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ANUSANDHAN
A SCIENCE TECHNOLOGY & MANAGEMENT JOURNALOF RNTU

From the Desk of the Patron

Dear Friends

In this era of fast developing technology, the number of research papers written and their complexity are growing at an unprecedented speed. In last one year researchers, all over the world published, over 45 lakh research papers in which India's contribution was over 2.4 Lakh which stands third amongst 272 countries. Findings and results in these ever growing number of papers are the base on which further research depends. Researchers must wade through numerous papers to keep abreast of development in their field, which includes papers published within and outside the country. Researchers are also confronted with a deluge of data and complex findings to go through – the task that looks very difficult. AI, Deep Learning and Data Science have come as a boon for researchers. Even with an accurate mathematical model what researcher achieve, better results can be given by AI based system almost thousand times faster. Covid-19 vaccines developed by various labs used AI extensively which resulted in very speedy development. The power of the AI is going to be a game changer for research and it's application, more so in all experimental work and scientific research.

A large number of surveys have been done using AI to predict how AI is going to impact various sectors in achieving sustainable goals. It has been found that of the 169 targets set by UN for 17 sustainable goals, AI is **positively** impacting 134 targets (79%) and **negatively** impacting 59 targets (35%). Sectors coming under very high impact are Education, Energy, Poverty, Climate, Security, Defence etc where impact is to the tune of over 90%. Thought it has positive as well as negative impact, positivity is more which is a relieving sign. Use of Drones, which are AI based, has totally changed the war strategy. The information system and use and protection of data will be another area where AI will decide the winners.

Use of AI in scientific research is going to be very crucial for all kind of developments. A small AI development by **Open - AI** in 2018, when they released the first version of their flagship platform the Generative Pre- trained Transformer (GPT) – an AI based language model to understand and generate human like language, it created small ripples, but when in Nov 2022 they brought advanced model Chat GPT for dynamic and more intelligent response it has created almost a havoc and generated a big

discussion on ethics and values. By current rating, success rate of Chat GPT is 80%. This will keep improving as time passes. On one hand AI has brought revolutionary change in scientific research where data analysis and results can be worked much faster at unprecedented speed and achieve greater accuracy and efficiency, and on the other hand unrestricted use of power of AI can prove to be very dangerous. Schools in USA have already banned Chat GPT, as students started using it for their homework. AI has potential to help building scientific work/findings by using its power and at the same time its unethical use is going to be detrimental for scientific research. There is need to develop strategy and policy for use of AI based systems in scientific research. Also Higher Education Institutes who invest handsomely in developing good resources in terms of men, material and equipment and set up advanced labs in the area of AI i.e. labs for IoT, Data Science, Cloud Computing, Robotics, 3D Printing, Drone Technology, Sensors etc will be immensely benefited in the long run.

This issue of **ANUSANDHAN** comes on the Hindu New Year Vikram Sanvat 2080. We wish a very research full year for all our readers and contributors.

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In This Issue

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Return of Holistic Learning System – Ancient Indian Gurukul Style

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ABSTRACT
Quality of education is at the heart of National Education Policy -20 (NEP-20). This paper draws a parallel between objectives and guidelines of NEP-20 and ancient Indian gurukul type of learning system. There is a lot common in both systems. Development in technology and computing technique has now made it more convenient to implement good of both systems in words and spirit. Curriculum has to be made very dynamic with an effective feedback mechanism and continuous upgrading system with all the stake holder i.e. teacher, learner, industry, technology and society an integral of the system. The paper brings out various aspects which will help in effective change over.

Keywords: - Gurukul System, NEP-20, Multidisciplinary approach, experiential learning, critical thinking, Lifelong learning

I ANCIENT INDIAN LEARNING SYSTEM

Till the eleventh century, glory of ancient Indian learning system was at the peak, when universities like Nalanda, Taxshila and Vikramshila etc. used to attract scholars from all over the world. The entire education system those days was based on Gurukul system- a residential teaching-learning place where the learning system was student centric and holistic in nature. Four components of learning made the system holistic. These four components related to the mind, body, heart and soul of the learner. It was believed that learning is holistic only when all the four components get adequate education in right proportion.

(a) Mind - On the delivery side the curriculum was so designed that concept and theory of the subject taught, ignited and exercised the mind of the learner in order to make him/her understand and retain the knowledge. Critical thinking was integral part of the system.

(b) Body - The skill development, practical's and project work were part of the curriculum which implied application of theory and experimenting with the theoretical knowledge gained. It encouraged certain amount of research orientation also.

(c) Heart - Learning is incomplete unless there is food for the heart. For this, system ensured that curriculum had adequate amount of social connect, learning of value system, arts and culture which developed values and concern for humanity in the heart of the learner.

(d) Soul - It is said that character building is most essential part of any education. The curriculum those days ensured adequate amount of spiritual learning which directly affected the soul of the learner.

Continues learning, monitoring, evaluation and counselling for all the four components of learning was integral part of the system. Unfortunately, this beautiful system of learning was destroyed by various invaders successively for over eight centuries when they demolished our world class universities. Slowly holistic learning was replaced by rot learning which primarily exercised only one component i.e. mind and promoted only remembering and not critically thinking and analyzing. The skill development, social connect, values and character building took back seat in the new western kind of learning system.

II THE NEW NATIONAL EDUCATION POLICY-2020 (NEP-20)

The new education policy which emphasizes on holistic education could be a game changer and could bring back the glory of ancient Indian learning system. It focuses on brining idea of India, Indian languages and Indian system of learning back into the curriculum. This policy makes learning more effective and efficient by totally restructuring the system and redesigning the curriculum. Some essential ingredients promoted in the new policy to make learning effective and meaningful are noteworthy.

(a) Medium of Learning- NEP-20 encourage learning in mother tongue which is one of the key point, as undoubtedly man thinks best in his own language. With development of technology now getting the resources in own language in not a big issue.

(b) Critical Thinking & Experiential Learning- Rot learning and cramming is to be replaced by critical thinking and rational in learning. Experiential learning is important aspect where learning is to be extended to real life experience in terms of applying the knowledge in to practice.

(c) Skill Development- The most important aspect in learning is developing skill to apply the knowledge gained. It should be not only in the core field of learning but also in other fields of interest including the area which are close to learner's heart. In skill, body heart and soul in unison produce best result.

(d) N is equal to one- The best learning system is where in a group of learners one should be able to feel as if the curriculum has been designed keeping only his needs and ability in the mind. Outcome based learning, continuous assessment and monitoring are parts of this kind of learning environment.

(e) **Multi-Disciplinary Perspective-** NEP-20 makes it mandatory for all HEIs to be of multi-disciplinary in nature. So professional institutions will also have departments like department of arts, science, humanities and languages. This will not only help bring development in all disciplines but provide better resources for holistic learning.

(f) **Research Environment-** Academics and research are two faces of the same coin called effective learning. Learning becomes effective when research is integral part of education. NEP-20 encourages HEIs to build research environment and make research part of all forms of teaching learning system.

(g) **Character Building & Values-** Ultimately the essence of learning is in building character and developing value system in a learner, in addition to going knowledge and skill in core area of education. This was possible in ancient Indian education system with dedicated and experienced teachers and a dynamic curriculum and continuous monitoring and assessment system.

III LEARNING SYSTEM POST NEP-20

NEP-20 provides excellent platform and right direction for developing an effective learning system. It has all the ingredients of time tested learning system of ancient gurukul times.

(a) **The Curriculum-** The curriculum has to be developed in such a way that it provides adequate learning in all four components i.e. Mind, Body, Heart and Soul of the learner core knowledge & concept building relating primarily to mind, practical's, skill development and Physical education for body, social connect and connect with the cultural roots for the heart and character building and value system development for soul. For this curriculum has to be dynamic and continuously growing after reviews by a competent Board of Studies. It should give equal weightage to all four components in the syllabus and assessment.

(b) **Delivery System-** The medium of learning is best in mother tongue. There will be need to develop learning material in regional languages. With unprecedented growth of AI and computing technology, it is possible to provide online resources and facility to enhance the power of learning. Adequate use of technology, virtual plat forms and computing and simulation techniques need to be exploited.

(c) **Critical Thinking & Experiential Learning-** Learning becomes effective if it answers basically three questions- What, Why and How. What relates to observational part and provides ground for inquisitiveness and critical thinking. Why operational part and system is should provide adequate ground for learner to learn the concepts and reason out. How the analytical is part and should provide ground for experiential learning and research motivation. Learning system should encourage learners to get satisfying answers to all the three questions. Spoon feeding and stereotype readymade answer should be avoided.

(d) **Collaboration and Multidisciplinary learning-** Collaborative learning and going to other discipline to form a cohesive group for learning makes not only learning effective and interesting but provides great exposure to learner. Role of industries, foreign universities and corporates is quite important this new vision.

(e) **Happiness Index-** Learning becomes most effective when learner is happy and feels deep satisfaction by what he/she is learning. Learner should have option to take some electives to develop knowledge and skill in subject of his/her choice. This will improve performance in all other core subjects. An effective feedback system may help developing an effective system.

(f) **Assignment and Project based Learning-** Learning becomes effective if there are assignments and projects related to subjects being taught on a regular basis. Research becomes integrated part of such learning system.

(g) **Life Long Learning-** The curriculum should encourage both the teacher and the learner to continuously upgrade their knowledge and keep themselves abreast with development in the field. It should encourage them to go beyond the curriculum.

(h) **Extra-Curricular and Co-Curricular Activities & Value Addition-** Such activities provide exposure to the learner and build their confidence level. It develops spirit –de-corpus and develop leadership qualities.

IV CONCLUSION

The learning system becomes effective if all the ingredients discussed above are taken care in developing a curriculum. It becomes the responsibility of not only the teacher but also of the learner to make the teaching-learning system dynamic and futuristic by continuously contributing in updating and changing the system. Autonomy provided to institutions by NEP-20 and has redefined the role of regulatory bodies in making it convenient to implement new learning system effectively.

Following aspect need to be looked in to seriously to bring about the desired change

(a) An effective Board of Studies to continuously develop curriculum with the help of experts in industries corporate and social domain to include all ingredients of holistic learning.

(b) A continuous monitoring and assessment system on N = 1 philosophy with right system of counseling.

(c) Providing large number of options for learner to choose major and minor subjects in core and allied areas as well as skill and electives in areas of interest.
(d) Make research an integral part of tearing through Projects, Assignments, Visits; guest/expert talks value added courses, extracurricular/Co-Curricular activities with credits added for these.
(e) Character building and social connect as part of the curriculum in words and spirit.
(f) Collaboration with industries and other institutes in India and abroad to keep the learner abreast with outside world.

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Wastewater Treatment by Low Cost Technology

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ABSTRACT
Nowadays many water resources are polluted by anthropogenic sources including household and agricultural waste and industrial processes. Public concern over the environmental impact of wastewater pollution has increased. Several conventional wastewater treatment techniques, i.e. chemical coagulation, adsorption, activated sludge, have been applied to remove the pollution, however there are still some limitations, especially that of high operation costs. The use of aerobic waste water treatment as a reductive medium is receiving increased interest due to its low operation and maintenance costs. In addition, it is easy-to-obtain, with good effectiveness and ability for degrading contaminants. This paper reviews the use of waste water treatment technologies to remove contaminants from wastewater such as halogenated hydrocarbon compounds, heavy metals, dyes, pesticides, and herbicides, which represent the main pollutants in wastewater.

Key Words: Sewage Treatment, Technologies and domestic wastewater.

I INTRODUCTION

A supply of clean water is an essential requirement for the establishment and maintenance of diverse human activities. Water resources provide valuable food through aquatic life and irrigation for agriculture production. However, liquid and solid wastes produced by human settlements and industrial activities pollute most of the water sources throughout the world. Due to massive worldwide increases in the human population, water will become one of the scarcest resources in the 21st century (Day D., 1996). In the year 2015 the majority of the global population (over 5 billion) will live in urban environments (UN, 1997). By the year 2015, there will be 23 megacities with a population of over 10 million each, 18 of which will exist in the developing world (Black, 1994). Central to the urbanization phenomena are the problems associated with providing municipal services and water sector infrastructure, including the provision of both fresh water resources and sanitation services. Currently, providing housing, health care, social services, and access to basic human needs infrastructure, such as clean water and the disposal of effluent, presents major challenges to engineers, planners and politicians (Black, 1994; Giles and Brown, 1997).

As human numbers increase, greater strains will be placed on available resources and pose even greater threat to environmental sources. A report by the Secretary-General of the United Nations Commission on Sustainable Development (UNCSD, 1997) concluded that there is no sustainability in the current uses of fresh water by either developing or developed nations, and that worldwide, water usage has been growing at more than three times the world's population increase, consequently leading to widespread public health problems, limiting economic and agricultural development and adversely affecting a wide range of ecosystems. Although India occupies only 3.29 million km2 geographical area, which forms 2.4% of the world's land area, it supports over 15% of world's population. The population of India as of March 1, 2001 was 1,027,015,247 persons (Census, 2001).

India also has a livestock population of 500 million, which is about 20% of world's total livestock. However, total annual utilizable water resources of the country are 1086 km3 which is only 4% of world's water resources (Kumar et al., 2005).Total annual utilizable resources of surface water and ground water are 690 and 396 km^3, respectively (Ministry of Water Resources, 1999). Consequent to rapid growth in population and increasing water demand, stress on water resources in India is increasing and per capita water availability is reducing day by day. In India per capita surface water availability in the years 1991 and 2001 were 2300 m3 (6.3 m3/day) and 1980 m3 (5.7 m3/day) respectively and these are projected to reduce to 1401 and 1191 m by the years 2025 and 2050, respectively (Kumar et al., 2005). Total water requirement of the country in 2050 is estimated to be 1450 km3 which is higher than the current availability of 1086 km3. Much of the wastes of civilization enter water bodies through the discharge of waterborne waste from domestic, industrial and non-point sources carrying unwanted and unrecovered substances (Welch, 1992).

Although the collection of wastewater dates back to ancient times, its treatment is a relatively recent development dating from the late 1800s and early 1900s (Chow et al., 1972). Modern knowledge of the need for sanitation and treatment of polluted waters however, started with the frequently cited case of John Snow in 1855, in which he proved that a cholera outbreak in London was due to sewage contaminated water obtained from the Thames River (Cooper, 2001). In developed nations, treatment and discharge systems can sharply differ between countries and between rural and urban users, with respect to urban high income and urban low-income users (Doorn et al., 2006). The most common wastewater treatment methods in developed countries are centralized aerobic wastewater treatment plants and lagoons for both domestic and industrial wastewater.

The degrees of wastewater treatment vary in most developing countries. Domestic wastewater may be treated in centralized plants, pit latrines, septic systems or disposed of in unmanaged lagoons or waterways, via open or closed sewers (UNEP, 2002). In some cases industrial wastewater is discharged directly into water bodies, while major industrial facilities may have comprehensive inplant treatment (Carter et al., 1999; Doorn et al., 2006). Modern civilization, armed with rapidly advancing technology and fast growing economic system is under increasing threat from its own activities causing water pollution, (Singh et al. (1989). India is the seventh largest country in the world with a total landmass of 3.29 million sq. km, population over 1 billion, 29% of which live in urban areas spread over 5162 towns. With enormous natural resources and growing economy India is the second largest pool of technical and scientific personnel in the world. Pollution from small size industries (SSIs) puts the Indian regulators in front of a difficult arbitrage between economic development and environmental sustainability.

The uncontrolled growth in urban areas has made planning and expansion of water and sewage systems very difficult and expensive (Looker, 1998).

Aerobic activated sludge reactors have been used on a limited scale as bio-scrubbers for the treatment of odorous air (Bowker, 2000). Despite numerous positive reports from full scale applications in North America, little data are available on the actual performance of these systems with wide ranging concerns on reduction of settling efficiency due to changes in filamentous organisms and bacterial flocks (Burgess et al. 2001). These concerns are alleviated in MBRs where gravitational settling of the microbial solution is replaced by physical filtration. Also, the diffusion and bioconversion of odorous gases are a function of contact time, bubble size, and reactor configuration (Burgess et al. 2001). Submerged MBRs incorporate the membrane unit within the bioreactor and rely on gas and liquid scouring to clean the membrane surface. Since modern livestock operations are equipped with blowers and ventilation systems, booster fans could be added to increase outflow pressure. This concept was explored in past research efforts when biofilter beds (compost and wood chips) were tested for odour removal (Mann et al. 2002).

II STATUS OF WASTEWATER IN INDIA

The total wastewater generated by 299 class-1 cities is 16,652.5 MLD. Out of this, about 59% is generated by 23 metro cities. The state of Maharashtra alone contributes about 23%, while the Ganga river basin contributes about 31% of the total wastewater generated in class-1 cities. Only 72% of the total treated wastewater generated is collected. Out of 299 class-1 cities, 160 cities have sewerage system for more than 75 percent of population and 92 cities have more than 50 percent of population coverage. On the whole 70% of total population of class-1 cities is provided with sewerage facility, compared to 48% in 1988. The type of sewerage system is either open or closed or piped. The main objective of this study was to perform a review of the treatment of domestic sewage using the aerobic sludge to ensure effective discharge and/or re- use/recycling.

III WASTEWATER TREATMENT IN INDIA

Out of 16,662.5 MLD of wastewater generated, only 4037.2 mld (24 %) is treated before release, the rest (i.e. 12,626.30 MLD) is disposed of untreated. Twenty-seven cities have only primary treatment facilities and only forty-nine have primary and secondary treatment facilities.

(a) Need of sewage treatment: Wastewater treatment involves breakdown of complex organic compounds in the wastewater into simpler compounds that are stable and nuisance-free, either physico-chemically and/or by using micro-organisms (biological treatment). The adverse environmental impact of allowing untreated wastewater to be discharged in groundwater or surface water bodies and or lands are as follows:

(i) The decomposition of the organic materials contained in wastewater can lead to the production of large quantities of malodorous gases.

(ii) Untreated wastewater (sewage) containing a large amount of organic matter, if discharged into a river / stream, will consume the dissolved oxygen for satisfying the Biochemical Oxygen Demand (BOD) of wastewater and thus deplete the dissolved oxygen of the stream, thereby causing fish kills and other undesirable effects.

(iii) Wastewater may also contain nutrients, which can stimulate the growth of aquatic plants and algal blooms, thus leading to eutrophication of the lakes and streams.

(iv) Untreated wastewater usually contains numerous pathogenic, or disease causing microorganisms and toxic compounds, that

dwell in the human intestinal tract or may be present in certain industrial waste. These may contaminate the land or the water body, where such sewage is disposed.

For the above-mentioned reasons the treatment and disposal of wastewater, is not only desirable but also necessary.

IV INDUSTRIAL, MUNICIPAL AND DOMESTIC REUSE OF WASTEWATER

Municipal uses of treated wastewater include the irrigation of road plantings, parks, playgrounds, golf courses and toilet flushing etc. (Bouwer, 1993). Industrial reuses of wastewater include cooling systems, agricultural uses (irrigation and aquaculture), the food processing industry and other highrate water uses (Bouwer, 1993b; Khouri *et al.* 1994; Asano and Levine, 1996). In Middle Eastern countries, where water is scarce, dual istribution systems will, in the near future, provide high quality, treated effluents for toilet flushing to hotels, office buildings, etc. (Shelef and Azov, 1996). In India, wastewater is currently being used for irrigation, gardening, flushing, cooling of air conditioning systems, as a feed for boilers, and as process water for industries (Chawathe and Kantawala, 1987). In China, national policy has been developed that promotes the development ofwater-efficient technologies, and encourages the reuse of reclaimed municipal wastewater in agriculture first, and then for industrial and municipal uses (Zhongxiang and Yi, 1991).

V CONCLUSION

This report is a review of variety of options that may be employed in the treatment, recovery and reuse of wastewater. It is apparent that a variety of options are feasible for use in the developing world and even more apparent that many low-technology options can be mixed and matched for very high efficiencies. Natural treatment technologies are attracting a significant level of interest by environmental managers. Natural treatment technologies are considered viable because of their low capital costs, their ease of maintenance, their potentially longer life-cycles and their ability to recover a variety of resources including: treated effluent for irrigation, organic humus for soil amendment and energy in the form of biogas. This report examined emergent issues and technological options related to the scale of collection and treatment systems. There is increasing

Momentum developing behind the notion that recycling loops, from point of generation (*e.g.*, the household) to point of treatment and reuse must be shortened.

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Composite Air Quality Index Assessment for Bilaspur District (Chhattisgarh)

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ABSTRACT
The current study's objective is to evaluate the district of Bilaspur's ambient air quality. The data collected has been calculated to determine the Air Quality Index (AQI) on a five-point scale for quantifying air pollution. This index is based on measuring parameters like sulphur dioxide (SO2), nitrogen dioxide (NO2), respirable suspended particulate matter (PM10), and total suspended particulate matter (TSPM) at designated locations such as residential areas, marketable areas, and business crossings. The status of the air quality has been estimated at each point, as shown by the air quality scale. According to the study, marketable regions and commercial crossings have the highest air quality indicator values, while domestic areas have the lowest levels.

