dibrugarh University, Assam, India
OP19 **12:35-12:45PM**	Mg-doped ZnO Nanomaterial: An efficient sunlight driven photocatalyst **Riu Riu Wary** Department of Physics, Central Institute of Technology Kokrajhar (Deemed to be University, MHRD, Govt. of India), Assam.
OP20 **12:45-12:55PM**	Direct Synthesis of Co_3O_4 Nanomaterials by Carbonate Precursor **Arnab Kanti Giri** Department of Chemistry, Karim City College, Jamshedpur, Jharkhand, India.
1.00-2.00PM	**LUNCH BREAK**

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	(Day2, Session 2, 2.30-5.00PM) Coordinators: Dr. Kaushik Chandra Dev Sarma & Bikramjeet Choudhury; Biswajit Paul and Nayanmani Barman
2.00-2.30PM	**INVITED SPEAKER** **Dr. Logudurai Radhakrsihnan** Associate Professor & Head, Department of Chemistry, Madanapalle Institute of Technology & Science, Madanapalle, Andrapradesh, India **Title: Electrochemical Investigation of Nano-porous Gold Electrodes in presence of Biofouling Solutions**
	ORAL PRESENTATION **Chairman: Dr. Logudurai Radhakrsihnan** Associate Professor,& Head, Department of Chemistry, Madanapalle Institute of Technology & Science, Madanapalle, Andrapradesh, India
OP21 2.30P-2.40PM	Orientational Order, Optical and Dielectric Properties of Liquid Crystals containing Bicyclohexane Rigid Core S. Mondal Department of Physics, Siliguri Institute of Technology, Siliguri, West Bengal-734009, India.
OP23 2.40P-2.50PM	Comparision of Polyvinyl Alcohol Capped Chemically Synthesized CdS and CdZnS Nanostructured Films Prince Kumar Mochahari Department of Physics, Bodoland University, Kokrajhar, India
OP24 2.50P-3.00PM	Application of Nanofluids for heat transfer processes Monisha Mridha Mandal University School of Chemical Technology, Guru Gobind Singh Indraprastha University, New Delhi
OP26 3.00P-3.10PM	Structural Evaluation of Muga silk protein by experimental and computational approach Prithvi Asapur Central University of Gujarat, Ahmedabad, Gujarat, India

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OP2 3.10P-3.20PM	Chromeno[2,3-b] indoles as ultra-high Stokes shift luminescent materials **Basanta Kumar Rajbongshi** Department of Chemistry, Cotton University, Panbazar, Guwahati – 781001, Assam, India.
OP28 3.20P-3.30PM	Nanoparticle analysis using Digital Image Processing **Minakshi Gogoi** Dept. Of CSE, Girijananda Chowdhury Institute of Management and Technology, Guwahati-17, Assam, India
OP29 3.30P-3.40PM	TL Dating of Potsherds from Tumu Ching, Manipur, India **Sheikh, M.R** Lilong Haoreibi College, Manipur, India.
OP30 3.40P-3.50PM	Design And Simulation Of Non-metallic And Flexible Broadband Metamaterial Absorber For X-band Applications **Dipangkar Borah** Department of Physics, B. N. College, Dhubri, Assam, India.
4.00-Onwards	**Valedictory** **Vote of Thanks**

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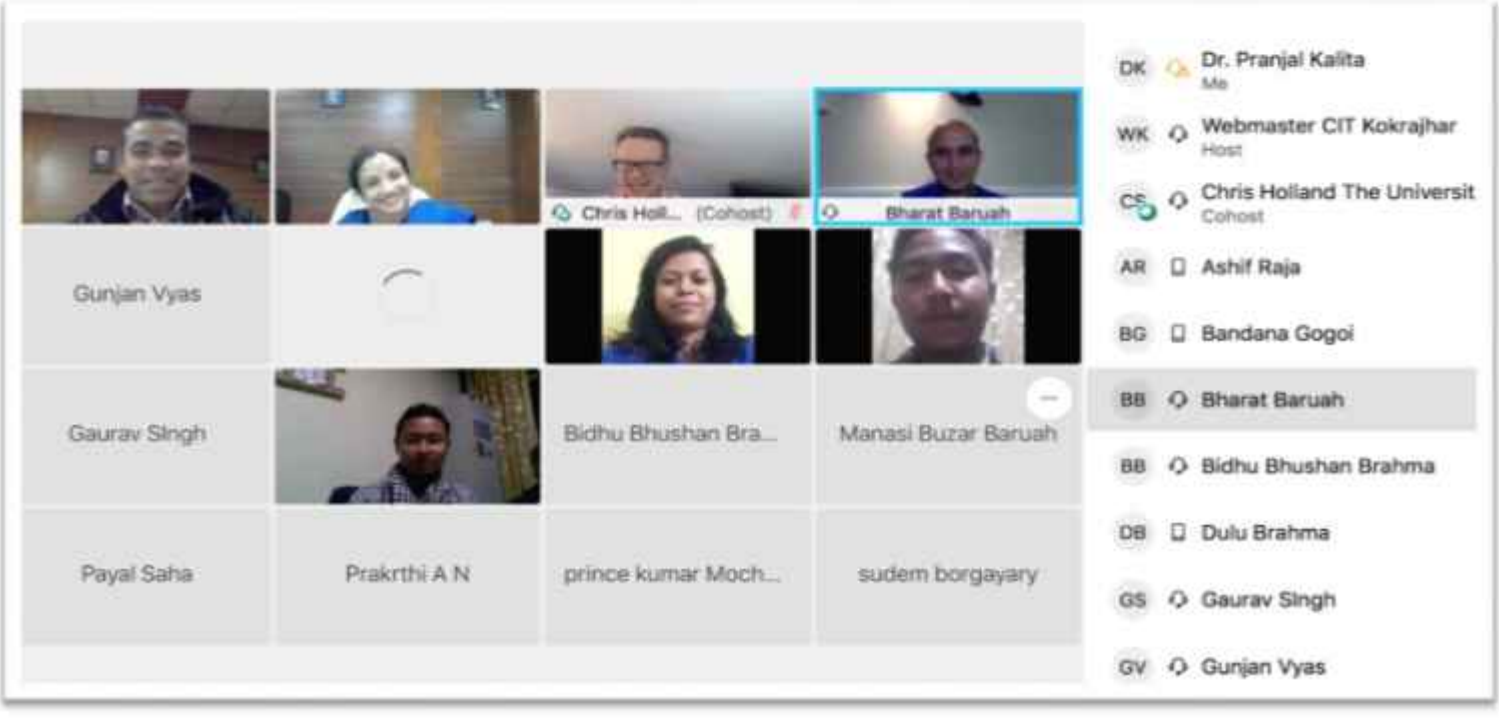

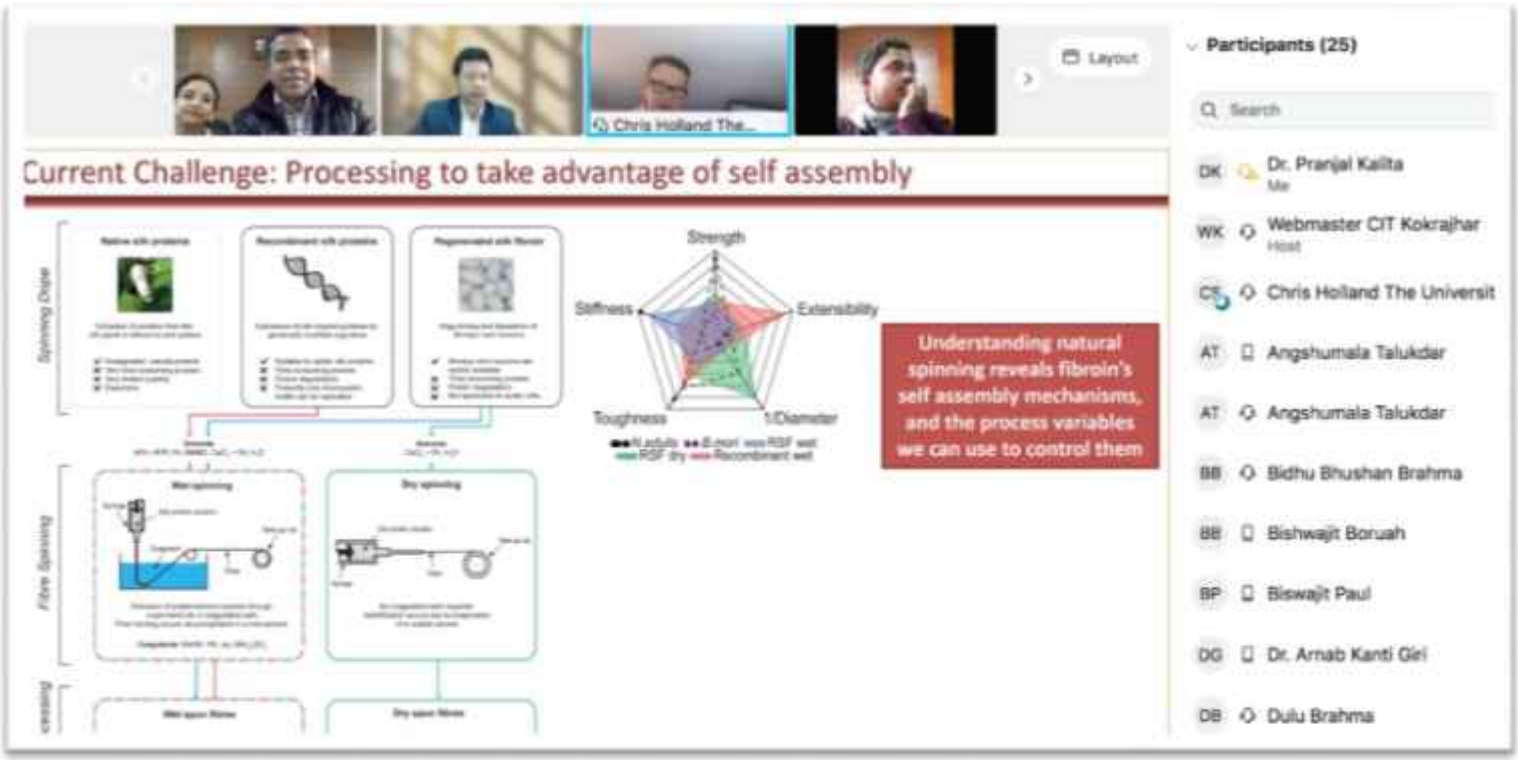
Chris Holland The...
Layout
Current Challenge: Processing to take advantage of self assembly
Spinning Dope
Fibre Spinning
Strength
Stiffness
Extensibility
Toughness
1/Diameter
Understanding natural spinning reveals fibroin's self assembly mechanisms, and the process variables we can use to control them
Participants (25)
Search
DK Dr. Pranjal Kalita Me
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Soumitra Sengupta · Samrat Dey · Saurya Das · Dhruba J. Saikia · Sudhakar Panda · Ramakrishna Podila *Editors*

Selected Progresses in Modern Physics

Proceedings of TiMP 2021

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Dhruba J. Saikia · Sudhakar Panda ·
Ramakrishna Podila
Editors

Selected Progresses in Modern Physics

Proceedings of TiMP 2021

Springer

Editors
Soumitra Sengupta
Indian Association for the Cultivation of Science
Kolkata, India

Saurya Das
University of Lethbridge
Lethbridge, AB, Canada

Sudhakar Panda
National Institute of Science Education and Research
Bhubaneswar, Odisha, India

Samrat Dey
Pragjyotish College
Guwahati, Assam, India

Dhruba J. Saikia
University Centre for Astronomy and Astrophysics
Pune, Maharashtra, India

Ramakrishna Podila
Clemson University
Clemson, SC, USA

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Preface

The Springer International Conference on Trends in Modern Physics (TiMP) 2021, the third annual conference of the Physics Department of Assam Don Bosco University (ADBU), was organised from 26 to 27 February, 2021, by the department, in collaboration with Indian Association of Physics Teachers, after successfully organising TiMP 2019 and TiMP 2020. A large number of participants, from various universities, colleges and institutes of India and abroad, presented around hundred research papers in the event. Due to the restrictions imposed by the COVID-19 pandemic, the conference was held in hybrid mode, with half of the participants making their presentations online and the remaining half presenting offline, in person. The organisers of the conference made all possible efforts to ensure that every delegate is able to seamlessly access all the presentations, irrespective of whether the presenter or the presentation is online or offline. To this end, all the offline presentations were also streamed live via web-conferencing and all the posters were made available online. Selected papers of TiMP 2021 have found their place in the proceedings after going through the due processes of peer reviews.

It was a felt need by the department to hold yearly national conferences on TiMP, as in this region there were no such yearly conferences of physics, where young researchers can share their ideas and get suggestions and help from renowned academicians of the country and other parts of the world. It may be noted, in this context, that the Physics Department, ADBU, ever since its inception in 2018, has been working at different levels to popularise elementary as well as advanced physics though various other approaches, like symposiums, workshops, refresher course, etc. The TiMP conference series has not been confined to any specific branch of physics, but, practically, to all the major disciplines of physics with the following underlying philosophy. While it is true that each discipline of physics has become so highly specialised that it is not easily legible to a person of another discipline, we must remember that over the history of the development of modern science, physicists' contributions were not only across different branches of physics but also to various other fields of science. For example, Marie Curie, a physicist, won a Nobel Prize in chemistry, apart from a Nobel Prize in physics. James Watson who got the Nobel Prize for proposing the double helix structure of the DNA molecule was actually

inspired by physics Nobel Laureate Erwin Schrödinger's book, "What Is Life?". World Wide Web (WWW) was invented in a physics research institute, CERN. The first computer simulation was developed in nuclear physics. Physicists' contribution to mathematics can be exemplified by the development of calculus by Isaac Newton. Venki Ramakrishnan, a Ph.D. in physics, got the Nobel Prize for his studies of the structure and function of the ribosome which is important in the production of antibiotics. The list of physicists contributing to other fields of science is actually too long. Thus, it is evident that if people from physics can make so many contributions to additional domains of science outside the realm of physics, it is both productive and likely for them, even if they are from specific branches of physics, to contribute to and collaborate with other disciplines within physics. With that philosophy in mind, this multidisciplinary physics conference series was conceptualised and has been being implemented successfully.

We thank the convener of the international conference, Mr. Parag Bhattacharya, together with the co-conveners, Dr. Debajyoti Dutta and Dr. Ngangom Aomoa. We also express our gratitude to all the reviewers, Dr. Lalthakimi Zadeng, Dr. Yubaraj Sharma, Dr. Simanta Chutia, Prof. Sunandan Baruah, Dr. Sumita Kumari Sharma, Dr. Kaustubh Bhattacharyya, Dr. Shantu Saikia, Dr. Debajyoti Dutta, Dr. Ngangom Aomoa, Prof. Atri Deshamukhya, Dr. Subhankar Roy, Dr. Debasish Borah, Dr. Wandahun Longtrai Reenbohn, Dr. Rashi Borgohain, Prof. Pritam Deb, Dr. Pralay Kumar Karmakar, Dr. Ashok Kumar Jha, Dr. Umananda Dev Goswami, Dr. Hemen Kumar Kalita and Dr. Subhaditya Bhattacharya. Finally, we thank all the authors for their contributions in the proceedings.

Kolkata, India — Soumitra Sengupta
Guwahati, India — Samrat Dey
Lethbridge, Canada — Saurya Das
Pune, India — Dhruba J. Saikia
Bhubaneswar, India — Sudhakar Panda
Clemson, USA — Ramakrishna Podila

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Contributors

S. Adhikari Department of Physics, University of Oslo, Oslo, Norway

Gazi Ameen Ahmed Department of Physics, Tezpur University, Napaam, Assam, India

S. Anciya PG and Research Department of Physics, The M. D. T. Hindu College, Tirunelveli, Tamil Nadu, India;
Manonmaniam Sundaranar University, Abishekapatti, Tirunelveli-12, Tamil Nadu, India

H. Bailung Dusty Plasma Laboratory, Physical Sciences Division, Institute of Advanced Study in Science and Technology (IASST), Guwahati, Assam, India

Kalyanjit Dutta Baruah State Cancer Institute, Gauhati Medical College, Guwahati, Assam, India

Dipankar Bhagabati State Cancer Institute, Gauhati Medical College, Guwahati, Assam, India

Ankita Bhagawati Department of Physics, Tezpur University, Tezpur, Assam, India

Chandrashekhar M. Bhambere Department of Physics, S. S. and L. S. Patkar-Varde College, Mumbai, Maharashtra, India

Ananya Bhattacharjee Department of Mathematics, Assam University Silchar, Silchar, Assam, India

Rangaraj Bhattacharjee State Cancer Institute, Gauhati Medical College, Guwahati, Assam, India

A. K. Bhunia Department of Physics, Government General Degree College at Gopiballavpur-II, Jhargram, Beliaberah, West Bengal, India

Rajib Biswas Applied Optics and Photonics Lab, Department Of Physics, Tezpur University, Tezpur, Assam, India

Kalpana Bora Physics Department, Gauhati University, Guwahati, Assam, India

Bichitra Bijay Boruah Tezpur University, Tezpur, Assam, India

Monojit Chakraborty Centre of Plasma Physics-Institute for Plasma Research, Tepesia Sonapur, Assam, Kamrup (M), India

Biprav Chetry Applied Photonics & Nano-Photonics Laboratory, Department of Physics, Tezpur University, Tezpur, Assam, India

Bidyut Chutia Dusty Plasma Laboratory, Physical Sciences Division, Institute of Advanced Study in Science and Technology (IASST), Guwahati, Assam, India

Simanta Chutia Department of Physics, St. Anthony's College, Shillong, India

Mrinal Kumar Das Department of Physics, Tezpur University, Tezpur, India; Department of Physics, Tezpur University, Napaam, Assam, India

Nipan Das Centre of Plasma Physics-Institute for Research, Sonapur, Assam, India

Pritam Das Department of Physics, Tezpur University, Napaam, Assam, India

Priyanka Das Applied Photonics & Nano-Photonics Laboratory, Department of Physics, Tezpur University, Tezpur, Assam, India

Saurya Das Theoretical Physics Group, Department of Physics and Astronomy and Quantum Alberta, University of Lethbridge, Lethbridge, AB, Canada

Upamanyu Das Rajiv Gandhi University, Doimukh, A.P, India

K. Deka Centre of Plasma Physics, Institute for Plasma Research, Sonapur, Kamrup(M), Assam, India

Kabita Deka Department of Physics, Tezpur University, Napaam, Assam, India

Paramita Deka Department of Physics, Gauhati University, Guwahati, Assam, India

Maibam Ricky Devi Department of Physics, Gauhati University, Guwahati, Assam, India

Samrat Dey Department of Physics, Assam Don Bosco University, Guwahati, Assam, India

Sangeeta Dey Cotton University, Guwahati, India

Zannatun Firdowzy Dey Department of Physics, Assam Don Bosco University, Sonapur, India

B. K. Duara Department of Radiology, Gauhati Medical College & Hospital, Guwahati, Assam, India

N. G. Durge Department of Physics, S. S. and L. S. Patkar-Varde College, Mumbai, Maharashtra, India

Debajyoti Dutta Department of Physics, Assam Don Bosco University, Sonapur, India

Suvangshu Dutta Dept. of Chemistry, D.R. College, Golaghat, Assam, India

Nayana Gautam Department of Physics, Tezpur University, Tezpur, India

J. P. Gewali Department of Physics, Lovely Professional University, Jalandhar, Punjab, India;
Department of Physics, Lovely Professional University, Phagwara, Punjab, India

Jeeban P. Gewali Department of Physics, School of Chemical Engineering and Physical Sciences, Lovely Professional University, Phagwara, Punjab, India

Sanjay Godara Department of Physics, MLV Government College, Bhilwara, Rajasthan, India

Bandana Gogoi Rajiv Gandhi University, Doimukh, A.P, India

Rupjyoti Gogoi Tezpur University, Napaam, Assam, India

Anirban Guha Department of Physics, Tripura University, Suryamaninagar, Tripura, India

Ansh Gupta Department of Physics, School of Chemical Engineering and Physical Sciences, Lovely Professional University, Phagwara, Punjab, India

Nilavjyoti Hazarika Physics Department, Gauhati University, Guwahati, Assam, India

Francis Iawphniaw Department of Physics, St.Anthony's College, Shillong, India; Department of Physics, Assam Don Bosco University, Guwahati, Assam, India

Yatendra S. Jain Department of Physics, North-Eastern Hill University, Shillong, India

B. Jaishy Department of Physics, Lovely Professional University, Phagwara, Punjab, India

B. M. Jyrwa Department of Physics, North Eastern Hill University, Umshing, Shillong, India

Jyotirmoy Kalita Department of Physics, Tripura University, Suryamaninagar, Tripura, India

Sachin Kaothekar Department of Physics, Mahakal Institute of Technology & Management, Ujjain, M.P, India

S. S. Kausik Centre of Plasma Physics, Institute for Plasma Research, Sonapur, Kamrup(M), Assam, India

Rukaiya Khatoon Tezpur University, Napaam, Assam, India

Anupam Kumar Department of Biotechnology, School of Bioengineering and Biosciences, Lovely Professional University, Phagwara, Punjab, India

Deepak Kumar Department of Chemistry, School of Chemical Engineering and Physical Sciences, Lovely Professional University, Phagwara, Punjab, India

Jugal Lahkar Department of Physics, Pragjyotish College, Guwahati, India

Soma Mandal Department of Physics, Government Girls' General Degree College, Kolkata, India

P. Arockia Michael Mercy PG & Research Department of Physics, Arul Anandar College, Karumathur, Madurai, India

A. K. Mishra Department of Physics, Vidyasagar University, Paschim Medinipur, Midnapore, West Bengal, India

Manoj Kumar Mishra Space Applications Centre, Indian Space Research Organization, Ahmedabad, India

Ranjeev Misra Inter-University Center for Astronomy and Astrophysics, Pune, India;
Inter-University Center for Astronomy and Astrophysics, Ganeshkhind Pune, India

R. Moulick Department of Physics, Rangapara College, Rangapara, Sonitpur, Assam, India

Biswajit Nath Silchar Medical College Hospital, Silchar, Assam, India

Pabitra Nath Applied Photonics & Nano-Photonics Laboratory, Department of Physics, Tezpur University, Tezpur, Assam, India

Ashamoni Neog Applied Optics and Photonics Lab, Department Of Physics, Tezpur University, Tezpur, Assam, India

Mahadev Patgiri Cotton University, Guwahati, India

R. Paul Centre of Plasma Physics, Institute for Plasma Research, Sonapur, Kamrup(M), Assam, India

Raj Prince Center for Theoretical Physics, Polish Academy of Sciences, Warsaw, Poland

A. Pyngrope Department of Physics, North-Eastern Hill University, Shillong, India

S. Jessie Jancy Rani PG and Research Department of Physics, The M.D.T. Hindu College, Tirunelveli, Tamil Nadu, India;
Manonmaniam Sundaranar University, Abishekapatti, Tirunelveli-12, Tamil Nadu, India

Jodie T. Ryngnga Department of Physics, North Eastern Hill University, Umshing, Shillong, India

S. Saha Department of Physics, Vidyasagar University, Paschim Medinipur, Midnapore, West Bengal, India

B. K. Saikia Centre of Plasma Physics, Institute for Plasma Research, Sonapur, Kamrup(M), Assam, India

Shantu Saikia Department of Physics, St.Anthony's College, Shillong, India

Jocelyn Sangma Centre of Plasma Physics-Institute for Plasma Research, Tepesia Sonapur, Assam, Kamrup (M), India

Lavina Sarma Tezpur University, Tezpur, Assam, India

A. Saxena Department of Physics, North-Eastern Hill University, Shillong, India

P. Selvarajan Department of Physics, Aditanar College of Arts and Science, Tiruchendur, Tamil Nadu, India;
Manonmaniam Sundaranar University, Abishekapatti, Tirunelveli-12, Tamil Nadu, India

Zahir Shah Inter-University Center for Astronomy and Astrophysics, Pune, India; Inter-University Center for Astronomy and Astrophysics, Ganeshkhind Pune, India

G. Sharma Centre of Plasma Physics, Institute for Plasma Research, Sonapur, Kamrup(M), Assam, India

Kuldeep Sharma State Cancer Institute, Gauhati Medical College, Guwahati, Assam, India

S. K. Sharma Dusty Plasma Laboratory, Physical Sciences Division, Institute of Advanced Study in Science and Technology (IASST), Guwahati, Assam, India

P. Sheron Department of Physics, Lovely Professional University, Phagwara, Punjab, India

M. Singh Department of Physics, Lovely Professional University, Jalandhar, Punjab, India

Madan Singh Department of Physics, M.N.S. Government College Bhiwani, Haryana, India

A. S. I. Joy Sinthiya PG and Research Department of Physics, The M.D.T. Hindu College, Tirunelveli, Tamil Nadu, India

R. Sree Devi Department of Physics, Aditanar College of Arts and Science, Tiruchendur, Tamil Nadu, India;
Manonmaniam Sundaranar University, Abishekapatti, Tirunelveli-12, Tamil Nadu, India

Dhanjit Talukdar Department of Physics, Pragjyotish College, Guwahati, India

A. Thakur Department of Physics, Lovely Professional University, Phagwara, Punjab, India

Ankush Thakur Department of Physics, School of Chemical Engineering and Physical Sciences, Lovely Professional University, Phagwara, Punjab, 144411 India

G. Jeeva Rani Thangam PG and Research Department of Physics, Pope's College, Thoothukudi, Tamil Nadu, India

K. S. Joseph Wilson PG & Research Department of Physics, Arul Anandar College, Karumathur, Madurai, India

Chapter 32
Review on Magnetism in Nanomaterials and Superparamagnetism

Bandana Gogoi and Upamanyu Das

Abstract Nanotechnology plays a prominent role in the fabrication of novel materials by controlling the structure of matter at the nanometric scale changing properties at a molecular level. The particles with nanodimensions change their material properties in a dramatic way showing uniqueness in behaviour with modified properties. In many ferromagnetic materials when the size is reduced to the nanoscale level, the magnetic properties enhance in a unique way, thus leading to a superparamagnetic state. The magnetic moment of the material randomly flips the direction of their magnetization, and the random orientations of magnetic spins inside the particles result in zero remanent magnetization and zero coercivity. An unusual change in the hysteresis loop shows the magnetization curve passing through the origin, showing the state of zero magnetization.

32.1 Introduction

At the nanoscopic dimension, the magnetic behaviours of magnetic nanomaterial show significant differences from those observed at bulk scale with the same chemical composition [1–3]. As the size is reduced material property gradually moves from the regime of bulk material behaviour to molecular-level material behaviour. Drastic changes in properties took place at the molecular level.

With the reduction of size, the basic magnetic properties or magnetism connected to different bulk ferro and anti-ferromagnetic material changes to develop in different modified ways. These changes may be shown to occur from the dimension of the material which becomes comparable to some of the basic fundamental characteristic lengths of one or more of various physical properties that are more relevant to the magnetic properties (e.g. the size of magnetic domains, exchange length etc.). With reduced size to nanoscale level, translation symmetry of the magnetic material breaks giving rise to specific sites with reduced coordination numbers, broken exchange and a higher proportion of atoms on the surface increasing surface effect. A high surface

B. Gogoi (✉) · U. Das
Rajiv Gandhi University, Doimukh, A.P, India

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to volume ratio brings more close contact with the exterior system. The spin-wave spectrum of the nanometric material also tends to change and this change can be observed as spin-wave energy becomes comparable to the thermal energy which plays a prominent role in developing new magnetic properties [3–12].

Nanoscale magnetism has been basically studied to be developing from unpaired d-orbital electrons as well as the coupling effect of these electrons with nuclear spins. At nanosized dimension, the surface area gets more exposure to the exterior neighbouring system, as a result of which the material achieves higher modified functionalities like increased reactivity, higher catalytic action and decreased melting point due to surface effect. The surface energy increases with increased surface area and hence surface effect dominates over the other observed effects at nanosized dimension. This increased surface energy effect also helps in developing extraordinary magnetic behaviours in magnetic nanomaterials. Particle size plays a significant role in determining the basic material property of any material like magnetic, electrical, optical or electronic property. Therefore increasing interest has been developed to study magnetic nanomaterials in recent times due to their size-dependent properties [13, 14].

Figure 32.1 shows the typical hysteresis loop of any bulk ferromagnetic material. In order to observe the changes of magnetic properties of ferro or anti-ferromagnetic materials with particle size, the magnetic hysteresis curve of normal bulk ferromagnetic material needs to be understood. In normal ferromagnetic behaviour, the curve is observed to have a remanence and a coercive field, i.e. the line of magnetization curve does not pass through zero or origin.

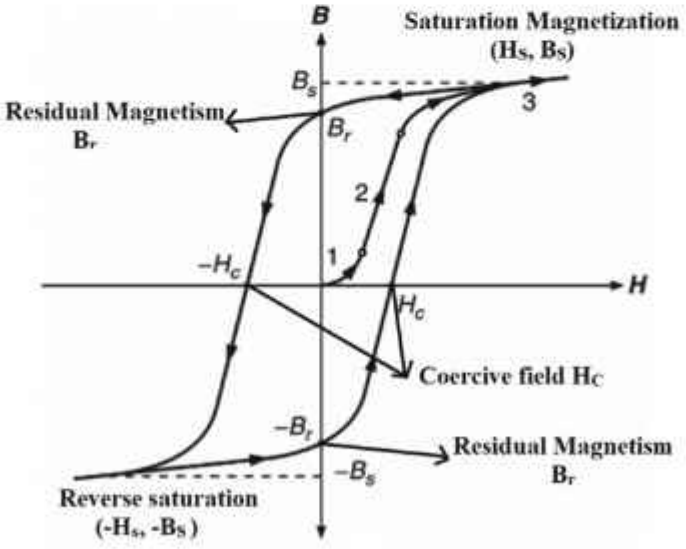

Fig. 32.1 Magnetization curve of ferromagnetic material in a bulk state

The development of uniqueness in the magnetic property of magnetic materials can be studied to be originated from the division of magnetic material into distinct and well-separated magnetic domains with magnetic moment alignment. The change in magnetic moment directions in magnetic domains may correspond to the total cancellation of the magnetic moment or may tend to minimize the total average magnetization to become nearly zero.

There are various interaction terms in a magnetic system that contribute to the total internal energy of a magnetic material and can be expressed as

$$E_{tot} = E_{ex} + E_A + E_{mx} + E_{ext} \tag{32.1}$$

Exchange interaction (E_{ex}) is responsible for the establishment of magnetic order in magnetic materials. This interaction arises from a quantum effect due to the indistinguishability of the electron.

$H = -2JS_iS_j$ where J is the exchange constant. S_i and S_j are spins.

Magnetostatic energy (E_{ms}) or dipolar energy is the measure of the magnetic energy of a magnetic sample because of its own magnetic field. This field is the demagnetizing field that arises from the divergence of magnetization.

Magnetic anisotropy (E_A) is crystallogenic in origin. The shape of the sample, the stress in the material and atomic segregation determine the value of magnetic anisotropy energy. The energy of a magnetically ordered sample depends on the relative direction of the magnetization and the structural axes; for example, a solid has an axis along which the energy is at a minimum. The anisotropy energy E_A is written as a function of the direction cosines α_1, α_2 and α_3 defined in relation to the axes of the crystal.

Uniaxial anisotropy is the approximation that in some samples anisotropy depends only on the angle θ between the magnetization and a given axis. The anisotropy energy per unit volume takes the form

$$E_A/V = K_1 sin^2\theta + K_2 sin^4\theta \tag{32.2}$$

where θ is the angle of magnetization with the single axis, and depending on the magnitude of anisotropy constants K_1 and K_2, the sample can have an easy axis or easy plan.

Magnetoelastic energy and magnetostriction is the elastic energy of a magnetic material that arises from the interaction between the magnetization and the strains. Magnetoelastic energy is the increase in the anisotropy energy of magnetic material when submitted to stress. Magnetostriction, the intrinsic property of magnetic material, is the coupling between magnetic and elastic energy, i.e. when subjected to magnetic field magnetic material changes shape [3, 14–16].

Exchange interaction is responsible for the ordering of atomic magnetic moments which causes the atomic magnetic moments to become parallel and showing magnetic ordering in ferromagnetic material. But the presence of other interactions such as anisotropy, dipolar, magnetoelastic etc. leads to the formation of magnetic domains,

where the magnetic moments are perfectly ordered [3]. As the size of the particle is reduced, the energy necessary to divide itself into magnetic domains is higher than the energy needed to remain as a single magnetic domain or monodomain [10, 17].

The size of the magnetic material has a great influence in determining its magnetic behaviour, e.g. a ferromagnetic material below a critical particle size (15 nm) can possess a single magnetic domain and can show paramagnetic behaviour above a characteristic temperature called blocking temperature (T_B). With the increase of the size of the magnet, the number of magnetic domains increases, and as a result, the number of domain walls also increases. During the whole process, there is a decrease in magnetostatic energy while there is an increase in the exchange and the anisotropy energies because of the more number of domain walls [8, 18]. This dependency of magnetic property on the size of the magnetic material can be illustrated by considering the coercivity of the magnet and the dependence of coercivity on the size of the magnet as shown in Fig. 32.2 [3, 16, 19].

For very small particles, with a diameter smaller than the critical diameter of superparamagnetism (D_{spm}), the particle shows unstable magnetization with flipping spin and it results in zero coercivity (H_c). For the diameter in the range between D_{spm} and the critical diameter of a single domain (D_{sd}), the magnetic moment shows stable nature and hence coercivity (H_c) does not become zero. Coercivity increases with the increase of single-domain diameter D_{sd} and after reaching the multidomain region with the increasing diameter, coercivity again decreases. Hence the magnet shows the maximum coercivity when the diameter is equal to the single-domain diameter, D_{sd} [8, 10, 20–22].

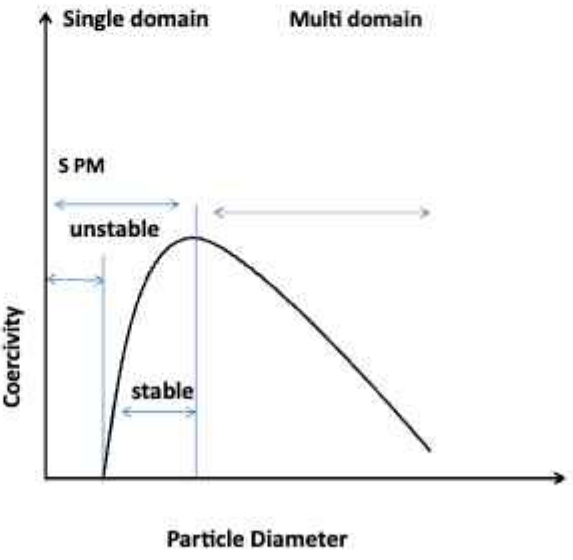

Fig. 32.2 Dependency of coercivity on the size of the particle diameter of magnetic nanomaterial

32.2 Basic Concept of Superparamagnetism

Superparamagnetism (SPM) is a type of magnetism that develops in small nanoparticles of ferromagnetic or anti-ferromagnetic materials which possess single-domain non-interacting magnetic moment grains. Nanosized material with a single magnetic domain can show superparamagnetic behaviour below T_B (blocking temperature) also when the size is sufficiently reduced below blocking volume (V_B), which is the maximum volume below which superparamagnetism starts at a particular temperature and that possibly arises due to spin-based momentum of the unpaired electrons present in the material [21–23].

The energetic stability of a single magnetic domain was theoretically predicted and established by Kittel in 1946 [24]. Magnetic nanoparticles generally show a preference along the direction where magnetic alignment takes place and are said to be anisotropic along these directions. Nanoparticles generally show uniaxial anisotropy, which means that there are two easy directions of magnetization pointing in opposite directions (antiparallel) and are separated by an energy barrier. For single-domain magnetic material, all the magnetic moments are aligned along the preferred anisotropy axis, therefore the free energy contribution from exchange and anisotropy becomes zero. Hence the magnetostatic energy becomes the only relevant energy term.

The critical diameter of the single domain (D_{sd}) of magnetic material has a close relationship with the anisotropy constant K. For identical saturation magnetization (M_s) single-domain diameter D_{sd} increases with domain wall energy, i.e. D_{sd} is proportional to the domain wall energy. When the size reduction of the particle is sufficiently large then thermal energy overcomes the anisotropy energy. At this stage of magnetization magnetic moment shows fluctuating nature rather than stable nature [8, 20, 21].

At a given temperature, as the size is reduced to a large extent, spin-wave energy modifies and becomes comparable to thermal energy in single-domain non-interacting magnetic grain or particle, and thermal energy becomes insufficient to overcome the spin–spin interaction and can lead to random orientations of magnetic spins inside the particles. The critical diameter D_{spm} is the maximum size below which the superparamagnetic behaviour starts at a particular temperature and the corresponding volume at which a particle goes from blocked to unblocked state is called blocking volume (V_B) [22, 23].

At blocking temperature (T_B), thermal energy overcomes the anisotropy barrier of nanoparticles. Above blocking temperature (T_B), thermal fluctuations dominate and magnetic moments are randomly orient. Nanoparticles with a uniaxial anisotropy randomly flip the direction of their magnetization and show a spontaneous reversal of magnetization when thermal fluctuation is sufficient enough to overcome the barrier potential that is supposed to arise from magneto crystalline in origin and due to magnetoelastic and shape anisotropy. It was Neel [25] who shows that above T_B a stable magnetization cannot be established due to thermal fluctuations acting on small particles, and as a result, the system shows *superparamagnetic* behaviour. The

typical time of average laps between two flips is called *Neel-relaxation time* τ_N. If τ_m is considered to be the measuring time of the magnetic effect of a particular nanomagnetic material for its observed magnetic behaviour, then the following observations can be made in a nanomagnetic material [25, 26].

If $\tau_m < \tau_N$, the material is in a blocked state and the magnetization flip does not take place.

If $\tau_m > \tau_N$, magnetic flip occurs and magnetic behaviour alters. The material shows superparamagnetism.

This shows that the observed magnetic behaviour in nanomagnetic material depends on measuring time τ_m. In most practical applications the measuring time τ_m is tried to keep constant. The transition between superparamagnetic and blocked state is used to study as a function of applied temperature.

The first and basic theory that describes the basic understanding of nanoparticle magnetism is the *Stoner-Wolfforth model* [14, 27]. In this model, each nanoparticle is considered as an ellipsoidal homogenous single-domain non-interacting grain. According to this theory, depending on the spin configuration nanoparticles may have a single domain, vortex or multidomain state. Nanoparticles in the smallest range of diameter do not behave as stable magnet but exhibit the phenomenon of superparamagnetism [3]. However, this model is suitable at $T = 0$ K and is applicable to nanoparticles with uniaxial anisotropy only. The large surface to volume ratio in nanoparticles enhances the magnetic moment and anisotropy [27].

32.2.1 BasicTheory

The energy expression for single-domain magnetic grain with uniaxial anisotropy in the presence of external magnetic field H can be expressed as the sum of magnetic anisotropy energy and Zeeman energies:

$$E = KV \sin^2 (\Phi - \theta) - \mu_0 M_s V H \cos \Phi \tag{32.3}$$

where V is the grain volume of the nanoparticle, K being the uniaxial anisotropy constant parameter and M_s is the saturation magnetization. All the three quantities, external magnetic field H, grain magnetization and magnetization easy axis lie in the same plane. Φ represents the angle between magnetization and magnetizing field and θ represents the angle between magnetization easy axis and magnetizing field [10, 17, 25, 28].

In absence of an external magnetic field, two equally energetically favourable directions exist. Both directions are parallel to the energetically favourable spontaneous magnetization direction also called magnetization easy axis for anisotropic magnetic material and there possess the energy barrier ΔE between them in KV. At temperatures higher enough, the thermal energy kT is capable of overcoming the

barrier potential and alteration of magnetization direction takes place. While in presence of an external magnetic field, the symmetry of the two magnetization easy axis directions breaks down. When magnetization direction is along the external magnetic field, domain energy of the nanoparticle grain decreases and therefore energy barrier for spin fluctuation becomes high. The reverse is the case when magnetization directs in opposite direction to an externally applied magnetic field, the energy barrier for spin fluctuation decreases and reversal of magnetization takes place spontaneously. So nanoparticles with uniaxial anisotropy flip the direction of their magnetization randomly and spontaneously. The thermally initiated fluctuations of the magnetization direction between the two easy axis directions are called *superparamagnetic (Neel) relaxation* and the typical expression for *Neel-relaxation time* τ_N can be expressed by the Neel-Brown expression as

$$\tau_N = \tau_0 exp\,(\Delta E\,/kT) \tag{32.4}$$

where τ_0 is the length of time and is the function of the characteristic of the material and usually lies between 10^{-12} s and 10^{-9} s. τ_0 depends weakly on temperature and various material parameters such as magnetic anisotropy constant, particle volume and saturation magnetization [10, 16, 17, 25, 28].

In this regard, a definition of blocking temperature T_B can be given as the temperature at which the relaxation time τ_N equals the experimental time τ_m or T_B can be defined as the temperature between the blocked and the superparamagnetic state [25, 28].

