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OPJU

4th International Conference
on
Innovation & Research in Science and Technology for Sustainable Development

May 29-30, 2025

Organized by:

School of Science, O. P. Jindal University, Raigarh (C.G.)

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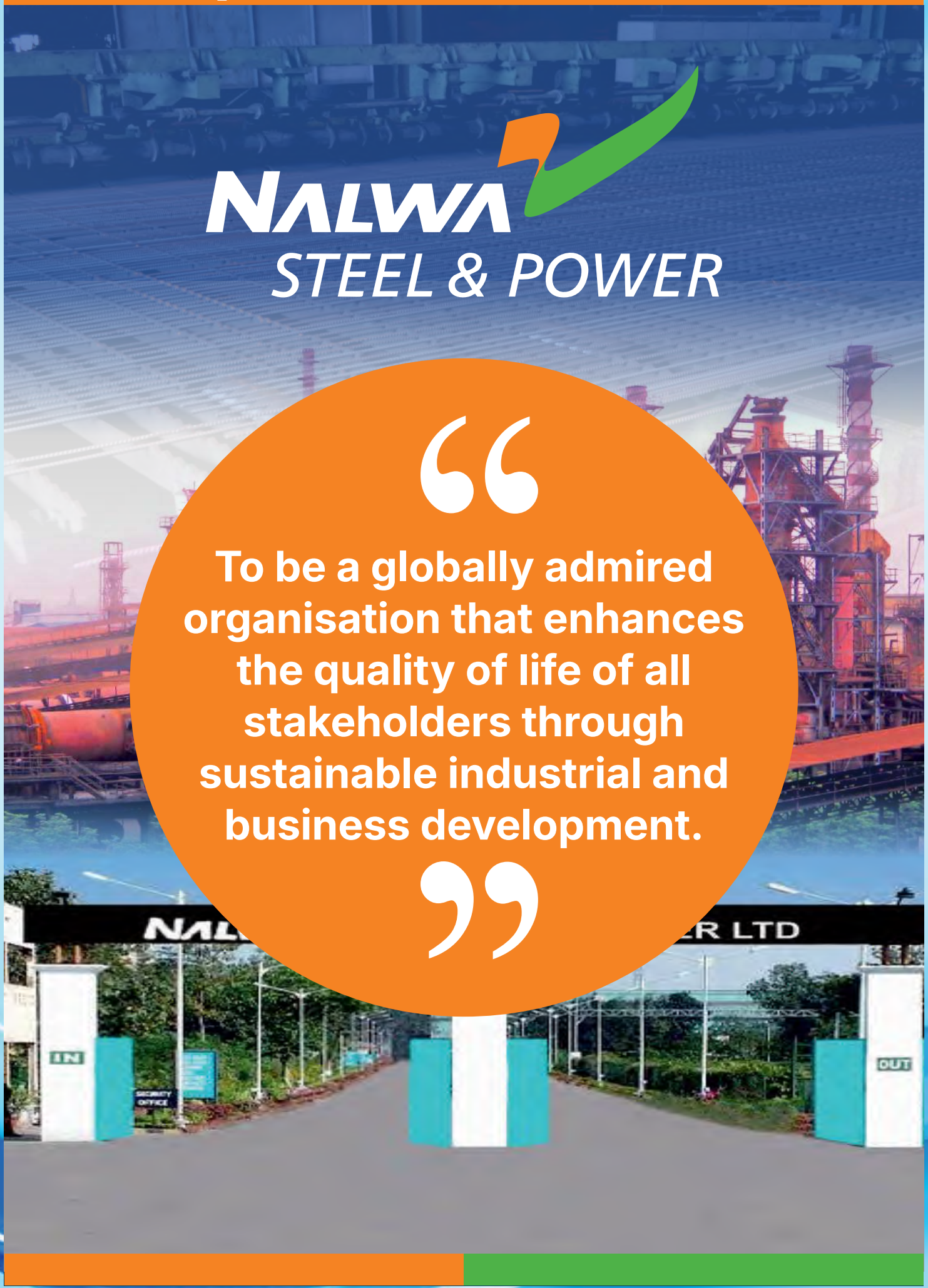

Message from the Hon'ble Chancellor's Desk

I'm delighted to learn that the School of Science at O. P. Jindal University, Raigarh, is hosting the "4th International Conference on Innovation and Research in Science & Technology for Sustainable Development," (ICIRSTSD) during May 29–30, 2025.