Keywords: Ambient air - Bilaspur, SO2, NO2, particle matter

I INTRODUCTION

With an expanded speed of industrialization particularly in creating nations, environmental issues have gotten worse as well. In parallel, there has been a rapid surge in air pollution sources due to population growth, lucrative development, and more transportation options. The advancement of air pollutants including SPM, SO2, NOx, and other organic and inorganic pollutants, as well as their detrimental effects on human and environmental health, are caused by vehicular emigration (Kaushik, Ravindra, Yadav, Mehta and Haritash, 2006). Because of the negative effects on ambient air quality, the continuous emigration of adulterants from the automotive industry is a source of concern. A key factor in determining health is air quality. The negative effects on health brought on by air pollution may include breathing difficulties, gasping, coughing, and a worsening of existing respiratory and heart diseases. As a result, it's crucial to consider an area's Air Quality Index (AQI). The ambient air pollution measured at monitoring sites on a specific time period is reported using the AQI standing scale. Since AQI takes into account the accretive effect of several debasements, the general medium air nature or air quality of a designated region can be assessed more effectively. The main goals of AQI are to implement necessary non super visional measures and to educate the public about the dangers of exposure to polluted circumstances. In India, a few studies were conducted to determine the Air Quality Index in order to understand the people's health and pollution levels (Mohan and Kandya, ; Bhaskar and Mehta, 2010; Mamta and Bassin, 2010; Sarkar and Srivastava, 2010; Panda and Panda, 2012). The air pollution problem is getting worse every day in Chattishgarh as well. The primary source of air pollution in the megacity of Bilaspur is the motor vehicle industry because the number of cars keeps growing (Sharma and Raina, 2012). In Bilaspur, Chattishgarh, there are about 9 lakh vehicles on the road, making it conceivably the state with the highest vehicle population in the nation. There have been a veritable plethora of research on ambient air pollution that have been recognised to determine the AQI of various areas in Chattishgarh. However, no systematic investigations have been conducted for lower municipalities, notably in hilly areas like Bilaspur City, a known crossroads and the starting point of Mahamaya Devi Ratanpur. Construction and demolition to provide better structures for tourists is an increasing tendency in Bilaspur, a religiously and economically significant city of Chattisgarh (22.0797° N, 82.1409° E, 207 feet). Due to the steady rise in tourists, there are also an increasing number of automobiles and other pollution-producing sources. The city confirms the daily influx of tens of thousands of pilgrims (Navratri Festival). In 2012, more stores, hospices, cafes, and other businesses were added to Bilaspur's burgeoning demand.

II OBJECTIVE AND METHODOLOGY

(a) Objective-

(i) To measure AQI at different crowded place in Bilaspur and develop a composite Air Quality Profile

(ii) To compare AQI levels of Residential and Commercial areas

(b) Methodology

(i) Identification of Nine locations (three residential, three marketable, and three business crossings)

(ii) The data collection and dimension of the air quality indicator following an extensive review of the city.

Fig. 1: Satellite picture of study region.

(iii) Periodiaty of the slice performance once a year, utilising a gassy slice attachment and an Envirotech High Volume Respirable Dust sample APM 460 BL.

III ANALYSIS

Particulate matter (APM 411). Nitrogen dioxide (NO2) was analysed using the Jacob and Hochheiser system, IS 5182, part VI; particulate matter (RSPM and NRSPM) was analysed using the gravimetric system, IS 5182, part IV; and sulphur dioxide (SO2) was analysed using the Adjusted West and Gaeke Technique or method, IS 5182, part II. Casting up the two has been used to determine TSPM attentiveness. The Tiwari and Ali, 1987 technique was used to construct the Air Quality Index (AQI). Each contaminant's air quality score was first determined for AQI using the following formula:

Q = 100 x V/Vs
Where
Q = Quality rating
V = Noticed worth of boundary
Vs = Standard worth suggested for the boundary
On the off chance that 'n' quantities of boundaries are thought of, AQI is the Mathematical mean (GM) of all the 'n' number of value appraisals.

IV OUTCOME AND CONVERSATION

The following tables show the results that were achieved. Table 1 displays the benefits of the Air Quality Record as assessed from data obtained for the local air quality of Bilaspur town at nine locations between July 2010 and June 2011. The equivalent is graphically depicted in Figure 2. The analysis of the data showed that at all of the selected locations, the concentrations of SO2 and NO2 were within the permissible outer limits of the Public Surrounding Air Quality Guidelines (NAAQS) established by CPCB, while the concentrations of RSPM and TSPM were above the permissible outer limits at the majority of the locations.

The AQI scale was separated into five classifications, every class depicts the scope of air quality and its related potential wellbeing impacts. The file utilizes wellbeing based portrayals to give significant data to general society.

The five levels of AQI are depicted in Table 2. During the evaluation period, the Air Quality Record values varied by at least 19.52 to a maximum of 56.58. According to the AQI theory, it was observed that local sites had lower AQI values whereas business districts and traffic intersections had higher contamination levels. Sites VII and VIII had the highest AQI, whereas site II had the lowest. All three commercial locations (sites V and VI) and one traffic crossing (site IX) have light-detected air contamination. Sites VII (Transport Stand) and site VIII (Railline Street) were found to be just mildly contaminated whereas every single private location (sites I, II, and III) is in the clean class, as seen in table 1. Thus, when compared with the other nine destinations, two traffic crossings all displayed a similarly higher contamination level. This could be attributed to how these two locations handle the busy traffic junctions in the community.

Table 1
AQI and AAQ class at chosen destinations during the review time frame

site	(AIR QUALITY INDEX) AQI	(AMBIENT AIR QUALITY) CLASS AAQ
A.Residential Areas		
1. Nehru Nagar	24.28	CA - CLEAN AIR
2. Rajkishore Nagar	18.42	CA - CLEAN AIR
3. Vashali Nagar	21.28	CA - CLEAN AIR
B. Commercial Area		
4. Gol Bazar	36.04	LAP - LIGHT AIR POLLUTION
5. CIMS Hospital Road	33.60	LAP - LIGHT AIR POLLUTION
6. Vyapar Vihar	31.13	LAP - LIGHT AIR POLLUTION
C. Travel Crossings		
7. Bus Stand	41.23	LAP - LIGHT AIR POLLUTION
8. Railway Station Road	55.57	MAP - MODERATE AIR POLLUTION
9. Tarbahar	38.02	LAP - LIGHT AIR POLLUTION

Table 2
score scale of AQI values

S.No.	key Value	comments
1	0-24	CA - CLEAN AIR
2	25-51	LAP - LIGHT AIR POLLUTION
3	52-76	MAP - MODERATE AIR POLLUTION
4	77-99	HEAVY AIR POLLUTION - HAP
5	Above 100	SEVERE AIR POLLUTION - SAP

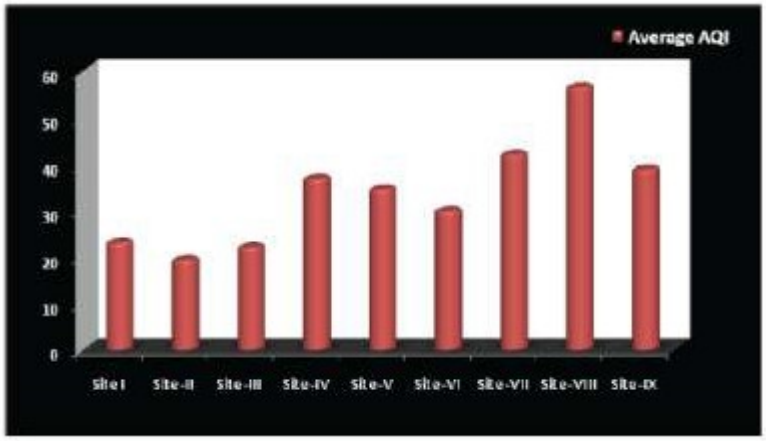

Fig. 2: standard AQI of selected site from July 2020 to June 2021

Cyclic difference of AQI

Table 3 shows the AQI trends in the four seasons (wintry weather, summer, monsoon weather and post-monsoon weather) from July 2020-June 2021.

Table 3
Cyclic difference of AQI of pollutant in dissimilar types of area

site	season			
	wintry weather	**Summer**	**Monsoon**	**Post-Monsoon**
A.Residential Areas				
1. Nehru Nagar	27.65	21.50	17.36	25.48
2. Rajkishore Nagar	22.26	16.04	15.35	26.44
3. Vashali Nagar	24.53	22.24	16.30	27.06
B. Commercial Areas				
4. Gol Bazar	42.40	36.52	32.78	38.73
5. CIMS Hospital Road	41.23	33.47	26.82	41.05
6. Vyapar Vihar	36.98	26.56	25.97	32.51
C. Traffic Crossings				
7. Bus Stand	43.07	38.73	32.51	53.47
8. Railway Road	66.05	56.97	44.12	61.64
9. Tarbahar	47.85	35.02	27.92	47.66

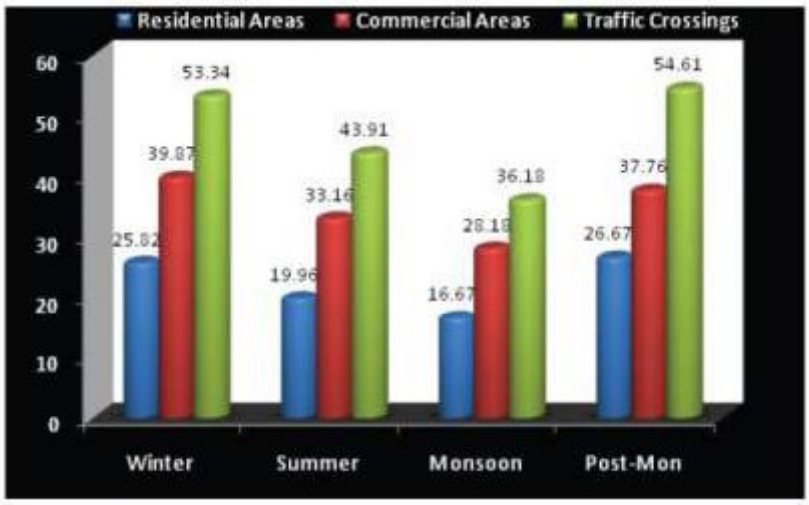

Fig. 3: cyclic middling of AQI in dissimilar area during the study phase.

Every location had the best air quality during storm or monsoon season, while six locations had the worst during the winter and three locations had the worst air quality at all during the post-storm season. Because of the large amounts of precipitation that led to the removal of poisons and subsequent cleaning of the air, the rainstorm season had the finest air quality. Wintertime's notoriously bad air quality may be attributed to calm meteorological conditions and hence less pollution dispersing. Additionally, compared to other seasons, the winter season in this area experienced significantly less precipitation. Additionally, Mohan and Kandya (2007) noted that the greatest seasons are storm season and winter season is the most over the top horrible in regards to air quality.

V CONCLUSION

From the review, it has been closed the convergence of SO2 also, NO2 has been seen to be well inside as far as possible though the convergence of together RSPM (PM10) and TSPM have cross the discontinue points the larger part of the period. The noticed AQI values in concentrate on region relate to sparkling or clean space air in neighborhoods to glow or light space air contamination in business regions and modest contamination at solitary of the traffic intersections. Occasionally, finest air qualities have been seen in rainstorm period and most terrible in wintry weather season followed by post-storm.

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Study of Control of High Frequency over Voltage Standing Wave Ratio

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ABSTRACT

After World War-II, the microwave engineering and technology have been developed a lot and opened several tremendous dimensions and scopes for the advancement in the field of Defence, microwave & Digital Communications, Satellite Communication, Computer & Information technologies. Microwave is an important component of Medical Science, Industrial and Defence growth of the country. For fast working of weapons, Defence needs Radar, Missiles and many other areas like Microwave Antenna, Microwave Ovens, Microwave Cellular Phones and Remote Sensing etc. All such activities are being pushed at a great speed. With the growth of Microwave Integrated Circuits (MICs) new technique has been developed with the emergence of computer science, engineering and technology with the recent advances in microwave communication system. High frequency signals can be sent to any corner of the universe. With the growth of digital communication our country moving very fast, new techniques are being designed where high frequency signal can be employed to control the propagation of waves through planar transmission line technology such as stripline, microstripline, coplanar waveguides and their variants. The most useful structure is micro stripline where metal strip conductor is separated from a ground plane by a layer of dielectric substrate. It is useful to convey high frequency signal of giga hertz range. It is also useful in high-speed digital printed circuit board designs. When two microstripline structures are placed parallel to each other in close proximity, a natural coupling exists between them forming a microstripline coupler. The characteristic impedance, propagation constant and coupling coefficients are the important characteristic parameters of this structure which are useful for the study of Directivity of the coupler, Reflection coefficient and Voltage Standing Wave Ratio (VSWR). The flow of energy in these two lines in the same direction constitutes even-mode and odd-mode when flow is in opposite direction. These parameters of the coupler are the functions of geometry of the structure and operating frequency. The incident and reflected parts of the waves form the Standing Waves having several maxima and minima. The ratio of maximum voltage to the minimum voltage constitutes the VSWR. The VSWR is related with characteristic impedance and reflection coefficients for even and odd-modes of wave propagation. These parameters of the coupler are the functions of geometry of the structure and frequency of the signal. The present paper aims at the study of VSWR and frequency control over it. The frequency of the signal plays significant role in the design of the directional coupler, Filters, resonators etc in the Giga Hertz range of frequency.

Keywords: MIC's, Characteristic Impedance, Phase velocity, Reflection coefficient, VSWR etc.

I INTRODUCTION

The Microwave Integrated Circuits (MIC's) have changed the large-scale transmission structures to a small, lightweight and cheap assembly with introduction of stripline and microstripline. The two parallel wire transmission lines are the simplest structure for microwave signals but these are very much loss in giga hertz range of frequency. To minimize the losses, to reduce the size & cost new technology known as planar transmission line technology has been developed with the advent of MIC's. There are various transmission structures which have been designed by different pioneers of this field suitable for Giga Hertz range of frequency such as stripline and microstripline. The microstripline is an open structure and modified version of stripline structure. It consists of a strip conductor patched on dielectric substrate supported by a conducting plate which serves as a ground plane.

When two microstriplines are placed together in close proximity, natural coupling exits between them forming the microstripline coupler as shown in figure-1. The field configurations for even and odd-modes are shown in figures-2 a & b. When the transmission structure is not terminated with characteristic impedance wave travelling through the structure gets reflected back and combines with incident wave to form standing wave. VSWR is the ratio of maximum voltage to the minimum voltage. It determines the efficiency of a signa from a power source and transmitted through the structure to the load. Present paper deals with the VSWR of microstripline coupler and its variation with geometry and frequency of the signal.

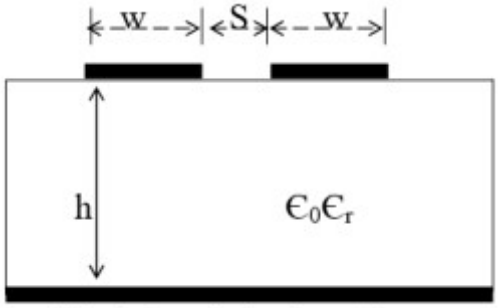


Fig-1 Coupled microstrip

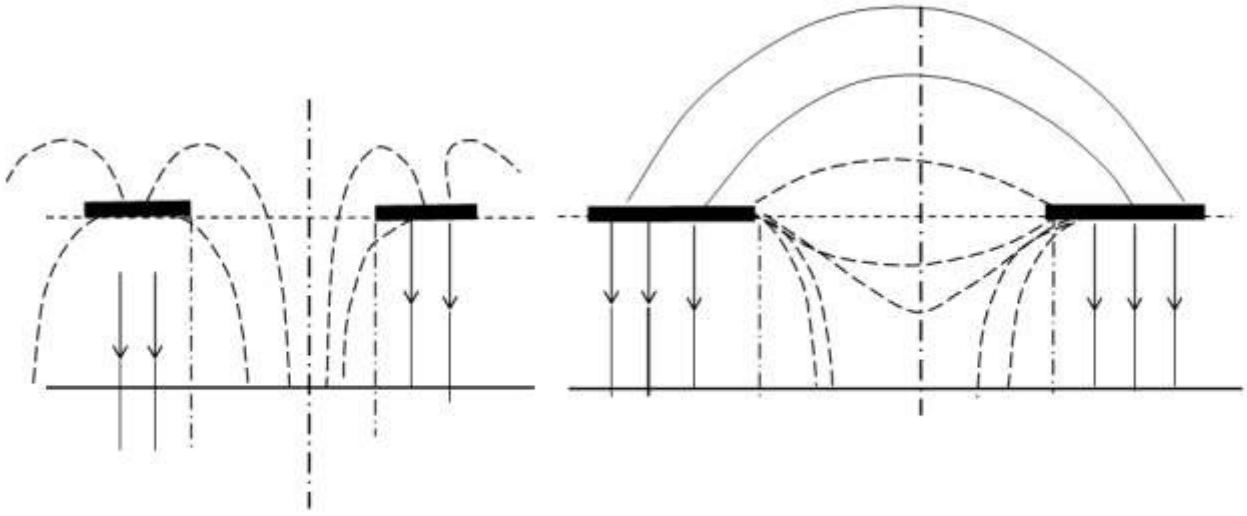


Fig-2 a. The Even-mode forward coupling Fig-2 b. The odd mode reverse coupling

II CHARACTERISTIC IMPEDANCE FOR EVEN AND ODD MODES OF PROPAGATION THROUGH COUPLED MICROSTRIPLINE

The characteristic impedance of coupled microstriplines can be described in terms of geometry of the conductor strips, geometry of dielectric substrates and its constants and spacing between two strips for both even and odd-mode of wave propagation. The even-mode characteristic impedance (Z_{oe}) is the impedance measured from one strip to ground where the strips are at the same potential and have equal currents in the same direction and expressed as

$$Z_{oe} = (30\pi/\sqrt{\epsilon}) \cdot \{K.K'_e / KK_e\} \text{ ohms} \quad \text{---------- 1}$$

Where K is a complete elliptic integral of the first kind and

$$K_e = \tan h(\pi w / 2h).\ \tan h\{(\pi/2).((w+s)/h)\}$$

$$K'_e = \sqrt{(1 - K_e^2)}$$

Where, ϵ is the dielectric constant, w is the conductor strip width, h is the height of the substrate and s is the spacing between two strips as shown in figure-1.

The odd mode characteristic impedance (Z_{oo}) is defined as impedance from each strip to ground when the strip–potentials are opposite and the currents are in opposite directions and expressed as

$$Z_{oo} = (30\pi/\sqrt{\epsilon}) \cdot \{K.K'_o / KK_o\} \quad \text{---------- 2}$$

Where

$$K_o = \tan h(\pi w / 2h).\ \cot h\{(\pi/2).((w+s)/h)\}$$

$$K'_o = \sqrt{(1 - K_o^2)}$$

These relations show that the characteristic impedances will be different for each mode and that the even- mode will always be higher. Because of the difficulty of evaluating the complete elliptic integrals, it is frequently desirable to express Z_{oe} and Z_{oo} in terms of the fringing capacities, which is applicable for the zero thickness strips. The characteristic impedance for even-mode propagation is

$$Z_{oe} = (94.15 / (\sqrt{\epsilon} [w / h) + (\epsilon/2) (C'_f(o) + C'_{fe}(o).(s/h)] \text{ ohms} \quad \text{----- 3}$$

and the characteristic Impedance for odd-mode propagation is

$$Z_{oo} = (94.15 / (\sqrt{\epsilon} [w /2 h) + (\epsilon/2) (C'_f(o) + C'_{fo}(o).(s/h)] \text{ ohms} \quad \text{---- 4}$$

This will hold good accuracy where w/h is greater than or equal to 0.35. Where,

$C'_f(0) / \epsilon = (2/\pi) \log_e 2 = 0.4407$

$C'_{fe}(0,s/h)/\epsilon = (2/\pi) \log_e(1 + \tan h (\pi s/2h))$

$C'_{fo}(0,s/h)/\epsilon = (2/\pi) \log_e(1 + \cot h (\pi s/2h))$

III VOLTAGE STANDING WAVE RATIO (VSWR) OF A MICROSTRIPLINE COUPLER

The SWR is designated by "S" & It is expressed as

S = Maximum voltage or current / Minimum voltage or current

$$= \frac{V_{max}}{V_{min}}$$

$$= \frac{I_{max}}{I_{min}} \quad \text{---------- 5}$$

As the standing wave is formed by superposition of incident and reflected parts of wave, which is not accepted by the load. VSWR (S) is also defined in terms of reflection coefficient (ρ) by the relation.

$$S = \frac{1+ \rho}{1 - \rho} \quad \text{---------- 6}$$

If ρ_e stands for reflection coefficient for even-mode and Z_o is the characteristic impedance of the single microstripline[6], then

$$\rho_e = \frac{Z_{oe} - Z_o}{Z_{oe} + Z_o}$$

Similarly, For odd-mode of propagation of wave, the reflection coefficient is defined as the

$$\rho_o = \frac{Z_{oo} - Z_o}{Z_{oo} + Z_o}$$

Using above equations, VSWR is expressed both for even & odd-mode as

$$S_e = 1 + \frac{\rho_e}{1 - \rho_e}$$

$$= [1 + \{(Z_{oe} - Z_o) / (Z_{oe} + Z_o)\}] / [1- \{(Z_{oe} - Z_o) / (Z_{oe} + Z_o)\}] \quad \text{---------- 7}$$

And, $S_o = 1 + \rho_o \{ 1 - \rho_o \}$

$$= [1 + \{Z_{oo} - Z_o / Z_{oo} + Z_o\}] / [1- \{Z_{oo} - Z_o / Z_{oo} + Z_o\}] \quad \text{---------- 8}$$

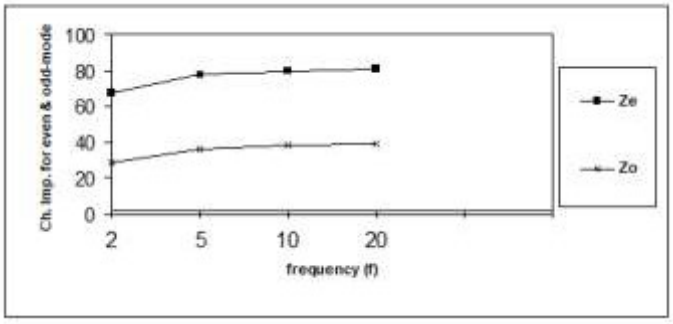
As it is evident, the VSWR must be the function of stripwidth, separation between two microstripline and the frequency of the signal which will be studied in the subsequent sections:

(i) Study of variation of even and odd mode characteristic impedances with frequency

(ii) Study of variation of even and odd mode VSWR with frequency

IV STUDY OF VARIATION OF EVEN AND ODD MODE CHARACTERISTIC IMPEDANCES WITH FREQUENCY

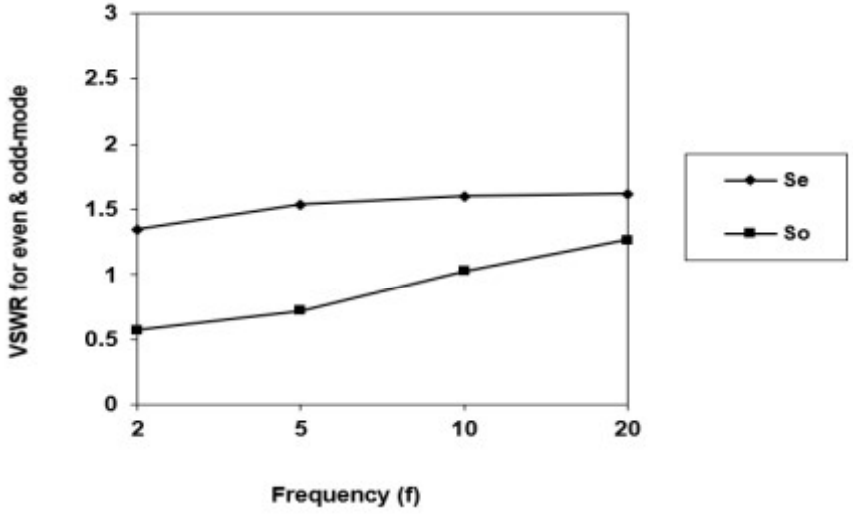
Computational works for the characteristic impedances have been carried out for different frequencies keeping strip width and spacing between two strips fixed. The even and odd-mode characteristic impedances have been obtained. Keeping frequency on x-axis and characteristic impedances on y-axis graph has been plotted as shown in graph-1. It is evident that both the impedances show increasing trend with increase of frequency for a given strip width and spacing. The even mode characteristic impedance is ever higher than the odd mode. This shows that flow of energy is smaller for even more than that in odd mode of wave propagation.