Equation (32.4) represents the connection between the time τ_N and the temperature T.

$$\text{At}\tau_N = \tau_m \quad T_B = \Delta E/kln\left(\tau_m/\tau_0\right), \tag{32.5}$$

A clear distinction between the two states can be expressed as

- The state is blocked when $\tau_m << \tau_N or\, T < T_B$.
- The state becomes superparamagnetic when $\tau_m >> \tau_N or\, T > T_B$.

The first reveal of single-domain particle magnetization presented by *Stoner* and *Wohlfarth* [14] suggested the existence of high coercivity fields below T_B. The anisotropy energy arising from magnetocrystallogenic origin becomes comparable to thermal energy and the direction of the magnetic moment starts fluctuating spontaneously and goes through a rapid superparamagnetic relaxation. The supposed system of uniform non-interacting nanoparticles at $T > T_B$ overcomes barrier energy and the magnetic moments started flipping between the easy magnetization directions. At $T < T_B$, the magnetocrystalline-originated anisotropy energy barrier cannot be overcome by the thermal energy and the magnetic moment of each particle rotates from the field direction back to the nearest easy magnetization axis because of which non-zero coercivity results. The total magnetization decreases with increasing temperature as the nanoparticles and the corresponding easy magnetization directions are randomly

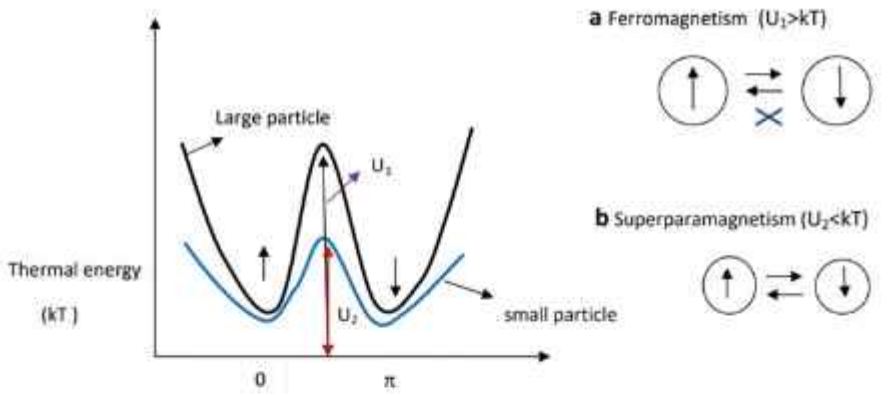

Fig. 32.3 Ferromagnetism in large and small magnetic particle,**a** large particle magnetism ($U_1 > kT$), no spin flipping takes place, **b** small particle superparamagnetism ($U_2 < kT$), with spin flipping

oriented and the randomness increases with temperature [20, 21, 28]. Figure 32.3 shows the ferromagnetism in large particles and superparamagnetism in small nanoparticles.

32.3 Brief Discussions

The typical behaviour of large particle ferromagnetism and small particle ferromagnetism can be observed from the thermal energy transition curve. For two vectors spin directions (vector upward ↑ and vector downward ↓), if spin vector cannot move from one direction to other, there exist some net magnetization and the material shows ferromagnetism, i.e. when exchange energy $U_1 > kT$ vector spin cannot flip or re-orient. In the energy plot (thermal energy as a function of the orientation of the spin) if one spin magnetic moment vector lies in the first stability zone (minimum energy) and if it has to come to the next stability zone (with minimum energy) it has to overcome the energy barrier. The energy barrier is proportional to the grain particle volume (V). The energy barrier potential for a large particle is large. If the spin has to change its direction it has to overcome the large energy barrier. For a small-sized particle of nanodimension, this energy difference is much smaller; therefore, it is easy for the magnetic vector to change its direction crossing the potential barrier. At room temperature also the thermal energy is much greater than the exchange energy between the magnetic vectors [10, 28].

Hence for large particles, at room temperature, the thermal energy is much less than the energy required to cross the barrier, but this energy is sufficiently more than the energy required crossing the barrier in small particles changing the magnetic vector. Hence there is an automatic reversible change in the direction of magnetic vector or spin. At normal temperature also this spin flipping can take place in a

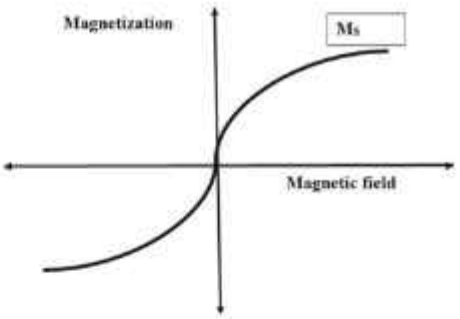

Fig. 32.4 Curve showing superparamagnetism with remanence $M_R = 0$ and $H_C = 0$

nanodimensional particle; hence both the possibilities of stable state are possible in the system. This spin flipping leads to the property of superparamagnetism in the nanosystem. Whenever the energy required or exchange energy U_2 is less than kT (thermal energy) then it can have spin fluctuation and it results in superparamagnetism. Figure 32.4 presents the typical behaviour of the superparamagnetism nature of magnetic nanoparticles, where the magnetization curve passes through the origin.

32.4 Conclusions

For large particle, the hysteresis loop possesses a particular area. When the particle size is reduced sufficiently (around 10–12 nm), these particles do not show the hysteresis loop but a plot that goes through the origin, which is like both remanence and coercive field are zero. This represents the typical paramagnetic behaviour. Although these particles are small they have several moments comprising ions or molecules. These moments are flipping among themselves and the resultant is a paramagnetic behaviour. This is one of the important aspects of the magnetic properties of nanostructures [29]. When the particle size is large it shows the hysteresis loop, but for the same material particle when the size is reduced to nanodimension it does not show hysteresis but passes through the origin with no remanence and coercive field, i.e. superparamagnetism is a function of the size of the particle.

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Artificial intelligence enabled smart glove for visually impaired

Jagdeep Rahul
Department of Electronics Communication Engineering, Rajiv Gandhi University,
Doimukh, India
jagdeeprahul11@gmail.com

Ashutosh Kumar
Department of Electronics Communication Engineering, Vellore Institute of Technology,
Amrawati, India
ashutosh.kumar007@gmail.com

Lakhan Dev Sharma
Department of Electronics Communication Engineering, Vellore Institute of Technology,
Amrawati, India
devsharmalakhan@gmail.com

***Abstract*— Object detection is a technique to tag objects present in the frame of an image, video sequence, and real-time video. In recent years, the world has been reshaped around deep learning algorithms. This paper makes the user aware of the obstacles present in his environment. There are two fundamental parts in this paper: the software part and the hardware part. The state-of-the-art You Look Only Once (YOLO) algorithm was applied in the present work for object identification. The overall analysis shows that this algorithm produces accurate results for real-time object detection and can be considered faster object identification.**

Keywords— Tensor flow, Object detection, Real-time video YOLO, Raspberry pi 3.

I. INTRODUCTION

The world we know is mainly designed keeping in mind the comfort of people without any visual problems. As a result, this creates a gap in communication for visually impaired people. Around 37 million individuals worldwide are blind or visually impaired, accounting for a significant part of the global population. Because of their handicaps, these visually challenged people encounter several challenges in their daily lives. They have the same right to education and information as everyone else. However, their capacity to learn new things is severely limited [1],[13-18]. They must rely on conventional and orthodox means of obtaining information, such as tactile sensations like finger Braille, manual alphabets, and the print on palm technique, but these methods are arduous, slow, and inefficient, and are not suitable for usage in a computer context. As a result, they are unable to access the internet, which is the information hub [2]. The proposed model helps to solve the object detection and identification problem for visually impaired people both indoors and outdoors. This project also adds a security layer for these specially-abled people.

II. LITERATURE REVIEW

Many researchers have proposed various models for helping visually impaired people, and few of them have a very good extent to abolish these problems.

P. Angelov et al. have proposed a model for real time independent object detection and tracking [3] was based on object detection and object tracking with color specific implementation. It was a visual project where video/image data was applied as an input into the model using a webcam with the Raspberry Pi connected. The model proposed by the Aydin Akan et al. [4] for obstacle detection and tracking for visually impaired people on sidewalks . A proposed concept for an obstacle detection and warning system on sidewalks was designed to assist visually impaired persons. On the hardware side, this model was created using a Raspberry Pi and three vibration sensors. The speaker was utilised as an output to communicate the object's name to the user. Python was selected as the programming language because to its speed, compatibility with the Raspberry Pi, and availability of packages. Tensorflow, a Python tool, was utilised to conduct object identification and classification using a pre-trained model in this study.

The method proposed by *Amir et al.* [5] was the *Implementation of the Line Tracking Algorithm using the Raspberry Pi*. The hardware implementation of the model was done on the Raspberry Pi due to its optimum size. The accuracy of the model was sufficient, although the FPS rate was not enough. The work done by *Srivastava et al.* [6] was a prototype of a hand glove for visually impaired people which converts the OCR text to speech. Problems can be reduced to some extent. MATLAB and Arduino were the two software tools used to implement this work. The image processing operations were done using MATLAB, while the ultrasonic sensor programming was done with Arduino. The effort then moved on to obstacle detection, picture to text conversion, and finally text to voice translation.

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In another work a smart glove was developed to assist the visually impaired people in [7]. A prototype of the smart glove was designed utilising a deep neural network and an object tracking algorithm. It is capable of directing the blind to the desired item in an interior setting. A USB camera is included in the palm of the glove, which transmits live video to the Raspberry Pi for processing. Its entire implementation cost was in the neighbourhood of sixteen thousand dollars, which is fairly high. It also made use of Intel movidius NCS, which distinguished it from the previous work. Our suggested model is adaptable to practically any maritime environment and may be used to accomplish the objective for which it was developed.

The suggested method entails creating a portable system capable of labelling objects using the OpenCV and Tensorflow frameworks. The second component of this study is the translation of tagged text to voice and then the output in the form of auditory signals to make the blind person aware of the item or barrier in front of him. This model consists of a hand glove attached to a pi cam. The camera captures real-time video and the algorithm performs object detection. It gives the output to the user as an audio signal through a speaker/earphone. This work is also implemented using the Raspberry Pi (version 3) platform, which makes the model portable. The model detects the object from a predefined and trained class that contains a particular label. This model is also capable of detecting objects from an image or from a video. Hence, this model can contribute greatly to the mobility and safety of visually impaired people.

.

III. PROPOSED METHODOLOGY

In the proposed work, the YOLO algorithm has been used, considering its advantages above all other algorithms.
-YOLO stands for You Look Only Once.

-This algorithm outperformed all of them.

-It divides the image into certain grid cells.

-The output is based on a confidence score.

-The limitation of YOLO is that it struggles with small images.

The object detection and categorization method You Only Look Once (YOLO) is a helpful one-stage technique. YOLO is an object identification method that employs just one neural network. Unlike previous object detection algorithms, which sweep the picture bit by bit, this approach analyses the entire image and reframes object detection as a single regression issue, going straight from image pixels to bounding box coordinates and class probabilities. The flow chart diagram in fig.1 depicts the steps that we have used during implementation of this work.

The proposed system consists of the following steps given below.

1. Real-time video is given as input
2. Image is captured for each frame
3. The captured image is compared to the pre-existing trained data set with the help of the YOLO model
4. The converted image is then further processed for text to speech conversion using the GTTS library.
5. In the last step, the converted speech is given as output with the help of an earphone/speaker

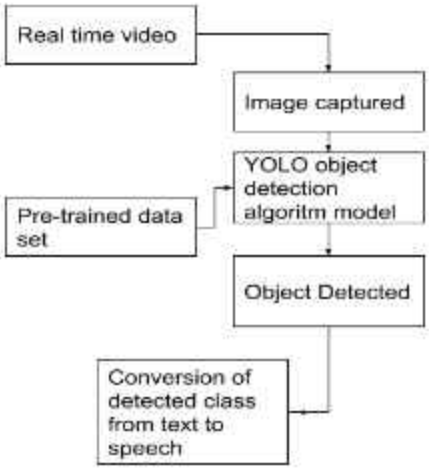

Fig. 1 Flow chart of the proposed model

The entire system can be divided into two sections:

1. Hardware section
2. Software section

1. Hardware section

Raspberry Pi 3:

The Raspberry Pi [8] is a very small, low-cost, and low-powered system on a chip (SoC).It has significantly less processing power than a regular PC or even most modern smartphones, but due to its versatility and cost, it has become popular even outside the initial target audience. The Raspberry Pi 3, which has been used here, boasts some new and improved features, but uses the same SoC as the Model B, at slightly higher clock rates, but with the same amount of RAM. The systematic diagram of the Raspberry Pi 3 is given in fig.2.

Table 1: Specifications of Arduino

Parameter	Specifications
Raw Voltage input	5V, 2A power source
Maximum total current drawn from all I/O pins	54mA
Clock Frequency	1.2GHz

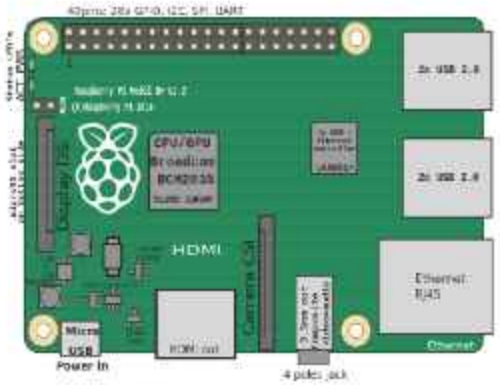

Fig. 2. Raspberry Pi 3 model.

Pi Camera :

Pi camer [9] is used in this work to get a real-time video of the environment. Other cameras could also be used, but the pi cam is more portable with a raspberry pi, so we have used it for this work. The specifications of the used Arduino are given in table 1, and the used Pi camera is shown in fig 3.

Fig. 3 Pi Camera used in model.

Audio Output -

The detected object is converted from text to speech, to get audio output from the used speaker. We have used a bluetooth speaker particularly for demonstration purposes to make this model more handy and portable earphones could also be used.

2. Software section:

The algorithm code for object detection was written in the Python language. There were a series of steps involved, from writing the code to implementing it. In the first step, all the required Python packages were installed, such as YOLO packages, num pi, openCV [10], and tensor flow for running a shell script command in a software environment. The installation of all the libraries was performed in a sequential manner, one by one. If any image is captured by the Raspberry Pi webcam, the width and height of the image are calculated. Based on this height and width, several classes are created, such as boxes, classes, and scores. That boxes were used to particularly bind the objects detected with random colours, and classes were used to name the objects detected, while scores were used to give the confidence value. This whole process gets calculated in a loop for all the detected objects. One key point of this model is that any object is detected only when the confidence value is greater than the threshold value (in this case, the threshold value assigned is 60%).

To convert the detected object into speech, a separate class was created in the code. The Python library used for converting text to speech is gTTS [11]. A new object is created which contains the object to be detected (having an accuracy equal to or greater than 60) along with the language in which the audio will be played and the pace at which the audio is going to play as an argument. The audio after getting converted from text gets stored as an mp3 file which gets played after each image detection.

IV. RESULT AND DISCUSSION

The results were obtained after implementation of the above algorithm for object detection. The steps of the proposed model are presented in fig. 4. This model can work for three kinds of input:-

a.) Image (.png)
b.) Video
c.) Real-time video

Fig. 4. Proposed model step

a) The portable network graphics (.png) file was given as input. The screenshots of the obtained results are shown in fig.5.

Fig. 5. Detected object in uploaded image.

1.) *Video as an input:* - The uploaded video is shown in fig.6

Fig. 6. Detected object in a uploaded video.

2.) Real-time video as an input

Fig. 7. Detected object during real-time video.

The proposed model worked completely well, satisfying all the conditions. However, real-time video processing took a bit of extra time to process when compared to the feed video. As mentioned above all the results obtained were as expected.

The proposed model was tested on all three given input formats, where the achieved results were found satisfactory. The speaker was connected to the Raspberry Pi with Bluetooth. The speaker produces the output as soon as the confidence value score crosses 60%. The limit was given as such to increase efficiency. However, there is sometimes negligible audio lag when compared to each frame processed.

The proposed model was further compared with the existing models to validate the performance of the model. The method given in [3] only uses the YOLO algorithm and neither portable nor audio as an output. The methods proposed in [4] and [6] were capable of producing audio as an output, but neither the portable nor the YOLO algorithm used there. The models in [5] and [12] were portable, but the YOLO algorithm was not used there. Our proposed model produces the audio as an output, is portable, and uses the YOLO algorithm to achieve object identification. The overall comparison of the proposed model was performed in table 2.

Table 2. Comparison of the models

S. No.	Existing Model	Authors name	Audio Output	Portable	Yolo algorithm Used
1	Real time approach to autonomous novelty detection and object tracking	P. Angelov [3]	No	No	Present
2	Designing an obstacle detection and alerting system for visually impaired people on sidewalk	Aydin Akan [4]	Yes	No	No
3	NETRA(2019)	N.K. Srivastava[6]	Yes	No	No
4	Line tracking algorithm using Raspberry Pi	Samreen Amir [5]	No	Yes	No
5	Object detection and human identification using Raspberry Pi	R.S.M. [12]	Yes	Yes	No
6	Proposed Model	J. Rahul	Yes	Yes	Yes

V. CONCLUSION

A prototype of an AI-enabled Smart Glove has been designed which is effective in helping the navigation of visually impaired people. It detects any object indoors as well as outdoors with the help of a trained data set. The device is compact and portable. The accuracy obtained using the YOLO algorithm is comparatively higher when compared to other algorithms like CNN and RCNN. When compared to other existing works, it also takes less time to process the video file. We have observed better accuracy when the image is given as

an input as compared to that of video and real-time video. The idea of detecting the object only after it reaches a minimum threshold value makes the model more precise and accurate, hence avoiding any false detections.

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José Machado, Hugo Peixoto, and Regina Sousa

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Chapter 2
A Review on Artificial Intelligence for Electrocardiogram Signal Analysis

M Krishna Chaitanya
VIT AP University, India

Lakhan Dev Sharma
https://orcid.org/0000-0002-5389-3928
VIT AP University, India

Amarjit Roy
Ghani Khan Choudhury Institute of Engineering and Technology, India

Jagdeep Rahul
https://orcid.org/0000-0003-4890-1898
Rajiv Gandhi University, India

ABSTRACT

Cardiovascular disease (CVD) is a broad term encompassing a group of heart and blood vessel abnormalities that is the leading cause of death worldwide. The most popular and low-cost diagnostic tool for assessing the heart electrical impulses is an electrocardiogram (ECG). Automation is required to reduce errors and human burden while interpreting ECG signals. In recent years, deep learning shows better performance in ECG classification and has also shown that automated classification of ECG signals can improve accuracy and efficiency. In this chapter, the authors review the research work on ECG signals using deep learning methods like deep belief network (DBNK), convolutional neural network (CNNK), long short-term memory (LSTMY), recurrent neural network (RNNK), and gated recurrent unit (GRUT). In the research articles published between 2017 and 2021, CNNK was found to be the most appropriate technique for feature extraction.

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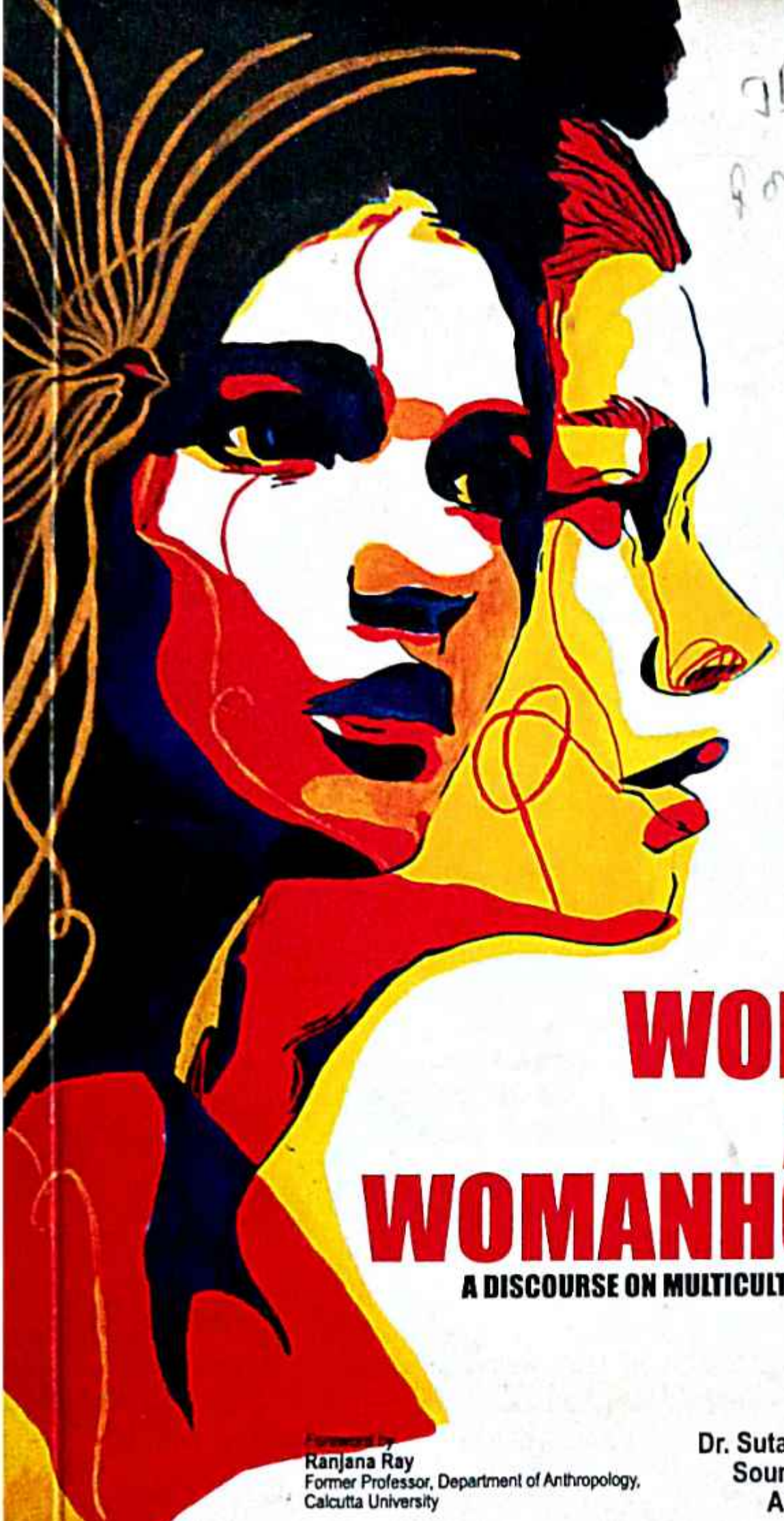

WOMEN AND WOMANHOOD

A DISCOURSE ON MULTICULTURAL IDENTITY

Foreword by
Ranjana Ray
Former Professor, Department of Anthropology,
Calcutta University

Editors
Dr. Sutapa Choudhury
Soumita Chatterjee
Animesh Manna

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THE EDITORS

Dr. Sutapa Choudhury is an Associate Professor in the Department of Anthropology, University of Calcutta, West Bengal, India. She has teaching experience of more than 20 years in the realm of Anthropology. Formerly she was engaged as an Assistant Professor in the Department of Anthropology of Vivekananda College of Women, Kolkata, West Bengal. Her research interests mainly involve Criminology, Women Studies, Heritage Management, Gerontology, Ethnography and Indigenous knowledge. She has research publications in National & International Journals and book chapters focused on Social and Cultural Anthropology. She is life member of Indian Science Congress Association and Indian Anthropological Society.

Ms. Soumita Chatterjee is a doctoral research scholar in the Department of Anthropology, University of Calcutta, West Bengal, India. She enjoys her teaching life more than 5 years in the Department of Anthropology, Shyampur Siddhesswari Mahavidyalaya, West Bengal, India. She has numerous publications in National and International Journals and book chapters. Her research interest includes Indigenous art forms, Anthropological approaches of crime, Women empowerment, and Psychological Disease in our daily life.

Mr. Animesh Manna, Assistant Professor in the Department of History, Shyampur Siddhesswari Mahavidyalaya, Howrah, C. U. has got his Post Graduation Degree in History from Rabindra Bharati University. His focus area of Research includes culture of Bengal, Food studies etc. He has edited one Book namely Nari Naraker Dwar and has written many book chapters and Articles in several edited book. He has few articles, occasional papers, book chapters published like Infusion of Gazal in Indian Style of Music, Bengali women in Armed Revolution, Solid Waste management: past, present and future, Divinity of Snake and Its Importance in Indian Mythology, Mahapith Kankalitala: Overwhelming Religiosity, Partition, Migration and Music: Transition of Gazal after 1947 etc.

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Department of Operations Research, Faculty of Graduate studies for Statistical Research
Cairo University
Giza, Egypt

Khalid Abdulaziz Alnowibet
Department of Statistics and Operations Research
King Saud University
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QOL Barometer for the Well-being of Citizens: Leverages during Critical Emergencies and Pandemic Disasters

Arindam Chakrabarty, Uday Sankar Das, and Saket Kushwaha

Abstract Improving the quality of life for its citizens has been the focal point of any governmental system across the globe. Every state is committed to providing good governance to its countrymen. Society is moving through the Fourth Industrial Revolution (4IR) where the e-governance ecosystem has become the priority need of the hour. The days of mechanistic bureaucracy have become unpopular and outdated. The modern democracies desire an organic, citizen-friendly governmental system where information needs to be collected from the people at the bottom of the pyramid so that the state could ensure delivery of improvised and augmented public goods and services effectively and efficiently keeping in view its commitments for achieving all the UN-SDGs by 2030. This chapter has devised a dedicated model based on an e-governance framework. This QOL Barometer would be designed using the 4IR ecosystem. The innovative QOL Barometer or the "CARE-Protocol" may be developed and implemented for improving the quality of life of its citizens. This protocol would be conceptualized, based on inputs and insights from secondary sources. The benefits of this model can be leveraged during critical emergencies and pandemic disasters.

Keywords e-Governance · Fourth Industrial Revolution · QOL Barometer · UN-SDGs Emergencies · Pandemic

A. Chakrabarty (✉)
Department of Management, Rajiv Gandhi University (Central University), Doimukh, Arunachal Pradesh, India
e-mail: arindam.chakrabarty@rgu.ac.in

U. S. Das
Department of Management & Humanities, National Institute of Technology Arunachal Pradesh (INI under MHRD Government of India), Jote, Arunachal Pradesh, India

S. Kushwaha
Banaras Hindu University, India & Vice-Chancellor, Rajiv Gandhi University (Central University), Doimukh, Arunachal Pradesh, India
e-mail: saket.kushwaha@bhu.ac.in

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25.1 Introduction

Qualities of life for the citizens are the real measures in the efficacy of governance. In the era of automation and knowledge and economy, it is imperative to provide prompt and quality solutions to the countrymen. Society deserves a dedicated comprehensive and robust mechanism so that the state can render appropriate services to its target audience. The fourth industrial revolution has been strengthening E-Governance systems to energize for the superior momentum of public service and distribution framework. It is observed that the developed states have been prioritizing creating an improvised E-Governance ecosystem to fulfill the commitment toward good governance.

25.1.1 Idea of Quality of Life

Mankind has been on a constant quest for the betterment of his living conditions since the inception of humanity. As humans grouped themselves under the societal banners many pre-scientific philosophers, thinkers, and administrators attempted at understanding the basics of quality and how it might be applied for improving the human condition.

These frugal attempts found a base when psychiatrist Viktor Emil Frankl conceptualized "Logotherapy" inspired by the works of Sigmund Freud & Alfred Adler. The idea of "Logotherapy" was simply an inquiry into the three basic psychological philosophical pointers, i.e., (a) Freedom of Will, (b) Will to Meaning, (c) Meaning in Life (VFI/Logotherapy and Existential Analysis n.d.). These ideas were derived from the experiences of his struggle to remain hopeful for a better life while imprisoned in a German Nazi Camp; the ordeal of which later turned out to be a best seller (Frankl 1963). The works of Viktor Emil Frankl silently conceptualized the idea called "Quality of Life" and cemented it in academics, literature, polity, healthcare, and global policies from the 1970s onward often without landing any credits to his works or perhaps simply denying it as an idea pulled out of thin air.

Quality of Life became the catchphrase of decision makers in determining the qualitative aspect of human life. Several symposiums derived and concluded several measurement tools to quantify the dimensions into measurable terms (Environmental Protection Agency USA 1973). Quality of Life (QOL) measurement is sometimes looked upon as a means of needs satisfaction for the holistic distribution of goods and services to propagate social justice (McCall 1975). Different academic streams tried to utilize the idea of QOL and formulate measurement tools for various fields like economics, healthcare, marketing, and organizational psychology (Michalos et al. 2006).

QOL is often modeled around a three-dimensional aspect of an individual's being, belonging, and becoming (Quality of Life Research Unit n.d.). Over the years QOL has turned out to be a favorite tool to assesses and quantify the qualitative

aspect of human life for both researchers and policymakers across the globe, pitching it up as a de-facto choice.

25.1.2 QOL as a Part of Holistic Development

The answer to the quest for refining the human condition is answered with improving the quality of life to achieve holistic development. Several indices and indexes are either formulated or incorporated in existing policy reports to measure the quality of life for a very long time.

One of the early attempts to measure the QOL in this direction was possibly the Physical Quality of Life Index (PQLI) that aimed at avoiding the limitations posed by Gross National Product by measuring literacy, infant mortality, and life expectancy (Morris 1978).

The "Human Development Report" produced by the United Nations Development Programme incorporated the QOL parameter in 1997 in the form of the Human Poverty Index based on figures like access to safe drinking water, and prevalent poverty(Undp 1997). The 1990s saw the indexing of countries based also known as the Human Development Index, which was later adjusted to the Inequality-adjusted Human Development Index from the year 2010 onward. The Human Development Report also measures gender gaps as Gender Development Index calculating the disparities between men and women in the health, knowledge, and living standards dimensions (Unit 2005).

Another such attempt in the same direction was attempted by the Economist Intelligence Unit of The Economist also known as "Quality of Life Index" that tracked the non-monetary social indices through its Life satisfaction survey, that quantified figures like material well-being, health, political freedom, security and stability, family and community life, climatic conditions, job security, and gender equality (International: The lottery of life|The Economist n.d.). This was later renamed as Where to be born Index as the lottery won predetermine the success of an individual based on the favorable dependent factors in a particular place (lessons from Bhutan on the pursuit of happiness above GDP|World Economic Forum n.d.).

The mountain nation of Bhutan is on a marathon run to promote QOL in the form of Gross National Happiness comprising not just the economic factors but also the moral development among its citizens. This was to be achieved riding on the back of good governance, environmental protection, cultural safeguard, sustainable and equitable economic development, and stepping into the future technologies for a holistic overall development (Interrogation 2008; World Happiness Report 2020 | The World Happiness Report n.d.). Good ideas resonate throughout the globe and it gave birth to the concept of measuring world happiness in the shape of the World Happiness Report by the United Nations Sustainable Development Solutions Network that added happiness and well-being along with the economic indicators for measuring the development vector of the country (About the HPI | Happy Planet Index n.d.). Another similar index is the "Happy Planet Index" that combines four

parameters namely well-being, life expectancy, inequality and injustice, average ecological footprint, which factors for a long happy life (WVS Database n.d.). A noteworthy mention at this stage would be of the World Values Survey (WVS) that tries to quantify and measure the intangible values like social, economic, religious, cultural, and political change in values of the global fraternity (Gender Development Index (GDI) | Human Development Reports n.d.).

A dimension of "Welfare Economics" popularly referred to as "Happiness Economics" is often vetted against traditional developmental economics as a much more inclusive and appropriate measure for a rounded development (What are the economics of happiness? | Yale Insights n.d.; The Economics of Happiness | Greater Good n.d.; The Economics of Well-Being n.d.; Why we need to choose happiness over economics | World Economic Forum n.d.).

Quality of life is not just about holistic development and economic well-being it has a hidden aspect, the factor of disposable time. The lack of which is referred to in the popular culture as "Time Poverty" which essentially means the individual does not have enough time for the contribution to social and human capital development (Kalenkoski and Hamrick 2014). QOL is also extensively used in the health care sector to measure the success or outcome of various medical procedures. According to the World Health Organization (WHO), QOL is an individual perceptual context based on individual standards, expectations, standards centered around the cultural value systems. WHO has created an instrument known as WHOQOL (WHOQOL-100 and WHOQOL-BREF) to measure the quality of life (WHO 2014).

25.1.3 Socioeconomic Changing Roles and New Dimensions of Governance: Good Governance and E-Governance

The world has been mostly governed by a democratic setup. In a democracy, every citizen of a county can choose their representative and the government is formed with the majority of a particular representative group. The role of the government in democratic orientation was to provide goods and services to its countrymen. This system is perfectly alright when there is no such competition, complexities, or higher commitments toward achieving improvised quality of life in consonance with rapid technological development. The state-controlled machinery has an inherently limited aspiration for higher growth trajectories rather it develops conservative and status quo syndrome with the growth of population it becomes unrealistic to provide goods and services to all its citizens. The momentum of liberalization privatization and globalization (LPG) coupled with the technological revolution had mended all of us into a massively competitive world both at an individual level and in a collective manner. It has made the state untenable to act as a provider of all utility products and services there is a paradigm shift that the state has initiated the role of being facilitator so that new entrepreneurial expeditions can be improvised and innovative startups can be patronized. The notion of good governance has become the focal

point not only to maintain law and order rather enhance a vibrant economy and ensure superior quality of life for its countrymen. There are two schools of thought of any good governance ecosystem of which a section of experts advocate for a higher order of human intervention with an increased face of humanistic touch to make the governance system highly acceptable and adaptable. On the contrary, the other school conservatively believes indiscriminate human intervention in the governmental machinery necessarily makes the system biased prejudiced ambiguous, and most importantly a genesis of corruption. Human-centric governance essentially suffers from procrastination syndrome. To address all these challenges and emerging dynamics of societal aspirations good governance has become the minimum condition for gaining and retaining power in the political corridor of the country where a substantial function can be accomplished by the e-governance ecosystem.

25.1.4 Revolution in E-Governance Ecosystem across the World

The United Nations Department of Economic and Social Affairs under the banner of the Division for Public Administration and Development Management devised a tool United Nations E-Government Development Database (UNeGovDD) that tracks the global E-Readiness for the member states of the UN. This database lists Denmark (Rank 1), Republic of Korea (Rank 2), Estonia (Rank 3), Finland (Rank 4), Australia (Rank 5), Sweden (Rank 6), United Kingdom of Great Britain, and Northern Ireland (Rank 7), New Zealand (Rank 8), the United States of America (Rank 9), Netherlands (Rank 10) among the top ten performers for the year 2020 out of 193 participant nations. Countries in the Indian subcontinent is ranked in the same list in the following order Sri Lanka (Rank 85), India (Rank 100), Bhutan (Rank 103), Maldives (Rank 105), Bangladesh (Rank 119), Nepal (Rank 132), Myanmar (Rank 146), Pakistan (Rank 153), and Afghanistan (Rank 169) (UN E-Governance Knowledgebase 2020). These rankings are derived using the United Nations E-Government Development Index (EGDI) that is based on the weighted average of Telecommunications Infrastructure Index (TII) essentially measuring the data connectivity as monitored by the International Telecommunications Union (ITU), Human Capital Index (HCI) measured by the United Nations Educational, Scientific and Cultural Organization (UNESCO), and Online Service Index (OSI) which is an independent survey conducted by United Nations Department of Economic and Social Affairs (UNDESA) in the form of an Online Service Questionnaire (OSQ). Each of the three indices contributes one-third of the value for calculating EGDI of any nation along with a section of Member State Questionnaire (MSQ), all these questionnaires try to assess the online delivery of services, openness of government data, digital divides, use of ICT and implementation in the whole of government.

More countries across the globe are adopting the E-government strategy in various innovative ways to reach the entire society with the whole of government,

with formulations like e-participation, data-centric focus revolving around technologies like artificial intelligence and blockchain to reduce the digital divide through digital kiosks in far-flung areas and achieve the development of smart cities/smart villages. Approximately 65% of the member countries now are in the high or very high group of EDGI ranking while 22% have moved up the rank since the year 2018. It is noteworthy to mention that the EDGI ranking has a positive correlation with the income level of the country. In the new normal of COVID19 E-Governance is facing a massive stress test as most of the face-to-face services were disrupted due to the social distancing guideline. It was evident that countries with robust E-Government infrastructure were able to steer clear through this pandemic with much more ease than those which lacked such facilities. However, the hope notation is that around 85% of the countries globally offer at least one transactional online service. Approximately an average of 14 different services can be availed through the E-Governance platforms of the member states, some of the most common services include applying for a birth certificate, registering or applying for a new business, and paying utility bills online (United Nations E-Government Survey 2020).

If one is to look with the magnifying glass to inspect landmark victory for principalities in the journey of human development then perhaps the bicycle nation of Denmark would possibly beat every other candidate black and blue in every parameter with radical margin. This still stands true for E-Governance where the nation has surpassed Estonia which happens to be an early bird to catch the E-Government train. The Danish governments' official website claims that the nation is digital by default hence you can get all your official work done from the comfort zone of your computer screen within a span of 24 hours be it registering a business, reporting a bicycle theft, or even dealing with a health care issue (The key to Denmark's digital success n.d.). None the less tiny nation of Estonia is still a tough competitor in the E-Governance space with 99% of the services offered online 24 by 7 and an astounding 44% of the citizen's vote digitally using the i-voting platform. The tall claim of this nation not only stops at this, they also officially claim to have saved 844 years of working hours and becoming a hassle-free nation (EAS 2019). Some of the key measures that helped this tiny nation achieve this feat are the digitization of registers to support e-services based on a platform called X-Road, provision of digital id's and making digital signature equivalent to physical signatures. This was backed by the early success of e-banking which helped the nation accept the idea of digital governance. Estonia is experimenting with blockchain in creating a digital embassy and promoting e-residency programs (How Estonia became an e-government powerhouse–Tech Republic n.d.).

India launched the "Digital India" campaign back in the year 2015 with the vision not to miss the train of the information age, the outcome of which was to accesses the various strengths for this adventure. The program revolves around three pillars of digital infrastructure, i.e., (i) Digital infrastructure as utility, (ii) On-demand Services and Governance, and (iii) Citizen Empowerment through Digitization.

India is among the top three digital economies with one of the largest unique digital identification program (AADHAAR), the digital divide is also reducing day by day as mobile services are penetrating the remote hinterlands. India also aims to

digitize the healthcare services sector, education sector, and built on a robust E-Governance ecosystem for the future (India's Trillion-Dollar Digital Opportunity 2019). Although these are great ambitions for a nation, however, the base of digital society needs to be built on the backbone of digital governance as is evident in the case of Denmark, Estonia, or South Korea.

25.1.5 *Recent Experience of E-Governance Protocol for Mitigating COVID Pandemic*

The COIVD pandemic struck the global community with shock and awe strategy paralyzing normal life, halting economic activities, even hitting very hard at the core of community life with forced social distancing, quarantining, and strict containment. The pandemic created such an atmosphere that even the most democratic governments of the world were forced to enact dictatorial practices and enforce sudden lockdowns as a choice between life and death. Several silver bullets were fired as a solution to this pandemic however least was achieved. One of the early outcomes of this pandemic was a global frenzy to trace and isolate COVID-positive cases. This phenomenon gave birth to a new trend of contact tracing apps across the world by governments as a measure to tackle COVID as a non-medical intervention in the form of basic E-Governance (Table 25.1).

Most of these applications track positive COVID cases the users' proximity to access a risk profile. Some of the applications are also able to trace the routes used by a user and alert any possible risk outcome to other users. The "Thai Chana" application possibly differs from the rest as it is designed to be a post COVID measure to step out in the world and perform day-to-day activities including commercial activities.

Even local governments used such half-baked applications as a non-medical intervention or even to disperse E-Governance services like the one launched by the Government of Delhi-NCR in India called "Delhi Corona" that was specifically designed to provide information about the availability of hospital resources and reduce the rush and run around in a massive, populated city like National Capital Region (Kejriwal launches 'Delhi Corona' app for real-time information on availability of hospital beds–The Hindu n.d.). It is not that any government could have produced a perfect application in these desperate times but a much more coordinated effort perhaps could have yielded better results.