In an era marked by rapid technological advancement, interdisciplinary research and collaboration—particularly in frontier areas such as artificial intelligence, machine learning, quantum computing, synthetic biology, nanotechnology, space science, and data-driven innovation—are vital for developing sustainable solutions to pressing global challenges, including climate change, energy crises, resource depletion, environmental degradation, biodiversity loss, water scarcity, social inequality, and concerns around cybersecurity and data privacy. Conferences like ICIRSTSD serve as pivotal platforms for fostering insightful dialogue, exchanging transformative ideas, and advancing forward-looking research that accelerates sustainable development. This event exemplifies our university's steadfast commitment to scientific excellence, technological innovation, and addressing the critical challenges that shape the future of our planet.

At O.P. Jindal University, we have always believed in the transformative power of knowledge, research, and collaboration to drive meaningful change. The ICIRSTSD serves as a vital platform for academicians, industry leaders, researchers, and policymakers to come together and tackle the challenges and opportunities in the fields of science and technology. I am confident that the discussions and innovations arising from this conference will play a key role in accelerating the transition towards more sustainable solutions.

I am confident that the deliberations and insights shared during this conference will contribute meaningfully to both academic progress and real-world applications. I also commend the efforts of the faculty, students, and staff of the School of Science for organizing this significant event and bringing together distinguished scholars, researchers, and practitioners from across the globe.

I extend my heartfelt greetings to the delegates joining us from all corners of the world and wish the conference immense success!

Ms. Shallu Jindal
Chancellor, OPJU

Message from the Hon'ble Vice-Chancellor's Desk

I am pleased to note that the School of Science, O. P. Jindal University, Raigarh is organizing its 4th International Conference on "Innovation and Research in Science & Technology for Sustainable Development" during 29-30 May 2025.

In a world marked by constant change, it is scientific innovation and technological progress that hold the key to overcoming the pressing challenges of our time. From climate change and resource scarcity to energy demands and sustainable infrastructure, the responsibility lies with the scientific community to pioneer solutions that are not only groundbreaking but also ethically and environmentally sound. This conference marks a significant step forward in our collective pursuit of knowledge-driven solutions for a more sustainable and equitable future.

At O. P. Jindal University, we remain deeply committed to nurturing a culture of research, innovation, and interdisciplinary collaboration that addresses the pressing challenges of our time. The theme of this conference — Innovation and Research in Science & Technology for Sustainable Development — resonates strongly with our institutional mission to not only pursue academic excellence but to ensure that knowledge leads to real-world, sustainable solutions.

I take great pride in the initiative taken by the School of Science in organizing the 4th International Conference, which serves as a vital platform for bringing together thought leaders, researchers, industry experts, and young scholars. By encouraging dialogue across disciplines and borders, the conference fosters an environment where meaningful innovation can thrive and impactful partnerships can emerge. I commend the School of Science for its dedication to academic excellence and curating a programme that reflects both depth and diversity in thought. I am confident that the discussions of this conference will contribute significantly to the global discourse on sustainable development and inspire new directions for impactful research.

On behalf of the university, I extend a warm welcome to all participants, distinguished speakers, researchers, and guests attending the International Conference. I trust this conference will offer you a dynamic and thought-provoking experience that fosters growth and inspiration.

As Vice-Chancellor, I am proud that our institution continues to be a hub for meaningful academic dialogue and transformative research. I look forward to the impactful outcomes that will emerge from this gathering.

Wishing all delegates a fruitful and enriching experience and the conference a great success!

Dr R. D. Patidar
Vice Chancellor, OPJU

Message from the Dean's Desk

It is with great honour and enthusiasm that I extend a warm welcome to all the distinguished guests, speakers, researchers and participants joining us for our prestigious 4th International Conference on Innovation and Research in Science & Technology for Sustainable Development during 29-30 May 2025.

In today's fast-changing world, shaped by rapid technology growth and global challenges, it is more important than ever to have platforms that support innovation, research, and collaboration. The organization of the International Conference on Innovation and Research in Science and Technology for Sustainable Development is a timely and purposeful initiative aimed at addressing these very needs. It will serve as a vibrant platform for the convergence of brilliant minds across academia, industry, and policy-making to share pioneering research, exchange transformative ideas, and foster collaborations that drive real-world impact. The sessions planned during this conference will cover a wide spectrum of disciplines, reflecting the interconnected nature of sustainable development. From smart technologies to green infrastructure and scientific policy frameworks, we aim to ignite discussions that not only advance knowledge but also inspire action.

The School of Science has always supported high-quality education and the search for knowledge that helps improve society. Organizing or taking part in a conference like this not only reflects our core values but also gives everyone a chance to share ideas, connect with others, and explore new areas of research and innovation. On behalf of the School of Science, I am proud to be associated with this important and inspiring event. This conference shows our strong commitment to supporting research, encouraging new ideas, and working together across different fields to solve real-world problems.