Graph-1: Variation of even and odd-modes characteristic impedances with frequency
(w=200 mils, h = 200 mils, t = 0.01mils, ϵ_r = 9.6, s = 20mils)

V STUDY OF CONTROL OF FREQUENCY OVER VSWR

For study of control of frequency over VSWR various calculations have been carried out. Keeping strip width, spacing between two strips and height of the substrate fixed characteristic impedances for even and odd-modes have been obtained for different operating frequencies. From these data VSWR have been computed for even and odd-modes of propagation.



Graph 2: VSWR with frequency
(h =100 mils, w = 20 mils, t = 0.01mils, s = 200 mils, ϵ_r = 9.6)

The results obtained have been plotted keeping frequency along x-axis and VSWR for even and odd-mode along y-axis as shown in graph-2. From such study it is clear that VSWR for both even and odd-modes increases with increase of frequency. The graph also shows that even mode VSWR is higher than that of odd mode.

VI DISCUSSION AND CONCLUSION

From the study of VSWR it is clear that the two traveling waves components add in phase in case of forward coupling and subtract in case of reverse coupling. VSWR is the ratio of maximum voltage to the minimum voltage. It is also expressed in terms of reflection coefficients for even and odd mode wave propagation. The distance between two successive maxima or minima is $\lambda/2$. VSWR denotes what amount of the incident wave gets reflected back If the VSWR is unity, it means no reflection of the wave occurs. Since the reflection coefficient is less than unity, so VSWR is a positive real number & should be greater than unity. From the results obtained above the VSWR for even-mode is actually practical value. If the reflection coefficient tends to zero, total incident wave energy gets absorbed and VSWR tends to unity. When reflection coefficient tends to unity, VSWR tends to infinity. High value of VSWR is always undesirable, because it results in the reduction of maximum power that can be transmitted through the transmission structure. The negative value of reflection coefficient shows the reflected wave with reverse polarity. Higher VSWR depicts a larger mismatch between the source and load impedances. So, for practical designs lower value of

VSWR is ever desirable. This can be done only by the frequency control. Thus, study of VSWR is very much useful for designing the coupled transmission structure. This will be further useful for determining the condition for impedance matching & obtaining the maximum power from the coupled microstripline structure.

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Investigation and Analyzing of Physico-Chemical Boundaries of Various Pond Water of Bilaspur District, Chhattisgarh, India

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ABSTRACT
This exploration composition deals with the study of quality of pond water. We were collect Pond water samples from 22 villages of District of Bilaspur, Chhattisgarh (India) in triplet. Samples were anatomized for physico- chemical parameters including pH, electrical conductivity (EC), total dissolved solids(TDS), temperature, saltiness and dissolved oxygen(DO). pH ranged from6.50 –9.69, Electrical Conductivity ranged from118.7 –206.6 µmhos/ cm, TDS ranged from165.5 –254.8 ppm, Temperature ranged from20.9 –33.8 °C, saltiness ranged from5.1 –6.9 ppt, Dissolved oxygen ranged from2.41 –4.8 mg/l. Correlation measure(r) was set up significant at p<0.05 position for the tasted parameters. The result of the proposed study will establish some data about the use of water for colorful purposes like domestic and husbandry.

Keywords: physico-chemical parameters; pH; EC; TDS; DO. Pond water

I INTRODUCTION

Water is the most necessary element for the living being. Life on the earth is no way possible without water. Water is one of the most vital elements of the mortal surroundings. It's being used for numerous purposes e.g., artificial water force, irrigation, drinking, propagation of fish and other submarine systems and generation of hydro- power shops. Water is the main source of energy and governs the elaboration on the earth. 71 of earth face is covered by water(CIA, 2008),96.5 of the world's water is ocean water which is salty that isn't to be directly useful for irrigation, drinking, domestic and artificial purposes.1.7 in groundwater,1.7 in glaciers and the ice caps. lower than 1 water is present in ponds, lakes, gutters, heads,etc., which is used by man for Industrial, domestic and agrarian purposes. According to an estimate about 70 of all the available water in our country is defiled due to the discharge of backwaters from the diligence, domestic waste, land and agrarian drainage (Shrivastava and Kanungo, 2013). Chemicals are a major source of water impurity that introduced during water movement through geological accoutrements (Kataria etal., 2011). Diseases and fungicides are major contributors to water pollution. Riding of jewels, filtering of soils and mining processing, etc., these are contaminate natural water(Manjare etal., 2010). In the ecosystem water is considered to be the most important element for the life but day by day the quality of water come demoralized. There are several factors which are responsible for deterioration of water bodies similar as increased mortal population, industrialization, use of redundant diseases in the husbandry and other man- made conditioning etc. There are several conditions have been linked among the mortal beings, which are caused by using polluted water. Water born complaint infections do during washing, bathing and consumption of polluted water during food medications. thus it's necessary that the quality of water should be checked at regular time of interval because the fiscal losses due to water born conditions have negative impact on the nation. Currently this is the major problem of developing countries throughout the world. The main end of the present study was to give an idea about the pollution position of pond water in terms of physico- chemical characteristics. There's no information is available in relation to physicochemical characteristics of pond water at Bilaspur. Many experimenters(Kiran, 2010; Raut etal., 2011; Naik etal., 2012; Bahekar and There, 2013; Mahajan and Tank, 2013) in different regions of India have been studied the physico- chemical parameters of the colorful water bodies.

II MATERIALS AND METHODS

(a) Area of Study - This examination was completed to assess the situation with the pond/lake water in Bilaspur region. Bilaspur locale is arranged between 210 47' to 230 8' North Scope promotion 810 14'to 830 15'. East Longitude (Fig. 1). These Pond/lakes water is utilized for agribusiness, fisheries and to some extent homegrown exercises. The current review was conducted to analyze physico-substance/chemical properties of water in the time of one year from Dec 2020 to Dec 2021.

(b) Collection of Sample - Water Samples from the pond of twenty seven named townlets of Bilaspur district were collected during Dec 2020 to Dec 2021. The pond Water samples were collected in bottles. All the preventives were taken during the slice. The collected water samples were anatomized for different physico- chemical parameters similar as for pH, electrical conductivity, total dissolved solid, temperature, saltness and dissolved oxygen by following the standard protocols(Table 1). All the below analyses were performed in triplet.

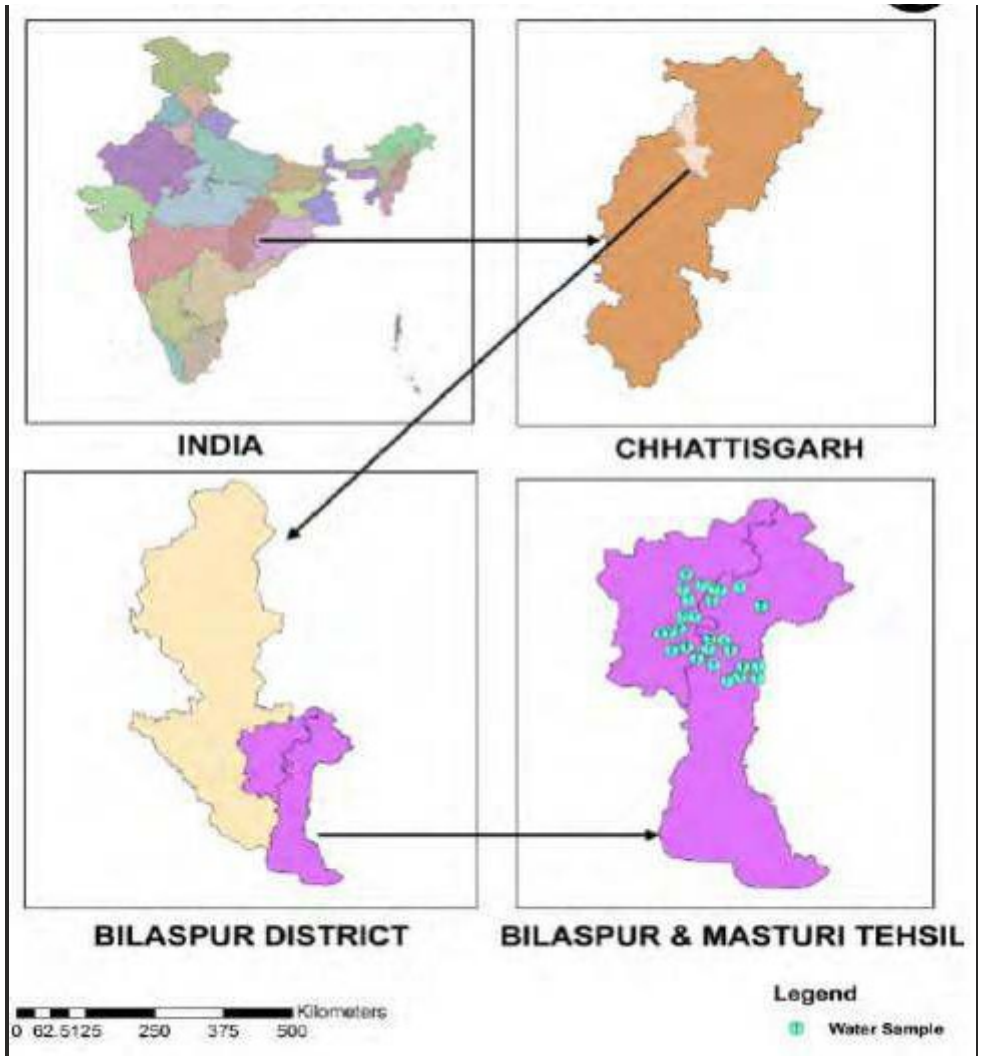

Fig. 1 :-Map of Water Sampling Locations

Table 1
Methods followed for analysis of water samples

S.No	Water quality Parameters	Method of Analysis
1.	pH	pH meter
2.	Electrical conductivity	Conductivity meter
3.	Total dissolved solid	Water and Soil analysis kit Model no 161
4.	Temperature	Thermometer
5.	Saltness	Refractometer
6.	Dissolved oxygen	Wrinkler's method

III RESULTS AND DISCUSSION

The variation in physicochemical parameters of pond water of twenty seven townlets presented in Table 2 and correlation portions among physico- chemical characteristics were shown in Table 3.

(a) pH - The pH (Potentia Hydrogeni) of a result refers to its hydrogen ion exertion and is expressed as the logarithm of the complementary of the hydrogen ion exertion at a given temperature. pH is measured in scales of 0 to 15. A pH value of 7 is neutral; a pH lower than 7 is acidic and lesser than 7 represents base achromatism or alkalinity. From the below trial, it was observed that among the 30 villages,

water analysis was carried out; pH ranged from6.50 –9.69, Maximum pH was recorded in Mohara vill, whereas minimum was observed in Kacchar vill. Shrivastava and Kanungo(2013), and Shyamala etal.(2008) reported the range of pH6.93 to and 7.5 to8.4 independently. Choudhary etal.(2014) reported a range of pH in between7.0 and 8.3. According to Umavathi etal.(2007), pH ranged between5.0 to8.5 is stylish for planktonic growth.

(b) Electrical conductivity - Electrical conductivity (EC) is the capability of an waterless result to conduct the electric current. Electrical Conductivity is a useful tool to estimate the chastity of water(Acharya etal., 2008). Water becomes a captain of electrical current when substances are dissolved in it and the conductivity is commensurable to the quantum of dissolved substance. The source of EC may be an cornucopia of dissolved mariners due to poor irrigation operation, minerals from rain water runoff, or other discharges. Electrical Conductivity ranged from118.7 –206.6 µmhos cm. Maximum electrical conductivity was recorded in the pond water of Pondi vill whereas minimum was in pond water of Pipra vill. Kataria etal.(2011), and Shrivastava and Kanungo (2013) also reported a range of EC in between 296 to723µmhos/ cm and115.11 to212.13 µmhos/ cm independently.

(c) Total Dissolved Solid - Total dissolved solids(TDS) denote substantially the colorful kinds of minerals present in water. There's no gas and colloids in TDS. TDS ranged from165.5 –254.8 ppm. Maximum TDS was observed in Beltukari vill, whereas minimum was recorded in Nipaniya vill. Rao etal.(2003), Kirubavathy etal.(2005), Garg etal. 2006) also reported the same result.

(d) Temperature - Temperature is the dimension of voguishness of any material. It affects the physical and chemical parcels of water and also affects the submarine foliage, organisms and their natural conditioning. During this study temperature ranged from20.9 to33.8 °C. Greatest temperature was seen in pond/lake water of Gataura Vill, whereas minimum was observed in pond water of Mohra vill. Thripathaiah etal.(2012) and Shyamalaetal.,(2008) also reported the range of temperature in between24.75 to28.5 °C and 26.3 to °C independently.

(e) Saltness - Saltness is the saltness or dissolved swab content of a body of water. From the below trial it has
been observed that saltness ranged from5.1 –6.9 ppt. Maximum saltness was recorded in pond water of Raliya vill, whereas minimum was recorded in pond water of Selar vill. Shrivastava and Kanungo(2013) reported the range of saltness in between5.13-6.27 ppt.

(f) Dissolved Oxygen - For all the forms of submarine life dissolved oxygen (DO) is essential element to break down man- made adulterants. The presence of dissolved oxygen is essential to maintain the advanced forms of natural life and to keep proper balance of colorful profanations therefore making the water bodies healthy. The chemical and biochemical process witnessing in water body are largely dependent upon the presence of oxygen. Estimation of dissolved oxygen is a crucial test in water pollution and waste treatment process control. In this present disquisition dissolved oxygen ranged from4.72 –6.13 mg/l. Greatest DO was observed in pond water of Selar Village, whereas minimum was recorded in pond water of Raliya vill. Shrivastava and Kanungo(2013) reported a rage of DO2.43-4.45 mg/ l in their study. Thirupathaiah etal.(2012) reported a range of DO by between5.18- 9.72 mg/l. Benerjee(1967), and Torzwall(1957) had reported that if the attention of DO is about 5mg/ l, throughout the time, the force will be productive for fish culture.

Table 2
Physico-chemical analysis of pond water

SN	Name of Village	pH	Electrical Conductivity (µmhos/cm)	TDS (ppt)	Temperature (°C)	Salinity (ppt)	D.O. (ppm)
1	Raliya	7.90	170.8	174.6	31.1	5.4	4.72
2	Parsada	7.88	179.4	178.8	31.0	5.9	4.74
3	Selar	8.14	167.9	193.1	20.9	5.1	6.1
4	Hardidih	8.28	145.8	236.5	21.2	5.3	6.07
5	Mopka	7.89	210.5	174.8	24.0	6.3	5.76
6	Mohra	9.69	157.5	196.3	21.0	5.8	6.12
7	Chilhati	8.10	195.6	251.3	23.9	5.5	5.85
8	Ucchbhatti	7.90	145.8	214.8	27.7	6.0	5.66
9	Nipaniya	7.95	148.7	165.5	27.1	5.2	5.81
10	Nawagaon	7.94	170.4	246.9	29.3	6.7	5.5
11	Jhalmala	7.86	195.4	161.1	27.5	6.6	5.77

12	Pondi	7.34	208.2	224.3	29.0	6.6	5.4
13	Phandi	7.25	123.4	212.5	31.2	6.3	4.77
14	Pipra	7.5	118.7	219.2	32.5	5.5	4.8
15	Khaira	7.51	198.6	187.3	32.7	6.2	4.83
16	Daganiya	7.58	183.1	178.5	32.9	5.8	4.79
17	Farhada	8.62	143.7	254.5	30.3	5.5	5.02
18	Devri	8.22	172.8	198.7	30.4	5.4	4.84
19	Parsada	7.88	179.4	178.8	31.0	5.9	4.74
20	Bijaur	7.38	181.7	187.5	32.2	5.5	4.9
21	Gataura	8.13	152.9	221.3	30.4	6.5	4.78
22	Rank	7.26	142.3	183.4	32.1	5.4	4.75
Average		7.81	167.70	208.45	29.26	5.83	5.16
Range		6.50 – 9.69	118.7 – 206.6	165.5 – 254.8	20.9 – 32.9	5.1 – 6.7	4.72 – 6.12

Table 3
Correlation Coefficient (r) between different physicochemical parameters of pond water

	pH	**EC**	**TDS**	**Temperature**	**Saltiness**	**DO**
pH	1					
EC	0.0038	1				
TDS	-0.01049	-0.18936	1			
Temperature	-0.63099	-0.07	0.039084	1		
Saltiness	-0.143	0.097996	0.076906	0.142968	1	
DO	0.528872	0.11747	-0.07376	-0.93656	-0.0508	1

(g) Statistical analysis - There are so numerous statistical tools to study the interaction between different variables. Among them correlation and retrogression are also the important tools for the study of the interaction between two variables. In the present paper correlation was used for reducing the range of query. Correlation Measure(r) was calculated by using the equation(Patil and Patil, 2010). Correlation measure(r) was determined by taking the upsides of two boundaries all at once displayed in Table 2. From the Table 3 it has been observed that the water pH set up to show positive correlations with EC and DO it implies variety of pH with EC and DO is in forward course i.e. if one is increases other will also be increased. pH has negative correlation with TDS, temperature and saltness i.e. if one is increases other will drop. EC has positive correlation with saltness and DO whereas negative correlation with TDS and temperature. TDS shows positive correlation with temperature and saltness whereas negative correlation with DO. There's the strong negative correlation in between DO and temperature. Temperature show positive correlation with saltness. There's the negative correlation between saltness and DO.

IV CONCLUSION

From the below trials it has been concluded that the pH value observed in different pond water samples generally ranged from6.5 to8.5 which in compliance of the water quality criteria given by CPCB, New Delhi for all the orders(i.e., A to E). still, water samples of Mohra vill, Parasahi vill, BhimaTalab showed comparatively advanced values(above 9) indicating that the water from these ponds are not reasonable/suitable for drinking, washing, proliferation of natural life and fisheries, and water system purposes. Grounded on the DO values measured at different ponds, it seems that utmost of them fell in the B or C order of water quality criteria indicating that water is safe for organized bathing and indeed drinking after conventional treatment.

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Developing a Hybrid Electric Bicycle

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ABSTRACT
Energy and environmental concerns, new paradigms for urban mobility and transportation increased in the past few years. The interest in Light Electric Vehicles has been catching up rapidly. Electrically Power Assisted Cycles or electric hybrid bicycle received a great deal of attention as it proves ease to the rider while riding. Electric hybrid bicycle is one that is suitable for general-purpose commuting. Electrically Power Assisted Cycles enables substantially longer distance power assist cycling. Several efforts have been made in order to improve its performance in terms of autonomy, weight, aesthetic and feeling with the rider. In this paper, hybrid electric bicycle developed by a team of engineering students as a part of their project is presented. The paper gives the methodology adopted, selection criteria of various components, their specifications and performance of the developed bicycle.

Key Words: BLDC Hub Motor, DC-DC Converter, Hybrid Electric Bicycle, Lithium Iron Phosphate Battery

I INTRODUCTION

1895 saw the first US patented electric bike but the first production of electric bikes was witnessed in early 90's. However, they did not gain much attention but it did spark big bicycle manufacturers to start developing bikes of their own. Initial electric bicycles were unbelievably heavy and less efficient. Nowadays mass production of electric bicycles is done by Hero, Revolt, Ola, TVS, Ather, Bajaj, Okinawa and many more in India.

Some of the key points based on the literature review carried out are highlighted as below:

- V. Thiyagaranjanet al [1] summarized that the BLDC motor for the electrical bicycle is of the quality 3 section tetragon kind, usually rated at some hundred Watts and therefore the battery voltage is typically 36V or 48V counting on the circuit current.
- DainisBerjoza et al [2] conducted a research so as to settle on a correct charging device, to optimally load the electrical wiring network likewise on opt for power and alternative parameters for energy devices so as to confirm the charging method.
- VidyadharGulhane et al [3] have discussed about choice of batteries, choice of electrical motors for specific capability vehicles, style of controllers, style of battery. They have emphasized basic details concerning characteristics of varied motors and controllers used for battery operated electrical vehicles.
- Matteo Corno et al [4] discussed about traffic congestion, energy, and environmental considerations as factors boosting the interest for light electric vehicles. They concluded that electrically power-assisted cycles (EPACs) have great potential as they are cost effective, safe, easy to use, and have a small footprint.

The Hybrid Electric Bicycle was implemented by a team of UG students (Pallav Chatterjee, Abhishek Kumar Urwasha, Mohan Kumar, Jayant Tandan) of Electrical Engineering from Rungta College of Engineering and Technology, Bhilai. The conversion of a normal bicycle into a hybrid electric bicycle and the process of planning, implementing, and testing a Hybrid Electric Bicycle is presented in this paper.