World Summit on Information Society (WSIS) is a UN forum that keeps a track of E-Governance progress across the world. It is a forum that keeps a track of the growing digital divide in the world. Around 40% of the global population lives in poverty-prone nations, and approximately 1 billion people have no access to ICT. Poverty and the digital divide are correlated. Several solutions are proposed to overcome the digital obstacle policy solutions like easy user-friendly web services,

Table 25.1 Indicative list of contact tracing apps for COVID-19 across the world

SL. No.	Country of origin	Name of the app
1.	Australian	COVID safe (COVIDSafe n.d.)
2.	Austria	Stopp Corona (Stopp Corona n.d.)
3.	Azerbaijan	E-Tabib (Download the "E-DOCTOR" mobile application n.d.)
4.	Bahrain	BeAware Bahrain (Kingdom of Bahrain–eGovernment Apps Store: BeAware Bahrain n.d.)
5.	Bangladesh	Corona tracer BD (Corona Tracer BD–Apps on Google Play n.d.)
6.	Canada	COVID alert (Download COVID Alert today–Canada.ca n.d.)
7.	China	Close contact detector (China launches coronavirus "close contact detector" app–BBC News n.d.)
8.	Colombia	Coronapp (Coronapp n.d.)
9.	Croatia	STOPcovid19 (STOPcovid19–STOPcovid19 n.d.)
10.	Czech Republic	eRouška (eRouška–chránímsebe, chránímtebe n.d.)
11.	Denmark	Smittestop (Stop udbredelsenaf COVID-19–Smittestop n.d.)
12.	France	StopCovid (StopCovid | economie.gouv.fr n.d.)
13.	Germany	Corona-warn-app (Bundesregierung | Aktuelles | Veröffentlichung der Corona-Warn-App n.d.)
14.	Ghana	GH Covid-19 tracker app (Bawumia launches GH COVID-19 Tracker App n.d.)
15.	Hungary	VírusRadar (VírusRadar–a Koronavíruskövetéséreés a COVID-19 ellenivédekezésre n.d.)
16.	Iceland	Rakning c-19 app (Information about Covid-19 in Iceland n.d.)
17.	India	AarogyaSetu Mobile app (AarogyaSetu Mobile App | MyGov.in n.d.)
18.	Ireland	COVID tracker app (COVID Tracker App–Ireland's Coronavirus Contact Tracing App n.d.)
19.	Israel	HaMagen (HaMagen–The Ministry of Health App for Fighting the Spread of Coronavirus n.d.)
20.	Italy	Immuni (Immuni - Download Immuni n.d.)
21.	Japan	COVID-19 contact-confirming app (New Coronavirus Contact Confirmation Application (COCOA) COVID-19 Contact–Confirming ApplicationlMinistry of Health, Labor and Welfare n.d.)
22.	Jordan	Aman app (Aman n.d.)
23.	Latvia	ApturiCovid (ApturiCovid n.d.)
24.	Malaysia	MyTrace (MyTrace, a Preventive Counter Measure and Contact Tracing Application for COVID-19–KementerianSains, TeknologidanInovasi (MOSTI) n.d.)
25.	Nepal	COVIRA (COVIRA n.d.)
26.	New Zealand	NZ COVID tracer app (NZ COVID Tracer app | Ministry of Health NZ n.d.)
27.	North Macedonia	StopKorona (StopKorona!–tracing of Coronavirus exposure and protection from COVID-19 n.d.)
28.	Norway	Smittestopp (Smittestopp–app–helsenorge.no n.d.)
29.	Qatar	Ehteraz (Qatar makes COVID-19 app mandatory, experts question efficiency | Qatar News | Al Jazeera n.d.)

(continued)

Table 25.1 (continued)

SL. No.	Country of origin	Name of the app
30.	Singapore	TraceTogether (TraceTogether n.d.)
31.	Spain	App radar Covid (App Radar Covid, la aplicación de rastreoparaEspaña | Noticias de Tecnología en Diario de Navarra n.d.)
32.	Switzerland	SwissCovid app (SwissCovid app and contact tracing n.d.)
33.	Thailand	Thai Chana quick response (Thailand wins n.d.)

installation of e-kiosks, or simplified mobile devices like "Simputer." Some of the factors determining good e-governance are:

- Cooperation between national and international governments.
- Normalization of the legal framework.
- Reasonable costing for interoperable services.
- Holistic promotion of digital literacy, e-learning, etc.
- Preparing underprivileged society for the Tsunami of Information Society (e-Readiness).
- Increased transparency and promotion of e-participation, e-services, etc..
- Overall all citizens inclusive public administration process to address bureaucratic deadlocks.
- Access to knowledge through e-services to achieve an overall improvement in "Quality of Life" (Stoiciu 2011).

Open Government Partnership is another popular concept based on the idea of responsive, accessible, accountable, open governance with long-term benefits across a broad range of issues and citizen engagement in overseeing governmental activities using digital tools (Open Government Partnership 2020).

Some unique technology-led solutions were also innovated during this Pandemic. For example delivery of essential goods to the households in containment zones/ risk-prone areas with participation from hand card vendors and reducing footfalls in local markets, preserving social distancing. Time allocation for consumers for the purchase of particular goods from a particular shop was also a prominent e-governance feat achieved in some cities in India (Covid-19: Use of new-age technologies for e-governance, Government News, ET Government n.d.).

25.2 Literature Review

Tons of literature are present about QOL, E-governance and COVID pandemic, however, a focused approach is applied to narrow down available relevant recent literature, specifically that devise assessment models for measuring QOL relevant to the present study.

25.2.1 Measuring Quality of Life

A dimension of QOL is strictly related to the health of an individual, with this view the "World Health Organization" endeavored to build a tool to measure the "Health for All" with a holistic vision of prompting social, mental, and physical well-being. This tool was named WHOQOL that assessed an individual's relative perception about his expectations, goals, and concerns in the context of his/her culture and value system. The scores are derived from a multidimensional profile of six domains and 24 subdomains (WhoQOL Group 1995). A pilot survey was eventually conducted containing 236 questions 29 dimensions of QOL divided across 6 domains. Each dimension had approximately four sets of questions of perceived and self-reported types of questions. This highly standardized questionnaire was administered after prepping the target population for about two weeks (Group 1998).

WHOQOL has been established over the years as a reliable de facto instrument to measure QOL in various cultural, language settings across the globe. An example is that "WHOQOL-l00 Hindi" was found to be a suitable instrument to measure QOL and "WHOQOL-l00 BREF Hindi" was found ideal for measuring results of a drug trial (Saxena et al. 1998). Similarly in the USA and UK, the standard "WHOQOL-l00" was found effective in meaning QOL for medical patients (Skevington 1999; Bonomi et al. 2000). Again the "WHOQOL-l00 BREF" passed its reliability test in both Korea and Brazil in the localized version. (Min et al. 2002; Berlim et al. 2005).

HRQOL is mostly administered in a pen and paper mode in a self-report, in person, or via a telephonic interview. This rudimentary technique is not just old-fashioned but also lacks the impunity ease provided by the much more responsive digital technologies like a computer or mobile-based instruments. Both the administrator and the responder showed a positive inclination to the use of technology in a survey conducted among 134 patients (Crawley et al. 2000). Several organizations both academic and non-academic are working toward developing instruments to measure HRQOL. Among them are the international society for quality of life research (ISOQOL) and the Scientific Advisory Committee (SAC). The Scientific Advisory Committee is focused on the refinement and development of HRQOL instruments reducing gaps and making them culturally inclusive, easily interpretable (Lohr 2002).

The 1960s played a significant role in highlight hidden poverty using social indicators and reporting. A proposed QOL barometer in public administration is to shift the scale of measurement from material welfare to universal common concerns of the society. This mechanism would help determine the how-to and what-to aspects of public administration through public participation in effectively resolving social issues (Johansson 2002). There stands a conflict between the established "Gold-Standard" translation norms and canonical methods in translating HRQOL instruments. This is specifically true when the barrier of language is deep between the original language of the instrument and the translated language. Alternative methods like an adaption of a dual translation pattern may prove to be efficient in such cases of need bases QOL measure (Swaine-Verdier et al. 2004). Asia may be

considered as a prominent example in such a scenario where a large chunk population speaks Mandarin followed by Hindi and other languages like Japanese, Malay, and Tamil. As most HRQOL instruments are adaptions designed in the western hemisphere major issues are incorporated in the process of translation that makes it ill fit for the Asian problem given the strict translation protocols. Asian countries are still infested with illiteracy and remoteness leaving these instruments designed to be self-completed infective and useless in the ocean of linguistic dialects that differs very often. The result is a biased reporting of economic developments rather than the ground-level picture of disease burden. These instruments may be designed keeping in purview the cross-cultural adaptions needed specific to Asian provinces (Cheung and Thumboo 2006).

The European Parliament made its intention clear regarding the measurement of holistic development and look beyond the GDP numbers in 2009 with five-point indicators. This was essential at a time when the world was preparing for measuring societal progress beyond economic growth only (Bache 2013). EuroQOL or EQ-5D is an inter-disciplinary EuroQOL instrument developed by the efforts of five countries composed of a three-level five-dimensional approach designed to measure the health status. The instrument ran into several issues with the initial translation in multiple languages the rectification of which further enhanced the instrument. This experience also resulted in two more versions of the instrument EQ-5D-5L and EQ-5D-Y for youth. None the less EuroQOL is also a popular instrument of choice for measuring QOL across the globe (Devlin and Brooks 2017).

Several sociodemographic variables play a vital role in determining the health and happiness of the community. This was evident in the case of the community residing in Juarez, Mexico (Molina-Herrera et al. 2019). To determine the impact of the multifactorial problem on the quality of life of its citizens a multivariable analysis is needed for understanding community-oriented problems (Callejo et al. 2019).

25.2.2 Governance and E-Governance

The United Nations have initiated e-Government measurement initiatives among 178 member states under the "e-Government Readiness Index" and "e-Participation Index" also known as e-PI and e-GRI using an e-Government Readiness Assessment survey based on Innovation Management Measurement Framework. The IMMF is built on Input, Knowledge Management, Innovation Strategy, organization and culture, portfolio Management, project management, and commercialization headers. These 7 constructs and 19 sub-constructs try to measure and promote e-Governance across the globe (Potnis 2010). An evaluation of three countries India, Ethiopia, and Fiji showed positive results that can help reduce corruption in government administration. Limited usage of e-governance in developing countries has deprived those countries of the benefits of e-governance mechanisms. However, an important point is that ICT technologies need to be revamped to effectively incorporate governmental plans and reduce the digital divide (Singh et al. 2010).

The single project, single governance, and single jurisdiction model is not efficient and hampers the applicability of administration and researches in continuation. e- Governance is a probable solution to solve this crisis and improve upon the existing mechanisms (Kaye 2011). Cloud computing as technology has significant application in the e-governance space as it frees the local governments which are often underfunded and has an infrastructure bottleneck for implementing successful online portals or governance sites. This also makes the portals much more reliable and available as the downtime is almost reduced to zero (Tripathi and Parihar 2011).

The Indian e-governance space is still nascent and there is tremendous scope for improvement and it needs to go through several phases of change management before it can achieve a self-sustainable model. Policy gaps exist in every facet of the e-government aspect as ICT is not completely incorporated into the system. The implementation framework is also not as robust and immense opportunities exist for improvement in the sector (Singh and Kiran 2013).

E-governance of e-commerce is still an under-investigated area. Research in a similar direction between government, business, and civil society highlighted severe lacuna and compromise in the system. E-consumer protection needs to be looked at from the angle of all the three dimensions as mentioned earlier rather than just from a marketing perspective. E-consumer protection will ensure the voice of the consumer is protected by the implementation of e-governance in this era of e-retail (Ha and McGregor 2013).

The early 1990s gave rise to the concept of New Public Management and E-Governance. Increased consumer expectations have left have pressurized local governments across the world to improve upon the governance mechanism and promote good governance. Information and communication technology lead governance is much more transparent and accountable and successful implementation of e-governance requires injection of finances, human resource, administrative, and citizen-oriented changes to be effective. India can achieve this feat by developing well-directed leadership intended to achieve these goals (Sapru and Sapru 2014).

The popular blockchain technology is found to be reliable, safe, and anonymous for building e-governance applications and when coupled with technologies like the Internet of Things will help the creation of e-democracy tools powered by automation and minimizing the security risk of exposed or open systems. This blockchain technology is a decentralized information exchange, used by millions across the globe as it shields the common user from the risks of the world wide web by default, which is unprecedented in historical terms (Qi et al. 2017).

Digital technologies have made citizen participation in the arena of public policymaking by reducing the cost of public participation to a minimum level. However, people would still need encouragement for deliberate participation in these processes. The scope of influence digital technologies can exert from lobbying to e-governance, e-participation, citizen budget, etc. (Baxter 2017). E-governance website has the probability to enhance the democratic nature of government (Lee-Geiller and Lee 2019).

It is a known fact that e-governance has improved the government machinery across the globe making it transparent and accountable. Investigations in the

literature show a major contribution of information system management, social networks, and open data in building such governments robust and resilient (Bindu et al. 2019).

25.2.3 *Changing Scenarios of E-Governance and Digital Divide in COVID Pandemic*

One thing that is already clear in this COVID world is no one will come out of this without something or the other. The lessons of COVID-19 will be a renewed struggle among the fittest in postmodernity testing both the strengths and skills of an individual and the nations as well. This is the new reality social freedom will no longer mean the same things that we once perceived. Old world order will have to stand the test of time against the rising powers. Information technology, e-governance, commerce, health, and artificial intelligence will play a much more potent role than earlier. There is a possibility of human rights conflict with extensive technology-driven monitoring systems for the citizens (Sharfuddin 2020). Taiwan is approximately 200 kilometers far away from the COVID-19 epicenter in China. The collaborative model of governance in Taiwan is often hailed for the early success against COVID as cooperation helped mobilize the essentials at a very early stage (Huang 2020).

COVID-19 pandemic quickly shifted hotspot from China to Europe and other Asian countries depending on the sociocultural context and soon hospitals were overwhelmed with resulting tragic stories. However, based on the responses East Asian countries were able to counter and manage this pandemic in a much effective manner, and an exaggerating amount of similarities exists between the responses of these countries (Shaw et al. 2020).

COVID-19 has pushed the digital agenda to the forefront of the society where normal functioning of day-to-day activities was only possible safely in the digital space. Also, governments across the world were using digital tracking and tracing systems (DTTS) or contact tracing apps to trace individual's locations and behavior patterns for risk analysis. This is where the question gets complicated and twisted as it directly hinders the agenda of cyber-surveillance and is perhaps a step closer than what we expect. The question of digital ethics is an unfinished agenda in this pandemic. While digital is the only answer to function as a normal society without interacting with the risks of COVID (Taddeo 2020).

COVID-19 has exposed many of the drawbacks of our public infrastructure and the lack of attention it has been facing for ages. New normal came with reinvented old terms like social distancing and quarantine soon enough the medical community and the medical systems also switched over to technology-infused solutions to safeguard their personal life. This exposed another dimension of our society the existing digital divide in our rural and remote communities where most of the vulnerable and poor people lived. This switchover left these communities deprived

of the so-called digital medicine due to accessibility issues. The telemedicine expansion also was gravely hampered by this digital divide (Ramsetty and Adams 2020; Bakhtiar et al. 2020).

25.3 Objectives

1. To explore and devise QOL Barometer as an integral part of the e-governance initiative by a state for achieving the holistic development of the citizens.
2. To leverage the QOL barometer and IoT ecosystem for combating humanitarian crises due to critical emergencies and pandemic disasters.

25.4 Research Methodology

The present study is designed to harness the appropriate e-Governance ecosystem for holistic development for citizens. The paper floats an idea of creating a dedicated Quality of Life Barometer, especially designed mobile application (Web-Enabled as well) which could become instrumental for enhancing QOL of its fellow users. The paper is developed using secondary information like relevant literature, reports, and recent experiments and experiences undertaken by various governments to handle this COVID pandemic. The exploratory model—QOL Barometer app or CARE protocol has been described with appropriate diagrams and algorithms. These recent experiences of the COVID-19 pandemic exhibit that the global communities have adopted a mobile-based app for exploring real-life databases to mitigate the vulnerability of COVID-19 infection. This has improvised the authors to conceptualize an innovative framework of mobile app-based comprehensive mechanisms for enhancing QOL of its citizens on a broader perspective rather than being confined to mitigating disaster or pandemic situations.

25.4.1 Analysis I

The *Comprehensive Automated Result-oriented E-Governance (CARE)* Protocol is illustrated in Fig. 25.1. This would function through the following indicative sequence. A nationwide mobile app "*CARE App*" (web enabled) will be developed which needs to be installed by the citizens of India. This app may be made compulsory for mobile *Original Equipment manufacturers (OEM)* operating in India. The app would be supported by state-controlled dedicated "*Expert Monitoring Team (EMT)*" for its operation, up-gradation, and e-governance manifestations in India. The EMT group would cover various dimensions of governance by providing relevant information asking for citizen's expectations, impediments, aspirations,

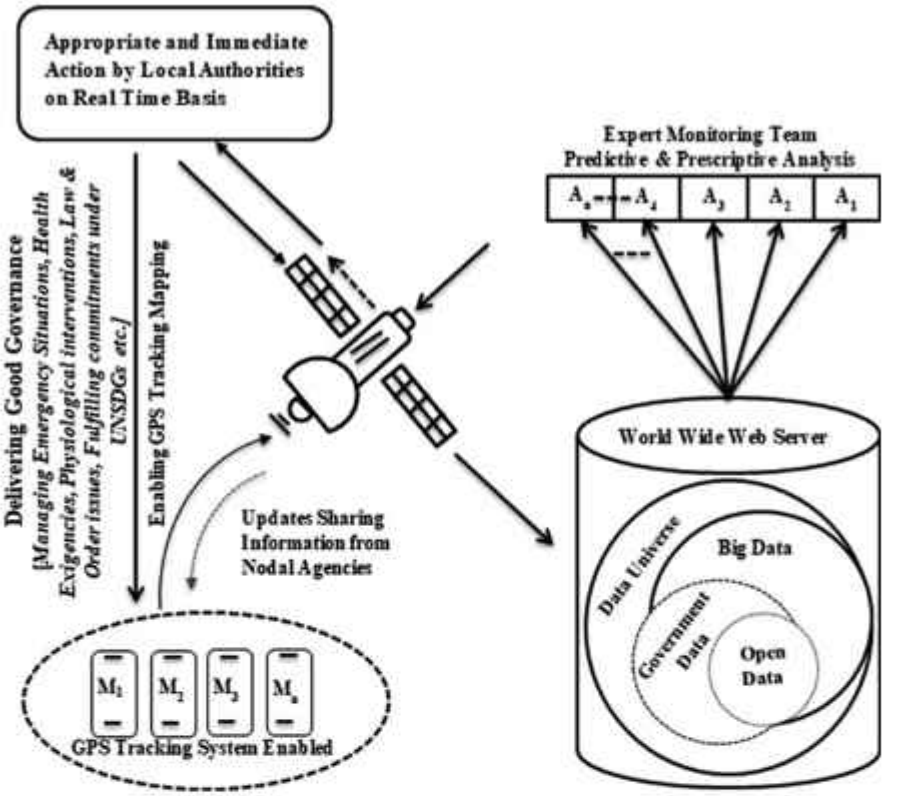

Fig. 25.1 QOL barometer for E-Governance—CARE protocol

quizzes, test batteries, and psychometric analysis so that the state of mind of every citizen can be mapped for predictive and prescriptive analytics along with indicators of holistic development matrix. The indicative list of dimensions may be as follows:

- Real-time information on localized emergency or vulnerability issues (landslide, forest fire, epidemic, endemic, pandemic, etc.)
- Individualized severe ill Health information for providing appropriate and immediate support facilities.
- Various law and order issues.
- Local-level information and feedback on community service on the functioning of respective public health engineer/municipality/Panchayati Raj intuitions.
- Individualized information for household activities, income, and participation in other developmental vectors.
- Various dimensions are covered under UNSDGs, etc.
- Appropriate information from all the citizens of India would be transmitted and stored in World Wide Web servers through dedicated satellites.

- From the server extreme cases in terms of life threats, livelihoods or socioeconomic critical factors both for the individual as well as collective modes would get automatically transferred to the respective expert domain for an appropriate recommendation, advisory, or instructions using Big Data analytics (BDA—Preventative, Predictive and Prescriptive Analytics) or intensive case studies.
- The appropriate recommendation, advisory, or instructions would be communicated to the respective, responsible local authorities (DM/DC, SP, SDO, BDO, etc.) through satellite system for immediate action and successful implementation of e-governance ecosystem using GIS/GPS-based tracking system.
- The local administration would identify the user and provide need-based support available within the jurisdiction of the authorities concerned on a real-time basis so that every citizen of India could be provided improvised good governance system by rendering immediate and need-based support facilities both for an individual level or collective purposes.
- The concerned local authority may also record the action taken report (ATR) they have taken against the corresponding advisory or instructions which would be communicated to all concerned through satellite.
- Through the entire process, the aspirations of data privacy and protection would be maintained until and unless the individualized score on a certain parameter or domain appears to be absurd, exceeding critical ranges. In that case, a GPS tracking system would be operationalized to provide instant/immediate support for the individual or group. Otherwise, the commitment of the state to good governance would be defeated. In general deplorable health hazards accidents emergencies, acute distress threats to life, extreme poverty, absolute hunger, etc. would have to identify for administering instant support by the concerned local authority. However appropriate data privacy and protection protocol as well as ethical practices would be followed without any deviations.

The CARE Protocol if implemented successfully will have several benefits that would percolate in all levels of society. In case of any unprecedented situations like COVID governments and administrative bureaucracy automatically goes to shock and are forced to implement or try policies whose benefits and losses cannot be an estimate or even speculated before the consequence of chain reactions that triggers massive public outrage and media frenzy.

The CARE protocol is a default deterrent and a mechanism to organically connect with the massive population of a country or even a region that may be dispersedly populated. Some of the hypothetical direct benefits transfers for existing situations are listed below:

- In India, approximately 10 people commit suicide every day. Out of which it was found that approximately 12% of victims were illiterate 17% are educated up to primary level, 19% up to middle level, and 23% were educated up to matriculate level (National Crime Records Bureau 2018a). This shows that there is a high degree of stress among the literate population which can be mitigated by examining the psychological status of an individual and application of CARE protocol.

- It was also seen during the same period, out of the number of cases resisted under IPC crimes against women showed that approximately 31% of women faced some kind of domestic violence 26% faced assault on modesty, 22% were kidnapped, and a staggering 10% rape victims (National Crime Records Bureau 2018b). The CARE protocol is a citizen-centric e-Governance model and thus provides direct access to the concerned authority in the virtual sphere with real outcomes. This will drastically reduce the number of attempted assaults as it may be used to trigger alarms in case of perceived threat by the potential victim.
- Out of the total cases registered under IPC Crime against Children were approximately 44% kidnapping, 34% child sexual offense, or child rape (National Crime Records Bureau 2018c). Children are indeed voiceless victims often not in a situation to either assess the attempt to assault or report abuse in case if it was already late thus saving other children from getting victimized. The CARE protocol may be designed to instruct parents and responsible adults to further train children to avoid escape or report such a situation.
- There are various forms of law and order issues (National Crime Records Bureau 2018d; United Nations Department of Economic and Social Affairs (UNDESA). 2015; Chakrabarty 2019) that may be overcome if the care protocol is effectively and efficiently administered.
- The CARE protocol has the potential to fulfill the commitments made to achieve UNSDGs by 2030. It will fulfill Goal 1 (No Poverty), Goal 2 (Zero Hunger), Goal 3 (Good Health and Well-being), Goal 5 (Gender Equality), Goal 10 (Reducing Inequality), Goal 16 (Peace, Justice, and Strong Institutions), Goal 17 (Partnerships for the Goals)(El-nafaty and Bashir n.d.) directly and indirectly if it is implemented and improvised on a continuous cycle.

Hence, the CARE protocol would act as a change agent for the citizen of a country through a comprehensive e-Governance framework. It would bring transformative changes in the lives of the people by elevating QOL or minimizing the impact of social evils and menace. The CARE protocol would embrace with robust, real-time, and responsible manner to accelerate the social developmental process.

The CARE Protocol would ideally be a mobile application as it is targeted at individuals. The installation would form a recognizable flexible, reliable source. The application would be authenticated based on a primary key and two factor or multifactor security authentication mechanisms as illustrated in (Fig. 25.2). The Care Protocol is the QOL Barometer that will help identify, monitor, and fix issues that are concerned with the well-being of a Citizen.

25.4.2 Analysis II

Due to the recent COVID pandemic, it is observed that various countries have taken a digital-based platform for identifying victims. So that appropriate strategies like the social distancing quarantine process and other advisories could be implemented

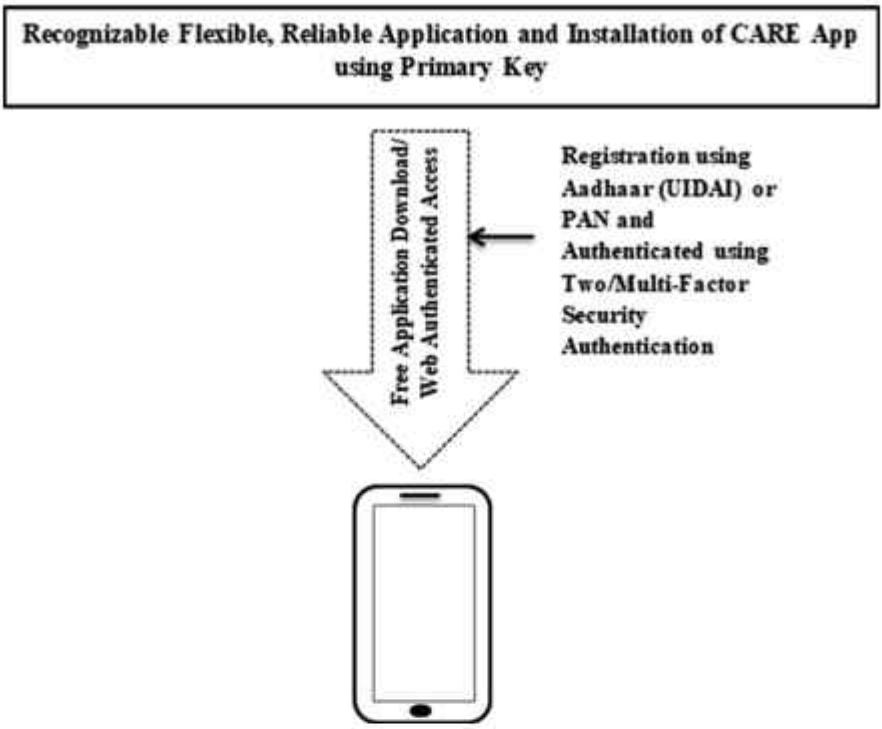

Fig. 25.2 Installation procedure of CARE app using primary key

immediately. The modus operandi of this software or mobile apps essentially have worked on Digital Tracking and Tracing Systems (DTTS). The digital platform enables the user to register their health-related information regarding the COVID pandemic. Based on this the concerned authority can take up steps to facilitate the victims for treatment. On the contrary, the noninfected citizens can get to know that the status and nature of the outbreak in the locality so that they can adopt appropriate defense mechanisms like improvising health hygiene issues and self-induced precautionary measures. However, the state needs to play a better role to improve the QOL of its citizens during pandemic disasters the world has witnessed severe economic downfall leading to loss of jobs, pay cut, struggle to maintain basic needs and amenities. It has a tantamount effect on the physiological state of individuals it has literally challenged the societal ecosystem. The entire discussions, deliberations, thought process and even media broadcasts have been overshadowed by COVID nemesis. The COVID pandemic generally doesn't differentiate in terms of wealth, gender, race, age, or geographic location but the worst victim, of this pandemic, were people belonging to the poor, and people working in the informal sector through long term collateral damage which is anti-thesis of UNSDG's. The developed nations have been supporting the unemployed youth's old age people under its social security schemes but it is a far cry from the people residing in

developing and underdeveloped nations. Vaccines, antibiotics, medicines, and other health facilities essentially help the victims to get rid of infections but the long-term effect of an economic pandemic impacts the entire society both the victims and non-victims. Under this critical juncture, the state may provide such financial support to the needy and helpless people saving them from destitution in consonance with the philosophy of Universal Basic Income (National Crime Records Bureau 2018d). The CARE protocol can function as the depth and breadth of the severity that occurred due to critical emergencies and pandemic disasters.

In consonance with the CARE protocol, the state can use the IoT ecosystem in critical emergency and pandemic hotspots. For instance, in identified hotspots, the IoT devices would be installed along with peripheral roads and lanes in the containment zones.

Based on various inputs received from various stakeholders and real-time information received through QOL Barometer critical zones (for emergency crisis) or containment zones (during pandemic disasters) would get identified further to reach the root of the targets. The appropriate IoT ecosystem may be installed with the short vicinity of the target area. The IoT devices would be strengthened by incorporating appropriate sensors. The sensor would support for analyzing image-based analytics, temperature sensor/ heat-sensing cameras (Udgata and Suryadevara n.d.), sound pattern recognition sensors, for instance, the COVID infected patients have certain symptoms like high or mild fever, cough, and cold, and breathing distress. The image sensor would identify the movement of trace passers within and around the containment zone while the thermal sensor would enable the IoT to understand any case of unreported fever, especially at night time within its range. Sound pattern recognizers would help to understand the high frequency of coughing sounds/ nebulization sounds coming out of the containment zones. This would further enable the response team to take appropriate and immediate steps as depicted in Fig. 25.3.

Indicative algorithm of the system:

- First, the containment zone or critical zones would be identified.
- Appropriate IoT ecosystems would be installed which would be embedded with an appropriate set of sensors relevant to the nature of the emergency pandemic management.
- The IoT ecosystem would be connected to the specific portals of local authorities and the response team via satellite.
- The IoT devices would capture all information that is imagery information, sound pattern recognition, and thermal image from the targeted critical/containment zone. Entire information would be passed instantly to the assigned portals through satellite communication. It would also provide the user with approximate Lat/Long of the source location.
- Based on the inputs local authorities and response teams would identify the place, rush to the location, and take appropriate action as per the standard operating procedures.

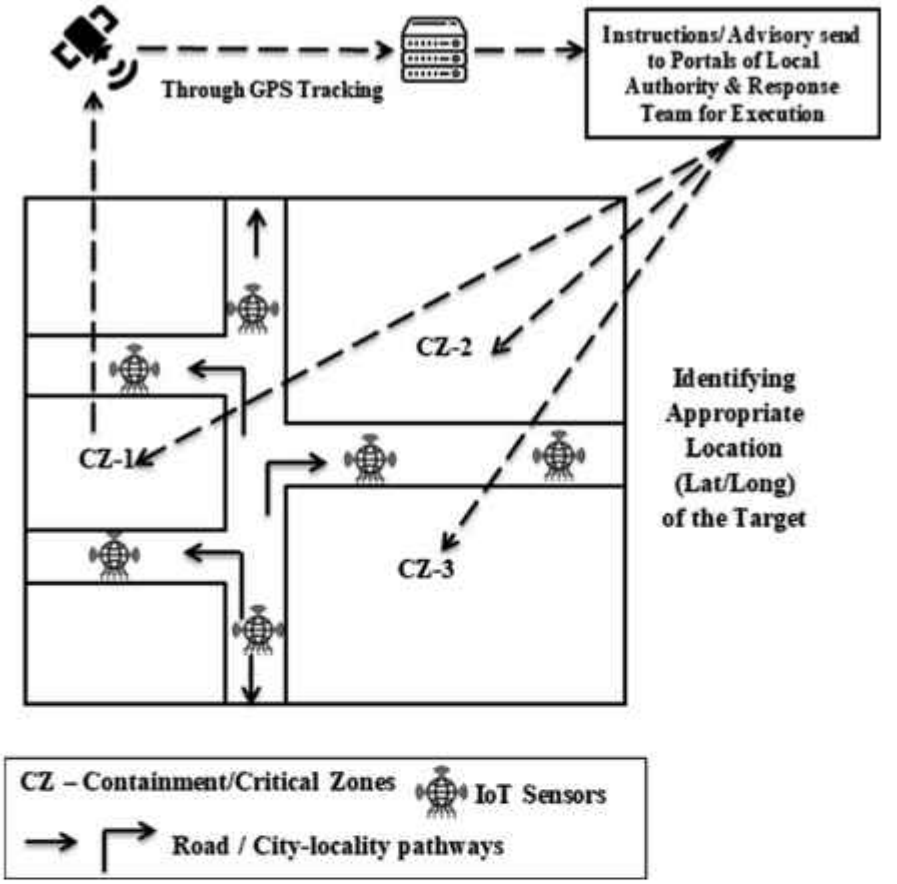

Fig. 25.3 IoT enabled emergency and pandemic management

Apart from this the local authority may also capture information, images by using appropriate unmanned aerial vehicles or drones which may be of additive value for taking a strategic decision.

25.5 Conclusion

In the era of the Fourth Industrial Revolution, it is inevitable for any government to choose an electronic medium for its long-term sustenance. During the issues like critical emergencies and pandemics, disasters are it is so important to sustain the existence of the civilization that the e-governance ecosystem has to be revamped by incorporating modern technological interfaces. This chapter has recommended devising a QOL barometer, a specially designed application known as CARE

protocol for a country like India where the system would enable the policymakers, planners as well as local authorities and response teams to act immediately on a real-time basis. There are numerous experiences where various nations adopted similar kinds of approaches during the recent COVID pandemic, but qualitatively this model is somehow different simply because it is not for mitigating only emergency or pandemic issues this can be a weapon for the state to foster holistic development and well-being of the society. Apart from the natural practice this app could be revitalized and leveraged during emergencies and pandemic disasters.

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SMART COMPUTATIONAL INTELLIGENCE IN BIOMEDICAL AND HEALTH INFORMATICS

Edited by
Amit Kumar Manocha, Mandeep Singh, Shruti Jain, and Vishal Jain

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Preface

Health informatics involves multidisciplinary domains to extract information and knowledge from physiological data to use in decision making for improved human health through the effective use of recently developed technologies and algorithms. The aim is to provide a cross-disciplinary forum to share information on research, simulations and modeling, measurement and control, analysis, information extraction, and monitoring of physiological data in clinical medicine and the biological sciences. Emphasis is placed on contributions dealing with the practical, applications-led research on the use of methods and devices in clinical diagnosis, disease prevention, patient monitoring, and management. Health informatics is closely related to artificial intelligence where heuristic as well as metaheuristic algorithms are designed to provide better and optimized solutions in reasonable amounts of time. These algorithms have been successfully applied to different application domains in biomedical, bioinformatics, and biological sciences. The practice of recent biomedical research requires sophisticated information technologies to manage patient information, and plan for diagnostics, prognostics, procedures, interpretation, and investigations. This provides a conceptual framework and practical inspiration for the quickly growing and promising engineering and scientific disciplines of computer science, decision science, information science, cognitive science, and biomedicine. The objective of this book is to provide the researchers a platform to present state-of-the-art innovations, research, design, and implement methodological and algorithmic solutions to data processing problems by designing and analyzing evolving trends in health informatics and computer-aided diagnosis. This book will provide support and aid to the researchers involved in designing decision support systems that will permit the societal acceptance of ambient intelligence. The overall goal of this book is to present the latest snapshot of the ongoing research as well as shed further light on future directions in this space. This book presents novel technical studies as well as position and vision papers comprising hypothetical/speculative scenarios.

Amit Kumar Manocha
Mandeep Singh
Shruti Jain
Vishal Jain

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Amit Kumar Manocha
Mandeep Singh
Shruti Jain
Vishal Jain

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Editors

Dr. Amit Kumar Manocha is presently working as an Associate Professor in Electrical Engineering at Maharaja Ranjit Singh Punjab Technical University, in Bathinda, India. Dr. Manocha obtained his Ph.D. in 2015, M.E. in 2006 and B.Tech in 2004. He is the author of more than 50 research papers in refereed journals and international and national conferences. Dr. Manocha successfully organized five international conferences in the capacity of conference chair, convener, and editor of conference proceedings and more than 25 workshops and seminars. He participated in many international conferences as an advisory dommittee member, session chair, and member of technical committees in international conferences. He is a member on editorial boards for many international journals. His area of research includes Biomedical Instrumentation, Remote Monitoring and Control Systems. He has guided more than 10 Master's degree and five Ph.D. candidates. He has been granted/published 03 Patents and Rs. 36 Lacs from the Department of Science and Technology, Government of India for a research project on Identification of adulterants in Indian spices.

Dr. Mandeep Singh is currently a Professor and Former Head in the Electrical and Instrumentation Engineering Department, Thapar Institute of Engineering & Technology, in Patiala, India. Dr. Singh obtained his Ph.D. in Tele-Cardiology, Master of Engineering in Computer Science, and Bachelor of Engineering in Electronics (Instrumentation and Control). Dr. Singh is a BEE Certified Energy Auditor and an Empaneled Consultant for PAT Scheme. Dr. Singh has more than 20 years of teaching experience. His current area of research interest includes Biomedical Instrumentation, Energy Conservation, Alternative Medicine, and Cognition Engineering. In addition to his regular responsibilities, he has served the Thapar Institute of Engineering & Technology as Faculty Advisor (Electrical) for more than eight years. Dr. Singh is currently handling two research projects with DIPAS-DRDO related to fatigue detection and wireless monitoring of ambulatory subjects.

Dr. Shruti Jain is an Associate Professor in the Department of Electronics and Communication Engineering at Jaypee University of Information Technology, in Waknaghat, H.P, India and has received her Doctor of Science (D. Sc.) degree in Electronics and Communication Engineering. She has 16 years of teaching experience and has filed five patents, out of which one patent is granted and four are published. She has published more than 15 book chapters, and 100 research papers in reputed indexed journals and in international conferences. She has also published six books. She has completed two government-sponsored projects. She has guided 6 Ph.D. students and now has 2 registered students. She has also guided 11 MTech scholars and more than 90 BTech undergrads. Her research interests are Image and Signal Processing, Soft Computing, Bioinspired Computing, and Computer-Aided Design of FPGA and VLSI circuits. She is a senior member of IEEE, life member and Editor-in-Chief of the Biomedical Engineering Society of India, and a member of

the International Association of Engineers. She is a member of the editorial board of many reputed journals. She is also a reviewer of many journals and a member of the technical program committees of different conferences. She was awarded a Nation Builder Award in 2018–19.

Dr. Vishal Jain is presently working as an Associate Professor at the Department of Computer Science and Engineering, School of Engineering and Technology, Sharda University, in Greater Noida, U. P., India. Before that, he worked for several years as an Associate Professor at Bharati Vidyapeeth's Institute of Computer Applications and Management (BVICAM), in New Delhi. He has more than 14 years of experience in academics. He has earned several degrees: Ph.D. (CSE), MTech (CSE), MBA (HR), MCA, MCP, and CCNA. He has more than 370 research citations with Google Scholar (h-index score 9 and i-10 index 9) and has authored more than 70 research papers in professional journals and conferences. He has authored and edited more than 10 books with various publishers, including Springer, Apple Academic Press, CRC Press, Taylor & Francis Group, Scrivener, Wiley, Emerald, and IGI-Global. His research areas include information retrieval, semantic web, ontology engineering, data mining, ad hoc networks, and sensor networks. He received a Young Active Member Award for the year 2012–13 from the Computer Society of India, and Best Faculty Award for the year 2017 and Best Researcher Award for the year 2019 from BVICAM, New Delhi.

List of Contributors

A. Sheik Abdullah
Thiagarajar College of Engineering
Chennai, India

Hritam Basak
Jadavpur University
West Bengal, India

Arindam Chakrabarty
Department of Management,
Rajiv Gandhi University (Central University)
Arunachal Pradesh, India

Soham Chattopadhyay
Jadavpur University
West Bengal, India

Uday Sankar Das
Department of Management & Humanities, National Institute of Technology
Arunachal Pradesh

Arijit Dey
Maulana Abul Kalam Azad University of Technology
West Bengal, India

A. Hridya
CHRIST Deemed to be University
Uttar Pradesh, India

Aditya Anand Doshi
MIT College of Engineering
Pune, India

Meenu Garg
Chitkara University Institute of Engineering and Technology, Chitkara University
Punjab, India

Ahona Ghosh
Maulana Abul Kalam Azad University of Technology
West Bengal, India

Deepali Gupta
Chitkara University Institute of Engineering and Technology, Chitkara University
Punjab, India

Sheifali Gupta
Chitkara University Institute of Engineering and Technology, Chitkara University
Punjab, India

Sowmya Kamath S
National Institute of Technology Karnataka
Surathkal, India

K. Karthik
National Institute of Technology Karnataka
Surathkal, India

P. Karthikeyan
Thiagarajar College of Engineering
Chennai, India

Utkarsh Nitin Kasara
MIT College of Engineering
Pune, India

Hafiz T.A. Khan
University of West London
London, England

Suchitra Khojeb
MIT College of Engineering
Pune, India

R. Priyatharshini
Easwari Engineering College
Tamil Nadu, India

Saket Kushwaha
Rajiv Gandhi University
(Central University)
Arunachal Pradesh, India

Pavanalaxmi
Sahyadri College of Engineering &
Management
Karnataka, India

Ashwani Kumar Mishra
All India Institute of Medical Sciences
(AIIMS)
New Delhi, India

Rajiv Narang
All India Institute of Medical Sciences
(AIIMS)
New Delhi, India

Dilip C. Nath
Assam University
Assam, India

Siddhanth Pillay
National Institute of Technology
Karnataka
Surathkal, India

R. Parkavi
Thiagarajar College of
Engineering
Chennai, India

Reena R. Roy
Easwari Engineering College
Tamil Nadu, India

Sriparna Saha
Maulana Abul Kalam Azad University
of Technology
West Bengal, India

S. Selvakumar
GKM College of Engineering and
Technology
Tamil Nadu, India

Tajinder Pal Singh
Chitkara College of Applied
Engineering, Chitkara University
Punjab, India

Anita Verma
All India Institute of Medical Sciences
(AIIMS)
New Delhi, India

Vivek Verma
All India Institute of Medical Sciences
(AIIMS)
New Delhi, India

A. Vijayalakshmi
CHRIST Deemed to be University
Uttar Pradesh, India

Roopashree
Sahyadri College of Engineering &
Management
Karnataka, India

1 Impact of Gender on the Lipid Profile of Patients with Coronary Artery Disease

A Bayesian Analytical Approach

Vivek Verma, Ashwani Kumar Mishra, Anita Verma, Hafiz T. A. Khan, Dilip C. Nath, and Rajiv Narang

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1.1 INTRODUCTION

Cardiovascular diseases are grouped into diseases based on problems of the heart and blood vessels [1], including acute coronary syndrome and coronary artery disease (CAD). CAD occurs when the heart has not received adequate amounts of oxygen and blood due to plaque buildup within the coronary arteries, and CAD is the most common type of heart disease. The deposition of cholesterol (known as atherosclerosis) and other materials (called plaque) within the coronary arteries causes the arteries to narrow and harden, which affects the blood supply to the heart. If such deposition continues, then it will lead to heart failure. According to the World Health Organization, CAD is one of the leading causes of morbidity and mortality and is also the leading cause of death.