II HYBRID ELECTRIC CYCLE

A hybrid electric bike is a just like a normal bike but equipped with an electric motor that gives you additional power to your pedaling action. This can help you get some exercise or move around quicker and more comfortably. Electric hybrid bicycle also work well for commuters who aren't pressed for parking space and want a little assistance when cycling to work. A basic electrical bicycle runs on a BLDC motor, is powered by batteries and controlled from an electronic unit.

A very basic block diagram of a hybrid electric bike is as shown in Fig. 1which shows the basic speed control and the transfer of power.

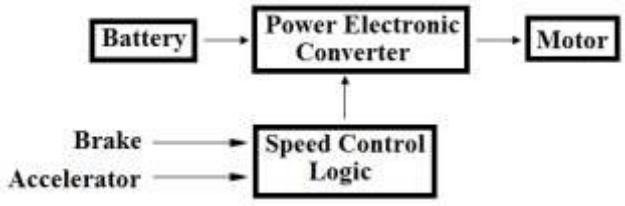

Fig 1: Block Diagram of a Hybrid Electric Bicycle

Hybrid electric bikes can be operated in three modes as given below:

- Pedaling manually
- Electric motor driven
- Hybrid mode i.e., simultaneous manual pedaling assisted by electric motor

The advantages of hybrid bikes over conventional bicycles are:

- Less effort is required; whether it is for leisure or commuting,
- Travel further, faster and carry heavier loads

Hybrid Electric bicycles are capable, versatile, cheap to run and offers manual exercise as a fringe health benefit.
The biggest disadvantages of Electrically Power Assisted Cycles (EPACs) are:

- The need of periodic recharging the battery
- Increased loading of bike due to the electric motor and associated components

The distance hybrid electric bicycle will get on full charged battery is dependent on a multitude of factors like:

- Topography (Road condition, geography, weather conditions etc.)
- Level of assistance
- Condition of tyres
- Load being carried

III METHODOLOGY

To design a capable hybrid electric bicycle, which maintains the characteristics similar to that of a conventional bicycle and provides pedal assist? The steps involved in the creation of hybrid electric bicycle are as listed below:

- Calculation of electric motor power
- Selection of Motor
- Selection of Controller for Motor
- Selection of DC to DC Converter and speed control
- Selection of Battery and Charger
- Specifications of Components required

The various steps are described below:

(a) Calculation of Motor Power output

Table 1 provides the calculation of tractive force and motor power requirement for the hybrid electric bicycle for a speed of 35 km/hr. and to carry a total weight of 200 kg.

Table 1
Calculation of Tractive force and Motor Power Requirement

Tractive force = $F_{rolling}$ + $F_{gradient}$ + F_{drag}		
Rolling force	Force to climb gradient	Force to overcome aerodynamic drag
$F_{rolling}$= C_r*m*a Where, C_r→coefficient of rolling resistance (depends on road) m→mass of vehicle (kg) a→acceleration due to gravity (m/s^2)	$F_{gradient}$= mg*Sinθ Where, m→mass of vehicle (kg) g→acceleration due to gravity (m/s^2)	F_{drag} = 0.5*e*v^2*C_A*A_f Where, e = density of air medium = 1.23kg/m^2(for air at sea level) v = velocity of vehicle (m/s) = 9.72 m/s C_A = Coefficient of air resistance = 0.88 A_f = frontal area of vehicle
Lets assume, C_r =0.01(for normal road) m =200 kg a = 9.81 m/s^2 (g) $F_{rolling}$ = 0.01*200*9 = 19.6 N	For flat surface θ = zero $F_{gradient}$ = 0 N	A_f = height*width*adjusting value Width → length of handle bar =500mm Height → ground to person helmet =1500mm (Adjusting value normally assumed to be 70% for bike) A_f = 1.50*0.50*0.70 = 0.525 m^2 F_{drag} = 0.5*1.23*$(9.72)^2$* 0.88*0.525 F_{drag} = 26.84 N
Power required to overcome rolling resistance	Power required to climb gradient	Power required to overcome air resistance
$P_{rolling}$ = $F_{rolling}$*vehicle velocity (m/s)= 19.6*9.72 = 190.51 Watts	$P_{gradient}$ = 0 Watt	P_{drag} = 26.84*velocity of vehicle in m/s = 26.84*9.72= 260.88 Watt
Power needed for motor = $P_{rolling}$ + $P_{gradient}$ + P_{drag} = 190.51+0+260.88 = 451.39 Watt Max. power = 450 Watt (approx)		

(b) Selection of Motor - The normal bicycle can be converted into electric bicycle by assembling on it DC motor, BLDC motor etc. Here a brushless DC electric motor (BLDC motor), also known as an electronically commutated motor is used. It uses an electronic closed loop controller to switch DC currents to the motor windings producing magnetic fields which effectively rotate in space and which the permanent magnet rotor follows. The controller adjusts the phase and amplitude of the DC current pulses to control the speed and torque of the motor. This control system is an alternative to the mechanical commutator (brushes) used in many conventional electric motors. Fig 2. shows the BLDC Hub Motor used in the hybrid electric bicycle.

Fig 2: BLDC Hub Motor

Fig 3: Controller

(c) Selection of Controller for Motor - The controller is an important component as it decides the rotation of the BLDC motor. The built in hall sensors in a BLDC motor helps in judging the rotor position and the controller in turn acts in tandem to give a proper control of the BLDC motor rotation. A BLDC motor controller regulates the speed and torque of the motor; it can also start, stop, and reverse its rotation. In a BLDC motor commutation happens electronically with the help of transistor switches. The sensors measure the rotor's position and send out this data. The controller receives the information and enables the transistors to switch the current and energize the required winding of the stator at the right time. Fig. 3 shows the controller used in the hybrid electric bicycle.

(d) Selection of DC to DC Converter and speed control - As the battery gives a DC output and the DC motor. A DC-to-DC converter matches the battery DC voltage with the motor DC voltage. A DC-to-DC converter is an electronic circuit or electromechanical device that converts a source of direct current (DC) from one voltage level to another. It is a type of electric power converter. Fig. 4 shows the DC to DC converter used in the hybrid electric bicycle.

The feedback from the person (rider) using the hybrid electric bicycle is important and helps in real-time feedback during the driving state. Throttle and Brakes helps in deciding the firing angle of the power electronic switches used in the DC to DC Converter. Throttle helps in increasing the speed of BLDC motor while the brake helps in cutting of the power to the BLDC motor. Brakes are also connected to the brake shoe for better braking performance. Fig 5 shows the throttle, and Fig 6 shows the brakes fitment used in the hybrid electric bicycle. This in turn helps in varying the amount of power delivered to the BLDC Motor.

Fig 4: DC to DC Converter

Fig 5: Throttle

Fig 6: Brakes

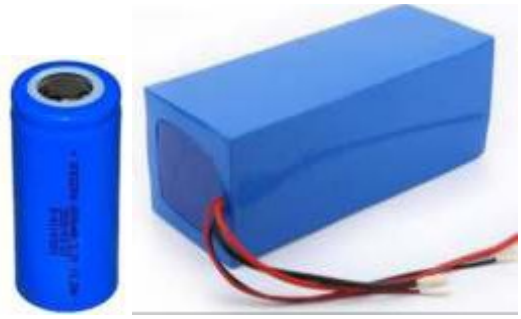

Fig 7: Battery Pack

(e) Selection of Battery and Charger - Because of low cost, high safety, low toxicity, long cycle life and other factors, Lithium Ion Phosphate batteries are finding application in vehicles, utility scale stationary applications, and backup power. Lithium Ion Phosphate batteries are cobalt-free.

When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products, and the free-energy difference is delivered to the external circuit as electrical energy. The battery used is Lithium Ion Phosphate type. The lithium iron phosphate battery ($LiFePO_4$ battery) is a type of lithium-ion battery using lithium iron phosphate ($LiFePO_4$) as the cathode material, and a graphitic carbon electrode with a metallic backing as the anode. Fig. 7 shows a battery cell and battery pack used in the hybrid electric bicycle.

A wall mounted battery charger is used for the charging purpose. A battery charger is a device that stores energy in a battery by flowing an electric current through it. The charging protocol (how much voltage or current for how long, and what to do when charging is complete) depends on the size and type of the battery being charged. The charger may have temperature or voltage sensing circuits and a microcontroller to safely adjust the charging current and voltage, determine the state of charge, and cut off at the end of charge.

(f) Specifications of Components required - The specifications of the various components used in the hybrid electric bicycle are tabulated in Table 2.

Table 2
Components used and it's Specification (may mention makes/model nos. also???)

S. No.	Components	Specification	Quantity
1.	Brushless DC Hub motor	350W, 36V Max Power: 500 W	1
2.	Motor Position Controller	36V	1
3.	DC to DC Converter to feed DC motor	36 V to 12 V	1
4.	Pedal assets	-	1
5.	Battery	36V, 12Ah	1
6.	Battery charger	43V	1
7.	Key lock with digital volt meter	-	1
8.	Head light, Horn	12V	1
9.	Electric throttle	-	1
10.	Cut off brake	-	1 Pair
11.	Cables	Copper	-
12.	Conventional Bicycle	-	1

IV ASSEMBLY OF HYBRID ELECTRIC BICYCLE

Initially the BLDC Hub Motor is mounted on the rear wheel in between the spokes and gear for chain mounted on the rear wheel on the motor shaft. The chain is connected with the pedal gears. The electrical connection is done for power transfer to the motor using a DC-DC power converter in between battery and motor. Motor Controller is responsible for maintaining the rotation of the Motor. Brake and throttle is used for deciding the speed of travel i.e., rotation of the motor. A battery charger is used from the wall socket and used for charging the battery.

The concept of the project is providing ease to the rider while riding a bicycle. Rechargeable battery is used with long life for charging. BLDC hub type electric motor is also used in this project. The hybrid electric bicycle is a project that can promote both cleaner technology as well as a reducing dependence on oil. It will run on clean electric power with the ability to recharge the battery. The final hybrid electric bike is shown in Fig 8.

Fig 8: Hybrid Electric Bicycle

The system here is tested and it is observed that it is capable of maintaining the battery charge and improvements can be achieved for urban cycling. An electric hybrid bike with minimal additional weight, a speed control system based on the decision-making of the rider (i.e., using throttle and brake) and microcontroller. This is capable of greater efficiency and various other feedback control mechanisms compared with typical hybrid bikes is implemented.

The project has been completed at cost of Rs. 18000/- which includes the cost of conventional bicycle. The basic cost of a hybrid electric bicycle in the market is around Rs. 24,000/-.

V RESULTS AND DISCUSSION

The growing demand of consumers for non polluting modes of transport is growing each day; this project will help in addressing this issue. The hybrid electric bicycle was designed keeping in mind the mechanical and electrical safety and considerations. It proves to be user friendly and easy to handle.

Some of the noteworthy points to be highlighted about the Hybrid Electric Bicycle during various phases of its testing (carried out by project members) as shown in Fig 9 are as given below:

- It could carry two people comfortably (also tested with load on carrier of the bicycle)
- It could travel a distance of 30 – 35 km on average with single charging
- The working was very smooth and noiseless
- There were no vibrations or jerks
- The components did not report any abnormal heating
- It could work even in rainy days, and short circuits were not detected (i.e., water poured on battery, controller, motor etc.)
- takes half unit of energy to charge the battery fully
- It can travel at a maximum speed of 40 km/hr

Fig 9: Hybrid Electric Bicycle (during testing phase)

VI CONCLUSION

The hybrid bike powered by dual source, pedaling and electricity powered BLDC Hub Motor. Compared to Internal combustion based bikes, hybrid electric bicycle is more efficient and economic. For environmental safety & protection use of electric vehicle instead of internal combustion engine vehicle is preferable. Use of electric vehicle reduces the noise pollution. The hybrid bike offers an eco friendly and cost effective solution to the high cost fossil fuel derived petrol.

Lithium Iron Phosphate battery helps in improved battery life of almost 7-8 years which will reduce the maintenance cost of the hybrid electric vehicle and it will help in reducing the cost of maintenance over time. Here electric propulsion system using BLDC motor with sensor speed control along with Smooth running operation is demonstrated and in future, a project may be taken for sensor less operation to economize the cost of hybrid bicycle. The solar PV charging of battery may also be considered in a future project. The cost can be reduced substantially due to economies of scale with large scale production to facilitate its purchase by economically weaker section of society.

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Identification of Factors Influencing Purchase of FMCG by Rural Consumers in Bhopal District, Madhya Pradesh, India

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ABSTRACT
India's rural areas now account for more than 573 villages and more than 70% of the country's population, making it a sizable consumer products market, who not only buy fast moving goods in a village market, but also mostly from urban outlets. FMCG has become a significant product segment for rural consumers. Companies that promote FMCG to consumers in rural areas cannot simply expand their general marketing tactics for rural consumers. Instead, they must develop solutions specifically for rural areas. They must comprehend critical difficulties with rural consumer behavior and, more precisely, issues connected to various geographical areas of the nation during this procedure. Understanding the elements that influence, Bhopal district rural FMCG purchases is the main goal of this essay. An empirical study was done in Bhopal district in Madhya Pradesh, to determine the main affecting factors. 24 important variables were grouped into five categories using analysis of variance with their correlation (influencing factors). The most important factor affecting the trust factor has revealed as the influence of retailer recommendations.

Keywords: Rural buying, purchase influencing factors

I INTRODUCTION

Since 1950, there has been a focus on rural development, which has helped India become an appealing rural market. The country's rural marketing environment was impacted by more knowledge and rising income levels (Velayudhan, 2002). Media penetration, rural residents' increased aspirations, and the packaging revolution are further variables that have led to the rise of rural markets (Bijapurkar, Rama, 2000; Kotler et al., 2009). According to Kashyap, Pradeep, and Raut, Siddharth (2007), one of India's most alluring rural marketplaces is the fast-moving consumer goods (FMCG) industry. In a rural setting, an effective FMCG marketing strategy primarily consists of a wide-ranging distribution network, price points, product categories, and product variants (Kumar & Madhavi, 2006). There are opportunities to advertise contemporary goods and services in rural India, contradicting the common perception that these marketplaces are exclusively viable for agri-inputs (Khosla, Ashok, 2000). In India, the rural FMCG market grew by 15% in 2011 (Nielsen Report, 2012). With 720–790 million consumers, the Indian rural consumer market expanded by 25% in 2008 and would reach US$ 425 billion in 2010–11. (Quarterly Report, CII-Technopak, 2009).

On what qualifies as "rural," many experts and organizations have differing opinions. According to Collins Cobuild Dictionary (2001), "rural" refers to a location that is removed from towns and cities. According to Dogra and Ghuman (2008), services, institutional markets, and consumer markets all make up a rural market. In order to increase the level of living, Velayudhan (2002) defines rural marketing as all those efforts that appraise, encourage, and transform the purchasing power of rural consumers into a real demand for certain goods. According to George & Mueller (1955), the flow of goods and services from rural to urban areas and vice versa is a two-way marketing process. Any marketing activity when the majority of participants are from rural areas is considered rural marketing (Kotler, et al., 2009).

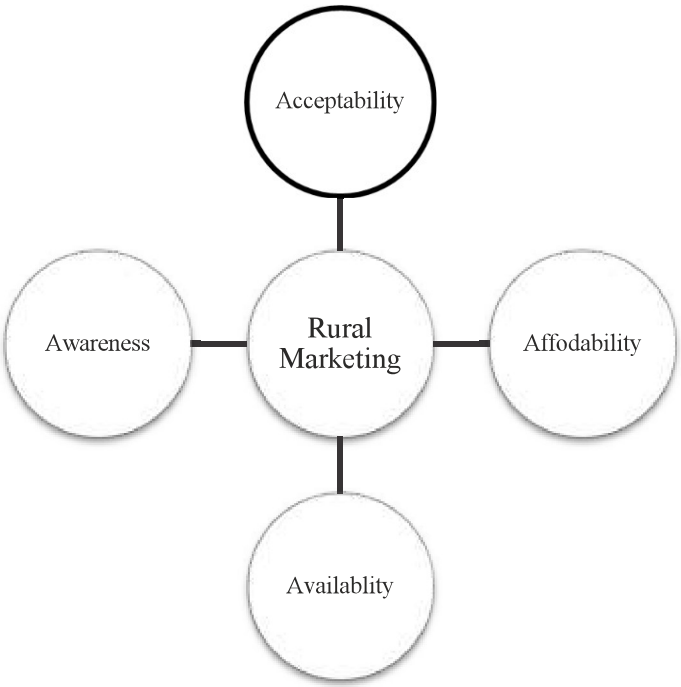

Fig. 1.1. Rural marketing Mix: Source: Pearson Education, New Delhi, 13 e,p. 12; Rural Marketing – 4 A's Structure - Source: Kotler et al. (2009).

The Rural Buyer-Seller (Producer) Matrix, which depicts the extent of rural marketing, was provided by Vaswani et al. in 2005. (Figure 1.1). The products created by rural residents in rural areas and eaten by rural residents are displayed on Shelf-I. Examples include hand-woven woolen, cotton, and silk fabrics, vegetables, fruits, and pottery. Products created and sold by urban residents to rural areas are found on Shelf II and include autos, bicycles, farm equipment, fertilizers, etc. Vegetables, agro-based goods, cottage industry products, and other items created in rural areas but used in urban areas make up Shelf III. Shelf-IV is not covered under the definition of rural marketing.

II LITERATURE REVIEW

After the 1990s, market liberalization measures in India transformed the marketing landscape (Gopalaswamy, 1997). The majority of Indian rural markets are "Virgin" in nature, and they are now opening for the majority of packaged goods and for a number of product categories (Habeeb-Ur-Rahman, 2007). (Bijapurkar, Rama 2000). Rural marketers must set themselves out with quality and value (Anand & Krishna, 2008). They must comprehend the variables that affect the purchasing of FMCG in rural areas in order to achieve this goal (Krishnamoorthy, 2008).

Customers' purchase decisions are influenced by a variety of factors (Blackwell and Talarzy, 1977). According to the literature that is currently available, factors that affect rural purchases include packaging (Pandey, 2005; Venkatesh, 2004), brand name (Narang, 2001; Bishnoi & Bharti, 2007; Sahoo & Panda, 1995), quality (Rashmi & Venu Gopal, 2000; Kumar & Madhavi, 2006), price (Sarangapani & Mamatha, 2008), and promotions (Bhatt & Jaiswal,1986). The consumption habits of rural people are also influenced by opinion leaders (Sayulu and Ramana Reddy, 1996). Retailers have become important factors in rural FMCG purchases as a result of this trend (Ying Zhao, 1994).

Although the currently existing study on influencing factors seems to be sufficient, much more work needs to be done in particular geographic rural markets because rural consumer behaviour varies in different product categories and geographic markets (Jha, Mithileswar, 2003; Bijoor, Harish 2004). (Sinha, 2008).

A renowned expert, named, Rajan, R.V. on rural marketing in India, expressed the view that much more study is still necessary because, even after 20 years, knowledge of rural consumers is still scant and superficial. Although research has been done on a variety of topics, including challenges in rural markets (Khatri, 2002), advertising issues in rural marketing (Balakrishnan, 2007), the value of creativity in message generation and message execution when communicating with rural markets (Bansal & Easwaran, 2004), and general issues relating to rural markets (Bijapurkar, Rama, 2000), there is still a great deal of room for further research.

The literature evaluation conducted for the current study reveals that there has been relatively little research on rural consumer behavior with regard to the factors impacting rural Indian consumers' purchases and consumption of FMCG, either generally or with reference to Bhopal, Madhya Pradesh, India. Therefore, a survey regarding the FMCG buying habits of rural customers in Bhopal, Madhya Pradesh region of Central India has been decided to be conducted. The study has been based on the 5 factors (including 24 variables) as fond in different literature.

III OBJECTIVE & RESEARCH METHODOLOGY

(a) Objective of the study

(i) To explore the factors influencing purchase of FMCG in Bhopal district

(b) Research Methodology

(i) Population of Madhya Pradesh: Of the total population of Madhya Pradesh state, around 72.37 percent live in the villages of rural areas. In actual numbers, males and females were 27,149,388 and 25,408,016 respectively. Total population of rural areas of Madhya Pradesh state was 52,557,404(source: census 2011)

Current population (2021) of M.P.: 87,558,507 (indiaonlinepages.com)

Table 1.1.
District wise population in select cities of M.P:

SN	District	Population(2011)	Male	Female
1	**Bhopal**	**2,368,145**	**1,239,378**	**1,128,767**
2	Indore	3,272,335	1,700,483	1,571,852
3	Jabalpur	2,460,714	1,278,448	1,182,266
4	Gwalior	2,030,543	1,090,647	939,896
Source: indiaonlinepages.com				

By distributing a well-structured questionnaire with a 5-point scale, primary data has been collected.

(c) Sample Size determination: Based on the census population of Madhya Pradesh, sample size has been determined by using Krejcie Morgan Table at 5% confidence.

SN	District	Population(2011)	Male (M.1)	Sample	Female (F.2)	Sample
1	**Bhopal**	**2,368,145**	1,239,378	4759	1,128,767	4334
Final sample (20% of each)			**1819**	**952**		**867**

Table 1.2.
Variables influencing the rural purchase of FMCG

SN	**Variables**	**SN**	**Variables**	**SN**	**Variables**	**SN**	**Variables**	**SN**	**Variables**
	Promotion Factor		**Lifestyle Factor**		**Trust Factor**		**Value Factor**		**Product Factor**
1	Shelf display	7	Brand awareness	12	Friend's recommendation	17	Intended benefits	21	Size
2	Free offers/ sales promotions	8	Packaging	13	Brand loyalty	18	Low price	22	More features
3	Product education & demonstrations	9	Dignity	14	Government promotions	19	Need based	23	Quality
4	Brand endorsements	10	Brand visibility	15	Availability	20	Affordability	24	Long lasting
5	Promotions	1	Lifestyle	1	Shop Keeper's				

		1		6	recommendation				
6	Relationship marketing								

Source: secondary

IV DATA ANALYSIS

(a) Data Analysis Tools and Techniques: I identified two strata: male and female to explore variability between group means is larger than the variability of the observations within the groups. So, I applied F-Test (to compare the population variances), and Z-test (two sample for means, to check whether the associations/findings is statistically significant or not). I used Excel 16 for calculation and analysis.