According to the American Heart Association, among several risk factors for coronary heart disease, the components of the lipid profile, namely triglycerides, low-density lipoprotein cholesterol (LDL-C), direct high-density lipoprotein cholesterol (HDL-C), and total cholesterol are very common. According to the Centers for Disease Control and Prevention (CDC), CAD is the leading cause of death in the United States for both men and women. CAD alone is responsible for more than 4.5 million deaths worldwide [2].

Risk factors associated with CAD include lifestyle, environment, and genetic factors [3]. Previous CAD studies have documented the association of the lipid profile; in this sense, intensive lifestyle changes can also stop or reverse its progression without the use of lipid-lowering drugs [4]. According to the American Heart Association, the recommended normal range prescribed for a lipid profile is: total cholesterol < 200 mg/dL, triglycerides < 200 mg/dL, HDL-C > 40 mg/dL, and LDL-C < 130 mg/dL. The lipid profile acts as a diagnostic tool for the detection and clinical management of cases of CAD. For example, in dyslipidemia, patients with CAD, LDL-C, total cholesterol and triglycerides, will be higher, and HDL-C cholesterol will be lower [5]. It is also well known that in patients with CAD, triglycerides [6], total cholesterol, and LDL-C are significantly higher, and HDL-C is significantly lower [7–10].

The influence of gender on the components of the lipid profile is also studied in various situations. Total cholesterol levels in women are significantly reduced in the 25- to 49-year age group and are higher in the 50- to 64-year age group than in men [11]. Total cholesterol, LDL-C, and the ratio of total cholesterol to HDL-C levels are significantly higher in older women (> 50 years) than in younger women (30–46 years), but in men, these levels do not change dramatically with age [12]. The impact of gender on triglycerides turns out to be significantly different [13–15].

In a study [6], it had shown that 13.3% of the population older than 55 years were affected by CAD and, among them, the percentage of men was higher than that of women. The appearance of CAD is associated with changes in the lipid profile, which is influenced by several factors, and among them, the sex of an individual is also an important factor. Therefore, the objective of the present study is to examine the impact of sex on the lipid profile in patients with CAD. For this study, the data set from the National Health and Nutrition Examination Survey (NHANES), 2015–2016, was used. The study population is made up of people 50 years of age or older. To compare the differences in the lipid profile between the sexes when the sample size is comparatively small, both a classic two-tailed Student test and a non-parametric Wilcoxon rank sum test, as well as the Bayesian t-test were adopted. Statistical significance was measured using p-values in the context of the Student's t-test and the Wilcoxon rank sum test, while the Bayes factor was used for the Bayesian t-test.

1.2 METHODS

For the evaluation of the health and nutrition component of the noninstitutionalized population in the United States, since the early 1960s, the CDC has conducted the NHANES. The NHANES program was initiated to assess the level of health

and nutritional status in the United States, collecting information on various characteristics—household, physical, and medical examinations of sampled children and adults. In this study, we used NHANES 2015–2016, which was launched with 15,327 people. The NHANES (2015–2016) database was considered, which included 9,971 individuals, who completed the interview.

1.2.1 Study Population

Participants aged less than 50 (n = 8635) and lipid profiles were not observed or declared (n = 291), are excluded. There were 1,045 participants, aged 50 years or older, and among them, 91 were clinically diagnosed with CAD and the remaining 945 did not have CAD (non-CAD), and their lipid profiles were observed and reported.

1.2.2 Laboratory Methods

Information on laboratory parameters, including lipid profiles, including triglycerides (mg/dL), LDL cholesterol (mg/dL), direct HDL cholesterol (mg/dL), and total cholesterol (mg/dL), were obtained from the participants, who were recommended too fast for at least nine hours before physical examination at the mobile examination center (MEC) for blood collection.

The criteria of the lipid standardization program of the CDC were used to standardize the parameters of the serum lipid profile due to changes in laboratory methods during years of research to ensure accuracy and comparability of measurements between studies.

1.3 STATISTICAL ANALYSIS

For the comparison of the descriptive statistics among gender, the results were expressed as Mean (μ) ± Standard Deviation (s) and percentage (%). Under the assumption that the variation among the components of lipid profile and other continuous differences based on sex (for male (μ_M, s_M); female (μ_F, s_F)) are fixed quantities, to test the hypothesis

$$H_0 : \mu_M = \mu_F \text{ vs } H_1 : \mu_M \neq \mu_F \tag{1.1}$$

the classical two-tail Student's t-test and Wilcoxon rank sum test under parametric and nonparametric setup, respectively, were appropriately used and discussed, and statistical significances were measured using their p-values. For testing the hypothesis of equation (1.1), the test statistic takes the following form under the classical paradigm:

$$t = \frac{\bar{x}_M - \bar{x}_F}{\left(\frac{(n_M - 1)s_M^2 + (n_F - 2)s_F^2}{n_M + n_F - 2} \right)^{1/2} \Big/ \sqrt{n_0}} \tag{1.2}$$

where, $n_0 = \left(\frac{1}{n_M} + \frac{1}{n_F}\right)^{-1}$, the degrees of freedom are $\tau = n_M + n_F - 2$, $\bar{x}_i$ and μ_i respectively, denotes the sample and population mean corresponding to each the continuous quantity of the i^{th} gender, $\{i = Male(M), Female(F)\}$.

In real sense, the exact characterization of the randomness inherent in the quantitative measurement is ignored. Under such situation, the comparison of any continuous quantities and their assessments under a traditional test of significance becomes a serious concern. Therefore, the present work emphasizes another promising paradigm of the statistical framework that can address such a situation by considering the formulation under the Bayesian t-test. In this analytical procedure, a reasonable and useful prior has suggested to obtain a closed form of Bayes factor for emphasizing the statistical significance. To test the hypothesis under two-sided alternatives, the Bayesian version of the two-sample t statistic under the null and alternative hypotheses was adopted, and the decision was made using the value of Bayes factor (B). In the present study, common variance, say σ^2, has assumed both sex corresponding to each quantity. In order to work with the Bayesian paradigm, we need to specify the prior distribution of the effect size (difference) that needs to be tested. Under the suggested hypothesis of a nonzero difference, the standardized difference $\frac{\mu_M - \mu_F}{\sigma}$ has prior mean, say θ, and prior variance, say σ_0^2. The Bayes factor for testing H_0 against H_1 of equation (1.1) is:

$$B(x) = \frac{T_\tau(t \mid 0,1)}{T_\tau(t \mid \theta\sqrt{n_0}, 1 + n_0\,\sigma_0^2)} \tag{1.3}$$

where $T_\tau(t|\alpha,\beta)$ denotes the value that results from plugging t into noncentral t distribution probability density function with f degree of freedom and parameters α for location and $\beta^{1/2}$ for scale [16]. The rule of thumb [17–18] followed for inference is as follows, if $log_{10}\left(B(x)\right)$ varies between 0 and 0.5, the evidence against null hypothesis H_0 will be poor, if $log_{10}\left(B(x)\right)$ lies between 0.5 and 1, it is substantial, if it is between 1 and 2, it is strong, and if it is above 2 it is decisive. The results are simulated by following the Gibbs sampling, with 100,000 iterations, by using R-software version 3.6.2, and data processing is done using the SAS University edition.

1.4 RESULTS

1.4.1 Descriptive Characteristics

Table 1.1 shows the comparison of patients with CAD and non-CAD, which includes the age at which CAD occurred, its duration, if the doctor ever said the person was obese and/or to reduce salt and fat/calories intake. A total of 91 CAD and 954 non-CAD participants [males (CAD = 55; non-CAD = 450) and females (CAD = 36; non-CAD = 504)] were included in this study. The overall mean age ± general standard deviation of the participants was 69.8 ± 7.5 years in CAD (54–80 years) and 64.5 ± 9.2 in non-CAD (50–80) years. The mean age of presentation to seek

TABLE 1.1
Demographic and Clinical Characteristics of the Patients with CAD Versus No CAD

Characteristics and Categories		CAD (n = 91) (Mean ± SD/ Percentage) (Range)	No CAD (n = 954) (Mean ± SD/ Percentage) (Range)
Age (in years) (Mean ±SD) (range)	Male	69.3 ± 7.2 (54–80)	64.5 ± 8.9 (50–80)
	Female	70.6 ± 7.9 (57–80)	64.5 ± 9.4 (50–80)
	All	69.8 ± 7.5 (54–80)	64.5 ± 9.2 (50–80)
CAD Occurrence Age (in years) (Mean ±SD)	Male	57.2 ± 9.8	NA
	Female	60.4 ±10.5	NA
	All	58.5 ± 10.2	NA
Duration of period of CAD	Male	12.2 ± 8.1	NA
	Female	10.1 ± 8.9	NA
	All	11.4 ± 8.4	NA
"Doctor ever said you were overweight"*	Yes	47 (51.7)	370 (38.8)
"Doctor told to reduce salt in diet" *	Yes	48 (52.8)	350 (36.7)
"Doctor told to reduce fat/calories"*	Yes	47 (57.7)	371 (38.9)

*From the questionnaire used in the study.

treatment for CAD in men (57.2 years) was earlier than in women (60.4 years). The duration of CAD in men (12.2 years) was longer than in women (10.1 years). Most of the patients with CAD were obese (51.7%), and it was recommended to reduce their salt intake (52.8%) and diet control (57.8%). Among non-CAD participants, the percentage distribution of obese people prescribed to reduce salt intake and diet control is almost the same.

1.4.2 Clinical Features

A comprehensive gender comparison between the lipid profile parameters as well as some of the derived parameters, namely triglycerides (mg/dL), LDL cholesterol (mg/dL), direct HDL cholesterol (mg/dL) and total cholesterol (mg/dL), non-HDL cholesterol, TC: HDL and LDL: HDL ratio are listed in Tables 1.2–1.4. The gender association between the various components of the lipid profile and their derived proportions has been measured under the classical (both parametric and nonparametric) and Bayesian paradigms. Furthermore, the empirical gender-wise distribution pattern of each of the lipid parameters and their means are shown in Figures 1.1–1.2, participants without CAD (n = 945) and CAD participants (n = 91).

In Table 1.2, it was hypothesized (null hypothesis) that there is no gender difference in the lipid profile of the participants (independent of CAD and absence of CAD). The classical t-test and nonparametric Wilcoxon rank sum test based

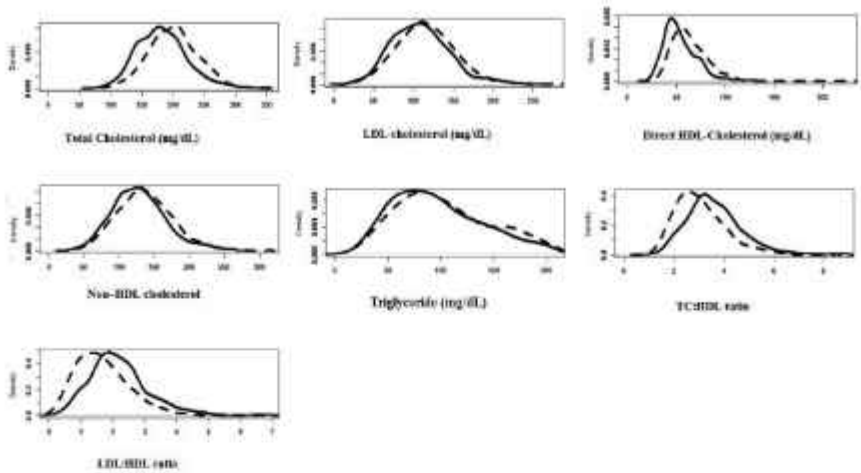

FIGURE 1.1 Gender-wise empirical distributional patterns of the lipid parameters pattern of no CAD participants (Male = 450; Female = 504), black denotes male and dashed denotes female.

on participants (n = 1,045) suggested a significant difference between the sexes ($p < 0.05$) for triglycerides, LDL cholesterol, direct HDL cholesterol, total cholesterol, and non-cholesterol, HDL, TC:HDL ratio and LDL:HDL ratio of the lipid profile. The similar significant gender difference in lipid profiles was also captured by Bayesian t-tests and revealed that the Bayes factor (Log (B)) is greater than 2

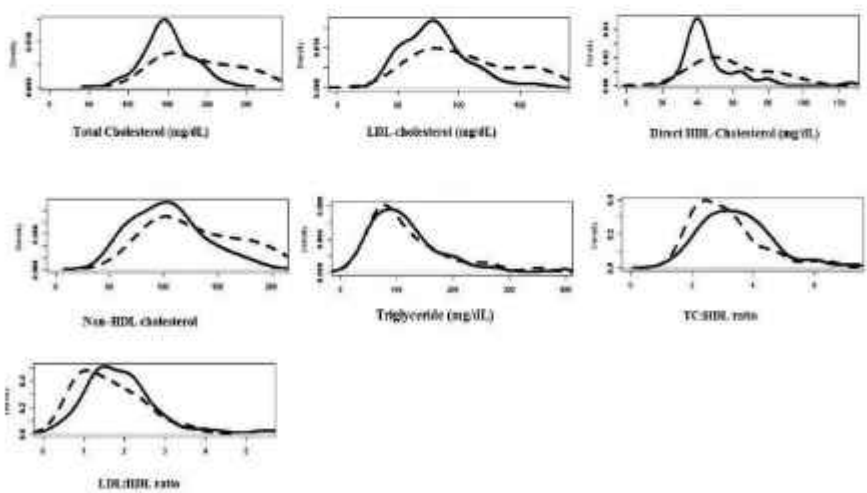

FIGURE 1.2 Gender-wise empirical distributional patterns of the lipid parameters pattern of CAD participants (Male = 55; Female = 36), black denotes male and dashed denotes female.

TABLE 1.2
Classical and Bayesian Evaluation of Gender Differences in Association of Lipid Profile Among Total Patients (Large Sample Size)

Parameter	Gender (n = 1,045)		Parametric Test for Difference in Mean		Nonparametric Wilcoxon rank sum test	Bayes Factor (Log(B))
	Male (n_M = 505) Mean ± SD	Female (n_F = 540) Mean ± SD	t-value	p-Value	p-Value	
Total Cholesterol (mg/dL)	178.80 ± 39.91	200.30 ± 40.97	–8.56	**< .0001**	**< .0001**	**14.03**
LDL Cholesterol (mg/dL)	105.90 ± 36.25	115.80 ± 36.54	–4.39	**< .0001**	**< .0001**	**2.76**
Direct HDL Cholesterol (mg/dL)	53.02 ± 16.73	63.41 ± 18.93	–9.37	**< .0001**	**< .0001**	**16.96**
Non-HDL Cholesterol	125.80 ± 38.28	136.80 ± 39.68	–4.57	**< .0001**	**< .0001**	**5.11**
Triglyceride (mg/dL)	99.21 ± 46.07	105.00 ± 46.66	–2.00	**0.0457**	**0.0347**	**8.58**
TC:HDL ratio	3.60 ± 1.11	3.36 ± 1.03	3.69	**0.0002**	**< .0001**	**2.73**
LDL:HDL ratio	2.17 ± 0.94	1.98 ± 0.85	3.40	**0.0007**	**0.0005**	**2.29**

as triglycerides (Log (B) = 8.58), LDL cholesterol (Log (B) = 2.76), direct HDL cholesterol (Log (B) = 16.96), total cholesterol (Log (B) = 14.03) and non-HDL cholesterol (Log (B) = 5.11), TC: HDL ratio (Log (B) = 2.73) and LDL: HDL ratio (Log (B) = 2.29).

The classical t-test and nonparametric Wilcoxon rank sum test based on no-CAD participants (n = 945) is presented in Table 1.3, which was also suggesting a significant ($p < 0.05$) gender-wise difference among Triglyceride, LDL cholesterol, direct HDL cholesterol, total cholesterol and non-HDL cholesterol, TC:HDL ratio and LDL:HDL ratio of lipid profile. Significant differences among lipid profiles of males and females were also captured by Bayesian t-tests with Bayes factor (Log(B)) greater 2, that is, triglyceride (Log(B) = 4.76), LDL cholesterol (Log(B) = 2.45), direct HDL cholesterol (Log(B) = 32.62), total cholesterol (Log(B) = 22.79) and non-HDL cholesterol (Log(B) = 3.51), TC:HDL ratio (Log(B) = 4.54) and LDL:HDL ratio (Log(B) = 4.06).

The classical t-test and nonparametric Wilcoxon rank sum test based on CAD participants (n = 91) is presented in Table 1.4, which suggested significant gender-wise differences only among LDL cholesterol, direct HDL cholesterol, total cholesterol, and non-HDL cholesterol, of lipid profile. On the other hand, Bayesian

TABLE 1.3
Classical and Bayesian Evaluation of Gender Differences in Association of Lipid Profile Among Patients with No CAD (Large Sample Size)

Parameter	Gender (n = 954)		Parametric Test for Difference in Mean		NonParametric Wilcoxon Rank Sum Test	Bayes Factor (Log(B))
	Male (n_M = 450) Mean ± SD	Female (n_F = 504) Mean ± SD	t-Value	p-Value	p-Value	
Total Cholesterol (mg/dL)	182.20 ± 39.67	201.10 ± 40.29	−7.28	< .0001	< 0.0001	22.79
LDL Cholesterol (mg/dL)	109.00 ± 36.14	116.60 ± 36.26	−3.23	0.0013	0.0006	2.45
Direct HDL Cholesterol (mg/dL)	53.76 ±16.62	63.72 ± 18.84	−8.61	< .0001	< 0.0001	32.62
Non-HDL Cholesterol	128.50 ± 38.04	137.40 ± 39.51	−3.55	0.0004	0.0003	3.51
Triglyceride (mg/dL)	97.12 ± 42.47	103.80 ± 44.28	−2.38	0.0176	0.0193	4.76
TC:HDL ratio	3.61 ± 1.10	3.35 ± 1.02	3.81	0.0001	< 0.0001	4.54
LDL:HDL ratio	2.20 ± 0.94	2.00 ± 0.86	3.68	0.0003	0.0001	4.06

t-tests suggested significant gender-wise differences among all lipid profile parameters with Bayes factor (Log(B)) greater 2, that is, triglyceride (Log(B) = 7.21), LDL cholesterol (Log(B) = 2.52), direct HDL cholesterol (Log(B) = 3.36), total cholesterol (Log(B) = 3.38) and non-HDL cholesterol (Log(B) = 4.55), TC: HDL ratio (Log(B) = 4.55) and LDL: HDL ratio (Log(B) = 3.76).

1.5 DISCUSSION

Table 1.1 shows that the mean age of participants with CAD is higher than that of non-CAD participants. The mean age of onset of CAD in men was lower than that of women; therefore, the mean duration of the CAD period was longer in men than in women. The age factor is an important predictor for CAD. The majority of the CAD prevalence occurred between the ages of 50 and 70, approximately four times the prevalence in people older than 70 years. Among patients with CAD compared to non-CAD, more than 50% of the individuals corresponding to each of the risk factors of being overweight, high salt intake, and high fat/calorie intake were prescribed to reduce the intake and food control. This suggests the need to focus on the daily routine of the participants.

TABLE 1.4
Classical and Bayesian Evaluation of Gender Differences in Association of Lipid Profile Among Patients with CAD (Small Sample Size)

Parameter	Gender ($n = 91$)		Parametric Test for Difference in Mean		Nonparametric Wilcoxon Rank Sum Test	Bayes Factor (Log(B))
	Male ($n_M = 55$) Mean ± SD	Female ($n_F = 36$) Mean ± SD	t-Value	p-Value	p-Value	
Total Cholesterol (mg/dL)	151.02 ±29.92	188.58 ±48.37	–4.15	**< .0001**	**0.0004**	**3.38**
LDL Cholesterol (mg/dL)	80.80 ±26.14	105.28 ±39.24	–3.29	**0.0017**	**0.0039**	**2.52**
Direct HDL Cholesterol (mg/dL)	46.96 ±16.60	59.14 ±19.88	–3.16	**0.0021**	**0.0007**	**3.36**
Non-HDL cholesterol	104.10 ±95.08	129.40 ±115.30	–3.21	**0.0018**	**0.0054**	**4.55**
Triglyceride (mg/dL)	116.29 ±66.93	120.8 ±71.31	–0.30	0.7613	0.8806	**7.21**
TC:HDL ratio	3.50 ±1.17	3.43 ±1.15	0.24	0.8110	0.5976	**6.14**
LDL:HDL ratio	1.91 ±0.90	1.91 ±0.79	–0.01	0.9893	0.9418	**3.76**

Nonsignificant results obtained in both of the classic nonparametric Wilcoxon rank sum t-tests for some of the important lipid parameters, namely triglycerides, TC:HDL ratio and LDL:HDL ratio, which is considered a good predictor of CAD, was found significantly different in Tables 1.2 and 1.3, which suggests that the null hypothesis is contrary to the theory of the difference between the sexes, and is also observed in the empirical densities shown in Figure 1.1–1.2.

Previous studies that focused on the impact of triglycerides, the TC:HDL ratio, and the LDL:HDL ratio on CAD have shown that elevated triglyceride levels increase the risk of prevalence of coronary heart disease and is lowered through clinical management in addition to diet control, regular exercise, and pharmacotherapy [19]. This is of great importance for public health since such a suggestion can have positive reinforcement among patients toward adopting a healthy dietary pattern in their daily routine. The higher value of the LDL:HDL ratio shows a positive association with the prevalence of hypertension and hypercholesterolemia in men and women [20] and the higher TC:HDL ratio was considered an independent indicator of extensive coronary disease [21]. As with the classic t-test and nonparametric Wilcoxon rank sum paradigms, some of the important lipid parameters, namely triglycerides, the TC:HDL ratio, and the LDL:HDL ratio were not found to differ significantly across

gender, which were found to be different in earlier studies. Based on the results obtained, data-based estimates for lipid profile parameters were found to be consistent with clinical characteristics and were also found to be effective in demonstrating statistical significance with clinical significance. Therefore, the quality of the data was not questioned regarding the insensitivity to distinguish the theory from the null hypothesis. However, to clinically link the data to theory, apart from certain lipid parameters, namely LDL cholesterol, direct HDL cholesterol, total cholesterol, and non-HDL cholesterol, these were found to be nonsignificant in the classical tests, Bayesian technique was adopted in Table 1.4. The Bayesian t-test suggested evidence of differences in the lipid profile across gender and was also observed in the empirical densities shown in Figure 1.1. The significant difference in elevated levels of lipid parameters, namely triglycerides, LDL cholesterol, direct HDL cholesterol, and total cholesterol in women with CAD as compared to men, has also been discussed in several other studies [22–26], which has also been observed under the Bayesian test paradigm.

The lipid parameters of LDL cholesterol, direct total HDL cholesterol, and non-HDL cholesterol that were significantly different between sexes according to the classical test paradigms also corresponded to the Bayesian paradigms. On the other hand, the reverse is not true, as triglycerides, TC:HDL ratio, and LDL:HDL ratio also differed significantly across gender in Bayesian t-tests and were discussed in previous studies, but they were not captured in the conventional classical tests, possibly due to a small sample size.

1.6 CONCLUSION

In the study, the Bayesian inferential procedure is presented, where the sample size is comparatively smaller, with emphasis on the possible differences in the parameters of the lipid profile of patients with CAD between men and women. Assuming that the differences in parameters due to gender are fixed, the classical t-test and the nonparametric Wilcoxon rank sum test were not fully compatible to capture significant changes in lipid parameters due to gender. On the other hand, even with a small sample size, the results obtained on the basis of Bayesian t-tests turned out to be more reliable for concordance of clinical practices on the sex difference in the association of lipid profile in patients. Patients with CAD whose results were not fully recognized in the conventional t-tests and Wilcoxon rank sum nonparametric tests, viz. Triglycerides (p-value = 0.7613 (0.8806), Log (B) = 7.21), TC:HDL ratio (p-value = 0.8110 (0.5976), Log (B) = 6, 14) and LDL:HDL ratio (p-value = 0.9893 (0.9418), Log (B) = 3.76).

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A Text Analytics-based E-Healthcare Decision Support Model Using Machine Learning Techniques

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poems-short stories-essays

ARUNACHAL CHAPTER
OF
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A LABYRINTH OF THOUGHTS ON THE CROSSROAD

Bompi Riba

An event that stays in the memory; that evokes a conundrum and enlightens one to see one's culture in a new light is worth documenting. But it is seldom done so when it involves an ordinary person who is but an insignificant member of a community of a prodigious state of a big country. He is but a diminutive voice like a tiny globule of the Universe. His story surely does not affect the course of the Nation's history or even the State's history and remains just 'his' story and fades into oblivion. And his death, whether natural or unnatural is again an insignificant event except for his family members who will gradually recover from that unpleasant experience and move on.

The event that led to the germination of this deep reflection was the death of a tribal man, a Galo to be precise. The mysterious events or just pure imaginations that were associated with the poor man's untimely death

being the talk of the small town leading to the bewilderment of the community, mostly second generation Christians who were still holding on to the fragile thread of their ancestors' indigenous faith unseals the unresolved cultural conflicts that in fact coalesce to create a not so simple but a rather complicated belief system. Yours truly presents a perspective among many perspectives that were unrecorded but were verbally exchanged among the onlookers at the funeral service. A humble attempt is therefore made to assess the traditional beliefs of the community that seem supernatural and yet logical and they are pitted against rational and scientific facts.

Amidst frequent allegations on Christianity for deviating the indigenous Tani people from their original roots and embracing an alien faith and culture, there has emerged a new breed of 'hybrid natives' who are not wholly practising Christianity nor endorsing indigenous faith. Occupying that space of belonging to both culture and yet feeling a sense of loss at one and alienated at the other have created a flustered generation that are at loggerheads in corroborating their identity. While the general understanding among them is that they are Galo by virtue of being born in that community and a Christian because of the faith in which they are brought up. The matter of contention, however, among their pure breeding counterparts is that one cannot be a tribal and an alien worshipper at the same time, since Christianity is considered to be a foreign religion. So in recent times, demands have also been made of the hybrid natives to surrender their Scheduled Tribe status and become a

minority community which to the latter is absurd and offensive. It is to be noted that language is one of the badges of one's ethnic identity. Galo churches play a crucial role in preserving and promoting the language. The religious services are conducted in Galo and even hymns are sung in the same language. They also conduct craft-making competitions which encourage the congregation, especially the women to weave gale or a traditional sarong. Some of the core cultural practices of the indigenous faith have been given up but much have been appropriated by them to continue the legacy of their ancestors such as the patrilineal method of naming the children to trace the geneology of their ancestor that is one of the unique traditional features of the Galo tribe.A traditional Galo name always has two syllables. The first syllable comprises the last syllable of the father's name, such as the name Marto has two syllables 'Mar' and 'to'. While 'Mar' is the last syllable of his father's name who must have been a Gomar or a Tamar and the last syllable 'to' of Marto shall be the first syllable of his son Tobom (To + bom) and daughter Topi (To + pi). In recent times three- syllable names such as Damaira (Dam + ai + ra), Marsona (Mar + so + na), Linusa (Li + nu + sa) and Marconi (Mar + co + ni) have also been observed among the Christian Galos as well as indigenous Galos. However, among the Christian Galos a trend has developed to give their children two names that is characteristic of their hybrid culture. For instance, 'Marto Samuel', where 'Marto' is the first name and 'Samuel' is the middle name which is, then, followed by the surname.A cursory look in to

the characteristics of the Galo tribe is pertinent to investigate the death of the Galo man who was at the time of his death the Bazaar President of Likabali that still shares a porous border with Assam. According to Eli Doye in his Myths from Northeast India: Functional Perspective of Galo Myths in a Changing Context, the nomenclature Galo has been derived from their ancestor's feat of crossing the Golo Yorbe, a mountainous range which is near the International Boundary that India shares with China. He also adds that this version of the origin story is, however, contested because of the fact that the Galos do not have recorded documents supporting the story of their migration or the inception of their community. Whatever information has survived was passed down from one generation to another orally, thus, resulting in different versions of the migration story. The generally agreed argument is that the Galo tribe has descended from the line of the Tibeto-Burman group of the Mongoloid race. And as any tribal communities of the world, they have their own myth of the origin of the universe. Though there are slight variations in the myth among the different clans of Galo tribe, most subscribe to the belief that they have descended from Jimi Ane (mother Jimi), the creator. She created Medo (the sky) and Sichi or Sisi (the Earth). Their union gave birth to their first son who was called Sibuk, whose son was called Buksin, Buksin's son was called Sintu, Sintu's son was called Turi and Turi's son was called Rini or Tani whom the Galo tribe deems as Abo Tani, the Father of Mankind. (42 – 44) However on careful observation of the myth it is noted that the first

child of Medo (abo or father) and Sichi or Sisi (Ane or mother) derived his name Sibuk (Spring water) from the second syllable of the mother's name in contradiction to the patrilineal method of the tribe.

Like all Tani tribes (Adi, Apatani, Galo, Nyishi and Tagin) the Galo tribe also worships Donyi (the Sun god) and Polo (the Moon god) for fertility, prosperity and protection from natural as well as unnatural calamities. According to Dr. Eli Doye in Myths From North East India: Functional Perspective of Galo: Myths in a Changing Context:

Besides, Donyi-Polo, the Galo believe in the presence of diverse spirits or deities who are associated with natural elements and are believed to defend their own surroundings. Basically, these spirits are of two types – the benevolent and malevolent spirits who are commonly called uyi regardless of their nature. Citum-jore, ite-bote, ali-ampir, peka, kate, etc, are considered by the Galo as benevolent spirits as they are appeased to seek their blessings and protection. On the other hand, doli-doga, rodu, gute-heder, kale, polle, etc. are malevolent spirits who are propitiated to be considerate (74).

The Galo tribe believes that there are supernatural powers that are apparently in control of everything in nature such as forests, rivers and mountains. So it is customary for them to conduct rituals such as 'roksin (chicken-liver divination) or reksin (pig liver divination) or pip chikanam (determining through divination of boiled egg)' (Doye, 75) before clearing

forest area for jhum cultivation or fishing or any hunting expedition. These rituals are performed by the village elders and nyibu (shaman). However in the present times such ritualistic practice is declining.

Among the traditional Galo the belief is that after death, the souls of men shall travel to uyu-moko or orom- moko, the land of the souls. There they shall meet all their dead relatives and enjoy the same status as they did on earth. They will have the need for the same things that they possessed on earth. Therefore the family of the deceased makes it sure to bury all his prized possessions along with the body. They also place food and water near the grave so that the soul will not remain hungry in his journey to the uyu-moko. So basically the Galo believe in the continuity of life after death where the soul after experiencing another span of life shall again die. In contrast to the indigenous Galo the Christian Galo believe in the Holy Trinity of the Father, the Son and the Holy Spirit. And following the Book of Genesis they have rested their faith in the Creation Story where God commanded and the Universe and everything in the Universe was created. And unlike the popular Galo belief that Tani is the father of humankind, they have accepted the Christian myth of Adam and Eve as the progenitor of mankind, though they still continue to consider Tani as the ancestor from whom they have originally descended. They hold onto the belief that they were gentiles who were saved when they accepted Christ, the Son of the Almighty God as their personal Saviour. Their belief in the Christian doctrine of the soul being judged for the man's deed on Earth when alive

also differs from the indigenous Galo belief. Instead of the soul living another span of life in uyu-moko as propagated by the typical Galo belief-system, the soul will either be sent to heaven or hell based on the kind of life lived on Earth.

With this lead in to the difference in the belief-system between the indigenous Galo and Christian Galo being established, it seems sensible now to present the case of Karto[1], the then Bazaar President of Likabali in the year 2009. It was the season of election and so on the day of his disappearance; he was busy campaigning for the prospective MLA. He mysteriously vanished from the house of the fellow campaigner who claimed to have dined with him till 11 at night. Thereafter he went to sleep with the host's son who later claimed that the deceased had covered him with a blanket before lying down next to him. But the very next day the host and his family found the guest missing. They immediately thought that he must have gone back to his home and so they did not look for him. When his family could not contact him the whole day, they started making enquiry and no one seem to have even a faint idea of his whereabouts. In this way two days and two nights passed without any success of locating him. Subsequently there was heavy downpour for two consecutive days which made the search arduous. And finally after repeated attempts he was tracked down in the thickly forest covered hill. His body was found entangled amidst bamboos in the bamboo grove.

There were several conjectures whispered among the grieving congregation during the funeral

service. Yours truly overheard them speaking about the possibility of 'murder' in connection to the competitive political scenario but since the father of the deceased did not permit post-mortem to be carried out on the body, that speculation could never be confirmed. Another opinion that was shared among the mourners who were mostly Second Generation Christian Galo was that he might have been taken by Yapom. According to Galo-English Dictionary, Yapom is a:

> fairie; demon; a potentially dangerous spirit who is believed to live in banyan trees, can fly, controls wild goats and stags, and who has the power to snatch people away and sometimes kill them. At the same time, some yapoms are benevolent and may save people from death.

It has already been mentioned above that the Galo tribe believe in the existence of supernatural powers that abide in various locations in nature. Yapom is one such spirit and the Galo also have a popular myth of the Yapom that she was the sister of Abo Tani. When the land was divided between them, Tani was given the good and fertile land and she was given the difficult terrains, thick forests, hills, mountains and rivers. It is said that Yapoms have world of their own just like the human world. They marry and have children too. They are very protective of their world. While Tani, being the first human being represents the materialistic world, Yapom represents the spiritual realm or the metaphysical world. They are believed to have made their abode in huge trees such as the hirek[2]. Though human beings cannot see them with their naked eyes, they can see the entire activities of the human beings.

Until and unless they are offended and provoked, they do not interfere in the lives of men. That also explains why Galo people conduct a ritual called digo linnam such as sacrificing animals or offering coins made of bamboo after hunting. They also conduct digo linnam by offering eggs or chicken to the spirit that is in charge of the forest before cutting a huge tree. And according to the Galo belief if such rituals are not conducted then Yapom gets offended and it gives punishment to men by damaging their property, field and livestock. Sometimes it even kidnaps the offender too. So it is a general practice of the offenders and their family to negotiate with the help of the nyibu[3] by conducting rituals to appease the spirit.

There have also been claims of Yapom being benevolent and a keden[4] of men. One Ngukkir Ori from Yigi Kaum village in West Siang district has claimed to have been kidnapped by three or four male Yapoms. He has avowed that he was taken to a huge tree where he had witnessed the world of the Yapom. There he was attended by a female Yapom who told her male counterparts that the captive is her keden and therefore, she insisted them to let him go free. He was then brought down from the tree by the male Yapoms and finally he was set free. However when he came to his senses, he found himself completely naked. This account of the old man confirms the traditional belief that there are both benevolent and malevolent Yapoms.

When enquired if the Yapom kills its captive, the response gathered was mixed. One of the common responses was that the Yapom kidnaps but it does not

kill its captive. He leaves his victim in deep jungle all by himself and usually the unfortunate person dies of heart attack. This response somehow seems to correlate with the second conjecture of the mourners who had attended the funeral service of Karto. The compelling thing about that observation was that that conjecture with firm conviction was made by Second and Third Generation Christian Galo people. That actually signifies how they are yet holding on to the cultural beliefs of their ancestors in spite of their different belief system. While the Christian missionary present in the deceased's house spoke about sin and God's will, he also did not totally deny the involvement of the spirit's work, though he did not openly blame Yapom for the cause of the death.

However on further enquiry, one disturbing information also surfaced about Karto and that was his frequent hallucination of Assam Police following him. He had confided about it to his close friends even on the night he had disappeared. Keeping this aspect in mind, a close study of the social scenario of Likabali, then under West Siang district of Arunachal Pradesh is imperative. The issue that used to trouble the local population back in the 90s still continues to persist even today after a decade. They are repeatedly threatened by boundary related disputes and the lackadaisical attitude of the successive ruling parties in the Government of India towards their predicaments has only aggravated their dilemma and confusion. The frequent meddling of the Assam Police and government officials of Assam in the internal affairs of the locals have also resulted with the latter losing their confidence in the utility of Arunachal

Pradesh Police (APP) in particular and the administration of the Government of India in general. While the state of Assam has taken advantage of the historical documents of British and Ahom rulers to prove their assertion that the claim of the Galo tribe as the natives of Likabali was based on purported occupation of land in Assam; the Galo tribe, unfortunately, like all the tribes of Tani clan do not have a script of their own to record their history of migration and settlement. This lack of script and lack of education of the early settlers have jeopardized the future of the locals of Likabali as they are made perpetual handicaps in the hands of recorded history.A chance meeting with Karto's father, the bespectacled ato with his decrepit body lying on the mat placed near the hearth of the traditional Galo kitchen enlightens one about this piece of geography called 'the No Man's Land' which apparently was the area between Likabali and Sonarighat. It was once upon a time covered with thick forests but the entire landscape changed because of the earthquake in 1950. Several mounds were flushed off by the gushing waters of the river Brahmaputra and its tributaries which were galvanized by the highly calamitous earthquake. And to this day one can witness the huge sandy residuals of that tsunami like situation. There were hardly any occupants in that belt and the area around the vicinity of Likabali was covered with thick dense forest which stood as natural sentinels around it. But with the establishment of the North Eastern Railway line between North-Lakhimpur and Jonai in 1958; the wild bushes and jungle were cleared

and gradually there was mushrooming of settlement all over that area. By late 1950s the flood victims of Sibsagar district started developing the areas between Dhemaji and Sisibargaon. And by early 1960s, as a result of agricultural revolution, the Galo tribe who were primarily involved in shifting cultivation migrated from the hills to Likabali and areas around it to carry out their wet rice cultivation. In the mean time while the Galo people started developing deep attachment to the area; the Assamese counterparts were developing shopping centres and government buildings in Silapathar as a result of the laying of the railway tracks.Silapathar came under the jurisdiction of Dhemaji and soon the awareness of the limitation of land came to the surface and the issue of Assam-Siang Demarcation got pronounced by the close of 1950. Assam had the advantage of being an established state with revenue departments and recorded history to preside over the boundary demarcation of Assam and Arunachal Pradesh, which was then NEFA (North East Frontier Agency). And Arunachal Pradesh, then NEFA, accused the Assam government of being arbitrary in the 1951 Notification of the boundary as the locals of NEFA were then not consulted. While the State of Assam adamantly stuck to the demarcation as stated in the First Schedule of the Constitution of India; the State of Arunachal Pradesh proposed for the re-adjustment of the Inter-State boundary taking into consideration the traditional and customary right exercised by different tribes of the state in the foothills adjoining the state of Assam. And the conflict still continues to persist.

This ceaseless conflict seems to have no permanent solution and the repercussions seem to worsen on both sides of the boundary with the passing of time. Examining the crisis of the citizens of Likabali; one comes across complaints of the locals being harassed by the civil as well as police officials of Dhemaji and Silapathar frequently. The alleged raid of Malini complex and demolition of the pandal and a storeroom that was built in 1994 on April 5th, 2012 is one such case. The recent report of the Assamese news channel DY365 on 2nd August, 2021 on how five villages of Likabali District have encroached the Assam land is a case of false accusation according to the afflicted villagers. While the locals of Likabali accuse the Assam police personnel of violating the status-quo; the Assamese counterparts exculpate and vindicate their act as an eviction drive against the encroachers.

Therefore one can assume that as the Bazaar President of Likabali Karto must have had several confrontations with the Assam police which might have had affected his psyche. He was also a chronic alcoholic and he probably might have had schizophrenia too. Schizophrenia is a long term medical disorder which is characterised by the patient losing touch with reality and withdrawing in to the world of fantasy. Karto's family had also admitted to the fact of him having hallucination of Assam Police following him everywhere. But they had never suspected his mental disorder to be schizophrenia as they were not even aware of such a disease, let alone the alien terminology. With time his death, which was shrouded in mystery, got lost in

oblivion. His family members moved on but to the conflicted soul standing in a crossroad, that dark rainy day evokes a labyrinth of thoughts that merge with the enigma of the dead man to only further the agitation within.