(b) Data Analysis and Interpretation: Objective of this research was to identify the underlying factors influencing the purchase decisions of rural consumers with reference to purchase of FMCG. Twenty four variables influencing the rural purchase of FMCG were identified after a detailed literature review. Table 1.2 presents all the variables.

Table.1.3:
Q.: how these factors influence your purchase behavior for FMCG items?

Q. N	**Question** To Bhopal rural consumers of FMCG	Strongly Agree (5)		Agree (4)		Neutral (3)		Disagree (2)		Strongly Disagree (1)		Total	
		Male (M.1)	Female (F.2)	M.1	F.2	M.1	F.2	M.1	F.2	M.1	F.2	M.1	F.2
1	Shop Keeper's recommendation	113	117	120	170	174	133	332	234	213	213	952	867
2	Relationship marketing	83	83	187	178	183	163	285	231	214	212	952	867
3	Friend's recommendation	242	83	242	178	107	163	217	231	144	212	952	867
4	Long lasting	119	207	328	328	207	113	182	104	116	115	952	867
5	Low price	211	117	433	170	137	133	83	234	88	213	952	867
6	Need based	232	232	345	345	174	90	113	113	88	87	952	867
7	Affordability	233	333	287	211	213	119	119	103	100	101	952	867
8	Brand awareness	117	107	332	218	169	154	121	147	213	241	952	867
9	Promotions	107	87	149	100	253	187	232	278	211	215	952	867
10	Availability	238	187	261	170	174	166	132	192	147	152	952	867
11	Dignity	113	100	120	154	174	140	332	322	213	151	952	867
12	More features offering more benefits	153	102	203	120	120	211	302	220	174	214	952	867
13	Packaging	174	137	260	186	167	109	128	200	223	235	952	867
14	Brand endorsements	103	107	152	218	211	154	264	147	222	241	952	867
15	Product education & demonstrations	103	103	282	223	183	153	174	174	210	214	952	867
16	Quality	174	133	213	213	120	126	312	262	133	133	952	867

17	Govt. promotions	113	87	111	142	183	133	213	293	332	212	952	867
18	Brand loyalty	127	127	260	217	173	121	179	179	213	223	952	867
19	Lifestyle	143	87	166	97	134	244	287	237	222	202	952	867
20	Shelf display	127	122	115	119	174	140	323	273	213	213	952	867
21	Intended benefits	167	87	287	142	168	133	136	293	194	212	952	867
22	Size	213	103	129	142	169	139	117	271	324	212	952	867
23	Brand visibility	125	132	188	178	174	147	252	207	213	203	952	867
24	Free offers/ sales promotions	153	124	127	131	138	141	324	264	210	207	952	867

Source: Field survey

Statistics (column): Interpretation

Mean Score (Male):	2.923144258	Moderate agreement of acceptance	Kurtosis (Male): -	0.441275591	Distribution high peaked than normal
Mean score (Female):	2.560705532		Kurtosis (Female):	2.404309242	
Standard Deviation (Male):	0.331687951	Data are very close to the mean (clustered)	Sample variance (Male):	0.110016897	All values within sample are identical
Standard Deviation (Female):	0.29451764		Sample variance (Female):	0.086740641	
Skewness (Male):	0.672148676	Moderately skewed data			
Skewness (Female):	1.793213464	Highly skewed data			

The samples of each male and female FMCG consumer in rural area, I applied F test and Z-Test:

F-Test Result: rejected the null Z-Test Result: rejected the null

F	1.208089322
P(F<=f) one-tail	0.330690032
F Critical one-tail	2.047770309

z	4.04010748
P(Z<=z) one-tail	2.67134E-05
z Critical one-tail	1.644853627
P(Z<=z) two-tail	5.34267E-05
z Critical two-tail	1.959963985

(c) Interpretation: The purchase of FMCG by male and female rural consumers (sample) are not very much affected by the identified 24 variables in five categories.

V CONCLUSION & RECOMMENDATION

Customers in rural areas have faith in local merchants.

It is discovered during the field trips that although the shops are aware of the fact that their customers pay attention to them because they are unaware of the Trust Factor. For fairly better results, the businesses must communicate rural retailers about these marketing techniques. It is advised to pursue the low-price strategy in rural marketing since pricing affects the purchasing of FMCG in rural areas.

Low-cost production is necessary to achieve low prices, but it's also important to carry out other marketing tasks including distribution and advertising in an efficient way. Value for money is achieved for rural clients when the FMCG purchased provides the desired results. Since the survey found that rural consumers also consider quality, performance, reliability, brand, and other important factors in addition to price, it is advised to sell FMCG in a logical manner rather than merely making cheap price appeals.

Rural marketers should develop creative promotional techniques for rural markets that can communicate messages to the villagers compatible with their level of knowledge and comprehension. It is advised to give FMCG with a long shelf life. Moreover, rural consumers connect larger size and/or product hardness with long-lasting features, so it is better to market FMCG along these lines.

Quality is crucial in the context of rural FMCG consumption and purchase because rural clients favor high-quality FMCG, and has been supported by many researchers with an advice, not to compromise on FMCG quality at lower price.

In rural marketing, rural customers' perceptions of packaging are positively influenced, which affects their purchasing decisions. It is advised to devote a lot of time to creating visually appealing packaging while keeping expenses down. Additionally, rural marketers can advertise their low price quality FMCG products using eye-catching packaging.

It is advised that rural marketers construct their plans in accordance with the government's programmes for rural development and incorporate information about such programmes into their marketing messages. This is so because rural residents tend to believe what the government says. Additionally, holding product demonstrations to inform rural customers and provide evidence of the products' functionality is advised.

In rural marketing, celebrity endorsements are effective, hence it is advised to utilize low-cost advertising techniques such using animated celebrity figures. Maintaining quality, creating and implementing sales promotion campaigns, using retail tactics like shelf display, using CRM strategies like consumption points, etc. are other recommendations.

VI FUTURE SCOPE

Rural research has a promising future, particularly in the FMCG area. Research can be done to suggest that promoting rural entrepreneurship can also be used to sell FMCG products in India's rural areas. Future studies should focus on each FMCG subcategory, such as hair care, child care, household cleaners, and premium product categories including color cosmetics and body deodorants. The similar research may be carried out in other part of India to understand the behavioral trend of rural consumers to strategize in accordance.

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Synchronous Condenser operation of Hydro Sets - An overview

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ABSTRACT
This article discusses usefulness of hydro sets in maintaining grid voltage by operating in synchronous condenser mode (SCO) by easily delivering or absorbing reactive power (Q) from it, particularly during lean periods of hydrological cycle when water level in the dam is low. Broad Contours of process of transferring and operating the set in (SCO) mode are given along with some practical data from sites.

Keywords: Synchronous condenser operation (SCO), Synchronous condenser relay (SCR), active/reactive powers (P&Q), Solenoid operated servo valves, L.P. air compressors and storage tanks, D.T. level sensors, Oil pressure unit (OPU)

Abbreviations

D/s	Downstream
DT	Draft Tube
EHG	Electro Hydraulic Governor
GV	Guide Vanes
MDDL	Minimum Draw down Level
MIV	Main Inlet Valve
SCO	Synchronous condenser Operation
SCR	Synchronous Condenser Relay
S/y	Switchyard
OPU	Oil Pressure Unit
TRC	Tail Race Channel
UCB	Unit Control Board

I INTRODUCTION

For power line voltage regulation in the grid, it is essential to match the incoming supply of reactive power (Q) with the Outgoing demand on real time basis. Hydro sets are very well suited for this, as they are easy to start/stop and operate. Generally, they are operated in generator mode, producing both active and reactive power (+P+Q) when water to run the turbine is available in plenty in the dam or weir. But, in some circumstances as given below, only SCO mode of operation is possible and desirable for keeping these sets in running condition for availing the following benefits.

(a) When water level in the dam or weir is low, around MDDL
(b) When the load controller of the grid instructs for it, for reactive power balance in the grid.
(c) When the D/s water demand for irrigation or drinking is not required to be fulfilled, as in multipurpose projects.

II BENIFITS OF SCO MODE OF HYDROSETS

As is well known, there are several ways available to the utilities for supplementing the requirement of reactive power in the system, like installation of capacitor banks in switchyard etc. But the SCO mode, wherever provided in the power houses, scores over all these methods for the following reasons.

(a) Hydro sets by their inherent mechanical inertia, electrical inductance effect, provide Stability to the grid during rapid / sudden fluctuations of loads. This is unlike of Capacitor banks which are static equipment.
(b) Hydro sets being easy to Start/Stop and operate lend themselves for quickly delivering or even absorbing reactive power to meet immediate requirements. (Capacitor banks Cannot absorb reactive power)
(c) Quantum of reactive power delivered by hydro sets is not dependent on system voltage which is also unlike of capacitor banks.
(d) By running hydro sets in SCO mode during lean months of April to June, Men & machinery would remain in good shape, not idling away and rusting. This will be indeed good utilization of idle period.
(e) As the machine is already synchronized with the grid, transfer back from SCO to Generator mode would be faster.

III CONCEPT OF SYNCHRONOUS CONDENSER OPERATION MODE

A hydro set, unlike a thermal set, can operate in the system in reverse power mode (- P + Q) without any problem. But, when this happens inadvertently due to closure of guide vanes or MIV, the generator is immediately isolated by reverse power protection to avoid

drawl of large amount of power P from the System owing to heavy churning losses of turbine runner. But in SCO mode, these losses are reduced to minimum (Less than 1 MW) by first closing the guide vanes and then injecting pressurized air in the DT, such that water level is forced to recede below the runner while the unit remains connected to grid in normal way to supply reactive power Q while drawing a small active power P (- Δ P + Q). The amount of reactive power Q is controlled from excitation system of generator as normally.

IV PRE REQUIREMENTS AND PROCESS DETAILS FOR TRANSFER TO SCO MODE

Given below in Figure 1 is the typical integrated scheme of SCO mode.

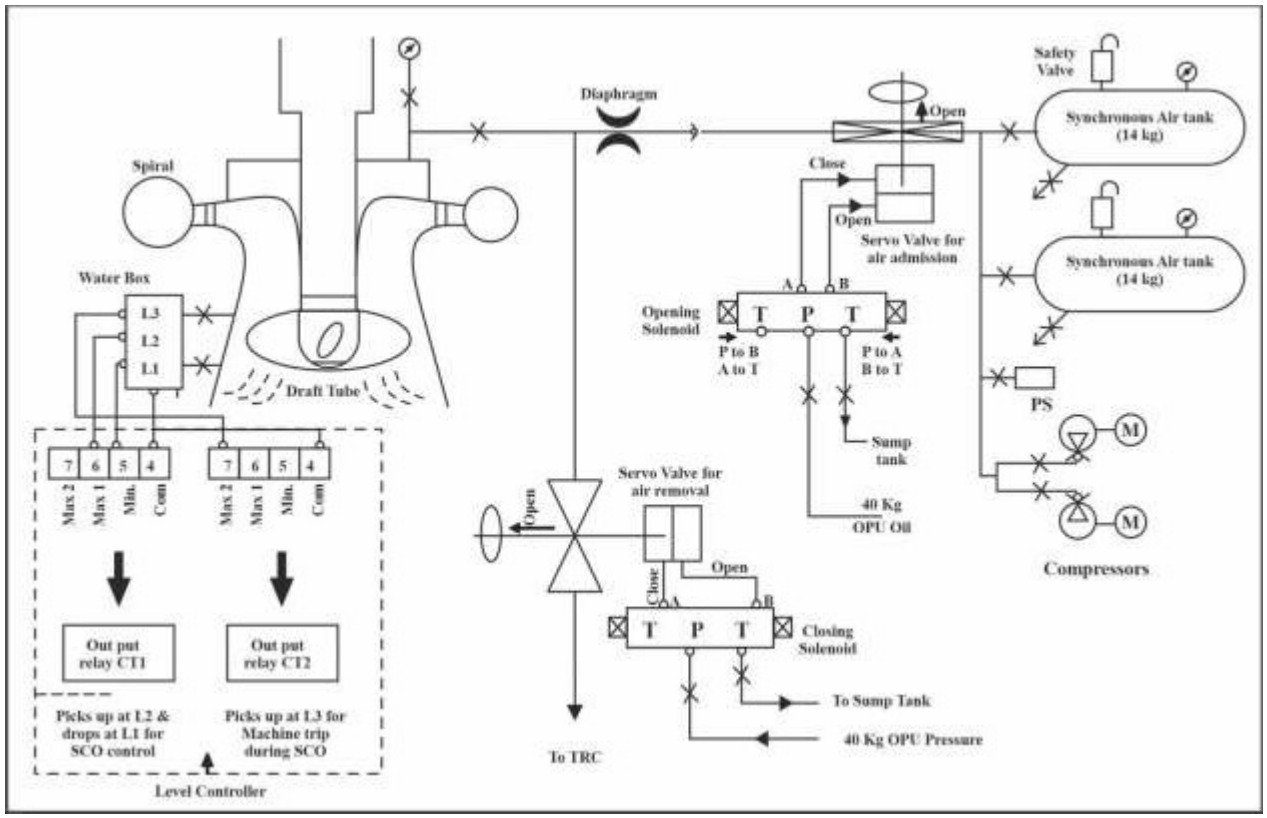

Fig. 1 Typical Integrated Scheme for SCO Mode

1. Following are the pre-requirements before transfer to SCO mode.
   (a) EHG system must be in auto working mode.
   (b) The LP compressors supplying compressed air for SCO must be working in auto, under control of their pressure switches.
   (c) DT water level monitoring by level controllers must be functioning properly as the success of SCO mode predominantly depends on this.
   (d) Solenoid operated servo valves for air admission & release from DT must be working well. The return line from T ports to sump tank must be open & clear for free flow of oil.
   (e) Proper functioning and co-ordination of Governor, UCB and protection control schemes must be ensured.

2. Process Details of SCO mode

(a) Machine is started in auto governing mode, synchronized as normally for generator mode on minimum load, just floating on the bus

(b) On issuing Command from Auto Sequencer Panel/UCB panel for transfer from generator mode to SCO mode, a synchronous Condenser relay (SCR) gets energized in the governor control circuits for following actions-

(i) Reverse power relay operation is blocked.

(ii) Guide vanes are closed.

(iii) Bulk Compressed air flow into DT takes place by energization of opening solenoid of servo valve which gets closed upon water reaching below runner as sensed by level controller. This completes the transfer to sco mode for reactive power (Q) generation by increasing the excitation.

(iv) When due to air leakages from DT, water level rises above the runner, Servo Valve again opens by action of Level Controller, to allow flow of make-up air for restoring the water Level below the runner.

(v) If for any reason water level rises to a pre-determined higher lever, Machine is tripped by the action of another level controller switch.

(vi) For transfer back to generator mode, Command for SCO to Generator mode (SCO → Gen) is issued which by de-energization of SCR, reverses the process steps. At first DT air is removed by energization of opening Solenoid of Servo valve of air removal followed by GV opening and unblocking of reverse power relay. Load on machine comes immediately through governor circuits after water level in DT becomes normal.

From Gen to SCO

Time Taken = 140 seconds.
ΔP = -0.4 MW

From SCO to Gen

Time Taken = 275 seconds.
ΔP = 3 MW

(c) In the 6x130 MW Idduki Power house in Kerala, Effect of reactive power Q generation /absorption in SCO mode was recorded as given in Table 1.

V FEEDBACK FROM SITES

Considering the benefits of SCO, provision of equipment's for SCO has been made in many hydro power projects for voltage management,

(a) In the 6 x 200 MW Sardar Sarovar RBPH in Gujarat, both positive and negative reactive power (±Q) is generated/absorbed in SCO mode as per directions of regional grid on regular basis, during which the unit draws approximately 4 MW Power (- ΔP) from the grid.

(b) In the 3 x 15 MW Rajghat hydro power project (M.P.) during trials for SCO, following data were recorded.

Table 1
Effect of Reactive Power

Regime	MVAR	Bus Voltage, kV	MVAR	Bus Voltage kV
In under excited Condition	0	224	-57.5	220
In overexcited Condition	0	224	31	226

VI CONCLUSION

The above presentation highlights a very useful feature of SCO mode capability of hydro sets for achieving voltage management of the grid in a cost effective manner. As such, it must be put to use wherever equipment for it has been provided, depending upon site conditions. All the same, contentious matter of sharing revenue loss in drawing some negative active power (- ΔP) for meeting churning losses of turbine and for excitation power of generator needs attention of authorities and of turbine designers for the consequential heating effect of turbine parts like labyrinth seal etc. For obtaining successful operation in Synchronous Condenser mode, only requirement is of ensuring "assured" transfers every time on giving commands for Gen → SCO & vice versa for which sufficiency of compressed air for initial bulk quantity for water depression, functional reliability of DT water level sensors amongst others, is essential. MW transducers for water level sensing may also be used in place of electromechanical level sensing controllers such that when -ΔP is -0.4 MW, Gen→ SCO transfer will be assumed as completed to stop air admission, which will be restarted say at –ΔP = -1.5 MW and to trip machine at -ΔP = -3MW, signifying failure of SCO mode.

Bio-Absorbent Treatment with Integration of Water Quality by Absorption Techniques in Industrial Area

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ABSTRACT
Unwanted patches of impurity in the water make it difficult to maintain the cleanliness and quality of the water. Fruit waste from bananas was employed to create a hospitable bio- absorptive surface for absorption of contaminants of waterless results. Before it was utilised in the treatment of artificial water, it was cleaned, cutted, dried based in greasepaint of strainer sized 170-312 m. Important factors like pH, colour, odour, alkalinity, hardness, residual free chlorine, turbidity, total dissolved solids, chloride, fluoride, sulphate, essence ions, dissolved oxygen, natural oxygen demand, chemical oxygen demand, and heavy essence are calculated prior to and following the processing of water through bioabsorbent. In addition to showing accurate results for criteria, bioabsorbent was designed to particularly successful in removing iron and arsenic and iron particle in predetermined state, with values of 20.35 and 20.13. This method offers genuinely inexpensive solution to one of the world's most difficult problems.

Keywords: Water pollution, Bio-absorbent, water treatment

I INTRODUCTION

Since many decades ago, eco-toxicity, specifically the effects of water supplies on living things, has become a major concern. The direct release of trash backwaters into swash water caused by rapid industrialisation and significant urbanisation has polluted the terrain. Sharma and Siddiqui, 2009). The manmade backwaters have a considerable harmful impact on submarine landscape due to the presence of heavy elements like as cadmium, nickel, mercury, arsenic, and bobby, among others.

Aside from these, adulterants gradually ground water and surface are added to the systems by natural deterioration and coloured mortal conditioning. All the factors listed below have an impact on both mortal life and underwater life. The weakened water is no longer fit for drinking, and it also worsens conditions in humans as well as harming the flora and animals. Thus, it has become a significant task for scientists to dispose of these undesired contaminants and heavy substances in a sustainable manner. Water impurity is not a recent issue, nor is it restricted to a specific region. Water quality varies depending on physiological and chemical factors which are largely affected by anthropogenic conditioning and geophysical conformations in a given place. It is a pressing global issue that demands high priority so as to protect generations from dangerous water generated illnesses. One chic solution to assist the generations in solving the issue is water sanctification. There are several techniques to cleanse water, but because of its effectiveness and naturally safe nature, the bio-method has gained attention. Agro-wastes may serve as implicit sources in biotechnology for the creation of bio-absorbents that are used to enhance quality of water. Other than this, it's affordable, widely accessible, & easy to use. A variety of bioabsorbents have been created from agricultural waste and utilised to discard heavy essence (Ashraf etal.,). Some of which include wood rise straw and see weed other debris, boat, tea trash, muck slime cob, EJO oil painting cutlet, sugarcane megass, tamarindus indica lodging, wood chips, rice cover, heliantus anguseifolius stem, etc. As bio-absorbents, strips of specific vegetables and organic goods can also be used. Banana strips look to be excellent absorbents and can be utilised as a priceless material for cleaning water from a distance. Kaewsarn et al. reported using bio-absorbent made from banana peels to remove chromium, cadmium, and bobby ions from waterless results (Memon etal., 2008; Kaewsarn etal., ; Hossain etal., 2012a, 2012b and Benaissa, 2006). In the research, an effort has been made to examine the suitability of this available & practicable bio-absorbent for treatment of artificial product sewage from generated from chemical firm and factory of chhatisgarh region. So as to use of banana peels as an absorbent as a possibility.

II CHEMICALS AND MATERIALS USED WITH METHODS

Outcome of Edetate dia sodium (EDTA), Buffer result (pH4.0,9.2 and10.01), eriochrome black T index HCl (0.1 N), PubChem CID (Merck), methyl orange acid, NaOH (0.5 M), and Nacl are set in distilled water. Banana peels from the kitchen are put to good use and can be used in batch test's.

Peels of Banana that washed repeatedly with valve water and then with distilled H2o (water). Material which was cleaned is divided in pieces heated to 80 °C in a hot air roaster (Narang) until it reached a desired weight. Material dried is powered & passed through strainers with a 150-212 m cut-size. The bio-face absorbent's area was configured to be 456.4298 m2g-1. Using Surface Area Analyzer (Micromeritics, ASAP 2020). The batch testing were conducted using a thermostated automatic orbital shaker (Spectralab, HM8T). Heavy elements such as cadmium, chromium, calcium, magnesium, iron, arsenic,

and bobby were found in samples. zinc and lead The results of the water testing lab in Dehradun's tiny submersion using standardized system on mercury and manganese were not conclusive. At a wavelength of 228.9 nm, cadmium was anatomized, followed by chromite at 355.7 nm, lime stone at nm, magnesia at nm, iron nm, arsenic nm, bobby at nm, manganese at nm, mercury at nm, lead at nm, and zinc at nm. After being evaluated by buffers of pH 4.0 and 9.2, the pH was measured using a digital alkaline pH cadence prepared with an adjustable consolidated pH schooner or glass anode (IS3025 Pt- 11-2002). Using conductivity cadence (Max 976) as a consequence of the estimation by 0.1 N potassium chloride, conductivity was ascertained. After turbidity was estimated using hydrazine sulphate and hexamethylenetetramine, it was measured using turbidity cadence (Mac 16490). (IS3025 Pt-10-2006). All of the disintegrated solids were evaluated using an outright drying framework is confirmed as a results by putting the similar samples through the Total Dissolved solid cadence (Max 878) after estimating it using the IS3025 Pt-16-2002 result for 0.1 N potassium chloride. Using a titration technique and markers for PubChem CID and Na orange, alkalinity was calculated. Sodium Fluoride be measured using a UV-VIS spectrophotometer in accordance with the standard method (APHA, 1995). (Thermo). By employing a potassium chromate index and an argentometric titrati Eriochrome Black-T was used as the internal index and ethylene diamine tetraacetate (EDTA) as the standard to calculate the total hardness (IS3025 Pt-21- 2003). The Honey Photometer was used to measure sodium and potassium (Systronics 132). Dichromate inflow system was used to evaluate chemical oxygen demand (COD) (APHA, 1995). Dissolve O2 DO) be calculated by a multi-parameter monitor equipment following estimation with Na2So3. Organic Oxygen require Duck) be calculated in a incubator BOD (SONAR) using KAP. On technique, the amount of chloride was measured (IS3025 Pt-32-2003).

III EXPERIMENTAL DETAILS

Standard procedures were used to conduct the testing at a pharmaceutical facility outside of Dehradun, Uttarakhand (India). This diligence gets the body ready for fevers, coughs and extra fitness issues. Sample be taken on or after artificial effluent and stored in bottles (plastic) at 40 degrees Celsius. Taking Care of Samples For different time periods (10 and 24 hrs), water samples (500 ml each) were stored with 1.0 g of bio-absorbent arranged as of banana strips in an repeted shaker at 145 rpm and 24 0C. Stripped test of water (designated A in diagram) with the samples completed later than treated with bio-absorbent for 10 hrs and 24 hrs, respectively (designated B and C Freely), be evaluated used for high-quality of vivid obstacles or parameters. Testing Conditions The sample "A "'s" temperature, smell, colour, turbidity, TDS, DO, pH, conductivity, and taste were all noted as it was being collected in the field. After saving the example under the predefined conditions, other packages such at the same time as alkalinity, solidity, cations , anions, , heavy essential irons,COD, BOD etc. be calculated inside the lab. The boundaries were treat cases B and C were too closely related.

IV OUTCOME AND CONVERSATION

The compliances along with effects attained designed for all the three samples, A B & C among recognize to colorful parameter are epitomized in Table which is given.

Table 1
Test Boundaries of water test when treatment

S.no.	Specification	Test		
		a	b	c
1	Hazen- shade	gloomy (Muddy)	blanched	blanched
2	Aroma	unpleasant	pleasant	pleasant
3	heat (ºC)	22	22	22.9
4	flavor	unpleasant	pleasant	pleasant
5	pH value	5.02	6.14	5.18
6	Turbidity	1100	600	400
7	Strength unit	.60	.33	.30
8	Total dissolve Solids	14000	9000	7000
9	Unit-ppm Total balanced Solids	1650	1100	950
10	Alkalinity - ppm	3000	400	700
11	Chloride -ppm	1006.5	210.1	215
12	Fluoride	3.5	3.3	3.3

13	Total hardness	800	640	620
14	Sodium	9	8.5	6
15	Potassium	2.1	1.7	1.4
16	COD	130	50	40
17	BOD	85	85	30
18	Dissolved Oxygen	7.5	7.7	7.1

Fig.1- This clearly demonstrates that after treating modern waste water with bio-absorbent, the concentration of chloride has decreased by a calculable amount. It is undesirable for sodium and potassium to be present in water. These two were discovered to be present in relatively small amounts in the untreated water, and the treatment was effective in getting rid of them to a certain extent. It has been observed that the calcium and magnesium concentrations appear to decrease during the healing procedure. Their attention previous to later than the treatment have been considered in Figure- 2. Chloride groupings after treatment are shown in Fig. 1. Since fluoride is only available in very low fixations, it has not been used in this idea.

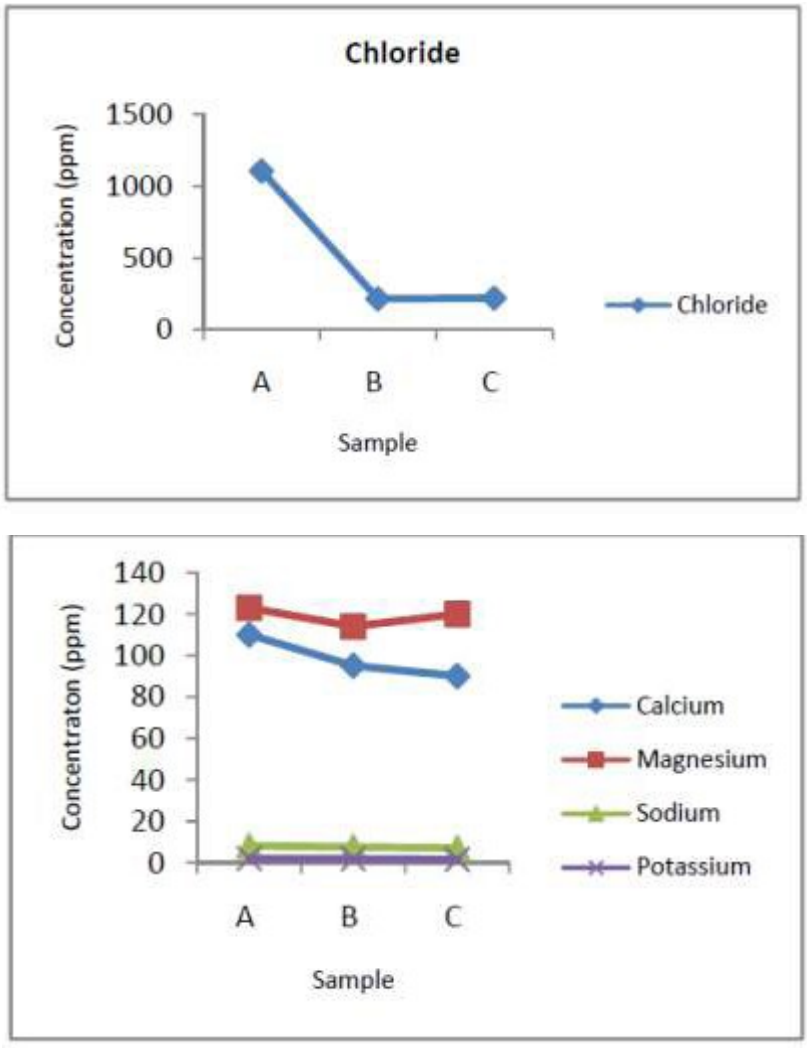

Fig1- Anions focus when treatment Significant metals in water should be accessible in immaterial total and in this manner is solitary of the essential limits at the same time as looking at the idea of water.

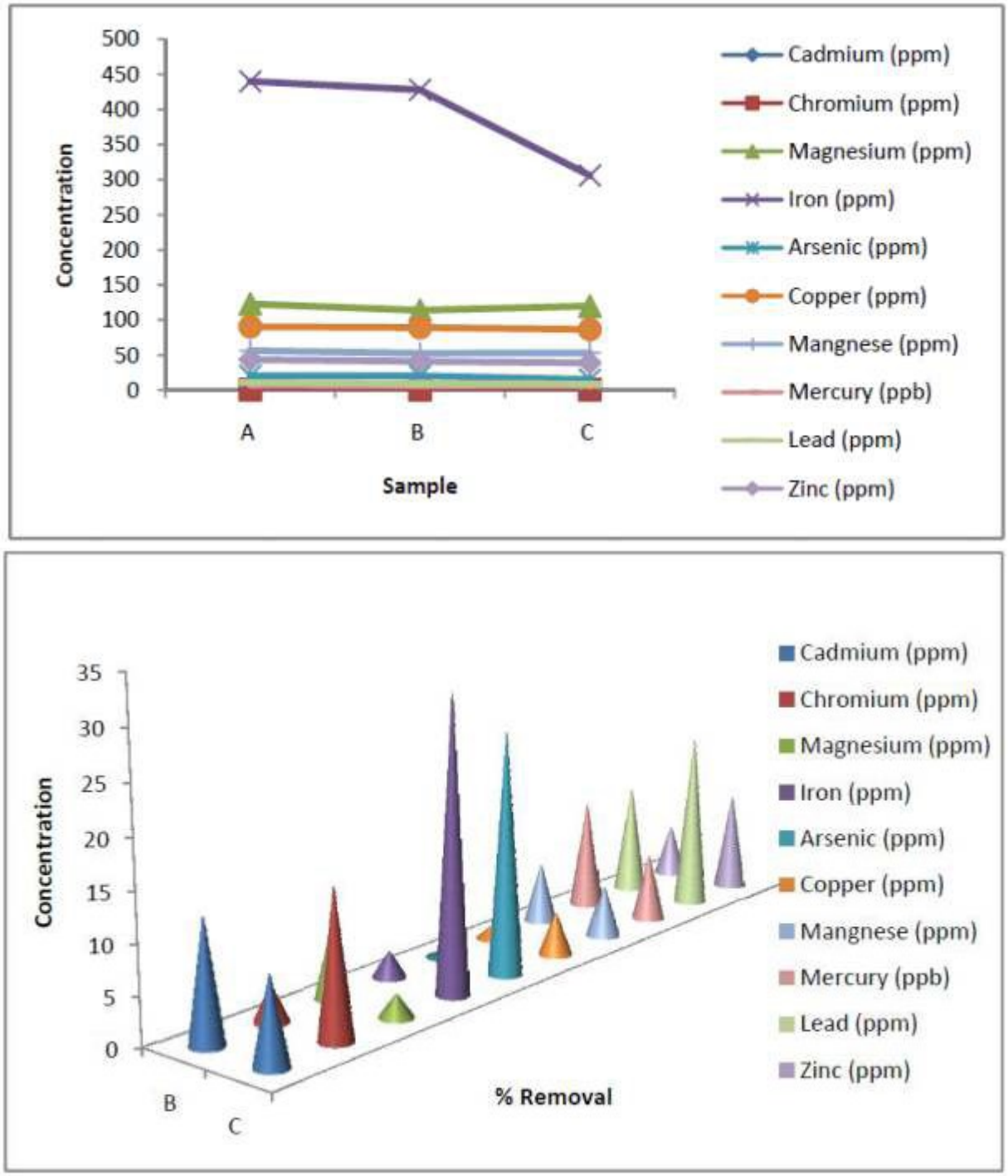

Fig.2 Cations focus when treatment

The bio-absorbent was used to concentrate on removing certain weighty metals from dissipate or waste water (Table no -2, Figure.3). The rate evacuation bend demonstrates its suitability for different metals (Fig.4). According to the study, using bio-absorbent in combination with waste water to decontaminate it at various limits is a promising practise. While it has been viewed as very efficient for the expulsion of calcium along with significant cations, it doesn't illustrate remarkably obvious outcome for the evacuation of Na (sodium), K(potassium) and Mg (magnesium). This is in addition to bring the properties such as total dissolved Solid, pH, friction, Body, and so forth as far as possible. Even while all of the heavy metals experienced a significant decline, the bio-absorbent has been hailed as particularly effectual in the decrease of iron & arsenic. According to Kaewsarn et al. (2008), the surface action of banana strips is mostly caused by the existence of

carboxyl, hydroxyl, and amide bunches at its shell or surface, which cancel out the effects of different metals and aid in their expulsion. Different metal particles compete with one another for the coordination sites on the absorbent's surface when there are other metal particles present. The feature of banana strips is enhanced by their high surface area, which makes it an exceptional and expensive absorbent for interactions with water purging. It is possible to boost concentration to speed up the cycle since different amounts of absorbent used in treatment were seen as effective to varied degrees toward different boundaries.

V CONCLUSION

The current work examines a different approach to improving water filtering using a less expensive, environmentally safe, and financially viable absorbent as an another to the more expensive absorbents. It contributes significantly to both the improvement of contemporary professional fluency and the waste of executives. The parameters of water with regard to TDS, alkalinity, hardness, body, and COD have been seen to change towards the passable range when handled banana strips are present. It demonstrates excellent results to significantly reduce the anions explicitly chloride. The report also reveals that calcium particles and heavy metal particles like iron, arsenic, and others are removed at a remarkable rate. Focus on demonstrates that banana strips can potentially remove contaminants from a water test up to a certain cutoff when used as bioabsorbents, but the cycle needs to be improved in order to use it at a contemporary level.

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Impact of Coconut Water Emulsion Fuel in a CI Engine

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ABSTRACT
In transportation sector, there are two primary justifications for using alternative fuels. One is to lessen our reliance on petroleum fuel, the other one is reduction of emissions from on-road cars. In diesel engine cars, biodiesel has been demonstrated to cut down the exhaust emissions. Particular attention should be paid to this in inner-city locations where rigorous environmental rules, such as EURO standards, are in effect. The fatty acid composition of biodiesel fuels was found to have a considerable impact on emissions in the literature. The coconut oil can be utilised to enhance the properties of coconut biodiesel because it has a greater cetane value and a lower iodine value. So, the purpose of the current experimental analysis was to examine the effects of mixing various amounts of coconut biofuels with water. To increase the uniqueness and dependability of the research, experiments were conducted. The study made use of a Kirloskar single-cylinder diesel engine (Model TV-1). Three different mixtures of the coconut oil and water were created to form the emulsion. The three separate blends, DCW10, DCW20, and DCW30, were created by combining Coconut Oil and Water Emulsion in various amounts viz. 10%, 20%, and 30%, respectively with Diesel fuel. On the basis of comparison under various loads operating situations, ***performance and emission characteristics results were examined*** *to comprehend the behavior of the aforementioned biodiesel blends. From the result analysis, it is concluded that the biodiesel of coconut oil and water blends reduces emissions from the diesel engine, but simultaneously it affects the performance parameters of the engine.*

Keywords: - CI Engine, Coconut Oil, Water Emulsion

I LITERATURE REVIEW

Large number of papers is reviewed and some of them discussed here to identify the research gap of the research work. **Badrana O., Emeish S., et al**. tested two micro-emulsions that contained 3.5 and 7% by volume of distilled water dispersed in diesel fuel together with the required surfactants/cosurfactants, namely Crillet-6/Span-20. Similar water micelles size distribution with an average dimension of 18 nm were present in both examined micro-emulsions. The investigation's findings showed that burning the tested water-fuel micro-emulsion in the AVL research engine reduced soot particle emissions even by 50% as compared to burning diesel fuel [1]. A rapid compression machine and a Komatsu direct-injection heavy-duty diesel engine with a high pressure common rail fuel injection system were used in an experiment **by Taisuke M., Kazutaka H., et al.** In order to assess the impact of water vapour dispersion on cylinder temperature and NOX generation, computational fluid dynamics simulations of the injection and combustion processes were also used to validate the hypothesis. According to research, when the timing of the water injection is correct, the combustion speed is slower and the cylinder temperature is lower than it would be with normal diesel combustion. As a result, emissions of NOX are drastically reduced, and soot emissions are also reduced. The computer outcomes offer thorough information on the mixing process and are consistent with experimental findings [2].

Koc B. & Abdullah M. in their experimental study discovered that as the water concentration in biodiesel nanoemulsions went from 10% to 15%, the rate of NOx reduction was faster than the rate of CO increase. The effects of raising the water concentration in biodiesel emulsions on lowering NOx and soot emissions from a 4-cylinder diesel engine were well supported by these data. A viable alternate strategy for decreasing harmful emissions from diesel engines without considerable engine changes is the use of emulsified biodiesel fuel [3]. In their investigation, **Armas O., Ballesteros R. et al.** discovered that the presence of DEE and water in the prepared fuels increased both performance and emission properties. Conclusion: By adding DEE and water, respectively, air pollution from the transportation and industrial sectors may be greatly reduced [4]. In an experimental study, **Wamankar A.K. and Murugan S** discovered that the engine could operate with all four emulsions without requiring any engine modifications. The findings showed that as compared to diesel running at full load, emulsions had a longer igniting delay of roughly 1-3°CA. While using the emulsions, the brake specific energy consumption (BSEC) was roughly 0.8 to 25 percent greater than when using diesel at maximum load. The outcomes also showed that, at full load, all of the emulsions reduced NO emissions by roughly 16–42% [5]. In their study, **López J.J. and Novella R.** validated the findings about the appropriateness of cutting-edge computational CFD modeling techniques for simulating the intricate processes connected to dual-fuel sprays. Furthermore, the significant advantages offered by dual-fuel mixes are validated, especially when taking into

account the anticipated decrease in pollutant emissions as a result of the variations in flame structure seen [6]. By using plain or B50 blends of the test biodiesel fuels, **Ismail H.M. et al.** discovered that the most substantial reduction in soot level is attained at high load operation, while the largest NOx reduction is observed under low load conditions. The optimal operating situation for biodiesel use to simultaneously reduce soot and NOx is at midload with an engine speed of 2000 rev/min [7].

Saad and Bari S I looked into how guide vanes placed in front of the intake runner of a compression ignition (CI) engine running on biodiesel affected their research. While using biodiesel, the vane model demonstrated the greatest advantages since it decreased brake-specific fuel consumption (BSFC), carbon monoxide (CO), and hydrocarbons (HC), as well as improving engine efficiency [8]. In their investigation, **Bari S., et al**. discovered that utilising fake flax biodiesel instead of diesel fuel reduced engine power and torque levels. The performance of the engine was further diminished by butane addition to biodiesel and diesel. When biodiesel was utilised instead of diesel fuel, CO2 emissions were reduced. Also, compared to diesel fuel, the CO2 emissions of diesel-biodiesel fuel blends were improved by butane. False flax biodiesel reduced CO emissions compared to diesel fuel, while butane addition to diesel-biodiesel blends improved CO emissions [9]. In their research**, Li J., Yang W.M., An H., and Zhao** discovered that A-Start of Injection (SOI) may provide greater control over combustion start, combustion phasing, and other factors while adjusting gasoline ratio. Regarding the production of emissions, adding more gasoline might result in more homogenous combustion, which would concurrently reduce NOx and soot emissions. However, the soot generation would rise when C-SOI and A-SOI were employed, especially when more biodiesel was injected. The specified spray angle for C-SOI is 78° [10]. According to **Hadi T., Shahram K., Soheila M., and Samad J**., regardless of the fuel type, 2000 rpm displays generally superior IP (indicated power), IMEP (indicated mean effective pressure), chemical availability, and thermo-mechanical availability. A different pattern may be seen in the mean irreversibility rate for the PMC (pre-mixed combustion) and MCC (mixing controlled combustion) combustion phases [11]. A CFD analysis conducted by **Harch C.A., et al.** revealed that 5% and 10% BLS biodiesel performed best for various injection timings and compression ratios. According to the simulation results, B10 biodiesel generally offers higher performance and efficiency and much lower engine emissions. As opposed to petroleum diesel, the B5 blend offers somewhat better performance and efficiency as well as slightly lower emissions [12]. **Yang W.M. and Li J.** discovered that the combustion chamber's narrow entrance could produce a powerful squish, especially at high engine speed, improving the mixing of air and fuel. Also, according to the simulation results, Omega Combustion Chamber (OCC) is preferable at high engine speed compared to Shallow Combustion Chamber (SCC) at low engine speed. As a result, at low engine speeds, SCC will produce considerably more NO than the other two piston bowl types. Similar to this, the high performance of OCC bowl shape may cause a high NO emission under conditions of high engine speed [13]. Six reaction mechanisms were used in the model **by Chen Z., Ke L., and Zongxuan** to characterize the chemical kinetics of various fuels under varied piston trajectories and to show the free piston engine's capacity for multi-fuel combustion. In terms of the in-cylinder gas temperature trace, the indicated output work, heat loss, and the process of radical species accumulation, analysis of the simulation data exposes the effects of the piston trajectory on the combustion [14]. **Khanbabazadeh M. and Jafarmadar S** demonstrated that combustion and emission behaviors' are significantly influenced by chamber shape. Also, they demonstrated that the high swirl, tumble, and low temperature combustion in the reentrant combustion chamber resulted in a reduction in soot and NOx emissions. Also, it is well known that the depth of the chamber affects the generation of NOx and soot [15]. **Hakan F.O., Varol Y., et al**. In their investigation, the conventional type and roof type combustion chambers' flow and heat transmission were numerically examined. In order to study the flow and heat transfer parameters during the intake stroke, a dynamic mesh model was used. For the turbulence solution equations, the k- turbulence model was selected. Using the finite volume method and the commercial programme FLUENT-12.0, the governing equations were solved. The inner velocity profile and temperature distribution of the results were presented, along with a comparison to both types of chambers [16]. Based on the crank angle degree parameters, simulation work by **Semin, Rosli A.B.,** and colleagues showed the diesel engine intake and exhaust valves rising and moving. As a result of this visualisation and simulation, the diesel engine model's air fluid flow and intake and exhaust valve lift movements are visible [17]. **Abdul G.C.P. et al**. discovered that for piston geometries with high bowl to piston diameter ratios as opposed to low diameter ratios, variation in initial swirl impacts in-cylinder pressure, temperature, and the emission parameters more strongly. Also, an optimization is done on the numerous cases findings for different beginning swirl and diameter ratios. The best emission and performance parameters are observed in the two examples with 70% diameter ratio and 0.5 beginning swirl ratio and 55% diameter ratio and 2.5 initial swirl ratio [18]. A mathematical model of spray combustion in direct-injection diesel engines was created by **Roberto F., Daniela M., et al.** to forecast engine performance, thermal efficiency, and pollutant emissions. The injected gasoline spray was broken up into several little packets. The temperatures of the gas and fuel droplets as well as the fuel evaporated mass in each package were calculated

[19]. The role of mass transfer in the creation of the two most significant engine emissions, unburned HC and CO, was studied by **Komninos N.P**. The findings show that mass transfer during combustion and expansion has a major impact on the production of both unburned HC and CO emissions, and as a result, this aspect of the closed engine cycle—compression, combustion, and expansion—must be taken into consideration [20].