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Glossary:

1 - Karto = name has been changed to maintain anonymity
2 - hirek = banyan tree
3 - Nyibu = shaman
4 - keden = friend

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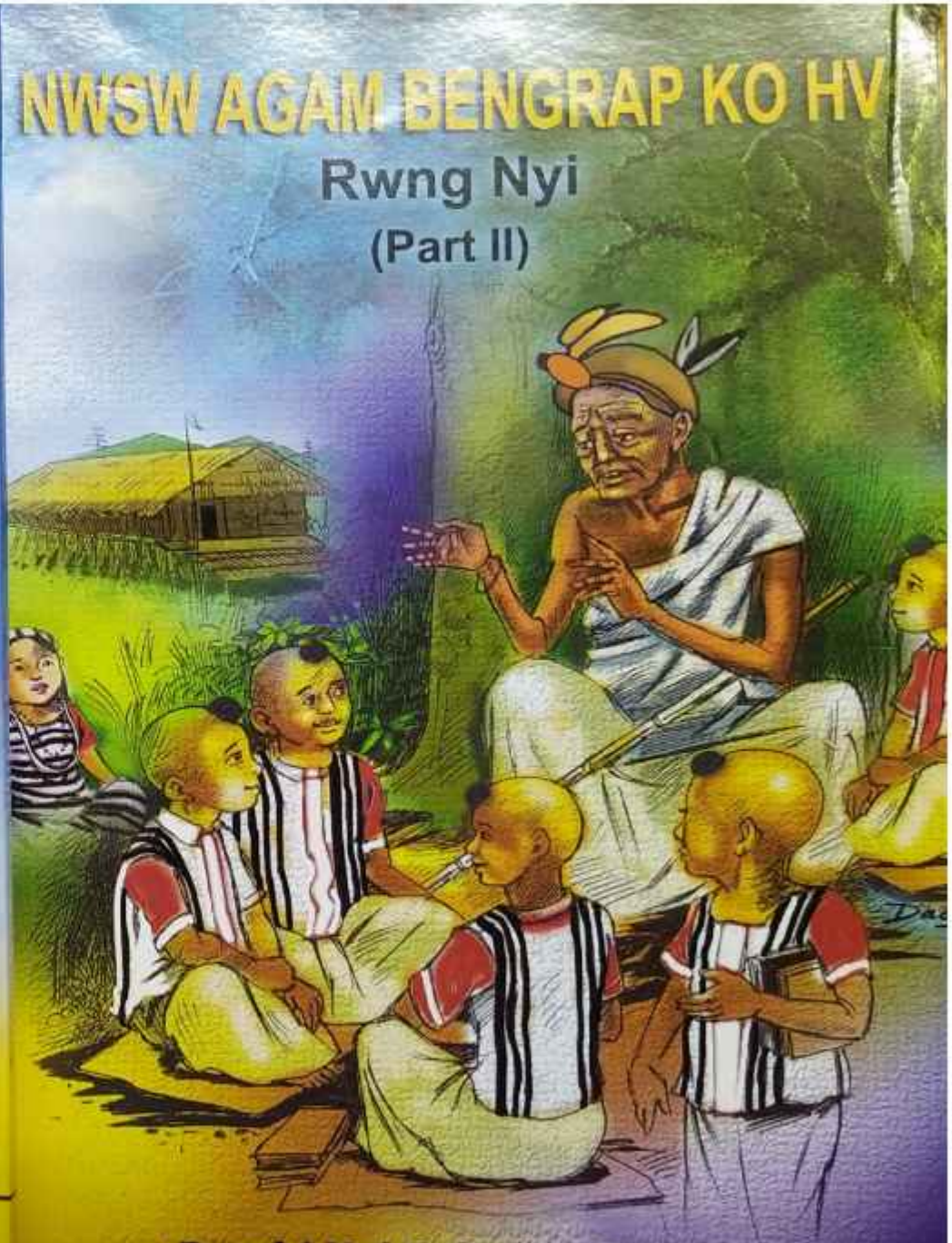

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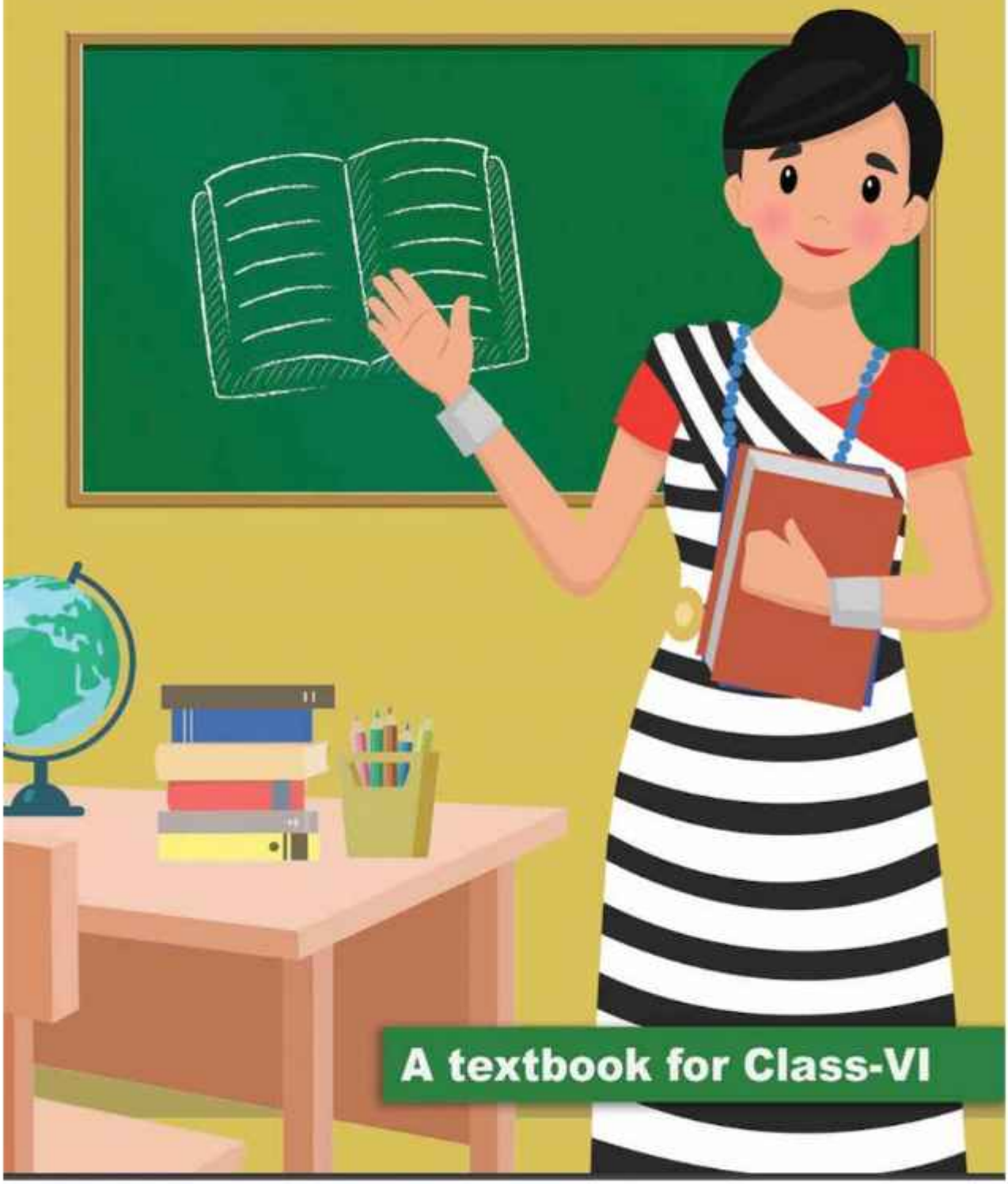

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TEXT BOOK FOR NYISHI LANGUAGE

CLASS VI

STATE COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING
GOVERNMENT OF ARUNACHAL PRADESH
GOHPUR TINALI, VIDYA VIHAR
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Itanagar
791113 Phone No. 03602203723
www.scertarunachal.nic.in *scertarunachal@gmail.com*

PUBLICATION TEAM:
CHIEF MENTOR:
Mrs. Soumya Saurabh, IAS
Special Secretary, Elementary Education
Government of Arunachal Pradesh, Itanagar.

MEMBER
Mr. Bango Palon, Jt. Director, SCERT
Mrs. D.Y. Ringu, Principal, SCERT
Mr. V.R. Sharma, Asstt. Director (Sci.), SCERT
Mr. S.S.S. Thakur, Asstt. Director (English), SCERT
Mr. N.K. Chourasia, Asstt. Director (Chemistry), SCERT
Mr. Shambhu Singh, Asstt. Director (Sci. & Maths), SCERT
Mr. Mudang Omo, Lecturer - Coordinator, TE Cell, SCERT

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FOREWORD

The State Council of Educational Research and Training (SCERT), an Academic Authority of the state, has been entrusted with the task of improving the quality of education in the schools of Arunachal Pradesh. The National Education Policy (NEP) 2020 stresses on the use of mother tongue as a medium of instruction in the schools especially in the primary and upper primary stage.

Keeping in view the importance of third language, the Government of Arunachal Pradesh has decided to introduce third language books from Class VI to VIII in the state by collaborating with the Apex bodies of various tribes. In the first instance, the books of NYISHI, GALO, TAGIN, MISHMI (Idu), MISHMI (Kaman), MISHMI (Taraon), TANGSA and WANCHO tribes are being introduced. These books will be taught in different schools of the tribes to which community they belong and will be introduced in the schools with a purpose to enhance their content knowledge so that the learners can understand things in a better way.

The introduction of third language Books aims at understanding of the contents in a better way. At the same time, it will help the learners in the development of skills and knowledge. This will inspire them to have close cultural ties with the tribe they belong to. In the recent years, it has been found that many children have been alienated from their mother tongue mainly due to the unavailability of third language in the Schools of the State.

With its introduction as the third language, it will improve teaching and learning of other subjects as well in the schools. This will also help in improving quality dimensions and will equip them with better and improved content-knowledge and pedagogical support while translating their goals in life.

Keeping in view the immediate need of it, the SCERT had been entrusted with the tasks of vetting and coordinating in the development of these books of third language. These books have been the outcomes of hard work by the Book Development Committee of different tribes as well as the Apex Body members of concerned tribes. The credit also goes to the Member Coordinators and the Editors who strived hard to give shape to the books as they are available before us now.

I am sure these books of third languages will meet the challenges in updating learners' ability and will prove immensely effective and helpful in transacting and learning the content. Additionally, SCERT welcomes all suggestions to improve the book for its further editions.

Niharika Rai, IAS
Commissioner (Education)-cum-Director, SCERT
Government of Arunachal Pradesh
Itanagar

State Council of Educational Research and Training
Government of Arunachal Pradesh

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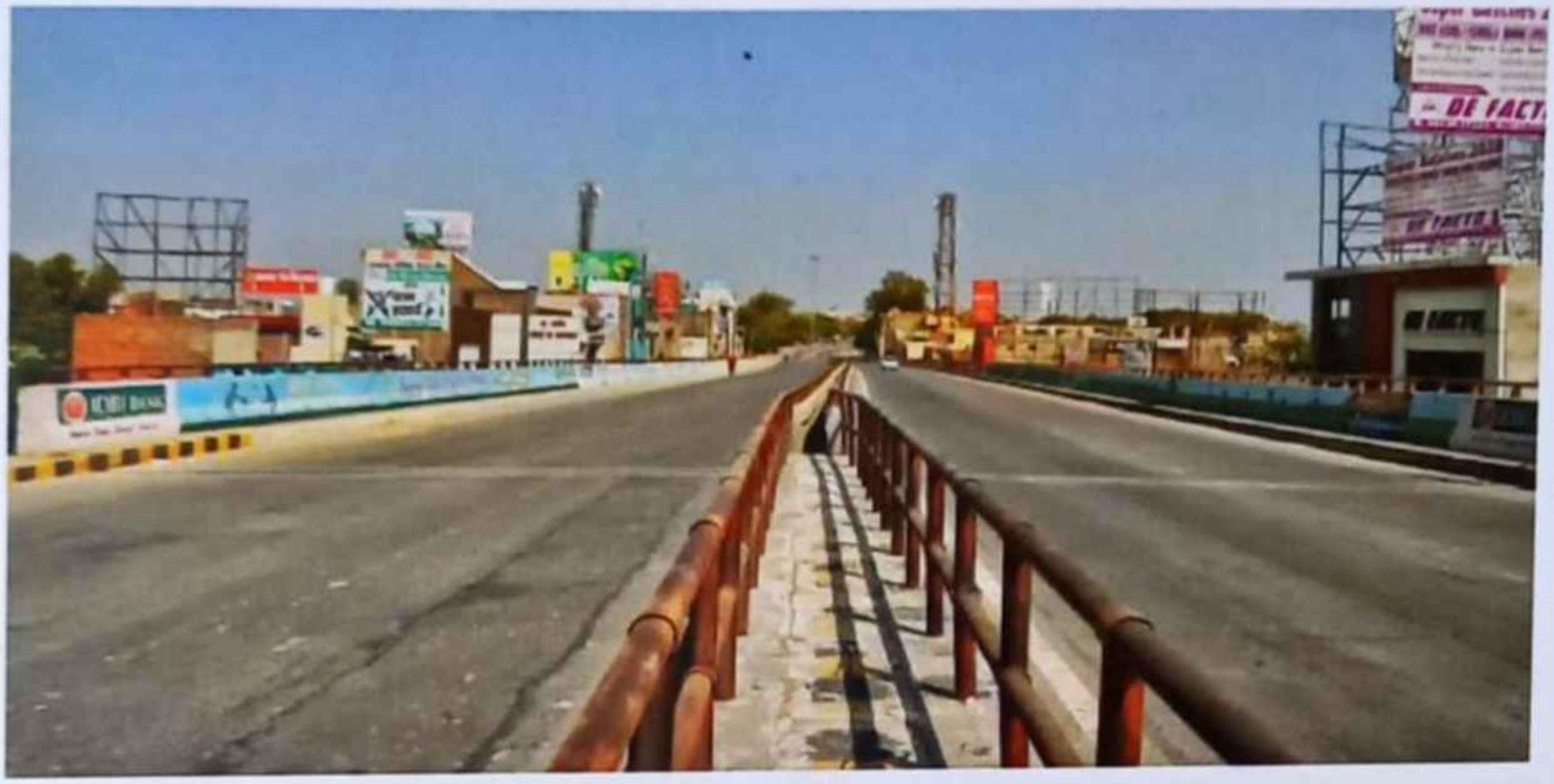

IMPACT OF LOCKDOWN ON PUBLIC DISTRIBUTION SYSTEM IN SONITPUR DISTRICT OF ASSAM, INDIA

DR PHILIP MODY
PUBALI RAHMAN

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E-mail: archerselevators@gmail.com

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EMPLOYEES JOB SATISFACTION AND ENGAGEMENT
(A CASE OF NRL, ASSAM)

PRAVEEN KUMAR SAHU
DR PHILIP MODY

ARCHERS & ELEVATORS PUBLISHING HOUSE

No.54, MM Layout,

Hesaragatta Main Road,

Bangalore -560090

Mob: + 91 9164362263

E-mail: archerselevators@gmail.com

Website: www.aeph.in

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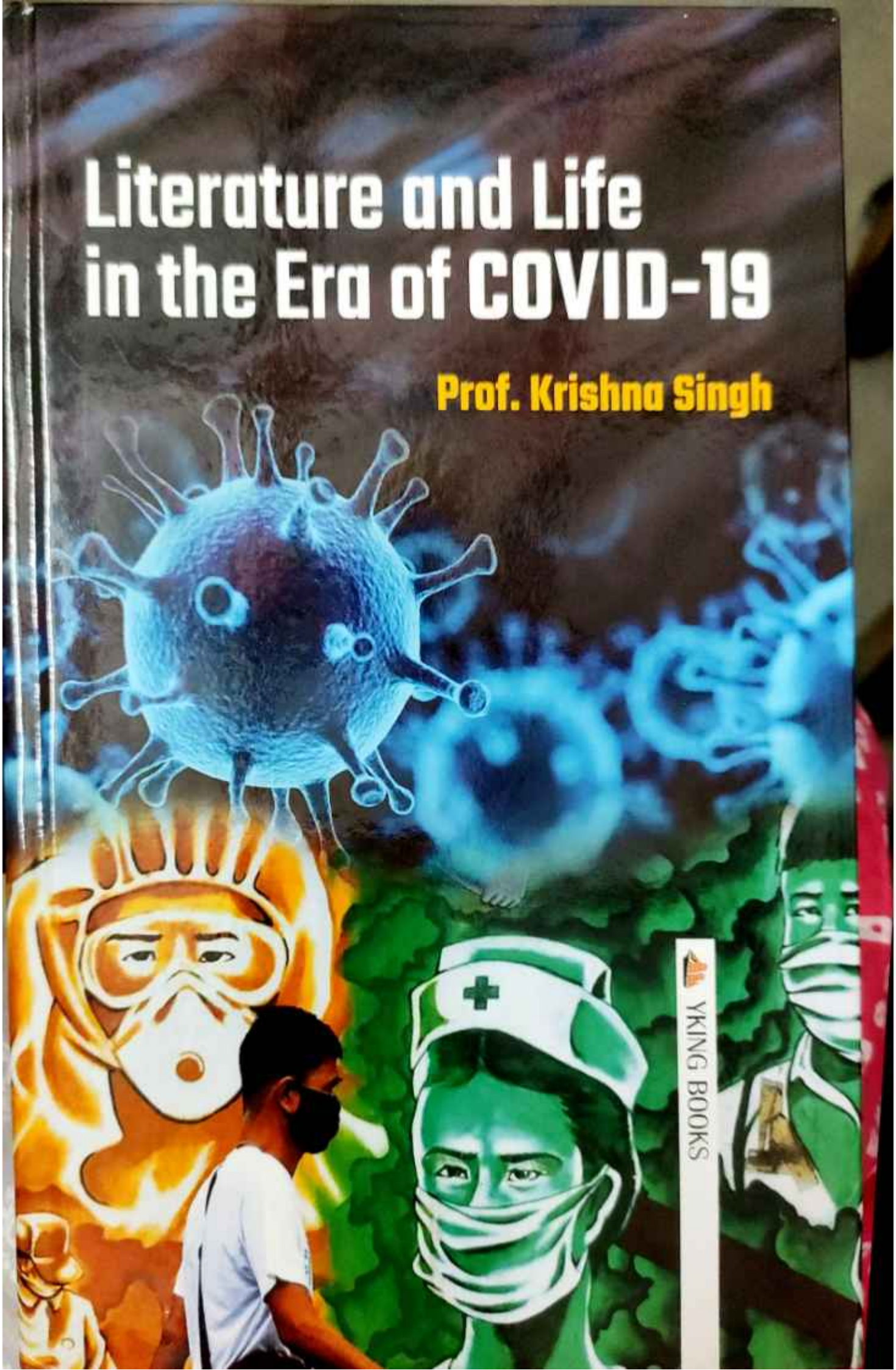
Literature and Life in the Era of COVID-19

Prof. Krishna Singh



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1

Decoding Pandemic Dislocations in the Paradigms of English Literature

Prof. Bhagabat Nayak

Dislocation is a temporary or abrupt condition of causing gap or disruption in the material as well as physical existence. It is a defect in the direction of movement when people are unable to mobilize from one place to another. Although 'dislocation' is more a usable term in material science, applied physics and micromechanics where it is a defect caused by glide or slip under some influential stress or irregularities in stability. In literary perspective decoding dislocation is understood more in immobilization of people from one place to another due to pandemic at certain situation of mankind's suffering. Dislocations cause disruptions or reverse movements of life due to outside stress or pressure or due to pandemics like plague, cholera, tubercolosis and influenza, HIV/AIDS, Ebola or Covid-19 in our contemporary situations. It not only causes defects or disrupts life in its progress but also causes abrupt hazards in the phenomenal aspects of human life. In common perception dislocation refers to deformation in the natural process of developments. Natural functioning fails during dislocation and it causes defects in normal arrangements of life. In pandemic situations historians, scientists and writers decode and deconstruct pandemic vector energy while recording, experimenting and narrating the effects of pandemic bond in life, living conditions, and mutual relations

of people. Pandemics affect the meaning and magnitude of life creating tension and stress due to the lack of free movement, communication and coordination among the human beings with the posing of multiple irregularities. Pandemic is the buzz word for a disease which affects human life exceptionally usually due to a virus that spreads more than one continent and affects larger people with its common complications. It is broadly a global epidemic which generally confuses the world about its effects and impacts.

In the history of pandemics writers across the world write about the complexities caused by the pandemics in their textual productions. In their locatedness and existential situations they observe and realize life's experiences and present them in their narrative techniques. The paper is a humble attempt to explore pandemic dislocation in the subjective contexts of literature. It demonstrates perceptually the lethality of pandemics, causes of the fault-lines and the difficulties and defects in everyday life. Dislocation during pandemics causes stagnation in life. Science becomes the last hope to solve the pandemic crisis. Unless science becomes successful for its prevention or remedy in its inventory mission it becomes difficult to check its lethal strains on life. This causes societal dislocations due to voluntary choice or mandatory administrative policies. Dislocation in life and society prevents harms and reduces life psychologically and spiritually. In this context Bruce K. Alexander of Psychology Department of Simon Fraser University says:

> Dislocation is the condition of great number of human beings who have been shorn from their cultures and individual identities by the globalization of the "free-market society" in which the needs of the people are subordinated to the imperatives of markets and the economy. Dislocation afflicts both people who have been physically displaced, such as economic immigrants and refugees, and people who have remained in place while cultures disintegrated around them. Dislocation occurs during boom times as well as recessions, among the rich as well as the poor, among capitalists as well as workers. Today, dislocation threatens to become, universal, as global free-market society undermines even more respects of social and cultural life everywhere (29).

Dislocation affects common man's life without essential services, normal living conditions, and creates social and psychological tensions making the people easy victims of it due to stress factors. Since the meaning and magnitude of life stop, normalcy of life gets hindered, irregularities affect the regularity of mutual relations, there takes place serious physical, social, psychological and spiritual dislocations. Countries across the world take wartime measures to provide basic knowledge to the people how to keep them safe and sustainable till the scientific community become successful to invent the right kind of medication for its prevention.

The paper analyses dislocation at the time of pandemic in the segments of human history with its fault lines, defects and periodic effects as well as the effect of Covid-19 that has caused a great havoc to the mankind in the contemporary context. Covid-19 menace has notoriously dismantled the philosophy of life, fractured the psychology of human beings and affected their lifestyle, health, economy, social conditions and cultural sensibility. Economy has become the worst causality of it. A long time stagnation, alienation, isolation has caused a wide scale social and psychological disruption. Like any pandemic in human history, Covid-19 has caused serious socio-psychological, economic and other disruptions in human life. It has almost brought a stagnation and pause in normal life. Like other pandemics Covid-19 has the "valence of change" in the social life, normative habits of the human beings, effect on their concept, personal and impersonal matters of cognition and attitude, perception, emotion, affiliation and other characteristics of life. Change is always welcomed in every society and every time as it is the sign of development and progress. Life is all about change and "all sociology is about change" (Sztompka xiii). One cannot definitely say that changes take place only due to revolution. In history revolutions bring change but pandemics bring abrupt changes either in macro sense or micro sense causing serious psychological consequences. This change due to dislocation or disruption affects interpersonal relationship, perception, memory, emotion, and destroys the stability in social continuity. The consequences of pandemics cause serious disruptions in human life, inertia due to destructive changes and disequilibrium in

epistemological estimation, orientation, frustration and helplessness in life.

Pandemic causes serious consequences. It causes gap in social and emotional relationships. During pandemics people fail to attend or meet their near and dear ones in need or difficulties. Often it happens that the close neighbours become distant members. Emotion is a normal pathological reaction that alleviates natural bond in human relationship during Covid-19. It becomes the first casualty during pandemics. In civic manners and normal human relationship shaking hands become contemptible, parents fail to embrace their children, and fear of death dominates the consciousness. Regulated environment either in the four walls of house, containment zones under medical supervision, and surveillance of administration make humans "a species of idleness", and "victims of grief". This helps them to take the pleasures of indolence, while educating the emotional hygiene or "drinking life to the dregs" through instrumental music and implied objects. Serious dislocations take place in trade and commerce, export and import, production and consumption. While this causes serious implications in human life, many migrate in search of engagements and income. Sometimes serious demographical changes cause mental stress, political struggle, crime and terror in normal living conditions. Unemployment due to lockdown causes division between rich and poor economic collapse, invites subordination, slavery, growing inequality, insecurity, poverty and turmoil.

Pandemic situation greatly affects the sentiment of the people and their emotional relationship. Emotions have been self-sacrificed in a very contemptible manner. Pandemic creates a kind of inertia in "absence of activity, a lack of capability ... and thus as an impediment rather than a desired condition" (Buchanan et al 190). The theoretical dimension of dislocation differs from its relative effects in the sociology of development. Pandemic causes economic dislocation in production, supply, economic capacity building, profit earning, business, and sustenance in life. Pandemic situation brings quick economic changes posing threat to industrial development and major economic planning. The outbreak of Covid-19 virus and lack of success in its treatment and cure has made humans untamed in emotions. Stress factors

due to lockdown, financial hardship, risk of unemployment, worry of loss of jobs and pay cuts, surge of misinformation cause disowning pets, discourtesy towards frontline workers and sorry condition of migrant workers. In the field of education and learning, emotional intelligence has faced serious difficulties due too much of self-awareness, self-regulation, self-motivation and policy possibilities. E-learning and e-training are adopted to enhance intellectual and emotional development. Discourses on medications, yogic exercise, health tips and motivational classes are conducted to counter individual's emotional distress. Measures to provide psychological counsellings, social distancing, sanitizing are taken for good health and positive spirit to keep humans free from contagion.

Covid-19 like other pandemics in history has its myth which is not ascertained in scientific research. Since scientific analogies are inconsistent to break its myth it is difficult to say about its history, bond and cure. The scientific communities of the world are in search of the methods to break its bond in "socialization ambiguity" (McDade & Worthman 49) which rapidly leads to a profound social transformation and produces rapture in the equilibrium of the social and normative structures. Its serious impact on "emotions, values, perceptions, identity" (Wall and Louchakova 266) due to alienation, containment, isolation and dislocation creates the situation to internalize individual's nostalgia or an experience of amnesia. Covid-19 poses immediate threat to life which compels the stakeholders to suspend theatres, concerts, ceremonies, rituals, prayers and sports events, political and cultural events. People either voluntarily or mandatorily suspend their engagement and involvement in cultural events. In other words, this makes culture the casualty of the pandemic. Popular culture has become the worst sufferer as Covid-19 has destroyed the interest of the culture consumers. It is almost like the situation at the time of war or aggression when people restrict themselves from the outside world in order to "feel safe".

During the pandemics disruption affects the human life in manifold ways including finance, emotion and psychology and leads life to an uncertainty. As a great disrupter Covid-19 affects social dynamics as well as the dynamics of life. People are unaware, unprepared, inexperienced and unequipped to meet the

situations during the peak time of pandemic. Isolation becomes the only preferable, forcible and feasible method to counter the loss. In hassle, fear, tension they enjoy some loss in life and need some physical, maternal and emotional support. Pandemic affects human psyche in self-isolation. Pandemic causes a frightening situation when human ability is disapproved as the master of the universe. Social distancing has serious repercussions on body, mind, spirit and soul. It develops a sense of impotence, grief, loneliness, anxiety and distrust in life with different psychological complications.

Pandemics invite extreme sorrows, miseries, difficulties and dangers to life. People become psychedelic in their existential reality. They desire to get a quick respite from this. Past becomes a subjective aspect of nostalgia and future either gets suspended for sometime or remains in a self-willed amnesia. Fear of death makes the existential reality unbearable. Horror provides new experiences, changes the paradigms of human perspectives, human relationship and normative experiences of life. Meaningless deaths evoke unspeakable horror. Literature and fine arts provide pleasure and comfort to life. Psychological safeties act as an emotional oxymoron and cause uncertainty and anxiety. The Covid-19 pandemic has created an existential sequence of its reality which gets revealed in the context of pandemic literature. Like other fine arts, literature has its healthy features for learning the complex situations and experiences life. Literature provides human response to the creative feelings like positivism love, kindness, patience and compassion in life. Literature heals the several scars on human life. It communicates the experiences of life and creates a quick and direct response to the complications of life. Social paradigms, life's existential problems and psychological suffering during Covid-19 dislocation get its revelation in pandemic literature.

The vector effect of Covid-19 virus has its cold and cruel effect on human life. Feelings of love, kindness, patience, compassion and lack of communication have made human life unbearable. The effect of the virus attack has reduced the nature and functioning of human life. It has reduced human cognitive and somatic response by causing trauma, moral injury and grief. Loss of taste or smell, difficulty in breathing, tiredness and chest pain,

severe pressure, loss of speech or movement as the tendencies of human life during covid-19 lead life to uncertainty. The pandemic features may be new of its types but pandemic miseries both literature and history reveal the miserable condition of life more or less similar. Pandemic subject has been revealed in literature since 8th century B.C.

The *Iliad* written in Homeric Greek significantly refers to the pandemic plague as the main context of Book-1. The narrative of the epic poem begins nine years after the start of the Trojan War where Achilles the greatest hero has a quarrel with his commander-in-chief of the army Agamemnon. The most valuable warriors of Achaian army were successfully advancing in their mission. Agamemnon conquered some of the territories closer to Trojan. As his soldiers captured two beautiful maidens – Chryseis and Briseis and they were brought to him Agamenon took Chryseis as his prize and Achilles claimed Briseis. As Chryseis's father Chryses was the priest of the god Apollo, he approached Agamemnon to return his daughter in exchange of enormous ransom. After Agamemnon's refusal Chryses approached Apollo for help. This made Apollo send plague to cause havoc on Greek camp inviting death to many soldiers. After ten days of pandemic suffering the Achaian army called for a soothsayer, Calchas to know the cause of it and its retribution. When Calchas revealed that plague was a vengeful and strategic move by Chryseis and Apollo, Agamemnon agreed to return Chryseis if Achilles would give him Briseis. In order to save the Achaian army from plague Agamemnon's demand humiliated and infuriated Achilles, who out of his rage threatened to withdraw from the war. When the two great heroes were in conflict over Briseis goddess Athena appeared there with the advice of Hera, the queen of gods to prevent the duel between the two. The reference of plague as retribution, its havoc and strategic measure of Apollo has greater dimension in the epic.

The great Greek historian Thucydides mentions about plague in his *Plague of Athens* (from 430- 427 BC). The book mentions about the four years of its devastation that had raged the city in the second year of the Pelopnnesian war with Sparta. His mentioning of the horror of plague pandemic which had nearly killed one quarter of the people as well as Athenian army

towards the third year of its rampage. Even Pericles (443-420 BC) the very influential Greek statesman, orator and general was succumbed to plague during the twenty seven year war that had not only divided and destroyed Greece as a power in the ancient world but also drained their resources decimating the people failing to regain their preeminence in the ancient world. Thucydides himself had the first hand experience of plague and he has discussed about its signs and symptoms. His essential features of Greek terminology and familiarity with medical terms reveal his knowledge of the disease. His key observations of the individuals recovering from plague reveal body resistance of humans to future attacks. His reference to the nature of the contagion of plague in Athens is presumably small pox or some other type of diseases like influenza, typhus, bubonic and measles reveal enough to study the nature of future epidemics.

From 1300 to 1347 there were frequent cases of bubonic plague in Europe. It was suspected that the epidemic was brought and spread by the rats and fleas in the Black sea region from the Mongol traders. Giovanni Boccaccio, the Italian poet and scholar mentions about plague in his *Decameron* (1353), a collection of one hundred tales which narrate ten days' horror of plague and reveal the horror of the situation in Florence in 1348. Seven young women and three young men narrate the stories while sheltering in a secluded villa outside Florence in order to escape the Black Death which was afflicting the city. With the horror of plague, theme of love, eroticism and tragic elements are expressed in Florentine language with the local oral tradition, mercantile ethic, quick wit, stupidity and dullness. The narratives deal with philosophical outlook in the aftermath of the Black Death. While four of the women narrators represent–Prudence, Justice, Temperance, and Fortitude, three young men represent three theological virtues like Faith, Hope, and Charity supposedly the Reason, Spirit and Appetite. Boccaccio concludes with a conservative tone that the society itself has caused plague due to its sinful behavior. In his view plague is a cure for social fragmentation and sin. The swelling in the groin and armpits confirm the symptom of bubonic plague with other symptoms like fever, body aches and fatigue. Boccaccio's observation of the pandemic gives a horrific presentation which had claimed more than millions of human lives only across the Europe. The book

expresses the view that in the time of pandemic horror love as the only message can transform the human heart.

Although Geoffrey Chaucer portrays plague in "The Pardoner's Tale" in the late 14th century the pandemic has its reference in Elizabethan playwright Thomas Nash's *A Litnany in the Time of Plague* (1592). It presents the grim reality and talks about plague as the Black Death for killing nearly 200 million people during the time of Queen Elizabeth-I. For many of its unexplored causes even the Queen was terrified for her life. Nash's imagination of death is fixity with human morality and associated with salvation. He indicates that death is inevitable and nobody can escape from death after his observation of the pains of death everywhere. He says that nothing would be able to protect the humans from death. The wealthy and able people cannot avoid death. He says, "I am sick, I must die" like the rich and the poor, the beautiful and the ugly, strength and intelligent as nobody will be safe from plague. The description of powerful images have association with plague which make many the victims and enjoy a painful life becoming frail, repulsive, and sick while "stooping to the grave". In the poem Nash gives an apocalyptic expression revealing that sickness requires divine mercy.

Daniel Defoe's *A Journal of the Plague Year* (1722) is a historical novel presents the return of the bubonic plague that had killed one quarter of London's population within eighteen months. Defoe describes about the families forced into quarantine due to infection and their shrieks for being terrified to death after seeing the condition of their dearest ones. The novel essentially presents the chronological details of the great plague that devastated London life in 1665 in a well-researched way. King Charles-II did not allow any trade and commercial relation with the Dutch in fear of its transnational infection. In its realistic portrayal Defoe presents the truth about plague that was killing people each week and people were paying desperately the medical bill. Defoe's observation of life's irregularities in his literary device is well observed when he writes:

> I can go no farther here. I should be counted censorious, and perhaps unjust, if I should enter into the unpleasing work of reflecting, whatever cause there was for it, upon the

unthankfulness and return of all manner of wickedness among us, which I was so much an eye-witness of myself (18).

The narrative focus of the text centrally deals with bubonic plague, its causes and consequence. The bubonic plague time greatly affects the society and economy with the revealing of people's grief, sadness and death, spirit for survival, sin, redemption, hope and faith with all negative impacts on human life. The terrible calamity had affected foreign trade. The narrator probably Defoe's uncle Henry Foe, who is the H.F. in the novel gives his account on bubonic plague specially in East London when Defoe was only five years old.

Marry Shelley, the daughter of distinguished feminist Mary Wollstonecraft and philosopher cum political writer William Godwin, and wife of P.B. Shelley writes about the global pandemic in her novel *The Last Man* (1826). The novel in its futuristic perspective presents the horror of the pandemic that has killed almost everyone on the Earth, except a person Lionel Verney, the only survivor of the world. The novel appears to be a production of Mary Shelley's reaction to the death of her husband. Although she is very well known for her novel *Frankenstein* (1818), the present novel serves as a tribute to Shelley's deceased friends and her feelings of isolation after their loss which had created the loss of Romantic political ideals that they were standing for. Loss of friends is the loss of ideals for Mary Shelley which creates a metaphorical plague effect causing the flaw in human nature. The crushing sense of loneliness of the novelist has the killing effect of plague for the intellectuals like her. While the novel deals with the themes of the anxiety of illness, national isolation and ethical aspects in human nature the author justifiably presents that the personal loss of utopian ideals create the plague effect. She views that the loss of ideals is the loss of ethic of a society and this becomes the cause to decimate the mankind. The novel as an apocalyptic and dystopian science fiction presents a plague-ravaged world in the medical theories of disease transmission. The plague serves as a metaphor of failure of the utopian ideals which support the traditional needs of the family. The novel in its biographical and political sketch helps to understand the ideals of her husband, father and Lord Byron's political ideals and their subsequent failure to support her and her children.

Influenza as a pandemic during the World War–I had greatly affected life, love, sentiment. Katherine Anne Porter's novella *Pale Horse, Pale Rider* (1939) narrate a classic story, all set around an event from her personal life during the World War-I when she was working as a reporter in Denver and fell in love with a lieutenant. The story centers on Miranda, a woman who survives the influenza pandemic during 1918. When her lover Adam died of influenza, Miranda became sick and delirious but finally recovered becoming exceptionally pale. The author enabled her to be contracted to Spanish flu in this autobiographical story but depicts that the epidemic is a conqueror on a horseback, death appears to be on a pale horse. The 'pale horse' is influenza and the 'pale rider' is Death. She symbolizes that the horseman is a conqueror and the rider of death. The novella in its historical and literary contexts presents the Spanish flu that had killed more than five million people living in over-crowded areas. The deadliness of the flu was almost a pandemic due to malnourishment and poor hygiene. The story presents the illness which caused the burial of the dead in common graves. It grapples the consciousness and alienation which are commonly found in Franz Kafka's *The Metamorphosis* (1915), T.S. Eliot's *The Wasteland,* (1922), and George Oppen's *Of Being Numerous* (1968). After Miranda's miraculous recovery she realizes that she is familiar with death from her experience of suffering and from the death of her near and dear ones which was causing "a clamour of pain" in her.

The bubonic plague pandemic has seriously affected the philosophy of life in Albert Camus' *The Plague* (1947). The novel presents how philosophy of life is meaningless during the time of pandemic which causes meaningless suffering and death. Plague causes the absurd condition for the existence of life. The archetypal title of the novel is a metaphor for the horrors of fascism and as an allusion to cholera epidemic in Algeria in 1849. Camus presents the nation's point of view in the plague sweeping French Algerian city of Oran. The novel is a snapshot of life in Oran during the wide spread of the invincible silent disease that kills and destroys life. The pitiless situation of life is viewed in the town of Oran where the gates of every house are closed due to the rage of plague. Camus consciously constructs the consciousness of the people who have isolated themselves in

"human decency" (151) for "doing one's job" (146). Dr. Rieu the narrator reveals his reason for writing what had to be done and to what against the relentless onslaught of plague. He narrates the scourge of plague which has become a murderer. He remarks that plague is "the very angel of death", a Whitman's phrase during quarantine when "the soul of the murderer is blind" (124). The citizens of Oran have become the prisoners of death without "freedom" as the very reality that amalgamates our ideas of existentialism and humanism. In the novel plague represents human suffering due to alienation as well as an allegory of the rise of Nazis in German that caused suffering of the Jews and Europeans during the World War II.

Barbara Wertheim Tuchman the twice Pulitzer Prize winner presents the idea of death and suffering due to the 14th century plague in *A Distant Mirror: The Calamitious 14th Century* (1978) which has similar repercussions and effects during the World War I. The novelist narrates the horror of war as plague effect that has "no sense of an assured future". The novel presents pandemic situations in the European experience of fourteenth century when the Black Death had its rage. Narrating the twentieth century situation in fourteenth century consciousness she presents the Hobbesian condition of human society. The novel as a fantasy fiction of love and corrupting-weaknesses of elites presents exciting times on commoners' "plague pillage and taxes". Apart from the Black plague the novel covers the other matters like the papal schism, pillaging mercenaries, anti-Semitism, socio-political and religious classes, and events related to nobles, and mercenaries.

The chronicles of human immune deficiency virus (HIV) and Acquired immune Deficiency syndrome (AIDS) have been addressed with the policy and political implications of the government in Randy Shilt's *And the Brand Played On* (1987). The author emphasises the horror of the pandemic virus as well as the political infighting in the United States during its spread. The novel analyses author's concern for the horror of the disease and the factors and biological agents that make it uncontrollable. The author explains how the disease exploded among the people in gay community's who were the victims of public apathy. In his journalistic reportage, investigative approach and extensive

analysis the author gives coverage of the disease when the gay communities were the victims of public apathy. The novel not only sounds an alarm on the dimensions of the AIDS and delay of government actions which "fundamentally disappointed" the probe on the broader questions of intravenous drug users, gay men homosexuals but also present "the pain and courage of individuals confronted with AIDS". It presents the human side of the crises. The horror syndrome of AIDS, its high impact on the people, its emergence and different orientations of the people are narrated in a meticulous documentation.

The spread of Ebola virus in Liberia and Siera Leone was an alarm to the people of the continent of Africa. The outbreak of Ebola as a pandemic in Kenya in late 1980s is traced with the true events and surrounding in Richard Preston's *The Hot Zone: the Terrfying True Story of the Origins of the Ebola Virus* (1994). The novel accounts Preston's concerns for the spread of Ebola as a pandemic with other viral diseases in 1970s and 1980s. As a scientific thriller the fictional work presents the factual view of terrifying events which had posed a greater threat to human life due to the virus like AIDS. The symptom of Ebola virus has its exposure with the death of the French expatriate, Charles Monet. The novelist presents how at the time of Ebola spread several American scientists and military personnel were spending their lives wearing space suits and doing research on the lethal virus for developing a vaccine for its cure, Preston's visit to *Kitum Cave,* the hot zone in Kenya where Ebola virus was detected. It presents the developing symptoms of Ebola, its sources and worries to protect the human race. Preston gives an account of the history of the devastation caused by two central African diseases like Ebola and Marburg for which quarantine was the only possible method to check infection and control the fatality rate.