Mustafa Canakci et al. in their study, discovered that biodiesel is a non-toxic, biodegradable, and renewable alternative fuel that requires little to no modification to operate in diesel engines. Although pricey, biodiesel would be more affordable if it could be made from cheap oils (restaurant waste, frying oils, and animal fats). These inexpensive feedstocks have a harder time processing because of their high quantities of free fatty acids. In earlier articles, a procedure for turning these feedstocks into fuel-grade biodiesel was devised. This study's goal was to look into how high-free-fatty acid feedstocks used to make biodiesel affected engine performance and emissions. Yellow grease made from animal fat and containing 9% free fatty acids and soybean oil were used to make two different types of biodiesel. The neat fuels and their 20% mixes with No. 2 diesel fuel were investigated in a four-cylinder turbocharged diesel engine under steady-state running conditions. Although the emissions of particulates, carbon monoxide, and unburned hydrocarbons were significantly reduced by both biodiesel fuels, the nitrogen oxides rose by 11% and 13% for yellow grease methyl ester and soybean oil methyl ester, respectively. Energy from the biodiesel fuel was converted to work at a rate that was equivalent to that of diesel fuel [21]. In the work **by Magín Lapuerta et al.** waste cooking oil methyl and ethyl esters are utilised as fuels in diesel engines This experiment was carried out to assess the diesel engine's output and emissions. The outcome reveals a small rise in fuel use, reduction in emissions of smoke, hydrocarbons, and particulates, but a rise in NOx emissions when compared to diesel [22]. According to **Zafer Utlu et al. i**n this study, waste frying oil (WFO) methyl ester is used as an experimental material, For the purpose of producing methyl ester from this kind of oil; a reactor was created and set up. The methyl ester's physical and chemical characteristics were studied in the lab. A direct-injection, turbocharged, four-cylinder diesel engine was used to test the methyl ester. The collected data was contrasted with No. 2 diesel fuel. The findings of engine tests used to compare torque and power measurements as well as specific fuel consumptions are very similar. Moreover, waste frying oil has fewer emissions than No. 2 diesel fuel, including CO, CO2, NOx, and smoke darkening [23]. **Gomez et al.** studied the performance and exhaust emission characteristics of a Toyota van with an IDI, naturally aspirated diesel engine that runs on vegetable-based waste cooking oil methyl ester. When compared to the No. 2 diesel fuel, the waste vegetable oil methyl ester created much less smoke opacity and reduced CO, CO2, and SO2 values, but had higher O2, NO2, and NO levels. With the two fuels, the power values were comparable [24]. **A. P. Roskilly et al.** carried out an experimental research of the use of biodiesel (recycled cooking fat and vegetable oil) on small marine craft diesel engines. The Perkins 404C-22 (Marinised) in Boat No. 1 (Fair Countess) and the Nanni Diesel 3.100HE in Boat No. 2 both underwent testing (Aimee 2). The test findings demonstrate that using biodiesel as fuel lowered NOx emissions. When the engines used biodiesel at higher loads, the CO emissions were found to be lower [25]. **Bhaskar Mazumdar et al.** in their experimental research, used waste cooking oil collected from a restaurant to manufacture biodiesel through a transesterification process and evaluated the chemical kinetics of biodiesel synthesis. Several ratios of biodiesel to petroleum diesel were used. Using baseline data from petroleum diesel, the blends' engine performance, emissions, and combustion parameters were assessed in a four-stroke, four-cylinder, indirect injection transportation engine. It has been noted that the mass emission of different regulated pollutant species from biodiesel blends is comparable to that of standard petroleum diesel. When biodiesel concentrations in blends grew, nitrogen oxide (NOx) emissions climbed and carbon monoxide (CO) emissions declined. When compared to petroleum diesel, biodiesel blends were shown to have superior brake thermal efficiency in all cases. All biodiesel blends were shown to have lower brake specific fuel consumption (bsfc) and brake specific energy consumption than petroleum diesel, with B20 having the lowest values. In this study, a diesel engine is powered by waste vegetable biodiesel. In this experiment, fuel containing 50% biodiesel and 50% diesel was utilised to assess the engine's properties, including injection pressure and combustion. Blending biodiesel reduces production and torque. Moreover, it provides reduced peak combustion pressures and lower auto ignition delays. Pressure and heat release traces alter as a result of pressure wave propagation [26]. In one study **by Gerhard Knothe et al.**, the fatty acid profile of utilised frying oils from 16 local restaurants was compared to the fatty acid profile of the oil or fat before usage. Gas chromatography and proton nuclear magnetic resonance spectroscopy were used to evaluate the fatty acid profiles. The samples' acid value and dynamic viscosity were also calculated in addition to their fatty acid composition. Due to some samples' non-Newtonian behaviour, dynamic viscosity was calculated. The findings show that oils and fats increase in saturation to variable degrees when used for cooking or frying, with the amount of these changes ranging from sample to sample, i.e., utilised frying oil samples have a highly unpredictable composition. The samples under investigation had acid value and viscosity, both of which regularly and randomly increased with use. There is minimal consistency of used cooking oil obtained from the same supplier, according to multiple independent

samples taken from the same eateries. The potential fuel qualities of biodiesel made from these leftover frying oils are examined in light of these findings [27]. According to **Hamad M. Algasim et al** in their study, biodiesel is made from used vegetable oil utilising the Fuel Pod 2TM method,. Methanol and sodium hydroxide were the catalysts employed in chemistry. Biodiesel made about 87% of the product, with the remainder being glycerin and soap. The cost of producing biodiesel was assessed in light of factors such as chemical costs, operating expenses, waste oil collection costs, etc. The cost of biodiesel was discovered to be roughly 60 pence per litre, which is less than half the cost of conventional diesel. The effects of petro diesel/biodiesel mixes on the functionality and emissions of the diesel engine were studied using a Ford Puma 2.4 litre diesel engine. Three blends, B10 (10% biodiesel and 90% petro diesel), B15, and B20 were tried in addition to petro diesel and biodiesel (B100) fuels. Engine load levels ranged from 25, 50, 75, and 100% full. The engine's revs ranged from 1500 to 2200 to 2600 to 3000 to 3300. Engine torque, fuel consumption, and emissions were assessed under these circumstances. As a result, performance metrics like engine power, specific fuel consumption, and engine efficiency were assessed. Total unburned hydrocarbons (THC), carbon dioxide (CO2), carbon monoxide (CO), and nitric oxides were among the exhaust emissions that were being measured (NOx) [28]. **Abuhabaya et al .'s** research was targeted to determine whether using waste and vegetable oils as an alternative to or addition to regular diesel fuel was feasible. Using a commercially available "fuel pod," the transesterification process was employed to create bio-diesel oil from rapeseed, sunflower, and spent cooking oil. The characteristics of the base oils were first assessed against diesel and then measured again following the conversion. The fuels were then put to the test utilising a cutting-edge four-cylinder compression ignition engine on a steady state engine test apparatus. During the transesterification procedure, a noticeable increase in viscosity was seen in the waste vegetable oils (WVO). Due to the WVO's reduced viscosity, both the specific fuel consumption and exhaust gas emissions were decreased. With biodiesel, the engine's thermal efficiency might be considered acceptable. It has been determined from the characteristics and engine test results that biodiesel from WVO can replace diesel without an engine modification or fuel preheating. Only small fleet operators may utilise the alternative fuel since sustainability constraints prevent widespread use [29]. **Rakopoulos C.D. et al** investigated in a fully instrumented, six-cylinder, turbocharged and after-cooled, direct injection (DI), Mercedes-Benz mini-bus diesel engine installed at the author's laboratory. The experiment was to evaluate the use of sunflower and cotton seed oil methyl esters (bio-diesels) of Greek origin as supplements in the diesel fuel at blend ratios of 10/90 and 20/80. The results demonstrate that using the aforementioned fuel blends with the engine running at two speeds and three loads lowered the smoke density. The amount of reduction increases as the percentage of biodiesel in the blend increases. When compared to those of neat diesel fuel, the NOx emissions were somewhat higher with all biodiesel blends; this rise was greater the higher percentage of biodiesel in the mix. By using only biodiesel fuel, the CO emissions were lowered, and the amount of biodiesel in the blend that was cut the CO emissions the most. Sunflower or cottonseed oil biodiesel blends produced engine performance that was comparable to that of clean diesel fuel, with approximately identical brake thermal efficiency and high brake specific fuel consumption [30].

II CONCLUSION FROM THE LITERATURE SURVEY

(a) A number of researchers have been attempting to use vegetable oils such sunflower, peanut, soybean, rapeseed and palm oil, as well as cottonseed and linseed, as an alternative fuel for diesel engines in recent years. It has been extensively researched in the literature; several studies have been conducted on the use of biodiesel and its blends in engines. It's also clear that single biodiesel provides acceptable engine performance and emissions characteristics for internal combustion engines. Experiments with the mixing of diesel and blend of water with biodiesel (Coconut oil) have been undertaken very sparingly.

(b) A large number of research papers were reviewed to find the objective for the present research work. Most of the research papers were based on the biodiesel which comprises the blends of biofuels with diesel fuel in varying proportion of biofuels. The literature survey reported that the improvement in combustion and performance parameters by using biodiesel, and it also affects emissions parameters by compromising with combustion and performance characteristics. By reviewing the above literature survey, Research gap is defined in terms of use of biofuels and diesel fuel.

(c) Although, researchers have worked with water and diesel blend with many biofuels, but no work was performed experimentally by using blend of Coconut oil and Water with diesel fuel in different proportions. Hence, the present research will be aimed to investigate the effects of varying quantity of Coconut biofuels with different proportions of water. Coconut –Water blends will be mixed with diesel fuel to understand the behavior of blends on Combustion, Performance and Emission Characteristics inside the combustion chamber.

(d) On the basis of experimentally verified performance and emission characteristics parameters, the effect of biodiesel made from blend of Coconut oil and Water with diesel fuel in different proportions will be studied.

III MATERIALS & METHOD

(a) Introduction

Emissions testing and biodiesel manufacturing have both been the subject of extensive study. Biodiesel research has focused toward making it more economically viable by lowering production costs and boosting the energy yields from various feed stocks, such as corn and at the same time lowering the emissions. When it comes to better understanding how these fuels operate in all diesel applications, research has been inadequate. A single-cylinder diesel engine will be used in this study to test the usefulness of biodiesel. So our primary goal is to conduct engine testing in order to analyze the performance and emissions. The testing was done at varied loads and at constant speed without any engine change in this study. The influence of various blends on the brake thermal efficiency, and the brake specific fuel consumption was observed and was noted. This chapter explains the experimental set-up utilised to meet the goals.

Engine testing is carried out in accordance with the aforementioned matrix for each fuel blend and load. Biodiesel blends and pure diesel fuel have been tested under varying loads, and the results will be recorded as per below parameters.

(i) Brake Specific Fuel Consumption (BSFC)

(ii) Brake Thermal Efficiency (BTE)

Exhaust emissions, such as Carbon monoxide (CO), Hydrocarbon (HC) and Nitrogen oxide (NOx), have been measured for various Coconut oil-water mixes and pure diesel under varied driving conditions. Unburned Hydrocarbon (HC) and Carbon monoxide (CO) are byproducts of incomplete combustion, but Oxides of Nitrogen (NOx) are formed at extremely high temperatures and is therefore more hazardous.

(b) Emission Measurement System - An exhaust gas analyzer is part of the emission measuring system, which measures the composition of exhaust gas. CO2, CO, NOx, HC, and O2 are all measured by the exhaust gas analyzer, which is a type of gas chromatograph that is used to analyse exhaust gas (O2). Figure 3.8 shows a photograph of the emission measurement equipment assembled for the experiment.

(c) Transesterification - Engine performance issues, such as carbon deposits and lubricating oil pollution, remain despite the use of oils and other solvents and micro emulsions of vegetable oils to lower the viscosity. Biodiesel fuel yields more biogasoline during pyrolysis than biogasoline does. Biodiesel is produced primarily through transesterification. Conversion from one ester to another, as the name says. Alcoholysis refers to the transesterification reaction between the initial ester and alcohol. By combining the reactants, the transesterification is an equilibrium reaction and the transformation takes place. Although the adjustment of the equilibrium is speed up greatly by the presence of a catalyst (usually a strong acid or base), in order to get a high amount of the ester, a lot of alcohol must be utilised. Transesterification is illustrated in Figure 1.

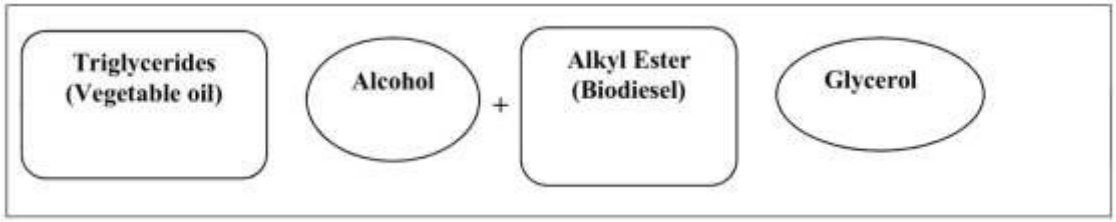

Fig. 1 Basic Transesterification Reaction

Typically, biodiesel is made from methanol or ethanol, both of which are types of alcohol. Transesterification can be catalysed in either a base or an acid environment. Acid catalysis is faster than alkali catalysis in homogeneous catalysis (sodium or potassium hydroxide or the corresponding alkoxides).

IV RESULTS AND DISCUSSIONS

Results are classified as Engine Performance Parameter and Engine Emission Parameter for various fuel Blends such as Diesel, DCW10, DCW20, and DCW30 at various loads.

(a) Engine Performance Parameters

(i) Brake Specific Fuel Consumption (BSFC) - The fuel flow rate per unit of power output is used to define Brake Specific fuel Consumption (BSFC). The engine's ability to produce work with the fuel it receives is assessed using this parameter. Because the engine uses less fuel to provide same output, a lower BSFC number is preferable. For comparative fuel testing, this is one of the most critical parameter to monitor.

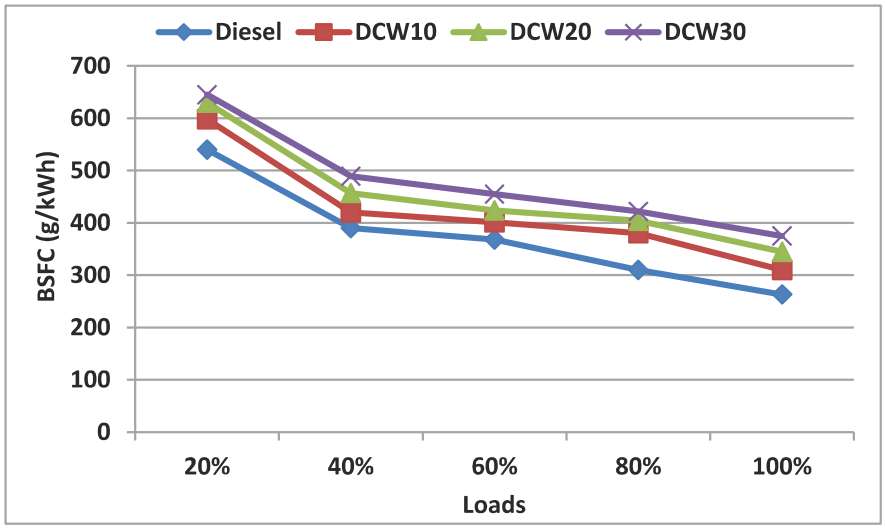

Fig. 2 Variation of Brake Specific Fuel Consumption at various Engine Loads

It can be seen from above figure 2 that BSFC is decreasing from 20% load to 100% load. But with respect to variation from Diesel to DCW30 it is increasing.

(iii) Observation: -

- The fuel flow rate per unit of power output is termed as the brake specific fuel consumption (BSFC). Hence, BSFC-is the amount of fuel consumption per unit of power produced by the engine in one hour.
- When the amount of Water in the blend increases the Calorific Value of the fuel decreases. So, BSFC is increasing accordingly.
- BSFC decreases with increase in load- Due to increase in total energy released i.e. the rate of increase in brake power is much more than that of fuel consumption.

(b) Brake Thermal Efficiency - Fuel injection mass flow rate multiplied by the lower calorific value yields the fuel energy input. Thermal efficiency is the ratio of power production to fuel energy input. Brake specific energy consumption is thus the inverse of thermal efficiency. Because experimental engine studies commonly uses braking power to determine thermal efficiency, the efficiency discovered is truly brake-specific. Biodiesel blends and pure diesel brake thermal efficiency is illustrated in the figures for varied loads. There is some evidence to suggest that biodiesel blends have a brake thermal efficiency somewhat below that of normal diesel under all loads.

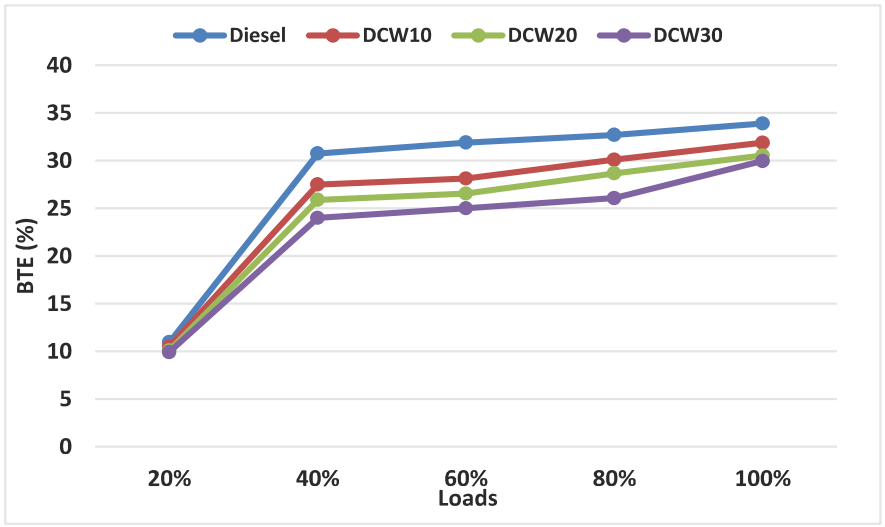

Fig. 3 Variation of Brake Thermal Efficiency at various Engine Loads

It can be seen from above figure 3 that BTE is Increasing from 20% load to 100% load. But with respect to variation from DCW30 to Diesel, it is increasing.

(i) Observation

- BTE- Brake thermal efficiency depends on LHV for constant effective power.
- It indicates the ability of the combustion system to accept the experimental fuel and assessing, how efficiently the fuel energy is converted to mechanical energy.
- Heat sinking phenomena: - Heat required to vaporization of particles.
- The heat sinking phenomena of water particles, reduces BTE
- As water quantity increases- LHV reduces, simultaneously BTE reduces.

(c) Engine Emission Test

(i) Carbon Monoxide (CO) - Lack of oxygen and low combustion temperature cause incomplete oxidation of carbon particles to carbon dioxide, resulting in CO emissions. Inhaling CO results in a lack of oxygen in the blood, which can cause headaches, unconsciousness, coma, or even death, depending on the time and concentration of CO exposure. As a result, it is crucial to do research into CO emissions.

It can be seen that CO emissions increase with load for all fuel blends. Furthermore, some blends appear to have lower CO emissions than diesel. Because biodiesel contains more oxygen molecules, its combustion is more complete, resulting in a lower CO emission rate.

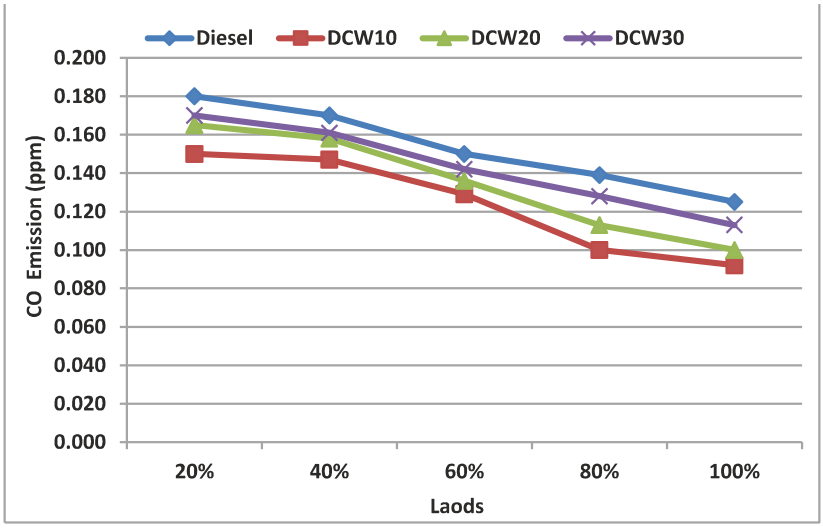

Fig. 4 Variation of Carbon Monoxide at various Engine Loads

Figures 4 show that CO emissions fall as the load increases. Biodiesel blends have lower CO emissions than that of Diesel, because their engine performance improves with better fuel combustion at higher temperatures.

Carbon monoxide (CO) is a sign that the chemical energy of the fuel has not been fully utilised. Coal combustion chamber design and atomization rate, engine load and engine speed all have an impact on CO emissions.

(ii) Observation

- As water quantity increased in the blend, peak in cylinder temperature gets reduced due to heat sinking effect of the water.
- Low in cylinder temperature results to incomplete combustion.
- Thus, CO emission increased, but not much as found in case of pure Diesel Fuel.
- Formation of CO emission is restricted by the oxygen quantity of the blended fuel.
- Higher amount of water in fuel decreases in cylinder temperature. Results to incomplete combustion but blends fuel restricts the CO formation in the combustion chamber.

(d) Unburned Hydrocarbons (HC) - Hydrocarbon emissions (HC emissions) are the unburned gasoline components seen in engine exhaust that contain hydrocarbon components. Incomplete combustion of fuel molecules results in the release of unburned hydrocarbons (UBHCs). Fuel-air mixture non-homogeneity is the primary cause of HC emission. Because UBHC emissions contribute to photochemical haze, their investigation is critical.

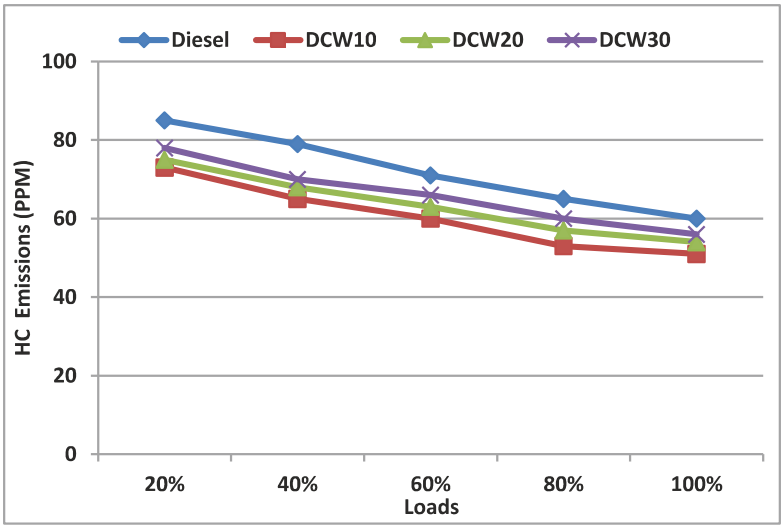

Fig. 5 Variation of Unburned Hydrocarbons at various Engine Loads.

The Fig 5 shows the comparative results of the unburned HC emissions at various loads for all the fuels under consideration viz. Diesel, DCW10, DCW20 and DCW30. It is observed from the figure that when the engine load is increased the unburned HC emissions are reduced.

Figure 5 shows the HC emission of an engine with various loads and for the various blends and diesel fuel. All biodiesel fuels were shown to emit fewer HC emissions than base diesel fuel.

Emissions of hydrocarbons (HC) reduced as a function of the amount of oxygen in the combustion chamber, whether that air or fuel was oxygenated. Biodiesel, on the other hand, despite having a lower final distillation point than diesel, has been found to have a higher volatility. Due to possible incomplete vaporization or burning of the final portion of the diesel fuel, higher levels of ultra-high concentration (UHC) emissions may result. Because biodiesel and biodiesel-diesel blended fuels are utilised in diesel engines, decreased UHC emissions should be expected.

(i) Observation

- As water quantity increased in the blend, peak in cylinder temperature gets reduced due to heat sinking effect of the water
- Low in cylinder temperature results to incomplete combustion.
- Thus, HC emission increased, but not much as in case of pure Diesel Fuel.
- Formation of HC emission is restricted by the oxygen quantity of the blended fuel.
- The peak temperature increases as load increases, which leads to complete combustion but high amount of water in fuel decreases in cylinder temperature.
- Results to incomplete combustion but blended fuel restricts the HC formation in the combustion chamber.

(ii) Oxides of Nitrogen (NOx) - In addition to contributing to acid rain, NOx is one of the most common air pollutants. At high temperatures, nitrogen and oxygen combine to generate NOx. CI engines produce more NOx due to greater combustion temperatures.

The following graphs compare the NOx emissions of diesel and various blends of biodiesel at varying loads. When comparing all biodiesel blends with diesel at various loads, it was found that NOx emissions skyrocketed significantly as the load increased.

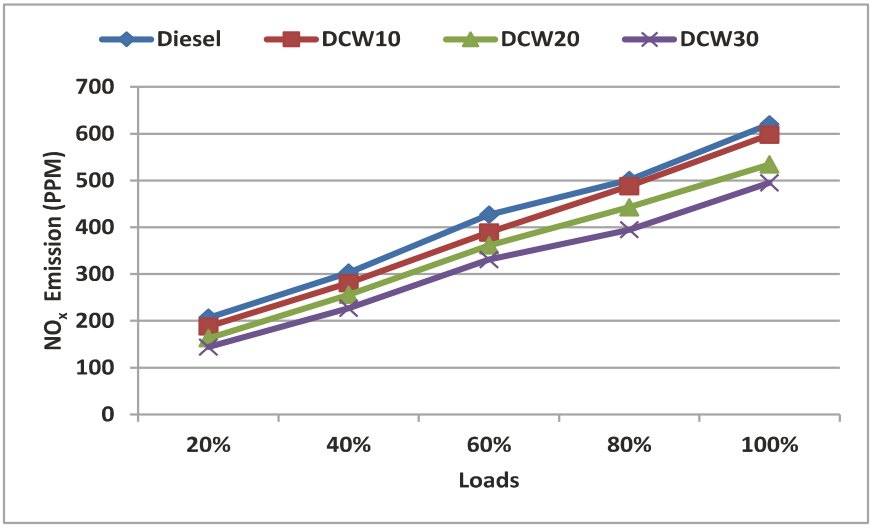

Fig. 6 Variation of emission of NOx at various Engine Loads

Figure 6 shows the variation in NOx concentration during the operation of the biodiesel-diesel blended with water fuel in maximum fueling mode, under varied loads. In terms of NOx emissions, the DCW30 has the lowest, followed by DCW20 and mixed biodiesel DCW10. It has been found that at full load (100%) DCW10 biodiesel emits higher nitrogen oxides (NOx), compared to other biodiesel mixes.

(i) Observations

- Nitrogen oxide (NOx):- Dissociation of molecular nitrogen and oxygen. The formation of NOx emission is highly depending up on the in-cylinder temperature.
- As water quantity introduced, heat sinking phenomena (micro combustion phenomena- the heat absorbed by the water particles in the form of sensible and latent heat reduces the combustion chamber temperature) presents thus, reduces NOx emission
- Heat sinking phenomena of water particles reduces peak temperature of the combustion process. As the load increases, more amount of fuel is injected inside cylinder. Accordingly, heat sinking phenomena is continuously acting at increasing load. Thus, NOx emission decreases at all loads due to application of Coconut water blended fuel.

V CONCLUSION

A detailed analysis of the performance and emission parameters of an Internal combustion diesel engine has been carried out with various biodiesel blends. Performance and emission analysis of an Internal combustion diesel engine carried out at different Biodiesel - Water blends have been examined for Diesel and mixed biodiesel of Coconut and Water (DCW10, DCW20 and DCW30). The following conclusion are made as per the results of performance and emission parameters.

(a) The Brake Specific Fuel Consumption (BSFC) of biodiesel blends are higher than that of Diesel fuel. The highest BSFC was recorded for DCW30 blends and trend shows that the BSFC of Diesel fuel and Blends reduces as load increases. It is better to run engine on low BSFC.

(b) The Break Thermal Efficiency (BTE) of biodiesel blends are lower than that of Diesel fuel. The lowest BTE was recorded for DCW30 blends and trend shows that the BTE of Diesel fuel and Blends increases as load increases. It is better to run engine on High BTE.

(c) The Carbon Monoxide (CO) emission of biodiesel blends are lower than that of Diesel fuel. The lowest CO emission was recorded for DCW10 blends and trend shows that the CO emission of Diesel fuel and Blends reduces as load increases. It is better to run engine on low CO emission formation.

(d) The Unburned Hydrocarbons (HC) emission of biodiesel blends are lower than that of Diesel fuel. The lowest HC emission was recorded for DCW10 blends and trend shows that the HC emission of Diesel fuel and Blends reduces as load increases. It is better to run engine on low HC emission formation.

(e) The Nitrogen Oxide (NOx) emission of biodiesel blends are lower than that of Diesel fuel. The lowest NO emission was recorded for DCW30 blends and trend shows that the NO emission of Diesel fuel and Blends increases as load increases. It is better to run engine on low NO emission formation.

From the above analysis, it is concluded that the biodiesel of coconut oil and water blends reduces emissions from the diesel engine, but simultaneously it affects the performance parameters of the engine. So to achieve the desired emission from the engine, one should compromise with the performance of the engine while using biodiesel of coconut oil and water blends. By considering different parameters of emissions, DCW10 blends resulted efficiently to reduce CO and HC emissions. However, to aim reduction of NOx emission, DCW30 shows good result after examination.

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Tourism & Covid-19:-Impact of Rural Tourism in Madhya Pradesh

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ABSTRACT
Tourism is playing an important role in the development of infrastructure of both international and national economies. Today tourism is the second largest industry in the whole world, the first being the oil industry. Rural Tourism is a living example of how tourism can transform a village and provide meaningful employment to the local community at the local level. Tourism is an important source of income and employment and contributes significantly to the GDP of countries. The global contraction of tourism arrivals due to COVID-19 has had a devastating impact around the world. The paper focuses on the study of the effects of Rural Tourism in (Ladpura Khas) Madhya Pradesh for visitors and tourists on the tourism industry due to COVID-19.

Keywords: Rural Tourism, COVID-19, Coronavirus, Pandemic

I INTRODUCTION

The covid-19 pandemic has hit the tourism industry the most, people from all over the world stopped coming, hotels closed, flights stopped. Pandemic has changed the mindset of the people, now tourists also like to go to such places where there is no crowd.

Rural tourism is emerging as a necessity, rural tourism provides a new experience to the tourists, it has become a means of meaningful contact and engagement between the town and the village. Due to this it is playing an important role in the social and economic development of the rural community apart from local environmental protection. Due to the arrival of tourists, employment opportunities have been provided in many ways in rural areas, due to which local business has been promoted and they have also got an opportunity to show their art.

Madhya Pradesh is one of the few states that has taken this up on a war footing for rural tourism, and the byproducts from this initiative are pleasantly surprising and potentially transformative. Ladpura Khas is a part of this campaign. The village is just 7 kms from Orchha and 20 kms from Jhansi which makes it a tourist circuit within Gwalior, Jhansi and Orchha.

Ladpura is blessed with natural scenic beauty, with the presence of hills, forest and river around it, making the village an ideal place to relax and enjoy nature. Cultural diversity within the community, traditional values and beliefs of Bundelkhand region along with traditional rural life make the community more diverse and attract more tourists to the place. The beautiful village is situated on the bank of river Betwa and Gurari.

The motto of the village is 'from farm to plate'. Guest will get farm fresh produce and can enhance their knowledge related to agriculture. The historical and cultural significance of the place has now been largely revived by the community through the celebration of various festivals.

It introduces the tourists coming here to the ancient cultures of India and Bundelkhand. Home stays have also been prepared for tourists to stay in the village. The most important thing is that 80% of the people of the village are literate. Due to this, the tourists coming here do not face any kind of problem.

A total of three villages from across the country were nominated for the United Nation World Tourism Organization "Best Tourism Village" award. In which "Ladpura Khas" village from Madhya Pradesh has been included, this village has been included in "Best Tourist Village".

Fig. 1 Best Tourist Village

Fig. 2 Ladpura (MP) Best Tourist Village

After the arrival of Covid-19, the condition of this village changed, people had started and suddenly everything stopped.

Rural tourism is one of the sectors most affected by the COVID-19 pandemic, which, being an emerging sector, affects the economy, livelihoods, public services and opportunities. All parts of its huge value-chain have been affected. Women, who make up 54% of the tourism workforce, youth and workers in the informal economy are among the most at-risk categories due to COVID-19.

The first four cases of the COVID-19 pandemic in Madhya Pradesh were confirmed on March 20, 2020.

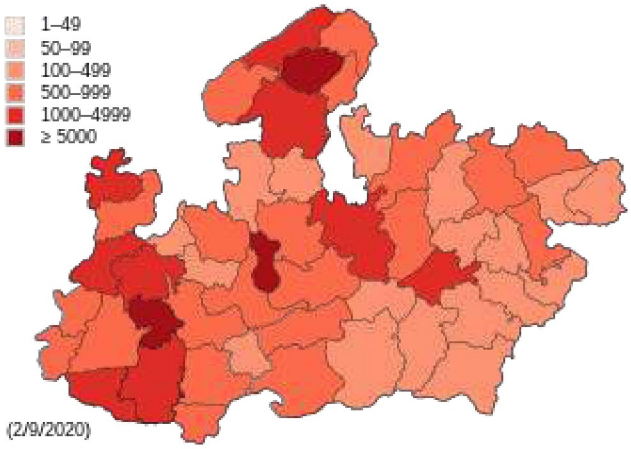

Fig. 3 MP- Covid Cases

UNWTO confirms the devastating impact of COVID-19 pandemic on world-wide tourism industry.

II REVIEW OF LITERATURE

World Travel & Tourism Council report, 2019, Before the COVID-19 pandemic, travel and tourism (including its direct, indirect and induced effects) accounted for 1 in 4 of all new jobs created worldwide, 10.3% of all jobs (333 million), 10.3% of Global GDP (US) % $9.6 trillion). But the scenario has been reversed after the beginning of COVID-19.

The COVID-19 pandemic has severely affected the tourism industry across the world, rural tourism which has started in Madhya Pradesh as well as tour operators, travel agents, air, land and sea transport industries and other sectors associated with this business Are included. The travel, tourism, rural tourism and hospitality industry has been decimated by the impact of the coronavirus COVID-19 outbreak. It is estimated that 120 million jobs are at risk, with economic losses expected to exceed $1 trillion.

III OBJECTIVE AND METHODOLOGY

(a) Objectives

(i) To study the factors affecting the development of rural tourism in Madhya Pradesh due to covid-19.
(ii) To Understanding the Impact of Rural Tourism Campaign on Madhya Pradesh Tourism
(iii) To study the Rural Tourism future of Madhya Pradesh as a tourist destination.

(b) Research Methodology

Tourism product is a specific type of product it is not a unit but a sum of many products. Rural tourism is also a very fast growing tourism product now a day so it can be studied under all those affected which make it a tourist product. Several studies have been done globally to quantify the effects of the pandemic during this period.

This research paper is the result of secondary data used as report and entry data of data and documents provided by Madhya Pradesh Tourism Department, Ladpura Khas village.

IV DISCUSSION

Madhya Pradesh has an immense range of resources which can attract a large number of tourists. It has all kinds of tourist attractions from natural to man made resources. Here forts, palaces and monuments of historical importance can be seen in almost all parts. The state government recently realized the importance of tourism in the state and worked on a plan to develop rural tourism. Now Madhya Pradesh is very aggressively engaged in tourism marketing campaign and its place in tourism map is changing very fast.

This campaign is happening continuously in India as well as abroad, due to which it is making its mark. As a result of which Lad PuraKhas Rural Tourism Village has got international recognition**.**

Madhya Pradesh Tourism's awareness and marketing campaign has won several awards for the state. The fact that Madhya Pradesh is the heart of India and rich culturally and archaeologically is widely recognized by the tourism marketing campaign and the efforts of the government.

The result of this is that today Madhya Pradesh has started showing and beautifying rural tourism, due to which there has been some increase in the number of tourists coming to the state in the last few years. The government and tourism department is laying great emphasis on training and development and is running a variety of skill development training programs like 'Earn while Learning', 'Hunar Se Rozgar' etc.

Madhya Pradesh Tourism represents one such land of India which radiates vibrancy from every nook and corner. The heart of India plays host to the best cultural and heritage festivals that cannot be seen anywhere else in the world. Fairs and festivals unite the souls of different religions and drench them in the colors of celebration.

Madhya Pradesh Tourism Department organizes events at various places throughout the year to attract tourists. In which Kumbh Mela, Orchha Festival, Mandu Festival, Malwa Festival, Dance Festival, Water Festival, Pachmarhi Festival, Film Festival, Lok Rang, Bhagoriya, Floating Festival including Gandhi Sagar, Alauddin Khan Music Festival, Hindi Drama Festival, Makhan Lal Chaturvedi Festival etc. .

Infrastructural development in Madhya Pradesh includes marketing initiatives, new tourism products and the state tourism is rapidly working on new developments and infrastructure improvements International tourist arrivals in the state are quite low. The main reason for this low arrival is the lack of facilities.

Though there has been some development in recent times but not as per international standards. Poor transport facilities and lack of better tourism facilities There are reasons too. The state is well connected by road and rail network but the condition of the roads, public transport becomes a problem. Rural tourism is being developed in Madhya Pradesh, local and traditional programs are being organized to create curiosity among the people, but if the basic facilities are further increased then it will be more advanced. The data of tourists coming across the country throughout the year month wise has been given till 2018-2020.

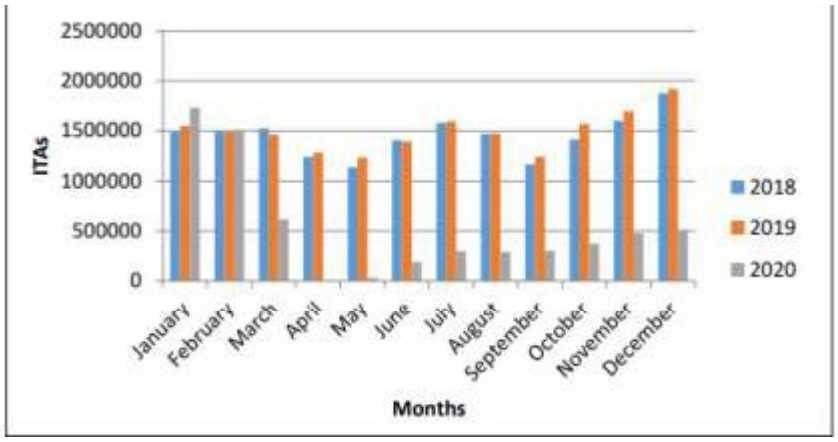

Fig.4 International Tourist Arrivals (ITAs) in India, 2018-2020

When it comes to international tourist arrivals in Madhya Pradesh

The state is not even in the top ten states. The state of air transport is also poor in the state with only two international airports i.e. Indore and Bhopal. The state is becoming increasingly popular with tourists, especially domestic ones, heading to the state in large numbers. The main reason behind is its cultural heritage and promotion of rural tourism along with its unique publicity campaign. Religious, eco-tourism, rural tourism, various festivals, these campaigns are able to attract the attention of the people.

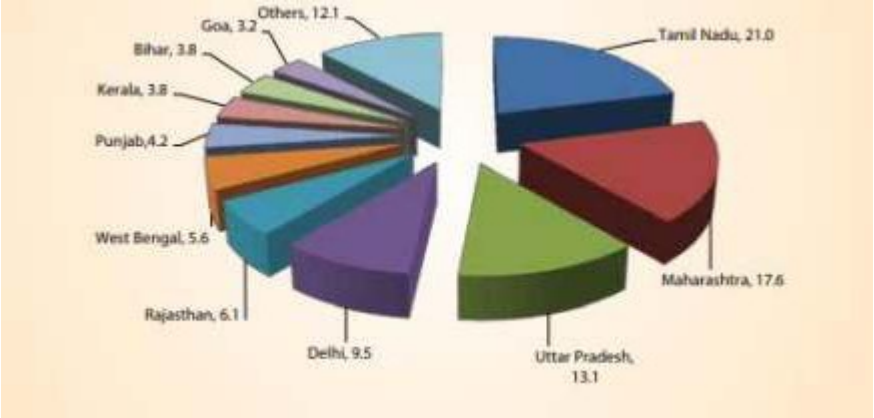

Fig.5 Share of top 10 States/UTs in India in Number of Foreign Tourist Visits in 2018

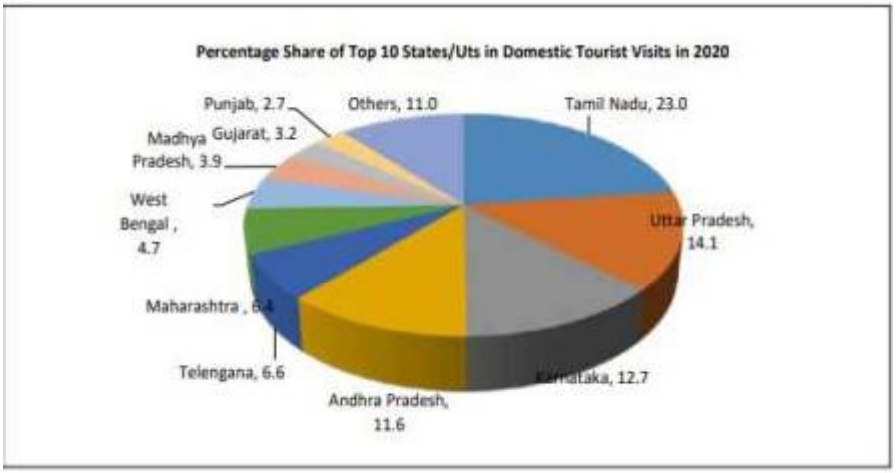

Fig. 6 Percentage Share of Top Status/UTs in Domestic Tourist Visits in 2020

Fig. 7 Tourist map of Madhya Pradesh

After the arrival of Covid-19, the tourism sector was greatly affected, as a result of which Madhya Pradesh Rural Tourism, which was developing rapidly, was greatly affected. Despite being the means of livelihood of the people, they became helpless, became focused on the crisis of unemployment and what will happen in the future.

V CONCLUSION

The tourism industry has been badly affected by COVID 19. Rural tourism had just started in Madhya Pradesh and has been very popular and very successful in attracting tourists since its initial stage. But Kovid-19 almost ended rural tourism. Safety measures are being taken care of to open the industry in a phased manner after the lockdown barrier is released.

In an effort to establish a cohesive approach to setting guidelines for a phased reopening of the tourism sector globally, the WTTC launched the "Safe Travels" stamp, which can be displayed to potential travelers at establishments around the world. Designed to allow individuals to be recognized who have adopted standardized health and hygiene.

In order to successfully revive tourism again, governments should prepare travel and tourism sectors as well as rural tourism along with new and well-prepared, phased ways of opening up and tourism plans with administrative and comprehensive support, including travel During the recovery phase, governments need to rebuild tourist confidence and encourage innovation and investment for a resilient and sustainable tourism sector.

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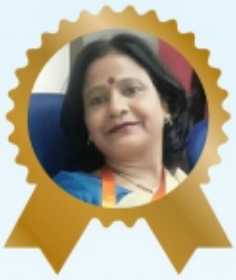

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