Gabriel Garcia Marquez's *Love in the Time of Cholera* (1995) narrates a sentimental story of love between Florentino Ariza a telegraph boy and Fermina Daza the daughter of a mule trader. There is no sign of cholera suffering in the novel but the novelist uses cholera as a metaphor of horror for pain causing impact in Florentino's longing for Daza. Florentino's lovesickness causes suffering which is as painful as cholera. Intense love and longing causes the similar pain of cholera. True love is enduring but

longing for love is infections one for a lover. In reality Fermina has married to Juvenal Urbino and they are perfectly happy after their marriage. But narrating Florentino's love for Fermina, Marquez states that love sickness is a literal illness for which Florentino suffers emotionally and realizes it highly infectious like cholera pandemic. Florentino, a poet by passion and emotion has dedicated his life to love in his sincere waiting for Fermina for fifty one year nine months and four days. Even after Fermina's marriage he waits for her for a long time and his love for her does not become pale for her. Fermina still appears as a "beautiful adolescent" with "almond shaped eyes" for him who walks with a "natural haughtiness in a journey of forgetting. When Juvenal Urbino dies an unfortunate death after chasing a parrot the situation changes. After Juvenal Urbino's funeral Florentino steps forward and declares- "Fermina", "I have waited for this opportunity for more than half a century, to repeat to you once again my vow of eternal fidelity and everlasting love". Marquez through his narration leaves the message that a man living with heart's eternal vow for more than fifty years was a kind of suffering from cholera which had plagued and made him precarious. Florentino's crazy love and desperate romanticism reveal the cholera symptoms in his emotion and heart.

Amitav Ghosh's *The Calcutta Chromosome* (1995) is a medical thriller that dramatizes the advantages of people who are brought together by mysterious turn of events. The novel wonderfully blends the facts and fiction. It weaves certain historical events which led to the discovery of the killer malaria and its cure. The novel has a background of malaria pandemic and about the research of Nobel winning scientist Ronald Ross (1857-1932). The ground breaking discovery of the cause of malaria and its cause due to the bite of a mosquito, a female anopheles has been manipulated by an Indian 'counter-science' group which has "systematically interfered with [his] experiments to push malaria research in certain directions while leading it away from other". The novel investigates into some historical events that lead to the discovery of the killer malaria and its cure. It correlates other relevant philosophical and sociological issues central to the politics of science. In the enigma of science Ghosh narrates its impact in cultural practices of treatment of psyche of the character who discusses the strategies of development for this impending

disaster. The novel highlights protagonist's lifelong obsession with the history of malaria research, transmission of malaria, and epistemology of folk medicine in the economically poor community.

Influenza pandemic of 1918 took nearly twenty million lives. History reminds us more about the horrors of the World War I but few remember the loss of lives due to the virus that killed millions of innocent people in the world. Gina Kolata's nonfiction *Flu* (1999) narrates the horror of the pandemic that had chiefly killed the healthy middle-aged individuals between two world wars. Influenza had its origin in Spain. The fatality of influenza was not covered enough in newspapers. The book covers influenza epidemiology and costs of the influenza with its rapidity in progression and human suffering. The lethality of the disease had many perplexing aspects in collective consciousness as it killed the people of developing and developed regions alike. The writer touches the human side of the suffering in well illustrated vignettes. As a science reporter of the *New York Times* Kolata makes flu enjoyable and educational as it had passed from birds and pigs to humans and produced the most dangerous strains. The research investigated by the medical experts had to discover the causes of transmission and strains of the flu. Kolata has tried his best to trace the scientific discoveries during 1918 establishing its connection between animals and humans.

London epidemic of 1854 is well mapped in Steven Johnson's *The Ghost Map* (2006). It gives a detailed mapping of the dead due to cholera and a lot of background of London as the filthiest city in the world in 1850s. The condition of people, their seriousness due to the bacterial and waterborne cholera, its infection causing harm to small intestine, dehydration causing symptoms and vomiting are common in the narration of the condition of people in urban communities where dense population were there. The author narrates the nightmarish effect of cholera as a pandemic in Victorian London. It had created a horror as there was no scientific success to prevent it except electrolytes intake in clean water. Cholera was a threat to human life then and now in urban areas. The book documents the steps taken and performed through experiments in order to know about its outbreak and its effect explaining the human ability to fight and counter its spread.

In literature pandemics are narrated as mass murderers. In the history of pandemic it will not be proper to say that the writers across the world only write on pandemic horror in English. Many writers of continental, national and regional identities have attempted their best to narrate the condition and helplessness in their peripheral contexts. Often manmade crises like war, riots, racial and ethnic subjugations make them suffer like the suffering during pandemics but the authors narrate pandemic effects in destroying families and destroying cities write great intensity. Judging the pandemic horror at different times in history and the human side of love, suffering, bereavement, and loss a few Indian writers have written about pandemic devastation. Either in English or in their native tongues they have narrated human suffering and their struggle in combating the epidemic with insightful reports. Indian writers like their English counterparts narrate human condition and their miseries with much responsibility. In this context few Indian writings, including the translated works are taken into consideration for the pandemic discussion, at the time of plague, small pox, influenza and cholera.

The tentacles of diseases become virulent due to the human failure to contain the pandemic with medication or in the preferred methods of isolation, containment and social distancing from others. Human failure or lacks of knowledge about the disease make it more dangerous for which it poses threat to human life. Rabindranath Tagore's long poem *Puratan Bhritya* (1895), The Old Manservant narrates the aching story of a much-reviled house help who nurses his master to health but succumbs to small pox. Kestha, the manservant nurses his master to health in spite of his master's abuse but unfortunately succumbs to small pox. His master, the zamindar repeatedly abuses, scoffs, and periodically orders Kestha to go out of the household with the instigation of his irate wife but he refuses to leave his employer, for whom he holds an astonishing sense of devotion. During zamindar's pilgrimage to holy Vrindavan Kestha accompanies him instead of his more-preferred servant Nibaran. On his pilgrimage when the zamindar is deserted by his fellow pilgrims in fear of being contracted to small pox Kestha provides him exemplary service but unfortunately succumbs to the virulent small pox. Similarly one of the eminent Odia writers Fakir

Mohan Senapati in his story *Rebati* (1898) narrates the horror of cholera that had hit an Odia village killing thousands. He deals with the shocking life of a village girl Rebati, the protagonist of the story whose life and expectations are destroyed due to cholera pandemic. It kills her parents and leaves her in desperation. Her grandmother and tutor Basu become the only supporting members. The story has its shocking effect when Basu fails to come to support them, Rebati becomes the victim of Cholera, and the grandmother superstitiously believes that everything happens due to the wrath of deities due to Rebati's education. The writer in his imaginative perception thinks cholera as a "problematic reversal" of the aggressive act of subjugation by the colonizers.

In the early twentieth century Indian a number of writers have narrated the horror of pandemics in their writings. Eminent Hindi writer Suryakant Tripathi had seen the horror of influenza outbreak in 1918 that had left thousands dead. The poet after losing half of his family members including his wife and daughter had realized that unsourced material may be challenged and removed. In his poem *Nirala* (1922) he writes about the time of influenza, the Spanish flu that had hit hard to Nirala on his way to meet his wife at his in-law's place. Before meeting his wife Nirala fall victim to the deadly disease. The poet narrates Nirala's misery with scores of others who had their meaningless deaths and for this there were no wooden logs left with to cremate the dead. The river Ganga had even grown heavy and exhausted with the burden of corpses. The poet conveys deep emotion, shock, loss, horror of death around his life.

Eminent Hindi writer Munshi Premchand's most remembered story *Eidgah* (1933) written under the pen name of Nawab Rai narrates the very moving experiences in the life of a five year old boy Hamid who has lost his parent due to the spread of *Haija* (Cholera). The writer in his artistic endeavour narrates the role of Hamid's grandmother who tells him that his father has left to earn money and his mother has gone to Allah to bring some lovely gifts for him. When the whole village is filled with happiness and celebrating the festival of Eid and Hamid's friends Mohsin Noorey and Sami are enjoying the day, he feels the absence of his parents and has no shoes or cap to go out to wish

his friends 'Happy Eid'. The writer presents how cholera has snatched away the happiness of a small boy who is too immature to understand the effects of pandemic on human life. Premchand's other story *Doodh ka Dam* (1934) exposes the injustice of the rigid social hierarchies that relegate Mangal, a bhangi, a sweeper who barely lives as a human as his sole protector, his mother nurses the rich village landowner's son Suresh who enjoys a lion's share of his mother's milk but treats Mangal as inferior. In the story the writer sensitively handles the miseries of the untouchables which is equally harmful and dangerous like cholera that has killed many in the village.

Indian born writer Ahmed Ali migrated to Pakistan has expressed his deep concern for the horror of 'Spanish flu' in his novel *Twilight in Delhi* (1940). The story narrates how the pandemic had taken away the lives of twelve to seventeen millions people in India. Ali addresses very intimately the life of the people in India's changing social, political and cultural climate when colonialism had its pandemic effect on Indian life. He presents how at this crucial time thieves were stealing sheets from the graves and the gravediggers were raising their fees four-fold during the pandemic. It presents how the people of Delhi were true to their traditions and not ready to miss an opportunity of having few digs at fortune when flu was deadly. The novel presents the sorry state of affairs in human condition due to the flu as everywhere human beings were dying meaninglessly.

Thnkazi Sivasankar, the eminent Malayali writer presents about a contagious disease that causes death to many in the town of Alappuzha. The reality observed by the novelist is well sketched in the life and career of a scavenger's son in his novel *Thottiyude Maken* (1947). It portrays three generations of a working class family engaged in Alleppey as scavengers who inspite of their sincere service to the society and people are oppressed, ostracized, and prejudiced. Even during the pandemic these *thottis* (cleaners of night soil) serve others but nobody cares for their suffering especially in the life and struggles of Mohanan, the third generation member of the *thotti* family.

The pandemic Kala-azar is a visceral disease caused by the parasites and transmitted with the bite of female sand flies. It generally affects the internal organs like liver and spleen, cause

anaemia, weight loss and sometimes darkening of the skin. This fatal disease had its horror causing effect on the life of the people in few districts of Bihar. Phanishwar Nath Renu's Hindi novel *Maila Anchal* (1954) the soiled Border presents the spread of Kala-azar in rural Bihar, in the village Maryganj. Although the novel centres on an English woman Mary, the wife of an Indigo-planter Martin during her living there, the book narrates the dedication of Dr. Alakh Niranjan who helps the people and with the help of people fight against Kala-azar as well as other diseases in the locality. Renu projects how pandemics pose threat to human life as well as the unity of people which make them able to fight untidily against the deadly disease.

The outbreak of small pox as a pandemic in George Varghese Kakkanadan's *Vasoori* (1968) narrates the story of disease that takes away love, lust, vengeance and everything in human lives. It explores the pandemic small pox in a hamlet in central Kerala where it had created a macabre atmosphere with the loss of human life, physical degradation, fragility of relationship, and a swaying side of melodrama.

Kannada writer U.R. Anantha Murthy gives reference to the deadly plague in his masterpiece *Samskara* (1996). No doubt the novelist has presented the causticity of caste as more harmful than the bubonic which has caused death to Narannappa who had reviled the purity of Brahmin caste. Even before this his wife had died of plague. The novelist had experienced the story of the plague in his hometown where the upper castes were getting the treatment of the doctor and lower castes were in perpetual fear and waiting for the soullessness of the system of caste in the *agrahara* of Durvasapura. The novel symbolically presents plague as a powerful symbol of doom for the sinful conduct Naranappa. Author's narration of the plague effect is a scientific progress that governs the metonomy of caste that outbreaks the myth of unbroken continuity with reality. In his enlightened view he makes Brahminism that has grown decadent, hypocritical and back-ward looking in the rite for a dead man. In his critiquing technique the novelist conveys the message on the epidemic either to modernize or perish for extreme cultural austerity. Epidemics make people helpless and kill them without discrimination and annihilate all.

The year 2020 is important for the outbreak of Covid-19 pandemic at Wuhan in China for a new type of virus that caused fever, tiredness and dry cough. The Covid-19 pandemic has affected millions of people across the world causing death and dislocation in human life. Although it has snatched away more than a million human lives, no scientific success is made to prevent it and protect the prospects of human life. When Covid-19 has created an atmosphere of horror in many countries in the world numerous writers write good number of poems, stories, and novels expressing the reality of life during this pandemic. Like every pandemic it makes human life uncertain and generates numerous problems in human life. Literary creations during Covid-19 become available both on the soft media and print media and have become a source of stress reliever for millions of readers. Realism, horror, tension, stress, superstition and conservatism become the prominent modes of expression in pandemic literature. Ashoke Mukhopadhyay's novel *A Ballad of Remittent Fever* (2020) narrates the story of three generations of doctors who attempt their best to fight against the diseases in the city of Kolkata. The novel takes the readers back to Bengal in 1884 where the generations of doctors of this family were combating the diseases like Cholera, Malaria, TB, and Spanish flu in the spirit of true medical profession. The book has a stunning revelation that the medicine for a pandemic serves as a miracle and the physicians as messiahs take their profession in true and tested spirit. Dr. Dwarikanath's daily life is propelled by a fierce desire to vanquish the diseases through his obdurate determinations.

To conclude, it is observed that pandemic paradigms in literature chiefly deal with the miseries and catastrophes of life which deeply affect human thoughts, emotions and concerns. It reveals different forms of human miseries, monotony, chaos and uncertainties in life. Writers of pandemic time express their concern for the meaningless martyrdom of many eminent persons as well as their near and dear ones. They deal with the changes of human behaviour, attitude, manners, habits, concepts and finer feelings like love and compassion in their writings. When esoterics believe pandemics are due to God's retribution on the human evils on the earth the writers of different countries foster every hope in their emotional resilience.

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About the Editors

Dr. Prasanta Kumar Barik, an Assistant Professor at Rajiv Gandhi University, India was born in the district of Jharsuguda, Odisha in 1977.He has obtained his M.A. (Education), M.A.(History) and Ph.D. in Education from Sambalpur University. He qualified UGC-NET examination in Education. His areas of interest and specialization are Higher Education, Teacher Education, Secondary Education and Pedagogy of Social Sciences. Currently, Dr. Barik is associated with Post Graduate teaching and research work. He is a teacher educator too. He has participated and presented in many national and international conferences, seminars, symposia, etc. He has published articles in journals, edited books at national and international repute. He acts a resource persons for various departments and colleges. He has completed a project work sponsored under ICSSR, New Delhi, India. He has also credited to publish a book titled "College Autonomy and Quality in Higher Education" along with his mentor Dr.Harihar Sarangi, Former Head, Department of Education, G.M. University, Sambalpur, Odisha.

Dr. Shishira Bania is currently working as a Lecturer in Education (SSB, Department of Higher Education, Govt. of Odisha) in Binnaharalpur College under Sambalpur University, Odisha. He has done his Post Graduation in Education from G.M. Autonomous College (Now G.M. University) Sambalpur, Odisha; Post Graduation in Sociology from IGNOU, New Delhi and Post Graduation in English from Odisha State Open University; M.Phil. in Education from Dr. P.M. Institute of Advanced Study in Education, Sambalpur, Odisha. He has qualified UGC NET and JRF in Education. He is awarded with Ph.D. degree in the subject Education from Sambalpur University, Odisha, India. He has more than 07 years of teaching experience. He has participated and presented many papers in National and International Seminars. He is the author of two Books. He has 18 research publications to his credit.

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Privatisation of Higher Education in India

Editors
Prasanta Kumar Barik, Shishira Bania

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Prasanta Kumar Barik
Shishira Bania

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1

Revitalizing Liberal Education: Cross Fertilization of Ideas Across Disciplines

P.K. Acharya*, Monika Gohain† *and* Elora Swain‡

Abstract

India is a developing country starving for the best quality education in its every stage. Changes have been occurred since the last policy on education has been introduced in India. Now in the era of science and technology needs and requirements are different. So there is a need to introduce new strategies to its education system and after thirty years government of India launched the New Education Policy 2020 which focuses on each level of education right from pre-primary to higher education. This policy came up with the idea of revitalizing liberal education to higher education which will bring new enthusiasm, a fresh work culture and abundant confidence, creativity among the youngsters. It becomes the need of the hour to completely transform the traditional higher education to a more liberal one.

Keywords: *Liberal education, Holistic development, Higher education, Quality education.*

THE PROLOGUE

In India students are being specialized in one discipline. They are being taught in one specified area like Mathematics, Physics, Fine Art, History, Geography etc. Institutions try to put students into one vessel of science, humanities, commerce or any other professional or vocational course. They are bound and confined to focus in one section from the broader scope of education. But

* *Professor*, Dept. of Education, Rajiv Gandhi University, Rono Hills, Arunachal Pradesh

† *Ph.D. Research Scholar*, Dept. of Education, Rajiv Gandhi University, Rono Hills, Arunachal Pradesh

‡ *PhD Scholar*, Dept. of Education, Rajiv Gandhi University, Rono Hills, Arunachal Pradesh

About the Editors

Dr. Prasanta Kumar Barik an Assistant Professor at Rajiv Gandhi University, India was born in the district of Jharsuguda, Odisha in 1977.He has obtained his M.A. (Education), M.A.(History) and Ph.D. in Education from Sambalpur University. He qualified UGC-NET examination in Education. His areas of interest and specialization are Higher Education, Teacher Education, Secondary Education and Pedagogy of Social Sciences. Currently, Dr. Barik is associated with Post graduate teaching and research work. He is a teacher educator too. He has participated and presented in many national and international conferences, seminars, symposia, etc. He has published articles in journals, edited books at national and international repute. He acts a resource persons for various departments and colleges. He has completed a project work sponsored under ICSSR, New Delhi, India. He has also credited to publish a book titled "College Autonomy and Quality in Higher Education" along with his mentor Dr.Haribar Sarangi, Former Head, Department of Education, G.M. University, Sambalpur, Odisha.

Dr. Shisira Bania is currently working as a Lecturer in Education (SSB, Department of Higher Education, Govt. of Odisha) in Birmaharajpur College under Sambalpur University, Odisha. He has done his Post Graduation in Education from G.M. Autonomous College (Now G.M. University) Sambalpur, Odisha; Post Graduation in Sociology from IGNOU, New Delhi and Post-Graduation in English from Odisha State Open University; M.Phil. in Education from Dr. P.M. Institute of Advanced Study in Education, Sambalpur, Odisha. He has qualified UGC-NET and JRF in Education. He is awarded with Ph.D. degree in the subject Education from Sambalpur University, Odisha, India. He has more than 07 years of teaching experience. He has participated and presented many papers in National and International Seminars. He is the author of two Books. He has 18 research publications to his credit.

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2

Self- Blended Learning among the Learners of Higher Education: A Needful in Post Covid-19 Pandemic Period

Dilima Siga*, P.K. Acharya† and P. K. Barik‡

Abstract

This review paper explains the needful importance of implementing self-blended learning also known as Heutagogy or self- determined learning approach or digital pedagogy among the learners' of higher education during post COVID- 19 pandemic period. The importance of self- blended learning even before the COVID- 19 pandemic has an important initiative for providing learners' learning and the organizational needs of the higher education ***(De George-Walker & Keeffe, 2010).*** *In the present paper, the investigators highlight the blended approach in the light of self- determined learning emphasizing learners' own learning pace for optimum learning engagement during post pandemic period. It reviews some of the gaps found in online learning behavior, issues sought defining 'resources inequity' and 'imposed distance learning' that often pose a serious concern over their attitude toward learning engagement during such unprecedented time. The findings indicate that Self- Blended Learning is necessary and practical approach among the learners of higher education which provides 'freedom of accessibility' and 'learning satisfaction 'while being engaging in digital learning. The paper concludes with some limitations, suggestions and future implications to put more light into the self- blended learning concept in theoretical manner.*

* *Ph.D., Research Scholar*, Rajiv Gandhi University, Arunachal Pradesh, India

† *Professor*, Department of Education, Rajiv Gandhi University, Rono Hills, Arunachal Pradesh, India

‡ *Department of Education*, RGU Rajiv Gandhi University, Arunachal Pradesh, India

About the Editors

Dr. Prasanta Kumar Barik, an Assistant Professor at Rajiv Gandhi University, India was born in the district of Jharsuguda, Odisha in 1977.He has obtained his M.A. (Education), M.A.(History) and Ph.D. in Education from Sambalpur University. He qualified UGC-NET examination in Education. His areas of interest and specialization are Higher Education, Teacher Education, Secondary Education and Pedagogy of Social Sciences. Currently, Dr. Barik is associated with Post graduate teaching and research work. He is a teacher educator too. He has participated and presented in many national and international conferences, seminars, symposia, etc. He has published articles in journals, edited books at national and international repute. He acts a resource persons for various departments and colleges. He has completed a project work sponsored under ICSSR, New Delhi, India. He has also credited to publish a book titled "College Autonomy and Quality in Higher Education" along with his mentor Dr.Harihar Sarangi, Former Head, Department of Education, G.M. University, Sambalpur, Odisha.

Dr. Shishira Bania is currently working as a Lecturer in Education (SSB, Department of Higher Education, Govt. of Odisha) in Birmaharajpur College under Sambalpur University, Odisha. He has done his Post Graduation in Education from G.M. Autonomous College (Now G.M. University) Sambalpur, Odisha; Post Graduation in Sociology from IGNOU, New Delhi and Post-Graduation in English from Odisha State Open University; M.Phil. in Education from Dr. P.M. Institute of Advanced Study in Education, Sambalpur, Odisha. He has qualified UGC NET and JRF in Education. He is awarded with Ph.D. degree in the subject Education from Sambalpur University, Odisha, India. He has more than 07 years of teaching experience. He has participated and presented many papers in National and International Seminars. He is the author of two Books. He has 18 research publications to his credit.

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Quality of Higher Education in Arunachal Pradesh: Issues and Challenges

Millo Mamung*, Prasanta Kumar Acharya† *and* Narender Singh‡

Abstract

The word quality is very dynamic and has a broad concept; there are different aspects of quality in higher education. The nation's urgency is the skillful citizens and adequate knowledge to procure a good development in the education system. The excellencies in higher education are significant to address the diverse needs of the learner and for the productivity of the education system. The growth and development of quality education emerged with the excellencies in the education present system. The main purpose of paper is to study the quality in higher education and to analyze the challenges that prevail in higher education. The paper notifies the quality in higher education and challenges published in different articles, views, and findings of the investigators and the stakeholders considering the different aspects of the quality education.

The authors used the conceptual and research paper to study the quality and challenges in higher education, the information and data collected from the national and international articles based on the quality education and the challenges of the higher education institutions. Consequently, the quality of education can be assessed and evaluated in terms of resources,

*Ph.D. Research Scholar, Department of Education, Rajiv Gandhi University, Rono Hills, Doimukh Arunachal Pradesh (Corresponding author)

†Professor, Department of Education, Rajiv Gandhi University, Rono Hills, Doimukh, Arunachal Pradesh

‡Assistant Professor, Department of Education, Rajiv Gandhi University, Rono Hills, Doimukh, Arunachal Pradesh

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Hareet Kumar Meena

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Imagining Mahatma in People's Perception

Dr. Prasanta Kumar Nayak

Associate Professor, Department of History,
Rajiv Gandhi University Rono Hills, Doimukh, Arunachal Pradesh

People have turned septuagenarian when we see them born when Gandhi died. All of us know, this six-lettered word has appeared in volumes in the history of humankind across the world. Born to India, Gandhi allowed entire mankind to explore and study him. He is still being discussed, deliberated, deconstructed and critiqued in academia. Volumes after volumes continue to add to his personality making him bigger and bigger with more unexplored areas around him to be worked upon. Probably, no area is found empty where we do not find him accorded a space for his timeless ideas and ideals. The more he grows old, the merrier is the interest to discover him. I feel, as if Gandhi refuses to die out from our memory and thought. Be they contemporary political leaders, social activists, religious interpreters, developmental economists, environmentalists, academicians, social scientists, film makers and lot more, Gandhi stands big as an inspirational source for them to advocate their individual ideas. He is next in everybody's thought when anything on human values is imagined, professed and talked about.

Gandhi lived for eight decades. But the last three decades made him what he is and most sought after an individuality the world today is looking for a deconstruct. The unveiling of the statue of Gandhi on 14th September 2019 by the President of the India Sri Ram Nath Kovind at Villeneuve, Switzerland, bringing Gandhiji to the banks of Lake Geneva by the Commune of Villeneuve and naming the Square after him as a tribute to Gandhi for his visit to Villeneuve in 1931 at the invitation of Nobel laureate Romain Rolland (https://zeenews.india.com: 09.09.2020) speak volumes of his relevance in the contemporary world. It was for his dispassionate love for country, kindness, selfless sacrifice, simplicity, righteousness and saint-like approach to life that Rabindra Nath Tagore

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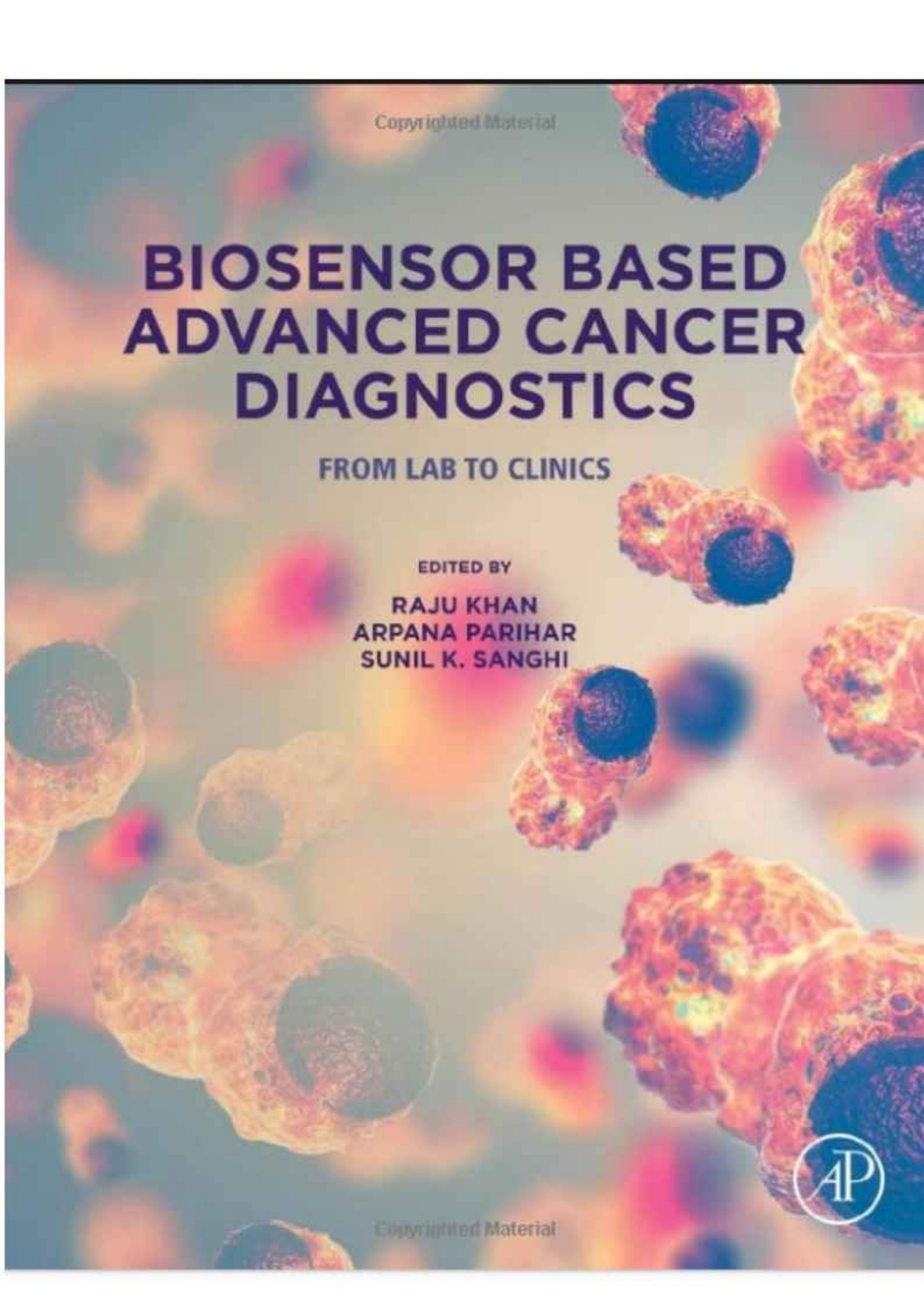

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About the editors

Raju Khan is currently working as the principal scientist and associate professor at CSIR-Advanced Materials and Processes Research Institute (AMPRI), Bhopal, MP, India. Dr. Khan received his PhD & MSc in chemistry from the Jamia Millia Islamia (Central University), New Delhi, India. Dr. Khan has published several refereed papers in national and international journals, has filed patents, and has edited as well as coedited several books on biosensors and antimicrobial applications. He has completed several national and international collaborative projects such as Indo-Czech Republic, Indo-Russia, and United States. He is a recipient of the reputed BOYSCAST fellowship from the Department of Science & Technology (DST) within the Ministry Government of India. During the fellowship, he has worked as a visiting scientist at the University of Texas at San Antonio (UTSA), United States. Since then, Dr. Khan is continuously very productive with more than 15 years of R&D and teaching experiences, producing high-quality research, mentoring students, and supporting the analytical and microfluidics division as outsource facility. His current research activities include nano-biomaterials, biosensors, point-of-care diagnostics, nano-biotechnology, antimicrobials, and biomedical engineering.

Arpana Parihar is currently working as a Women Scientist B at CSIR-Advanced Materials and Processes Research Institute (AMPRI), Bhopal, MP, India, under the scheme of DST-WoS-B awarded from the Department of Science and Technology, Government of India. She did her PhD from Raja Rammana Centre for Advanced Technology, Indore. Her doctoral research work involves the evaluation of tumor selectivity and photodynamic therapy (PDT) efficacy of chlorin p6 through receptor-mediated targeted delivery in oral cancer. After PhD, her postdoctoral research work at the Centre for Biomedical Engineering (CBME), Indian Institute of Technology (IIT) Delhi involves the enhancement of osteoinductive and osteoconductive properties of various implants made up of metals, ceramics, and polymers. Dr. Parihar is awarded prestigious GATE, CSIR-NET, DST-WoS A, and WoS B fellowship. She has more than 7 years of research and teaching experience at various prestigious institutes that fetched several peer-reviewed papers in national and international journals of repute. Her current research activity includes fabrication of biosensors for early diagnosis of cancer, molecular docking and simulation for drug designing, tissue engineering, targeted cancer therapy, and 3D cell culture.

Sunil K. Sanghi was working as chief scientist, professor, and Head of Department at Microfluidics & MEMS Centre, CSIR-Advanced Materials and Processes Research Institute (AMPRI), Bhopal, India. His past research areas were on development of manual and automated procedures for all kinds of analytes in biomedical, pharmaceutical, and environmental samples using micro liquid, capillary gas chromatographic, and capillary electrophoretic separation techniques in combination with sample preparation, derivatization and reaction-detection systems, micro-chip-based separation under the concept of lab-on-a-chip. Dr. Sanghi has successfully completed several international and national collaborative R&D projects—Indo-European Union, Indo–French, New Millennium Indian Technology Leadership Initiative (NMITLI).
He was awarded the reputed Marie Curie Fellowship of the European Union, and worked as a visiting scientist for 3 years at the University of Amsterdam and Institute Curie, Paris. He holds an experience of 35 years in R&D and teaching. Recently, Dr. Sanghi has received the 2021 National Meritorious Innovation Award from Government of India.

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List of contributors

Aida Alaei Department of Life Science Engineering, Faculty of New Sciences & Technologies, University of Tehran, Tehran, Iran

Kavita Arora Advanced Instrumentation & Research Facility (AIRF) and School of Computational & Integrative Sciences (SCIS), Jawaharlal Nehru University, New Delhi, India

Neha Arya Department of Medical Devices, National Institute of Pharmaceutical Education and Research, Ahmedabad, India; Department of Translational Medicine Centre, All India Institute of Medical Sciences, Bhopal, Bhopal, India

Rinti Banerjee Nanomedicine Laboratory, Department of Biosciences and Bioengineering, Indian Institute of Technology Bombay, Powai, Mumbai, India

Saptaka Baruah Department of Physics, Rajiv Gandhi University, Itanagar, India

Niloy Chatterjee Food and Nutrition Division, University of Calcutta, Kolkata, India

Meenakshi Choudhary Centre for Biomedical Engineering, Indian Institute of Technology Delhi, New Delhi, India

Samraggi Coudhury DBT-National Institute of Animal Biotechnology (DBT-NIAB), Hyderabad, Telangana, India

Mehdi Dadmehr Department of Biology, Payame Noor University, Tehran, Iran

Surojeet Das European Molecular Biology Laboratory Australia, Australian Regenerative Medicine Institute, Monash University, Melbourne, VIC, Australia

Krishna Das Saha Cancer Biology and Inflammatory Disorder Division, CSIR-Indian Institute of Chemical Biology, Kolkata, India

Nitu Dogra Proteomic & Translational Research Lab, Centre for Medical Biotechnology, Amity Institute of Biotechnology, Amity University Noida, Noida, India

Manuela F. Frasco BioMark Sensor Research/UC, Faculty of Sciences and Technology, Coimbra University, Coimbra, Portugal; BioMark Sensor Research/ISEP, School of Engineering, Polytechnic Institute of Porto, Porto, Portugal; CEB - Centre of Biological Engineering, Minho University, Braga, Portugal

Sonu Gandhi DBT-National Institute of Animal Biotechnology (DBT-NIAB), Hyderabad, Telangana, India

Shagun Gupta Shoolini University, Solan, India

Morteza Hosseini Department of Life Science Engineering, Faculty of New Sciences & Technologies, University of Tehran, Tehran, Iran

Pouria Jafari Department of Life Science Engineering, Faculty of New Sciences & Technologies, University of Tehran, Tehran, Iran

Surbhi Jain Department of Biochemistry and Genetics, Barkatullah University, Bhopal, India

Deepak Kala Amity Centre of Nanotechnology, Amity University, Gurugram, India

Deepshikha Pande Katare Proteomic & Translational Research Lab, Centre for Medical Biotechnology, Amity Institute of Biotechnology, Amity University Noida, Noida, India

Ankur Kaushal Amity Centre of Nanotechnology, Amity University, Gurugram, India

Raju Khan Microfluidics & MEMS Centre, CSIR-Advanced Materials and Processes Research Institute (AMPRI), Bhopal, India; Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, India

Lucky Krishnia Amity Centre of Nanotechnology, Amity University, Gurugram, India

Ashok Kumar Department of Biochemistry, All India Institute of Medical Sciences, Bhopal, Bhopal, India

Avinash Kumar Department of Mechanical Engineering, Indian Institute of Information Technology Design & Manufacturing Kancheepuram, Chennai, India

Pradip Kumar Integrated Approach for Design and Product Development Division, CSIR-Advanced Materials and Processes Research Institute (CSIR-AMPRI), Bhopal, India

Sanjeev Kumar Department of Physics, Rajiv Gandhi University, Itanagar, India

Bidyarani Maibam Department of Physics, Rajiv Gandhi University, Itanagar, India

Ruchi Jakhmola Mani Proteomic & Translational Research Lab, Centre for Medical Biotechnology, Amity Institute of Biotechnology, Amity University Noida, Noida, India

Krishnendu Manna Cancer Biology and Inflammatory Disorder Division, CSIR-Indian Institute of Chemical Biology, Kolkata, India; Department of Food and Nutrition, University of Kalyani, Kalyani, India

Shubhangi Mhaske Oral and Maxillofacial Pathology and Microbiology, People's College of Dental Sciences & Research Centre, People's University, Bhopal, India

Maryam Mousavizadegan Department of Life Science Engineering, Faculty of New Sciences & Technologies, University of Tehran, Tehran, Iran

Niladri Mukherjee Cancer Biology and Inflammatory Disorder Division, CSIR-Indian Institute of Chemical Biology, Kolkata, India

Sayali Mukherjee Amity Institute of Biotechnology, Amity University Uttar Pradesh, Lucknow, India

Sagar Narlawar DBT-National Institute of Animal Biotechnology (DBT-NIAB), Hyderabad, Telangana, India

Fatemeh Nemati Department of Life Science Engineering, Faculty of New Sciences & Technologies, University of Tehran, Tehran, Iran

Riyaz Ali M. Osmani Nanomedicine Laboratory, Department of Biosciences and Bioengineering, Indian Institute of Technology Bombay, Powai, Mumbai, India

Udwesh Panda Department of Mechanical Engineering, Indian Institute of Information Technology Design & Manufacturing Kancheepuram, Chennai, India

Ritu Pandey Department of Biochemistry, All India Institute of Medical Sciences, Bhopal, Bhopal, India

Arpana Parihar Microfluidics & MEMS Centre, CSIR-Advanced Materials and Processes Research Institute (AMPRI), Bhopal, India; Department of Biochemistry and Genetics, Barkatullah University, Bhopal, India

Dipesh Singh Parihar Engineering College Tuwa, Godhra, India

Azam Bagheri Pebdeni Department of Life Science Engineering, Faculty of New Sciences & Technologies, University of Tehran, Tehran, Iran

Amarjitsing Rajput Nanomedicine Laboratory, Department of Biosciences and Bioengineering, Indian Institute of Technology Bombay, Powai, Mumbai, India; Department of Pharmaceutics, Poona College of Pharmacy, Bharti Vidyapeeth Deemed University, Erandwane, Pune, India

Pushpesh Ranjan Microfluidics & MEMS Centre, CSIR-Advanced Materials and Processes Research Institute (AMPRI), Bhopal, India; Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, India

Tripti Rimza Integrated Approach for Design and Product Development Division, CSIR-Advanced Materials and Processes Research Institute (CSIR-AMPRI), Bhopal, India

Amirreza Roshani Department of Life Science Engineering, Faculty of New Sciences & Technologies, University of Tehran, Tehran, Iran

Mohd Abubakar Sadique Microfluidics & MEMS Centre, CSIR-Advanced Materials and Processes Research Institute (AMPRI), Bhopal, India

M. Goreti F. Sales BioMark Sensor Research/UC, Faculty of Sciences and Technology, Coimbra University, Coimbra, Portugal; BioMark Sensor Research/ISEP, School of Engineering, Polytechnic Institute of Porto, Porto, Portugal; CEB - Centre of Biological Engineering, Minho University, Braga, Portugal

Shikha Saxena Amity Institute of Pharmacy, Amity University, Noida, India

Nikita Sehgal Proteomic & Translational Research Lab, Centre for Medical Biotechnology, Amity Institute of Biotechnology, Amity University Noida, Noida, India

Amit Seth School of Life Science, Manipur University, Imphal, India

Deepshikha Shahdeo DBT-National Institute of Animal Biotechnology (DBT-NIAB), Hyderabad, Telangana, India

Kosar Shahsavar Department of Life Science Engineering, Faculty of New Sciences & Technologies, University of Tehran, Tehran, Iran

Ekta Singh Nanomedicine Laboratory, Department of Biosciences and Bioengineering, Indian Institute of Technology Bombay, Powai, Mumbai, India

Shiv Singh Lightweight Metallic Materials Division, CSIR-Advanced Materials and Processes Research Institute (CSIR-AMPRI), Bhopal, India

Ayushi Singhal Microfluidics & MEMS Centre, CSIR-Advanced Materials and Processes Research Institute (AMPRI), Bhopal, India; Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, India

Raquel Vaz BioMark Sensor Research/UC, Faculty of Sciences and Technology, Coimbra University, Coimbra, Portugal; BioMark Sensor Research/ISEP, School of Engineering, Polytechnic Institute of Porto, Porto, Portugal; CEB - Centre of Biological Engineering, Minho University, Braga, Portugal

Vivek Verma Shoolini University, Solan, India

Shalu Yadav Microfluidics & MEMS Centre, CSIR-Advanced Materials and Processes Research Institute (AMPRI), Bhopal, India; Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, India

Monal Yuwanati Department Of Oral Pathology and Microbiology, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India

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Chapter 15

Biosensor-based early diagnosis of gastric cancer

Saptaka Baruah, Bidyarani Maibam and Sanjeev Kumar
Department of Physics, Rajiv Gandhi University, Itanagar, India

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15.1 Introduction

Gastric cancer is one of the most commonly found cancers worldwide (Kono, 2016). Gastric adenocarcinomas constitute most of the stomach cancer or gastric cancer, and based on the anatomical location of the tumor, it is sub-divided into cardia (gastro-esophageal junction) and noncardia (true gastric) tumors (Van Cutsem, Sagaert, Topal, Haustermans, & Prenen, 2016). Gastric cancer is uncommon in all populations below the age of 50, and the incidence rate increases with the increase in age, reaching its peak at the age of 55–80 years. The frequency of gastric cancer is two- to threefold higher in men than in women. The age-standardized incidence rate is 15.7 per 1,000,000 men and 7 per 1,000,000 women in 2018 (Thrift & El-Serag, 2020). The highest incidence rate was seen in the high-income Asia Pacific region (29.5 per 100,000 population, age-standardized), especially Japan, South Korea, and East Asia (28.6 per 100,000 population). In East Asia, China contributed about half of the global incident in 2017, followed by Eastern Europe and Andean Latin America. Other than these regions, Mongolia and Afghanistan had the overall highest age-standardized incidence rates. Southern and eastern sub-Saharan Africa and high-income North America experienced the lowest incidence rates. The highest age-standardized death rate is experienced by East Asia, followed by Andean Latin America and central Asia (Etemadi et al., 2020). India falls in the low incidence category in the context of gastric cancer. There is a huge regional difference in gastric cancer occurrence across India. According to the national cancer registries, gastric cancer is the leading problem in the northeastern and southern states of the Indian subcontinent. As per the available report, Aizawl, Mizoram, has the highest recorded incidence of gastric cancer followed by Tamil Nadu. The lowest incidence of gastric cancer in India is reported in Gujrat. Gastric cancer is the fifth most frequent cancer among men and sixth among women in India. It is also the second most common reason for cancer-associated death in Indian men and women among the age group of 15–44. Detection of gastric cancer in the advanced stage in most of the patients leads to a decrease in the 5-year survival rate in comparison with the countries where early diagnosis is made. The treatment standard and protocol in most of the institutions are good as any other country, although it is not observed evenly across the country (Dikshit, Mathur, & Mhatre, 2011; Servarayan Murugesan et al., 2018; Sharma & Radhakrishnan, 2011). The incidence of stomach cancer remarkably decreases in the last half century. Nonetheless, stomach cancer is in the fifth and third positions of cancer incidence and deaths due to cancer, respectively, all over the world (Balakrishnan, George, Sharma, & Graham, 2017).

Helicobacter pylori (*H. pylori*) infection is the most important risk factor which causes a prolonged inflammatory reaction of the immune response (Crew & Neugut, 2006; Rawla & Barsouk, 2019). Salt and salt preserved food may also increase the threat of stomach cancer. A decrease in stomach cancer is associated with a reduction of *H. pylori* infection (Cisco, Ford, & Norton, 2008). The decline in infection rate is due to better sanitation, hygienic practice, and better food preservation methods (Sharma & Radhakrishnan, 2011). Stomach cancer epidemiology has significant geographical diversity leading to at least a 10-fold variation of incidence worldwide (Servarayan Murugesan et al., 2018). Part of this variation is related to *H. pylori* infection frequency throughout the population, and environmental factors which are also responsible for stomach cancer (Etemadi et al., 2020). Cigarette smoking is a risk factor for both the type of cancer. Because of the higher occurrence of risk factors such as smoking or hormonal factors, both the cancers are more common in males.

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The decline in gastric cancer is not universal (Balakrishnan et al., 2017). Reduction in the incident cases and deaths in East Asia will lead to a decrease in absolute incident cases and death, as half of the incident cases and death occur there. Migrant studies and secular trends in stomach cancer rates reveal that environmental factors play a significant role in the pathogenesis of stomach cancer. In contrast, only about 1–3% are known to be hereditary syndromes (Thrift & El-Serag, 2020; Van Cutsem et al., 2016). Reduction in high salt food consumption in Asian countries is an approach to decrease stomach cancer since lifestyle, particularly high sodium diets in East Asian peoples and smoking in males, plays a significant part in stomach cancer burden. The main focus is on preventing *H. pylori* infection, since it is the most crucial element of danger for stomach cancer.

Gastric cancer is grouped into two: (1) early gastric cancer (EGC, stages I and II) defined as the malignant tumor confined to the mucosa and submucosa irrespective of lymph node metastasis; and (2) advance gastric cancer (AGC, stages III and IV); there is lack of a homogeneous definition of advance gastric cancer. However, gastric cancer is a cancer that has attacked the muscularis propria or gastric wall (Cisco et al., 2008; Ooki et al., 2009; Saragoni, 2015). Surgery can treat EGC, but AGC usually requires multidisciplinary treatment. Early diagnosis and careful staging can reduce mortality. Despite all this, gastric cancer staging is facing difficulties because of the lack of defined risk factors. Thus, late diagnosis and inadequate staging arrangements may cause an increase in mortality. So a fast and noninvasive method is needed for early diagnosis and staging of gastric cancer.

General cancer treatment procedures are related to characterizing the cancer cells at the early stages, like chemotherapy, surgery, and radiation. So the diagnosis of cancer is essential for timely individuating a viable cancer treatment. Existing tumor diagnosis depends on an assortment of complicated clinical settings, which include x-ray, magnetic resonance imaging (MRI), computerized tomography (CT), endoscopy, positron emission tomography (PET), cytology, sonography, thermography, and biopsy. In addition, both genomic- and proteomic-based molecular tools are progressively used, such as polymerase chain reaction (PCR), radioimmunoassay (RIA), enzyme linked immunosorbent assay (ELISA), immunohistochemistry (IHC), and flow cytometry (Altintas & Tothill, 2013; Mittal, Kaur, Gautam, & Mantha, 2017; Prabhakar, Shende, & Augustine, 2018). The current technologies and methods are proficient, but most of them are invasive, costly, time-consuming, and restricted to laboratory centers in big hospitals (Cui, Zhou, & Zhou, 2019). For instance, an invasive method biopsy is a medical process that needs the insertion of the medical tool into the patient's body to deduce specific tissues to be examined to find the presence of cancer cells. Such a procedure is tedious, and further, has numerous constraints. Patients experiencing biopsies complain of weak health, nausea, sleeping disorder with further postbiopsy impacts. Therefore, the requirement for noninvasive detection has come into significance in the present time. Also, rapid detection is needed to give patients instant results to start treatment without wasting any time. So the requirement of rapid noninvasive detection of cancer has driven the researchers to develop instruments that would identify cancer early without an invasive technique. This lead to the development of biosensors for noninvasive early detection of cancer (Devi & Laskar, 2018).

15.2 Biomarker for gastric cancer

Researchers and scientist from all around the world have turned their attention to the noninvasive diagnosis of cancer using cancer biomarkers due to numerous drawbacks of the invasive process of cancer detection (Devi & Laskar, 2018; Grossmann, Avenarius, Mastboom, & Klaase, 2010; Wu & Qu, 2015). Cancer biomarkers are essential indicators of cancer status (Karley, Gupta, & Tiwari, 2011). They are utilized not only to analyze and monitor disease but also to provide a prognostic approach to deal with treatment (Chatterjee & Zetter, 2005; Mayeux, 2004). The National Cancer Institute (NCI) (Park, Ross, Klagholz, & Bevans, 2018) defines a biomarker as "a biological molecule found in blood, other body fluids, or tissues that is a sign of a normal or abnormal process or a condition or disease." A biomarker may be used to see how well the body responds to a treatment for a disease or condition (Biomarkers Definitions Working Group, 2001). Biomarkers can be of several molecular origins, counting DNA (i.e., specific mutation, translocation, amplification, and loss of heterozygosity), RNA, or protein (i.e., hormone, antibody, oncogene, or tumor suppressor). The existence of biomarkers in blood or some other body fluid confirms the presence of cancer cells in the body (Tothill, 2009). There are different biomarkers for different types of cancers (Meyer & Rustin, 2000; Smith, Humphrey, & Catalona, 1997; Tothill, 2009). The maximum of these biomarkers still has to exhibit adequate sensitivity and specificity for translation into routine clinical use or treatment monitoring. This is an area that biosensor technology can improve upon (Bohunicky & Mousa, 2011).

There are several biomarkers available for the early diagnosis of gastric cancer (Fu, 2016). Fig. 15.1 displays the summary of gastric cancer biomarkers. Serum protein biomarkers of gastric cancer are gastric tissue specific or related to gastric-specific infections and divided into two types: gastric cancer-specific markers, and general tumor markers. Proteins such as pepsinogen I (PGI or PGA), pepsinogen II (PGII or PGC), and gastrin 17 are considered specific markers of gastric cancer

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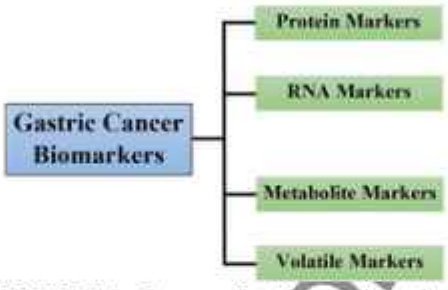

FIGURE 15.1 Summary of gastric cancer biomarker.

because of their gastric specific gene expression (Hallissey, Dunn, & Fielding, 1994; Shiotani et al., 2005). Antibodies linked to gastric specific infections such as *H. Pylori*, CagA, and antiparietal cell antibodies, which reflect current or past gastric infections associated with gastric cancer growth, are useful biomarkers for assessing gastric cancer risk (Kaise et al., 2013; Kikuchi, Crabtree, Forman, & Kurosawa, 1999; Sugiu et al., 2006). Many proteins are regarded as gastric cancer screening markers, although most of them are not gastric cancer specific. These proteins comprise carcinoembryonic antigen (CEA), pyruvate M2 kinase, cancer antigen 125 (CA125), cancer antigen 19-9 (CA19-9), Alpha-fetoprotein (AFP), serum amyloid A, macrophage migration inhibitory factor, leptin, dickkopf (Dkk), olfactomedin 4, VAP-1, UPA, cathepsin B, HMW kininogen, P53 antibody, cytokeratin 18, RegIV, IPO-38, S100A6, thrombin light chain, fibrinopeptide A, angiopoietin-like protein 2 (Capelle et al., 2009; Chan et al., 2007; Ebert et al., 2005, 2006; Gao, Xie, Ren, & Yang, 2012; Ghosh et al., 2013; Hao et al., 2008; Harbeck et al., 2008; Herszenyi et al., 2008; Ick et al., 2004; Kaplan et al., 2014; Kumar, Tapuria, Kirmani, & Davidson, 2007; Lee et al., 2012; Liu, Sheng, & Wang, 2012; Mitani et al., 2007; Suppiah & Greenman, 2013; Tas, Karabulut, Serilmez, Ciftci, & Duranyildiz, 2014; Umemura et al., 2011; Yu, Wang, & Chen, 2011; Zhang, Zhang, Jiang, & Zhang, 2014). Among them, carcinoembryonic antigen (CEA) and cancer antigen 19–9 (CA19–9) are most commonly used. CEA was firstly recognized by Gold and Freedman in 1965 (Gold & Freedman, 1965) and was first used for the diagnosis of early gastric cancer in 1980 (Tatsuta et al., 1980). CEA is currently regarded as the most valuable serum protein marker for identifying patients at risk of developing gastric cancer and for the diagnosis of early-stage gastric cancer (Jin, Jiang, & Wang, 2015). CEA was observed to improve colon carcinoma cells' metastasis with its sialofucosylated glycoforms which function as selecting ligands (Deng et al., 2015; Kikuchi et al., 1999). CEA is produced in a high amount of carcinomas in numerous different organs (Kikuchi et al., 1999; Kumar et al., 2007). CEA significantly affects the tumor prognosis because of its effect on tumor metastasis and may be connected with gastric cancer prognosis. Gastric cancer patients show expanded CEA levels, which are associated with patient survival based on an organized analysis of serum markers for gastric cancer (Sugiu et al., 2006). As per literature, preoperative CEA levels could predict gastric cancer (Ick et al., 2004; Schneider & Schulze, 2003), yet few reports deny this thought (Chan et al., 2007; Kumar et al., 2007; Moshkovskii, 2012). There is still discussion encompassing gastric cancer patients' prognosis with expanded CEA levels (Gao et al., 2012; Lee et al., 2012). Henceforth, it is important to build up a state-of-the-art, highly specific, and sensitive CEA detection technique for clinical examination and diagnostics (Tao, Du, Cheng, & Li, 2018). CA19–9 is a glycoprotein highly associated with malignant tumors and a commonly used marker in gastrointestinal cancer; however, it is present in some cancer types, particularly pancreatic, colorectal, and gastric cancer. The CA 199 test combined with the CEA test is a beneficial aide for observing carcinoma of the stomach; though, the sensitivity of performing these tests concurrently is similar to performing the CEA test alone in gastric carcinoma (Szymendera, 1986).

Warburg effect (i.e., cancer cells' dependence on glycolysis for energy and normal cell dependence on oxidative phosphorylation) is the most important difference between cancer cells and normal cells (Vander Heiden, Cantley, & Thompson, 2009; Liberti & Locasale, 2016). In gastric patient's serum or tissue samples, level of lactate which is a result of glucose glycolysis was found to increase constantly (Abbassi-Ghadi et al., 2013; Hirayama et al., 2009). Besides, cancer cells have a high protein synthesis rate. Hence, in gastric cancer patients, numerous metabolic studies showed an increase of amino acids; for example, glycine, asparagine, methionine, tyrosine, and aspartate. Moreover, cancer cells have a high nucleotide synthesis rate for the growing demands of DNA synthesis and DNA repair. Reports also suggested altered nucleotide metabolites in a certain type of cancers. Some of the researchers studied the fatty acid metabolism metabolites in gastric cancer patients. Though both increased fatty acid synthesis (FASN) and fatty acid oxidation (CPT1A) have been related to cancer growth. Fatty acid oxidation metabolites, such as β-hydroxybutyrate and acetone, have been recognized as possible biomarkers of gastric cancer (Fu, 2016).

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Usually, RNA is inappropriate for cancer as biomarkers since it is an unsteady species of biomolecules. But current research proposed that certain serum non-coding RNA could also be possible gastric specific markers, for example, RNA HULC and H19 were favorable novel biomarkers in plasma of gastric cancer patients (Abbassi-Ghadi et al., 2013). MicroRNA (miRNA) is a comparatively stable type of RNA in the serum. In gastric cancer, 21 individual miRNAs and six miRNA clusters are consistently upregulated, while miR29c, miR30a5p, miR148a, miR375, and miR638 are usually downregulated (Tatsuta et al., 1980). The most frequently used tumor markers, such as CEA and CA19–9, have limited application in early diagnosis of gastric cancer since they have insufficient sensitivity and specificity. Thus, the foundation of novel robust definite biomarkers with adequate sensitivity is a perfect approach for improving the early detection and the cure rates for gastric cancer patients. Also, these biomarkers should be easy to estimate and consistently linked with clinical results. miRNAs are seen as a desirable cancer biomarker because of the acceptance of their part in tumorigenesis. Discovery of miRNAs and the approval of their role in tumorigenesis and the development of various cancers have presented them as suitable cancer biomarkers. There is also developing evidence that miRNAs exist in cells as well as in an assortment of body fluids, counting blood, saliva, and urine. Those miRNAs that can be found in the circulation system are called circulatory miRNAs. They are generally cancer-specific, and their expression patterns are incredibly comparable among healthy persons and patients. The circulatory miRNAs are remarkably resistant to RNase digestion, non-physiologic pH values, and high temperature. Henceforth, these miRNAs have been considered as a capable biomarker for early detection of cancer (Daneshpour, Omidfar, & Ghanbarian, 2016). But the selection of a high reference gene is an essential element in using miRNA as a tumor biomarker.

Volatile organic compounds (VOCs) released from cancer cell metabolism are considered significant markers for biochemical procedures are happening in cancer cells. The study of VOCs may be capable of predicting and diagnosing early cancer. Volatile metabolites associated with genomics and proteomics represent pathway feedback mechanisms, which positively point out the possible pathophysiological growth in cancer cells. To a certain point, volatile metabolites embody the status of cancer cells. Considering volatile biomarkers from gastric cancer cells and creating an ultrasensitive detection method will help early warning and diagnosis of gastric cancer (Capelle et al., 2009; Chan et al., 2007; Ebert et al., 2005, 2006; Gao et al., 2012; Ghosh et al., 2013; Hao et al., 2008; Harbeck et al., 2008; Herszenyi et al., 2008; Ick et al., 2004; Kaplan et al., 2014; Kumar et al., 2007; Lee et al., 2012; Liu et al., 2012; Mitani et al., 2007; Suppiah & Greenman, 2013; Tas et al., 2014; Umemura et al., 2011; Yu et al., 2011; Zhang et al., 2014).

15.3 Biosensor and gastric cancer

Evidence recommends that a growing amount of attention have been focused on developing rapid techniques named "biosensor technology" for the identification, detection, and checking of human health-related conditions (Islam & Uddin, 2017). A biosensor is an analytical device used to identify biological analytes, be it environmental or biological in the source (i.e., inside the human body). A usual biosensor contains a recognition element, a transducer, and a signal-processing unit (Qian et al., 2019). The signal in the form of an analyte is detected by a molecular recognition component converted into an electrical signal by a transducer (Bohunicky & Mousa, 2011). Cammann used the word "biosensor" first (Cammann, 1977), and the International Union of Pure and Applied Chemistry (IUPAC) introduced its definition (Thévenot, Toth, Durst, & Wilson, 2001) and Clark and Lyonsin started biosensor application journey in 1960s (Clark & Lyons, 1962). Biosensors' applications for cancer diagnosis are very promising for conventional methods since it provides better performance in terms of speed, flexibility, automation, and costs (Balaji & Zhang, 2017; Bohunicky & Mousa, 2011; Jainish & Prittesh, 2017; Li, Li, & Yang, 2012; Mittal et al., 2017; Pasinszki, Krebsz, Tung, & Losic, 2017). The recognition of cancer biomarkers present in the blood is the most challenging task because of the low biomarkers' concentration in early-stage patients. A biosensor can measure shallow levels of biomarkers in physiological samples, which can help diagnose cancer at an early stage (Choi, Kwak, & Park, 2010).

Fig. 15.2 demonstrates the working procedure of biosensors for the detection of cancer. The process comprises three key steps: discovery of biomarker, biomarker detection with biosensors, and analysis of data. Every stage plays a vital role and decides the outcomes of the biosensor device (Qian et al., 2019).

15.3.1 Role of electrochemical biosensors in early detection of gastric cancer

Among all biosensors, electrochemical sensors have been of great interest, mainly because they are simple, portable, sensitive, inexpensive, and offer a fast response (Topkaya, Azimzadeh, & Ozsoz, 2016). Electrochemical biosensors use electrochemical transducers that transfer a biological entity (i.e., protein, RNA, and DNA) into an electrical signal that can be analyzed and detected (Qian et al., 2019; Wang, 2006). Amperometric and potentiometric transducers are most commonly

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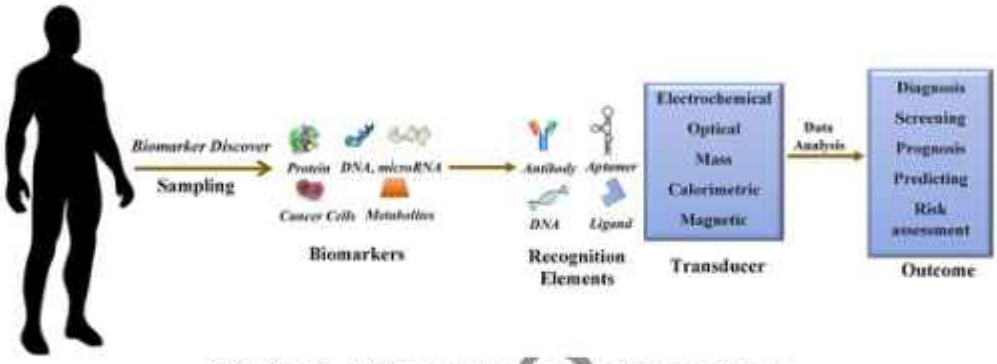

FIGURE 15.2 Working procedure of biosensors for cancer diagnosis.

used in conjunction with electrochemical biosensors. In potentiometric devices, the analytical information is obtained by converting the biorecognition process into a potential signal in connection to the use of ion selective electrodes (ISE). Amperometric biosensors operate by applying a constant potential and monitoring the current associated with the reduction or oxidation of an electroactive species involved in the recognition process. An amperometric biosensor may be more attractive because of its high sensitivity and wide linear range (Wang, 2006). Electrochemical impedance spectroscopy (EIS), differential pulse voltammetry, square wave voltammetry, capacitance measurement, and dielectrophoresis spectroscopy have also been used to measure biosensor response to biomarkers.

Daneshpour et al. (2016) fabricated a novel electrochemical nano biosensor using a double-specific probe approach and a gold-magnetic nanocomposite as tracing tag to detect miR-106a gastric biomarker. EIS and cyclic voltammetry (CV) approaches were used to confirm the electrode's successful modification and hybridization with the target miRNA. For quantifiable estimation of miR-106a, recording the reduction peak current of gold nanoparticles DPV approach was used. The proposed biosensor showed notable selectivity, high specificity, linearity ranging from 1×10^{-3} p.m. to 1×10^{3} p.m., agreeable storage stability, and great performance in real sample investigations and offered a promising application to be used for medical early detection of gastric cancer. B. Li et al. (Balaji & Zhang, 2017; Bohunicky & Mousa, 2011; Jainish & Prittesh, 2017; J. Li et al., 2012; Mittal et al., 2017; Pasinszki et al., 2017) carried out a two-stage cyclic enzymatic amplification method (CEAM) to determinate miRNA-21in in the blood serum of gastric cancer patients. The electrochemical biosensor exhibits a low detection limit of 0.36fM with notable specificity. Most importantly, it can be employed to study the expression level of miRNA in the gastric cancer patient blood serum. Tao et al. (2018) developed a selective and sensitive sandwich-type electrochemical aptasensor based on Pt/Au/DN-graphene-CEAapt2-Tb bioconjugate to detect gastric cancer. The proposed method was demonstrated to be sensitive, as indicated by the improved electrochemical response, since the dendritic Pt/Au/DN-graphene showed peroxidase-mimic activity for the reduction of H_2O_2 introduced into the electrolytic cell, thereby confirming its desirable catalysis capacity. Since dendritic Pt/Au/ND-graphene is very conductive and possesses peroxidase-mimic activity, the electrochemical response signal and the charge transfer were promoted through catalysis of H_2O_2 reduction introduced into the electrolyte cell. Hence, aptasensor was found to enhance analytical capacity and attained desirable sensitivity. Amouzadeh Tabrizi et al. (Amouzadeh Tabrizi, Shamsipur, Saber, Sarkar, & Sherkatkhameneh, 2017) also fabricated a sandwich type electrochemical aptasensor for the sensitive detection of adenocarcinoma gastric cell AGS cancer cells in the presence of H_2O_2 by using MWCNT-Aunano as a nanoplatforms and the secondary aptamer-Au@Ag nanoparticles as the labeled aptamers. The aptasensor was also used in the detection of AGS cancer cells in a human serum sample. The developed aptasensor showed a wide linear range and good stability and selectivity. Ilie and Stefan-van Staden (2019) developed a graphite paste modified with 2, 6-bis((E)-2-(furan-2-yl) vinyl)-4-(4,6,8-trimethylazulen-1-yl) pyridine based electrochemical sensor for the detection L-tryptophan gastric cancer biomarker, which is an amino acid in real whole blood samples. The proposed gastric cancer sensor exhibits a high sensitivity with a low limit of detection. Zhang, et al. (Y. Zhang et al., 2014) developed an ultrasensitive electrochemical biosensing interface based on Au-Ag Alloy coated MWCNTs to detect volatile biomarkers of gastric cancer cells. Results displayed that eight various volatile biomarkers were screened out between MGC-803 and GES-1 gastric cancer cells. Fig. 15.3 shows cyclic voltammogram of MWNTs/AU-Ag/GCE was exposed to the head space of MGC-803 gastric cancer cells, GES-1gastric mucosa cells, and cell-free medium. The particular volatile biomarkers of MGC-803 gastric cancer cells and the well-adapted electrochemical system have substantial potential in the near future for applications, for example, screening and warning of early gastric cancer. Rahman et al. fabricated an Ag-Cu bimetallic alloy nanoscale based electrochemical sensor (Rahman et al.,

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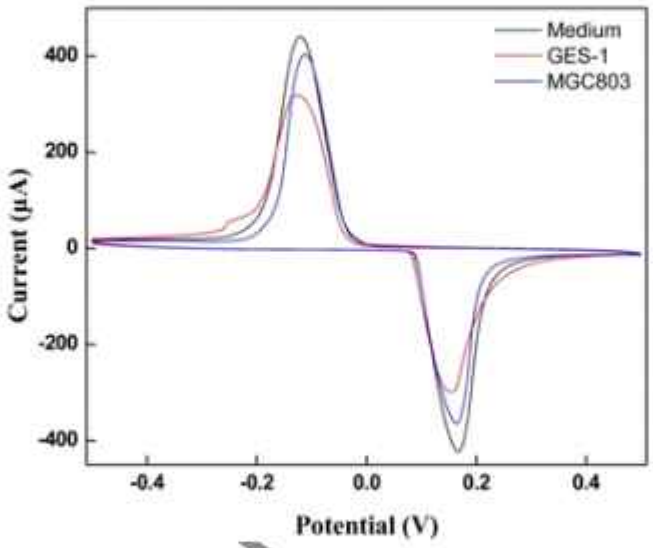

FIGURE 15.3 CVs of MWNTs/AU-Ag/GCE exposed to the head space of MGC-803 gastric cancer cells, GES-1gastric mucosa cells, and cell-free medium.

2015) for the monitoring of 2-butanone. The sensor showed the best sensing properties for the detection of 2-butanone with 0.1 μM detection limit. It was expected that the designed sensor could effectively be applied to detect the early stages of gastric and lung cancer caused by 2-butanone. Wu and Qu developed a novel and sensitive nonenzymatic sandwich type electrochemical immunosensor (Devi & Laskar, 2018; Grossmann et al., 2010; L. Wu & Qu, 2015) for the detection of gastric cancer biomarker CA72–4 using dumbbell-like PtPd-Fe_3O_4 nanoparticles (NPs). The immunosensor was fabricated by modifying the glassy carbon electrode by rGO-TEPA for effective immobilization of primary anti-CA72–4 antibody, and the secondary anti-CA72–4 antibody was adsorbed onto the PtPd-Fe_3O_4 NPs. The proposed immunosensor showed wide linearity ranging from 0.001–10 U/mL with a low detection limit of 0.0003 U/mL and possessed outstanding clinical value in cancer screening along with suitable point-of-care diagnostics. To meet the clinical demands for early detection of gastric cancer, Yao et al. (Yao et al., 2015) developed a disposable easy-to-use electrochemical microfluidic chip combined with multiple antibodies against six kinds of biomarkers. The electrochemical microfluidic chip showed linearity ranging from 0.37–90 ng mL^{-1}, 10.75–172 U mL^{-1}, 10–160 U L^{-1}, 35–560 ng mL^{-1}, 37.5–600 ng mL^{-1}, and 2.5–80 ng mL^{-1} for CEA, CA19–9, HP, P53, PG I, and PG II biomarkers, respectively (Fig. 15.4). This method showed improved sensitivity compared with ELISA results of 394 specimens of gastric cancer sera. The electrochemical microfluid chip is a promising candidate for early screening of gastric cancer, therapeutic evaluation, and real-time dynamic review of gastric cancer advancement in the near future. Mohammad Shafiee and Parhizkar (2020) successfully fabricated Au nanoparticles/g-C_3N_4 modified electrochemical gastric cancer biosensor for the detection of miRNA. The sensor used a hairpin locked nucleic acids probe and Zn^{2+} functionalized TiP nanospheres labels. The sensor showed linearity ranging from 0.6 nM to 6 nM with a limit of detection to 80 pM. For the detection of miR-100 in the sera gastric cancer patients, Zhuang, Wan, and Zhang (2021) developed a rapid, selective, and sensitive biosensor based on Au electrode (AuE) modified with gold nanoparticle (AuNP) which was attached with DNA capture probes (CPs) (CPs/AuNP-AuE). The range of detection and detection limit of the biosensor for miR-100 was 100 a.m. to 10 p.m. 100 a.m. respectively.

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15.3.2 Role of SPR biosensor in early detection of gastric cancer

In recent decades, various optical biosensor approaches have been established, counting surface plasmon resonance (SPR) (Nelson, Grimsrud, Liles, Goodman, & Corn, 2001), ellipsometry (Arwin, Poksinski, & Johansen, 2004), and quartz crystal microbalance (QCM) (Frank, Elke, Neil, Kenichi, & Yoshio, 1997). Amongst them, the SPR-based method is a representative type of label-free procedure for checking biomolecular interactions in a real-time (Nguyen, Park, Kang, & Kim, 2015). SPR is an optical phenomenon take place in the overall internal reflection of light at a metal film-liquid interface (Van Oss & van Regenmortel, 1994; Raether, 1988). At the point when the incident light is completely reflected, a part of the incident light momentum named as evanescent wave penetrates the liquid medium near the metal (generally Au)

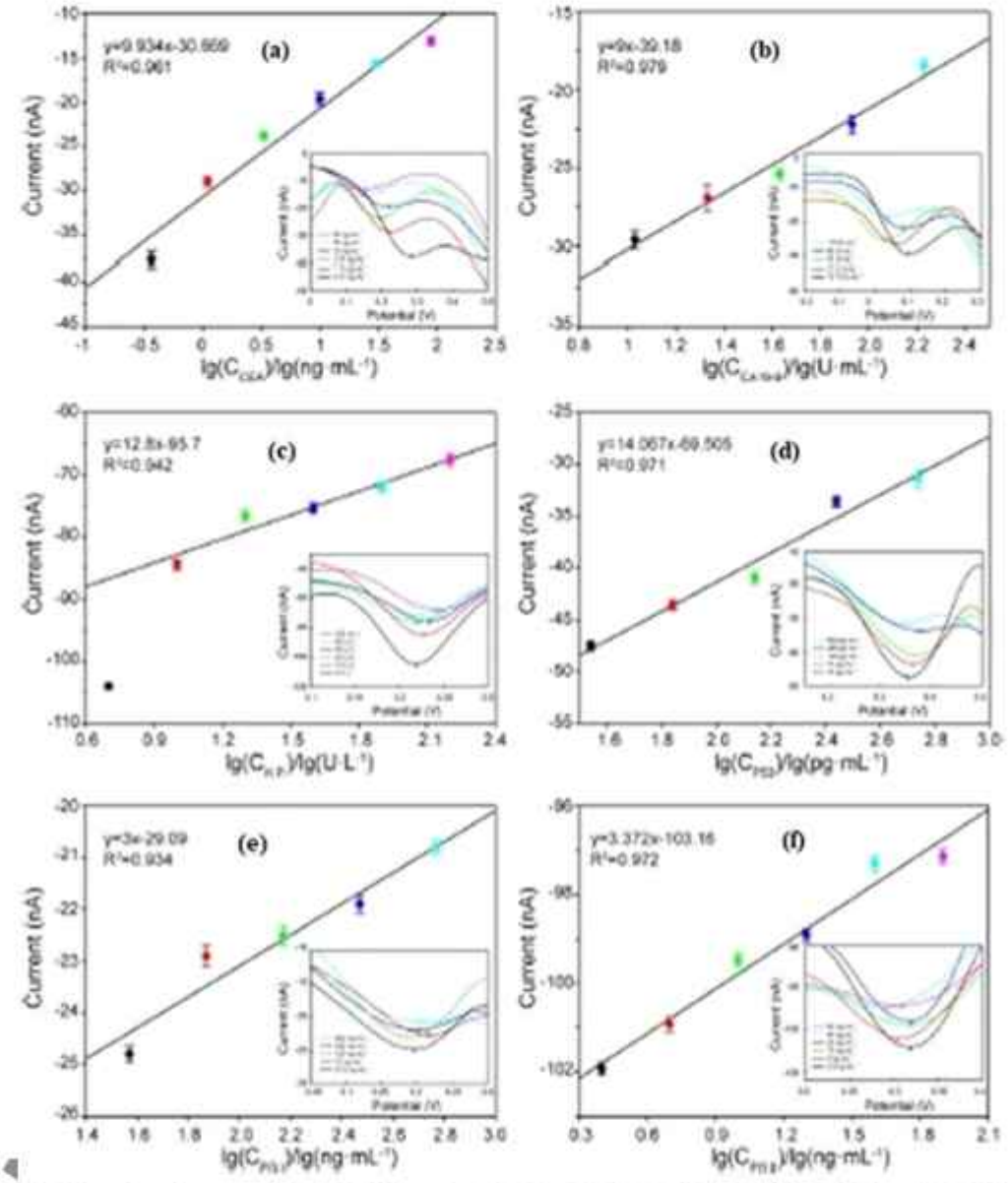

FIGURE 15.4 Linear detection ranges of six kinds of biomarkers (A) CEA, (B) CA19–9, (C) HP, (D) P53, (E) PG I, and (F) PG II by differential pulse voltammetry.

surface. In the thin metal film surface, the evanescent wave interacts with longitudinally oscillating free electrons termed surface plasmon. During SPR, metal film absorbed the energy of incident light, decreasing the light intensity. While the angle of incidence is fixed, the resonance phenomenon happens only at an accurately defined wavelength, which depends upon the medium's refractive index (RI) near the metal surface. RI changes in a direct extent to the mass and dielectric permittivity of the present medium. Immobilization of antibodies on the metal surface causes the corresponding antigen to bond on the surface when it touches the liquid samples. The binding method can be observed via observing the SPR wavelength which depends on the quantity of antibody-antigen binding. The SPR biosensor is sensitive to refractive index adjustments or thickness of biomaterials at the interface between a metal thin film and a surrounding medium. Therefore, using antibodies peculiar to pathogens of interest can measure the number of pathogenic bacteria existents in a sample by quantifying the

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change in refractive index and characterize interactions of biomolecules on the surface in real time without labeling (Brockman, Nelson, & Corn, 2000; Fang et al., 2010; Green et al., 2000)

For the early diagnosis of gastric cancer, Fang et al. (2010) fabricated a SPR sensor based on the detection of MG7-Ag, a gastric cancer-specific tumor-associated antigen in human sera. The measurements contained two cases of healthy blood donors, nine cases of gastric cancer patients, and an MKN45 cancer cell lysate sample solution for positive control. Results showed the binding of MG7-Ag onto the sensor surface was observed from SPR spectra. The prepared SPR biosensor showed potential for the early diagnosis of gastric cancer, but the limit of detection and measure for cancer risk assessment in early diagnosis was not confirmed. F. Liu (Capelle et al., 2009; Chan et al., 2007; Ebert et al., 2005, 2006; Gao et al., 2012; Ghosh et al., 2013; Hao et al., 2008; Harbeck et al., 2008; Herszenyi et al., 2008; Ick et al., 2004; Kaplan et al., 2014; Kumar et al., 2007; Lee et al., 2012; Liu et al., 2012; Mitani et al., 2007; Suppiah & Greenman, 2013; Tas et al., 2014; Umemura et al., 2011; Yu et al., 2011; Zhang et al., 2014) used surface plasmon resonance phase sensing to detect EGFR on active human gastric cancer BGC823 cells. The results showed that the SPR phase sensing is proficient of real-time recognition of molecular interactions and cellular responses on living cells. It also proposed that more studies on the mechanism and method might let SPR sensing become a useful tool for the essential research of cell biology, yet also for medical diagnosis and drug development.

15.3.3 Role of surface-enhanced Raman spectroscopy sensor in early detection of gastric cancer

Amongst optical nano biosensors, those established on surface-enhanced Raman scattering (SERS) spectroscopy have been drawing significant attention. It is because of the combination of the intrinsic prerogatives of the technique, such as structural specificity and sensitivity, and the high degree of modification in nano-manufacturing, which translates into consistent and robust real-life applications. In SERS, the excitation of localized surface plasmon resonances (LSPR) at the surface of nanostructured metals with light induces the massive intensification of the Raman scattering from molecules located close to the metallic surface. This effect yields an ultrasensitive plasmon-enhanced spectroscopic technique that retains Raman spectroscopy's intrinsic structural specificity and experimental flexibility. As impressive advances in instrumentation and nanofabrication techniques enabling the engineering of finely tuned plasmonic nanomaterials continue, SERS is progressively expanding into the realm of viable biomedical applications (Guerrini & Alvarez-Puebla, 2019).

There are 14 VOC biomarkers in human breath used for differentiating gastric cancer patients from healthy persons. Chen et al. (2016) fabricated a SERS sensor based on breath analysis to identify VOC biomarkers to distinguish EGC and AGC cancer patients from healthy persons. They prepared a clean SERS sensor using hydrazine vapor adsorbed in graphene oxide (GO) film by in situ formations of gold nanoparticles (AuNPs) on reduced GO (RGO) deprived of any organic stabilizer. The SERS sensor effectively analyzed and distinguished various simulated breath samples and 200 breath samples of medical patients with over 83% and 92% sensitivity and specificity, respectively. Yunsheng Chen et al. (2018) fabricated non-invasive, cheap, fast SERS sensors based on salivary analysis to screen early and advance gastric cancer patients. The developed graphene oxide nanoscrolls wrapped with gold nanoparticle (A/GO NSs)-based SERS sensors detect the biomarkers in 220 clinical liquid saliva. These sensors successfully analyzed and distinguished various stimulated and medical patients' samples with sensitivity and specificity greater than 80% and 87.7%, respectively. For the detection of miR-34a biomarker, Lee et al. (Capelle et al., 2009; Chan et al., 2007; Ebert et al., 2005, 2006; Gao et al., 2012; Ghosh et al., 2013; Hao et al., 2008; Harbeck et al., 2008; Herszenyi et al., 2008; Ick et al., 2004; Kaplan et al., 2014; Kumar et al., 2007; Lee et al., 2012; Liu et al., 2012; Mitani et al., 2007; Suppiah & Greenman, 2013; Tas et al., 2014; Umemura et al., 2011; Yu et al., 2011; Zhang et al., 2014) fabricated a uniform, highly robust, and ultra-sensitive surface-enhanced Raman scattering substrate by using silver nanostructures grown in gold nanobowls (SGBs). They were accomplished by consistent and direct detection of miR-34a in human gastric cancer cells by applying the advantages of SGBs in SERS sensing. An essential chemokine named interleukin 8 (IL-8) plays a vital part in tumor growth and angiogenesis and has been found in various human tumors, counting gastric and breast cancer. Zhen-yu Wang et al. (Qian et al., 2019; Wang, 2006) fabricated a double antibody sandwich format-based SERS immunosensor for the determination of IL-8. The immunosensor showed high sensitivity, selectivity, and low detection limits for the detection of IL-8 in PBS and human serum, hence, providing a great possibility for application in clinical diagnosis.

15.3.4 Role of GMI-based biosensing system in early detection of gastric cancer

In recent times, the giant magnetoimpedance (GMI) effect has attracted considerable attention due to its possible application in magnetic field sensing (Wang et al., 2017). The GMI effect is the change of complex impedance of soft magnetic mate-

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rials conveying alternating current upon the use of the external magnetic field in Beach and Berkowitz (1994), Knobel and Pirota (2002), Phan and Peng (2008), and Panina and Mohri (1994)

Kurlyandskaya et al. (2003) introduced a GMI sensor into the field of biosensors. A GMI-based biosensing system linking with the magnetic labeled technology was used to distinguish gastric cancer cells (Chen et al., 2016). For the recognition of functional nanoparticles-probed gastric cancer cells, Lei Chen et al. (2011) planned, fabricated, and tested a GMI-based biosensing system with a Co-based ribbon sensing element. Functionalized nanoparticles were structured by coating Fe_3O_4 with chitosan and conjugating with cyclic RGD peptides. This fabricated system can recognize the dissimilarities among targeted and nontargeted cells.

15.3.5 Other types of biosensor in early detection of gastric cancer

Different types of biosensors can also detect gastric cancer related biomarkers. Stefan-van Staden et al. (Stefan-Van Staden, Ilie-Mihai, Pogacean, & Pruneanu, 2019) developed an exfoliated graphene (E-NGr) based high sensitive stochastic sensor used for pattern recognition of CEA, CA19-9, and p53 in whole blood and urine samples of patients found in very early and later gastric cancer stages.

15.4 Conclusion and future perspectives

Due to the numerous limitations in conventional detection methods of cancer, scientists and researchers are showing their attention to biosensors' development for effective rapid noninvasive detection of cancer markers. In the body, presence of cancer cells is confirmed by cancer markers. These markers exist in saliva, blood, or some other body fluids. As a complex heterogeneous disease, gastric cancer is one of the most widely recognized malignancies around the world. Gastric malignant growth is the fifth most regular kind of disease and the subsequent driving reason for the third leading malignant growth-related mortality (accounted for 8.2%) overall (Sitarz et al., 2018; Zhou et al., 2018). Early gastric cancer can be cured with surgery. In contrast, advanced gastric cancer often needs combined multidisciplinary therapy, and delayed diagnosis and inadequacies of the staging system may increase mortality. Therefore, it is very demanding to develop a rapid and noninvasive diagnosis technique to realize early detection of gastric cancer and simultaneous staging. Consequently, it is challenging to create a rapid and noninvasive diagnosis technique to realize early detection of gastric cancer and simultaneous staging. Early detection of gastric cancer prominently increases the probabilities for effective treatment and survival rates of cancers. Several types of biosensors have been proposed to detect gastric biomarkers and have shown an excellent opportunity for the early diagnosis of gastric cancer.

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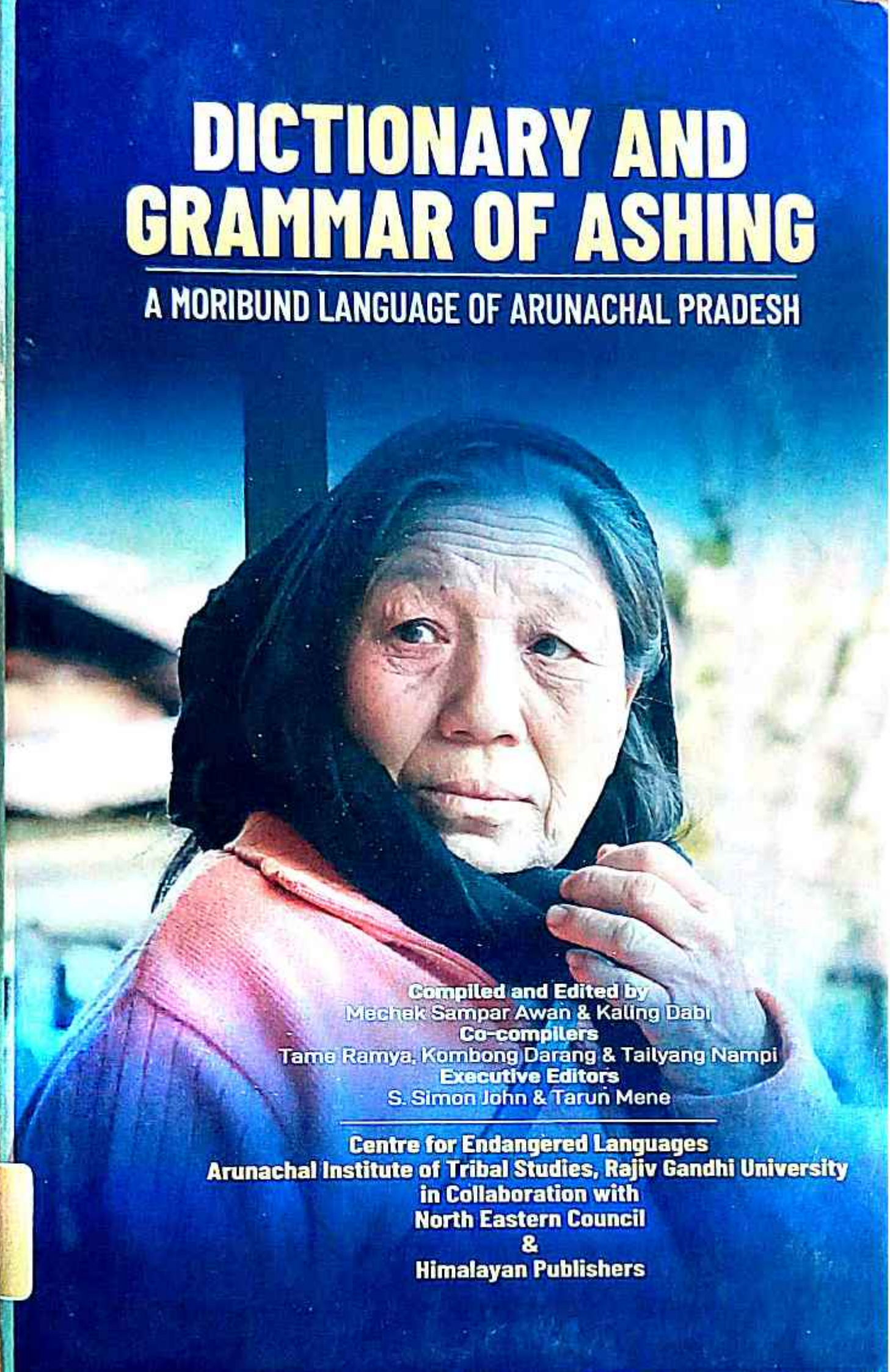

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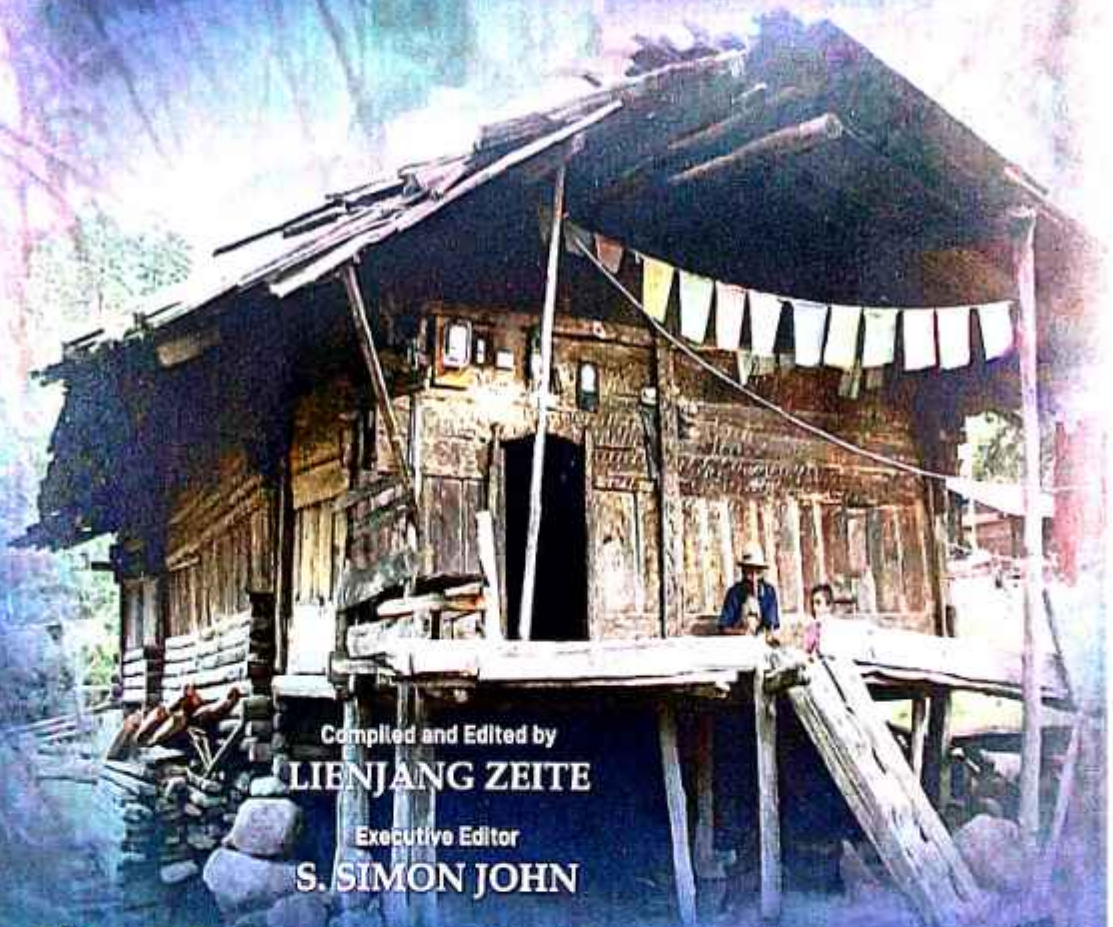

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SUICIDE PREVENTION STRATEGY

From Research to Policy and Practice for the Idu Mishmi Tribe

Compiled & Edited by

Dr. Tarun Mene
Dr. Rajiv Miso

IDU MISHMI CULTURAL AND LITERARY SOCIETY
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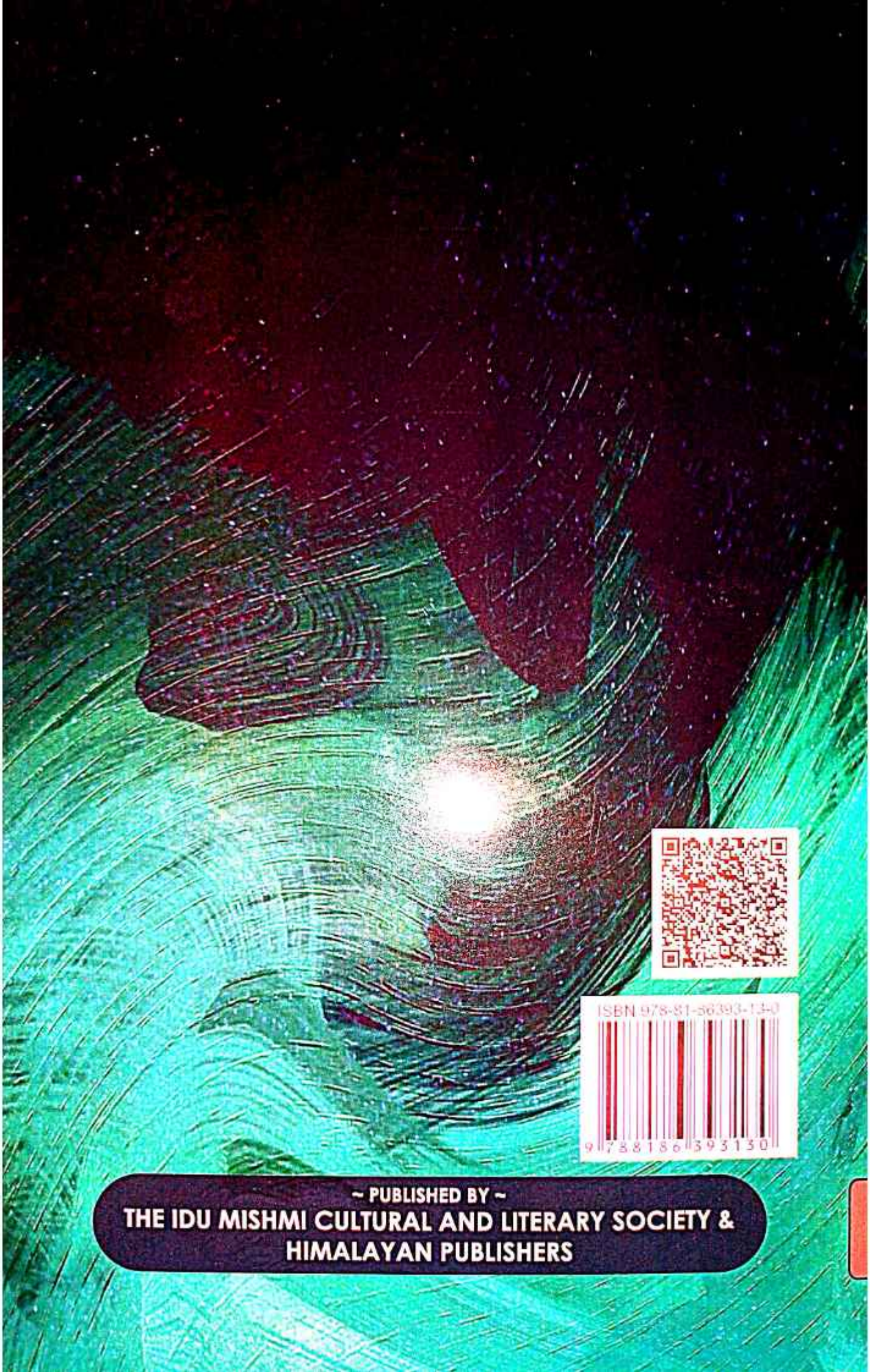
ARUNACHAL PRADESH
2022



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30

Review of Periyar's Contribution towards Social Justice and Rationality in Indian Landscape

Dr. Vinod Kumar Yadav
Assistant Professor, Department of Commerce,
Rajiv Gandhi (Central) University, Arunachal Pradesh,
Email: avvhyadav2020@gmail.com
Mobile: 9089749076

Abstract

Periyar is still relevant and contextual in the contemporary modern society for his lifelong struggles against casteism, social injustice, irrational thinking, superstition, blind adherence to religion, custom and tradition, exploitation of weaker and vulnerable sections of the society, etc. He was the champion of social justice and campaigner of marginalized society. He is recognized as the father of Dravidian Movement who struggled throughout his life for the rights and reverence of the oppressed and depressed class peoples. He was a strong opponent of Brahmanism as in his view, it was against the social justice, equity and equality in the society, and rational thinking that would paralyze the process of establishment of progressive society ahead. Rationalism and non-violence were the core elements of Periyar's philosophies and principles. The prominent mission of his life was to establish a progressive society through eradication of all the religions and annihilation of caste system. Periyarism is nothing but adherence to Periyar's ideology. He is an iconic figure of social justice and rationality across the globe.

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Indigenous Salt Production among the Nocte and Tutsa Tribes of Tirap District, Arunachal Pradesh

CHAWAK TANTE
PhD Scholar, Wanglit Mongchan, Assistant Professor, AITS, Rajiv Gandhi University

Abstract: The salt well or salt deposit was one of the most important natural resources found abundantly in Tirap District of Arunachal Pradesh. The black salt was one of the most precious and scarce commodities in the medieval and colonial period in the history of North East India. It was once regarded as a kind of black gold that brought the attention of the outsiders like the Ahoms, Sonowal-Kacharis, Bodo-Kacharis, Rabhas, Makum and other neighboring tribes. This black salt was locally produced by the Noctes and Tutsas of Tirap district. It has played a significant role in socio-cultural, political and economic development of the tribes in the region. In fact, the production of black salt was an important economic activity and livelihood of the Noctes and Tutsas at one point of time. In this paper, the authors intend to unearth the indigenous knowledge of salt production among the Noctes and Tutsas of Tirap District, Arunachal Pradesh. The paper has four parts – the first part focuses on the myth about origin of salt, second the traditional process of salt preparation, third the taboos associated with it and fourth the significance and relevance of the black salt.

Keywords: Indigenous, salt, black salt, myth, taboos, mediaeval and colonial period, trade, Tutsa, Nocte

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Skill Development Initiatives in Arunachal Pradesh

Yami Melo
Research Scholar, Department of Economics,
Rajiv Gandhi University, Arunachal Pradesh,
yamimelo2017@gmail.com
Anup Kumar Das
Assistant Professor, Department of Economics,
Rajiv Gandhi University, Arunachal Pradesh,
anupdas97@gmail.com,

ABSTRACT

The paper briefly highlights the skill development initiatives taken in Arunachal Pradesh. In the State, primarily the government is taking various skilling initiatives. NGOs are also involved in such activities. The State is providing vocational training to its people through various industrial training institutes and polytechnic colleges in various subjects such as plumber, carpenter, welder, electrical, secretarial practice, computer etc. In addition, government has also started skill development initiative schemes, both long and short term particularly for the

unemployed youth and the early school leavers. It was found that many individual were selected through the 'Job Mela', a government flagship program, in different districts for their skill development. Majority of the students joined skill development trainings have completed their courses. It is found that about 60 per cent of trainees under SDI scheme were employed, revealing a good employment outcome of the scheme.

Keyword: Skill Development Initiatives, Training, Employment, Arunachal Pradesh

1. Introduction

Skill development has a vital role in economic growth and social development. Skill development improves the labour productivity and makes them more adjustable with the challenges and opportunities in the real world of work. Furthermore, skill development enhances women empowerment, improves standard of living, expands trade and wage and makes the labour more employable as well as adaptable to new technologies (Riaz et al., 2014; Saner and Yiu, 2014; Epifani and Grancia, 2008; Punjani, 2014).

In view of these, skill development has been included in national policies of many countries in the world (Fernandez, C.M. and Choi, K., 2012). In fact, over the years, skill development has gaining importance increasingly due to its significant role in increasing income, saving, investment, productivity and transforming the economy (Rodrick et al., 1995).

India is expected to surpass China, highest populated country in the world, in terms of population by next few years and to become the world's youngest country. More importantly,

about 64 per cent of India's population is expected to fall under the working age group by the next few years while the other developed countries are on ageing stage. Exploration of the potential benefits posed by the young population highly depends on adoption and implementation of the appropriate policies and strategies. In this context, Kanchan and Varshney (2015) stated that if the increasing population is left untrained and unemployed it may turn into demographic liability. The country can take advantage of the demographic dividend by converting its huge population to skilled manpower. Accordingly, the National Skill Development Policy 2009 has been adopted to guide skill development strategies and to link these strategies to policies in economic growth, employment and social development arenas. With this policy plan, the country aims to impart skill training to 500 million people by 2022. In addition, The Ministry of Skill Development and Entrepreneurship, a separate ministry of the government of India, has been created in the year 2014 with the aim to accomplish all the skill development efforts of the Government of India throughout the length and breadth of the country.

In accordance with the centre's ambitious aim of skill development, the State Arunachal Pradesh has also been engaged in the adoption and implementation of skill initiatives in order to produce manpower with higher quality. Arunachal Pradesh is located at the eastern most part of the country and is characterized by low level of development owing to geographical disadvantage and other factors such as poor infrastructure in terms of transport, connectivity, lack of skilled manpower etc. Skill development trainings have a great role to play in the development of the State. The State has various formal institutions for skill training like Industrial Training

Institutes (ITI's), Polytechnics etc. In addition, State has initiated other short term skill development training initiatives for the unemployed and drop out students in the State. Besides, Department of Rural development, Textile, Industry, Agriculture, Horticulture, Tourism, Women and Child Development etc are the other departments that are also involved in such initiatives[3]. From the various local dailies also, it is visible that the skill development initiatives are not confined to only one agency or stakeholders. NGO's and other agencies are also involved in such initiatives.

Given the role of skill development in overall development and the great scope of such initiatives to contribute in the development of Arunachal Pradesh, one among the states adopting various skill development initiatives, an attempt is made to look in to the status of skill development initiatives in the State along with the outcome of those initiatives.

2. Skill Development and India- A Review of Literature

Skill development training has a crucial role in the economy of any country. It has been observed that the investment in human capital add directly to the economic growth of the country (Romer, 1994). Such instances have also been recorded in the economies of South Korea and Taiwan. Rodrick et al. (1995) showed that the presence of highly skilled labour and the timely intervention of Government in skill development process transformed the economies of these two countries in 1960's. Globalization has raised the importance of skill development even more. Epifani and Gancia, (2008), globalised world will facilitate trade and with its expansion, market size will enlarge which in turn will increase the demand for highly skilled labour. Further, there may be slow down in the economic development

in the absence of requisite skilled manpower and also endangers the country's competitiveness (Saner and Yiu, 2014). A good economic environment along with skilled manpower transforms the economy from labour intensive to capital intensive and ultimately to knowledge intensive economy (Saner and Yiu, 2014).

To ensure the future needs for skilled manpower in the development process, the Government of India has initiated many skill training initiatives mainly in the form of institutional technical and vocational trainings. To strengthen the skill training initiatives in the country, the Government of India has launched the National Skill Development Policy 2009 framework and many other training initiatives. The creation of Ministry of Skill Development and Entrepreneurship is another effort to encourage the skill related initiatives in the country. Despite of these initiatives for skill development, there is still deficiency in skilled manpower in the country. It has been identified that even after the advantage of having largest young population, India is facing acute shortage of skilled manpower (Okada, 2012) which has affected its economy (Kemal, 2007). Further, due to the launch of ambitious project 'Make in India', there arises urgent necessity for skilled manpower within the country (Sharma and Nagendra, 2016). The 'Make in India' project aims to make India a global manufacturing hub and for that the country has to be ready with latest modern know how to grab the future opportunities. It is expected that such project will encourage foreign as well as domestic investment and create employment and other beneficial opportunities (Deka and Batra, 2016). Thus, it is clear that skill development initiatives have great significance in India. Failure to comply with the demand for skilled manpower may endanger India's competitiveness as

the country has the advantage to play a key role in labour supply in the near future. All these necessitate more pro-active measures to fill the skill gap.

The issues such as employability, adaptability, quality, qualification mismatch etc also needs to be addressed properly because it affects the employment opportunities. According to Chenoy (2012), these issues arise particularly due to the non focused nature of skill development initiatives of both government and private space on the employability as most of the courses were not based on the needs of industries. However, challenges like attitudinal challenges, delivery, leadership and external challenges, rigid labour laws and tedious approval and submission process in certification and training, being faced by various stakeholders in the way of skill development training in India (Chanda, 2015). In certain circumstances, many hesitant to start business venture after the completion of skill training particularly due to the lack of guidance, support and financial resource (Grover and Dak, 1986).

It is evident that the skill development initiative undertaken in India has great potential to contribute to its development but yet to get full attention of the researchers. Owing to this research gap, an attempt has been made here to see the state of skill development initiatives in Arunachal Pradesh.

3. Objective

The specific objective of the study is to examine the status of skill development initiatives in Arunachal Pradesh along with the outcome of those initiatives.

4. Methodology

The study is based on secondary data collected from sources

such as NSDC Skill Gap Study of North East– Arunachal Pradesh, Ministry of Skill Development & Entrepreneurship, (2012); An Overview of Skill Development & Entrepreneurship in Arunachal Pradesh-2016 (GoAP); Skill Development in Arunachal Pradesh-A Comprehensive Study 2017, North Eastern Development Finance Corporation Limited (Nedfi) and various research articles and online data sources.

Skill Development Initiatives undertaken in the State are examined based on the available secondary data. However, the outcome related data were not available for the existing scheme/ skill initiatives, except for skill development initiative scheme undertaken by the Department of Skill Development and Entrepreneurship. Thus, considering the data limitation, especially the outcome related data, the outcome of the skill development initiative in the State are evaluated for the trainees selected through the government flagship programme called **Job Mela** under the skill development initiative scheme in the year 2013.Using simple statistical tools like percentages, tables and figures, the analysis has been made in the present study.

5. Skill Development Initiative in Arunachal Pradesh

Socio-economic development is one of the main objectives of any government and skill development, being essential for foundation of the socio-economic development, is highly recommended. The requirement of skill for the development of any country or economy is identified all over the world. Due to its importance in the socio-economic development, countries are increasingly giving more and more emphasis on the skill development. It is also identified that mere education without any practical skill make more difficult for the job aspirants to get job in today's competitive world. As per the Federation of

India chambers of commerce and Industry (FICCI, 2015), the shortage of skilled manpower in the world will stand at approximately 56.5 million by 2020.

Similarly in India, the importance of skill and its requirement is identified from the very beginning of planning period. The skilling process was running alongside the general education system in the country. Formal vocational and skill training system in the country was started with the setting up of first Industrial training institute (ITI) in 1969 by the ministry of Labour & Employment, Government of India (GOI). In order to formalize and regulate vocational education for higher level skills, the All India Council of Technical Education (AICTE) act 1987, has been made an official regulator of polytechnics and technical colleges in the country.

As per the Census 2011, GOI, the population of India is the second highest population in the world having literacy rate of 73 per cent and projected to be the youngest country by 2020. New opportunities in new sectors after 1990's led the government to expand the skilling capacity of the country. Finally in an effort to train the huge population of the country Government of India formed the National Skill Development policy in 2009. The initiative started with the aim to impart skill training to 500 million people by 2022[4]. After that, many such initiatives have been carried out by government through partnership with private stakeholders, state government and through its various departments. Finally in 9th November 2014 a separate ministry has been formed to coordinate all the skill development efforts throughout the country.

In Arunachal Pradesh, other than general education system, formal technical and skill development training are provided through properly established institutions under various

departments. The Directorate of Higher Secondary Education providing skill development training through government higher secondary schools of the State. For the higher and technical education, the Directorate of Higher and Technical Education is implementing diploma level courses through its polytechnics. There are seven polytechnics which are currently functioning in the State namely: Rajiv Gandhi Government Polytechnic, Itanagar; Tomi Polytechnic College, Basar; Government Polytechnic, Dirang; Government Polytechnic, Laying; Government Polytechnic, Namsai; Government Polytechnic, Pasighat and Government Polytechnic, Roing.

Other than the polytechnics, the State has one higher and technical institute, North Eastern Regional Institute of Science and Technology (NERIST). It is a public deemed university. Selection process of students are based on three type of entrance examination and out of the total seat, 80 per cent seat are reserved for North Eastern (NE) students, 10 per cent each for eight NE states and remaining 7 per cent seat is for meritorious students, 10 per cent for rest of the country and 3 per cent for disabled students[5].

Apart from the above, Directorate of Skill Development & Entrepreneurship is providing training programme through its various schemes namely Craftsmanship Training Scheme (CTS), Skill Development Initiative Scheme (SDIs), and Capacity Building Programme under Border Area Development Programme (BADP). In addition to these, government is also planning to start Micro Units Development and Refinance Agency (MUDRA) and Chief Minister's Soft Loan Scheme for skilled persons. These two schemes are the loan and subsidy provisions which the department is planning to provide to the skilled person those who possess NCVT certificate[6].

Craftsmanship Training Scheme

Under the CTS, department is imparting vocational training through various Industrial training institutes (ITIs). First ITI was established at Roing, Lower Dibang Valley District of the State in 1971. In subsequent years, more ITIs were established and till date there are six ITIs in the State. Out of them, ITI East Siang is privately owned and managed by private company and remaining five ITI's are owned and controlled by government. Courses offered in these ITIs are presented in Table 1.

Table 1:

Industrial Training Institutes (ITIs) in Arunachal Pradesh

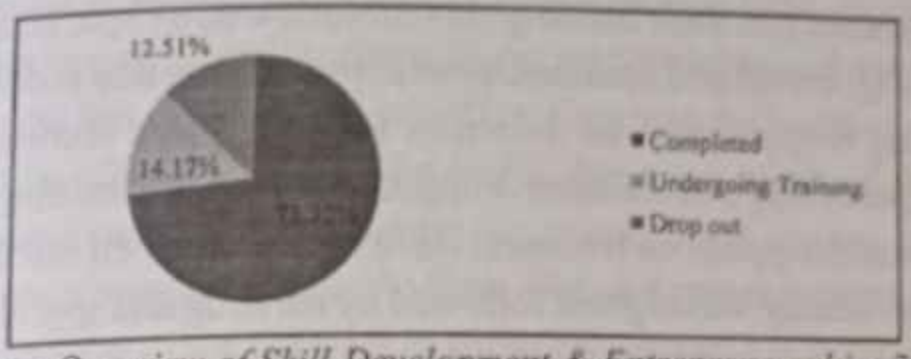
Sl. No.	ITIs	Courses Offered
1.	ITI, Roing	Plumber, Carpenter, Welder, Wiremen, Mechanic, Fitter, Electrician, D/Man, Surveyor, IT&ESM
2.	ITI, Dirang	COPA, Preservation of Fruits & Vegetables, Welder, Secretarial Practice, Electronic and Mechanic.
3.	ITI, Yupia	Secretarial Practice, Hair & Skin care, Baker & Confectioner, Fashion Technology.
4.	ITI, Tabarijo	D/Man, IT &ESM, Electrician and Secretarial Practice
5.	ITI, Balinong	D/ Man COPA, Mechanic Diesel, Mechanic RAC
6.	ITI, East Siang	Electrician, Mechanic Diesel and Welder Source: NSDC Skill Gap Study North-East, Arunachal Pradesh, GOI, 2012

Source: NSDC Skill Gap Study North- East, Arunachal Pradesh, GOI, 2012

Skill Development Initiative Scheme

Under the skill development initiative scheme, trainees were selected through the State flagship programme called Job Mela and sponsored to various registered Vocational Training Providers (VTPs) for further training. Job Mela is an awareness and sensitization programme on the importance of skill development and training. The counseling and selection of trainees to undergo training and job placement was done by various registered VTPs under the guidance of District Administration and District Industries Centre (DIC). Through the counseling programme, various categories like educated unemployed, dropouts etc were encouraged to take up one or two trade of their own choice and pursue the subjects in the vocational institutes of India. Under SDI scheme, 100 per cent placement assistance was provided to all the trainees and 70 per cent job guarantee to all the trainees in a batch. The trainees were awarded with National Council of Vocational Training (NCVT) certificate by the Director General of Training, Ministry of Skill Development & Entrepreneurship after the successful completion of training. The Job Mela was held in all districts of the State and through this program the sensitization on the importance of skill development was done. The first maiden Job Mela was held in 30th August to 1st September, 2013 at Itanagar. The second was held in all districts from 2nd February to 8th March and third was in 16th November to 20th December 2015.

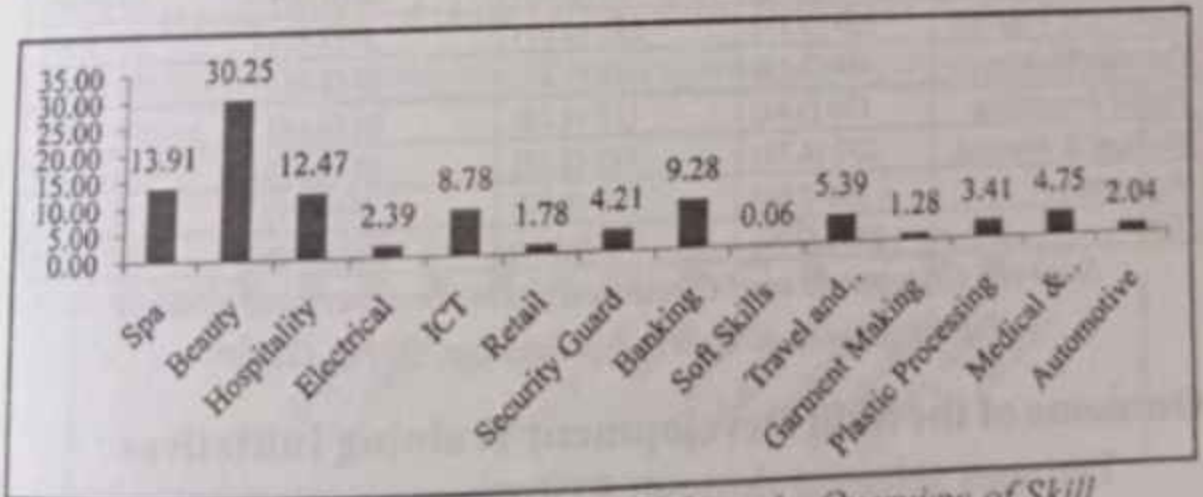
Figure 1:
Trainees Trained under SDI Scheme



Source: An Overview of Skill Development & Entrepreneurship, 2016, GoAP

Figure 1 shows the trainees trained under the SDI scheme. It appears from the figure that about 73 per cent have completed their training, 14 per cent undergoing training[7] and remaining 12.51 per cent were dropped out from the training. Among the total trainees selected, highest was in beauty subject followed by spa, hospitality, banking, information communication technology (ICT), travel and tourism and medical and nursing respectively (Figure 2).

Figure 2:
Percentage Distribution of Trainees attended Skill Development Training



Source: Compiled and Computed from An Overview of Skill Development & Entrepreneurship, 2016, GoAP

In terms of percentage of completion by subject wise, it was found that highest percent of trainees completed their training that opted beauty as their training subject followed by spa, hospitality, banking, travel and tourism, plastic processing and medical and nursing respectively, as shown in Table 2. It also shows subject wise percentage of trainees dropped out from the training among the total dropped out trainees. Here again, dropped out from the subject beauty was highest followed by banking and spa. Similarly, beauty sector constitutes the highest under the category of undergoing training followed by medical and nursing and hospitality respectively.

Table-2:

Percentage of Trainees attended Skill Development Training

Sector	Total Trainees participated	Trainees Completed the Courses	Drop Out	Trainees Undergoing Training
Spa	694 (13.91)	570 (15.58)	92 (14.74)	32 (4.53)
Beauty	1509 (30.25)	942 (25.75)	169(27.08)	398 (56.29)
Hospitality	622 (12.47)	504 (13.78)	53 (8.49)	65 (9.19)
Electrical	119 (2.39)	119 (3.25)	00 (0.00)	00 (0.00)
ICT	438 (8.78)	373 (10.20)	39 (6.25)	26 (3.68)
Retail	89 (1.78)	89 (2.43)	00 (0.00)	00 (0.00)
Security Guard	210 (4.21)	160 (4.37)	35 (5.61)	15 (2.12)
Banking	463 (9.28)	328 (8.97)	135 (21.63)	00 (0.00)
Soft Skills	03 (0.06)	03 (0.08)	00 (0.00)	00 (0.00)
Travel and Tourism	269 (5.39)	220 (6.01)	24(3.85)	25 (3.54)
Garment Making	64 (2.18)	46 (1.26)	18 (2.88)	00 (0.00)
Plastic Processing	170 (3.41)	152 (4.16)	04 (0.64)	14 (1.98)
Medical & Nursing	237 (4.75)	119 (3.25)	25 (4.01)	93 (13.15)
Automotive	102 2.04)	33 (0.90)	30(4.81)	39 (5.52)
Total	4989 (100)	3658(100)	624 (100)	707 (100)

Source: Computed and Compiled from An Overview of Skill Development & Entrepreneurship, 2016, GoAP

Outcome of the Skill Development Training Initiatives

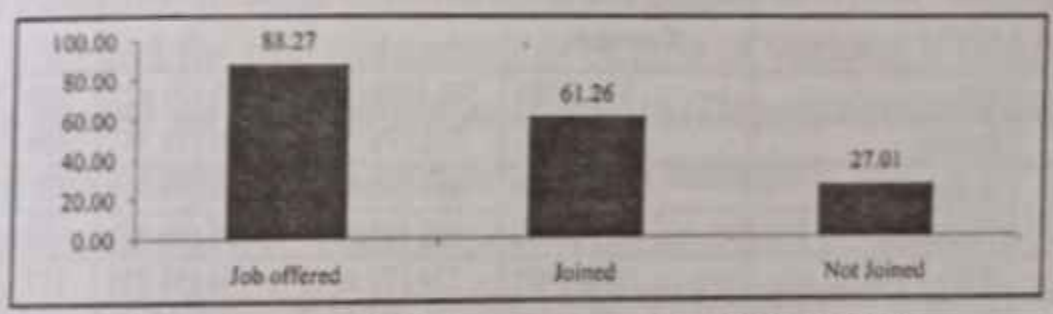
Trainees selected through SDI scheme were sponsored to private vocational training providers for the training with the

guaranteed job placement. Accordingly, employment offer were given to the participants that completed their training. About 88 percent of the trainees were offered job in their respective fields (Figure 3). The offer was accepted by about 61 per cent trainees and remaining 27 per cent has declined the job offer. This may be because of less interest in staying outside the home State, as most of the job placements were done outside the home State owing to low employment opportunities in the State. Figure 4 presents employment offer provided to the trainees in different sector. Among the total trainees, employment was offered to around 88.27 per cent trainees and out of that highest percent of job were offered in beauty sector followed by spa, hospitality and banking.

Figure 3:

Job Offered to the Trainees

Source: Computed and Compiled from - An Overview of Skill

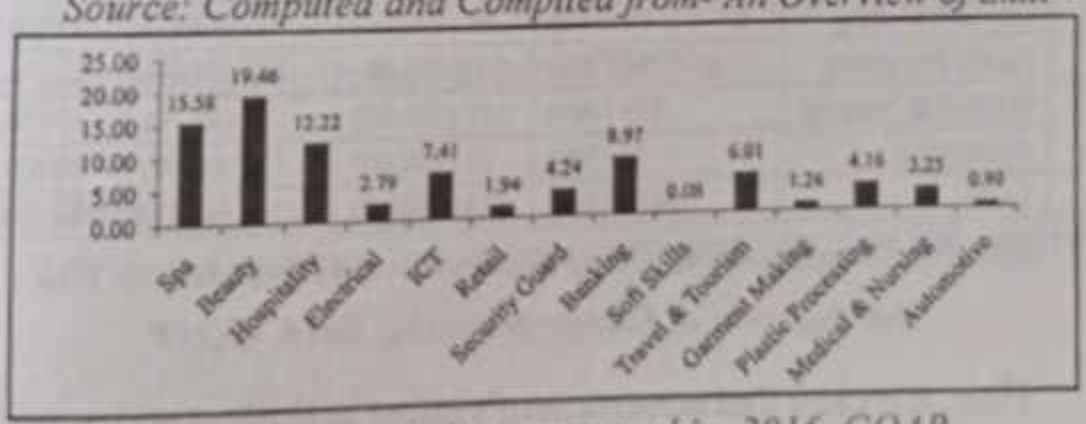


Development & Entrepreneurship, 2016, GOAP

Figure 4:

Percentage of Job Offered in Different Subjects

Source: Computed and Compiled from- An Overview of Skill



Development & Entrepreneurship, 2016, GOAP

Table 3 presents the percentage of trainees accepted and declined the job offer provided in their respective sectors. It appears from the Table that 100 per cent job were offered in subjects such as spa, banking, soft skills, travel and tourism, garment making, plastic processing, medical and nursing, automotive but except automotive, most of the trainees declined the offer. In medical and nursing, soft skills and electrical, the percentage of trainees declined the job offer were about 56, 66 and 51 per cents respectively. On the other hand, more than 50 per cent of trainees have accepted the job offer in all the sectors, except medical and nursing, soft skills and electrical.

Table -3:

Job Offered in Various Trade (in per cent)

Sl. no.	Sector	Trainees Completed the Courses	Job offered	Accepted	Declined
1	Spa	570 (100)	570 (100.00)	455 (79.82)	115 (20.18)
2	Beauty	942 (100)	712 (75.58)	508 (71.35)	204 (28.65)
3	Hospitality	504 (100)	447 (88.69)	318 (71.35)	129 (28.86)
4	Electrical	119 (100)	102 (85.71)	50 (49.02)	52 (50.98)
5	ICT	373 (100)	271 (72.65)	154 (56.83)	117 (43.17)
6	Retail	89 (100)	71 (79.78)	41 (57.75)	30 (42.25)
7	Security Guard	160 (100)	155 (96.88)	117 (75.48)	38 (24.52)
8	Banking	328 (100)	328 (100.00)	189 (57.62)	139 (42.38)
9	Soft Skills	03 (100)	03 (100.00)	01 (33.33)	02 (66.67)
10	Travel & Tourism	220 (100)	220 (100.00)	151 (68.64)	69 (31.36)
11	Garment Making	46 (100)	46 (100.00)	43 (93.48)	03 (06.52)
12	Plastic Processing	152 (100)	152(100.00)	129 (84.87)	23 (15.13)
13	Medical & Nursing	119 (100)	119 (100.00)	52 (43.70)	67 (56.30)
14	Automotive	33 (100)	33 (100.00)	33 (100.00)	00 (00.00)
15	**Total**	**3658 (100)**	**3229 (88.27)**	**2241 (69.40)**	**988 (30.60)**

Source: Computed and Compiled from - An Overview of Skill Development & Entrepreneurship,2016, GOAP

Thus, it is clear that government's effort in skilling and providing livelihood opportunities to the people of State through SDI scheme

is a commendable to a great extent. Many students were provided different types of training under this scheme and also employment, who otherwise would have been outside the ambit of any skill training and without employment at least for some times.

6. Capacity Building Training under BADP

As per the information from department of Skill Development & Entrepreneurship, Itanagar, the empanelled Vocational Training Providers (VTPs) have provided training to 3298 people, belonging to the international border area, under the Border Area Development Project (BADP) scheme during the year 2013-2014. The subjects of the training were handicrafts, basic computer, weaving, bee keeping and envelope making etc.

In addition to the said schemes and programmes, department is also planning to start Pradhan Mantri Kaushal Vikas Yojana (PMKVY) and for that uploading of details of various VTPs is already started for the registration process (Department of Skill Development Training & Entrepreneurship, Itanagar).

Besides the above, other departments involved extensively in skill development initiatives[8] in the State are Department of Rural development, Textile, Industry, Agriculture, Horticulture, Tourism, Women and Child Development etc. Further, skill development initiatives are not confined to only one agency or stakeholders. Various agencies, NGO's are also organizing and providing skill development training to the people of the State.

7. Conclusion

Skill development, an important strategy for the socio-

economic development, is increasingly preferred in developmental policies. In Arunachal Pradesh, a State of India having many features of backwardness and inherent challenges, many skill development initiatives are going on. The State is imparting such training mainly through different vocational and technical training institutes such as polytechnics, industrial training institutes etc. Apart from such institutes, government is also implementing different programmes like skill development initiative schemes, capacity building under BADP, loan and subsidy schemes. Many NGOs are also engaged in skilling the people in the State. The skill development initiatives in the State are of both long term and short term. The outcome of such initiatives has been recorded only for participants in the SDI scheme and it is found that a good number of them are employed. Thus, in the State skill development is going on and benefiting the people. However, concern authority may take care of issues like proper recording of data which is significant in evaluation of such initiatives and making those more effective and extensive. Further, it is found that some vocational training centre are sponsored by vocational training providers of other states revealing the absence of infrastructure for training in the State which is in conformity with Saini (2015). As per Saini (2015), the access to skill acquisition is uneven due to the absence of formal skill institutions across the country, especially in rural areas. Hence, there is scope for the concerned authority to focus in facilitating the required infrastructure within the State which will certainly enlarge the scope for the people and thereby participation therein.

Footnotes :

1. *Skill development in Arunachal Pradesh: A comprehensive study*, NEDFI, 2017

2. National Skill Development policy in 2009
3. https://en.wikipedia.org/wiki/North _ Eastern _ Regional _ Institute _ of _ Science _and _Technology
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5. Undergoing trainees are those that was participating during 2016-2017
6. Skill development in Arunachal Pradesh: A comprehensive study, NEDFI, 2017

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ABOUT THE BOOK

"Contemporary Issues of Development Policies of India' is a peer reviewed edited book published by the publication cell of IQAC, Dispur College, Guwahati Assam. The book is a collection of contributions by academician and scholars from different educational institutions of India. The contributors try to examine different issues like social, education, employment, agriculture, rural development, environment, marketing, skilled development and human development which are very important for the development of a country. It is hoped that the publication of the book will be able to draw the attention of those who are involved/ related in the socio-economic development of the country including students, researchers, economists, academicians, NGOs and planners for policy formulation.

The editor of the book, Dr. Himangshu Kalita is Assistant Professor in Economics at Dispur College, Guwahati, Assam with 20 years of experience in teaching in UG level in Arts, Commerce and Business Administration. He is specialized in Mathematical Economics and Rural Development and is responsible for educating the community by giving dedicated service. He has published number of research papers in edited books, conference volumes and attended number of national and international level seminars.

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