I extend my heartfelt congratulations to the organizing committee for their meticulous planning and dedication. Let this conference be a catalyst for meaningful progress and lasting partnerships. Together, through science and innovation, we can build a more sustainable and equitable future for all.

Once again, a heartfelt welcome to all, and we wish you a successful and memorable experience!

Dr G. C. Mishra
Dean, School of Science, OPJU

Message from the Conveners' Desk

It is indeed a great honour for us to extend a warm and heartfelt welcome to all participants of the "International Conference on Innovation and Research in Science & Technology for Sustainable Development (ICIRSTSD-25)". We are truly pleased to host delegates, scholars, and experts from across the nation, and especially honoured by the presence of our international guests, who have brought with them the depth of knowledge and experience gained through years of dedicated research and practice. Your participation adds immense value to the dialogue and purpose of this conference.

Innovation and research open up new vistas of knowledge and new dimensions to our imagination to make everyday life more meaningful and richer in depth and content. "Research & Innovation" is at the helm of technological progress and is the key to increasing productivity, exploiting growth opportunities in emerging markets and creating knowledge-driven competitive advantage. The theme of this conference reflects the ever-expanding boundaries of knowledge, acknowledging the crucial role that scientific advancements play in confronting contemporary challenges and fostering sustainable development. The theme also reflects our commitment to interdisciplinary collaboration and responsible innovation.

As India moves forward on its path toward the vision of Viksit Bharat @2047, it becomes imperative to leverage the power of research and innovation as drivers of meaningful, inclusive, and sustainable growth. This conference aims to serve as a dynamic platform for sharing contemporary insights and practices, fostering the exchange of ideas, promoting collaboration, and formulating strategies that resonate with this national vision and contribute to building a resilient and prosperous future. We are proud to host thought leaders who will present cutting-edge findings and methodologies that push the boundaries of knowledge and offer practical solutions to some of the world's most pressing issues.

On behalf of the organizing committee, we extend a warm invitation to you to actively participate in this conference—not only as a delegate, but also as a valued contributor in the mutual exchange of knowledge and ideas. Your interactions—with both emerging young minds and seasoned experts—will add significant value to the collective experience. Events of this magnitude offer a unique opportunity to cultivate purposeful relationships, where even brief exchanges can evolve into long-term collaborations. Such connections, grounded in shared vision and commitment, have the potential to drive mutual growth, enhance innovation, and ultimately contribute to improved competitiveness and sustainable success.
The organizing committee is dedicated to ensuring a smooth and enriching experience for all participants and has made every effort to provide a comfortable and welcoming environment for our esteemed guests. However, there may be occasional lapses. We kindly ask for your understanding and apologize for any inconvenience caused.
Once again, we extend a warm welcome and look forward to engaging, insightful, and meaningful deliberations throughout the course of the conference.

Dr Ankur Rastogi
Sr. Associate Professor,
School of Science, OPJU

Dr Taniya Sengupta Rathore
Associate Professor,
School of Science, OPJU

Guests

Prof. (Dr.) L. P. Pateriya
Vice Chancellor,
Shaheed Nandkumar Patel University,
Raigarh

Dr. Ashish Panda
Dy. Secretary, NITI Aayog,
New Delhi

Dr. S. S. Rathi
Plant Head,
Nalwa Steel & Power,
Raigarh

Prof. (Dr). Arun Kr Tripathy
Department of Mathematics,
Sambhalpur University,
Odisha

Dr. Maruthi Kasyap GNV
CEO, VB Group,
Hyderabad, Telangana

Mr. B. K. Singh
COO, MSP Steel & Power Ltd.,
Raigarh

Keynote Speakers

Dr. Bijoy Kumar Sahoo
Professor of Physics,
National Institute of Technology Raipur

Dr. Arvind Deshmukh
President,
MBSI, Nagpur

Dr. Ulrich Berk
President,
German Association of Homa Therapy, Germany

Mr. Thomas Abdallah
Lecturer; Deputy Vice President and Chief Environmental Engineer,
MTA New York City Transit

Dr. Subha Pratihar
Assistant Professor of Chemistry,
Akansas Tech University, USA

Dr. Shiv Raj Nile
Scientist C, BRIC- NABI,
Department of Biotechnology,
Mohali

Dr. Prashant S. Alegaonkar
Professor, Department of Physics,
Central University of Punjab Bathinda,
Punjab

Dr. Sandeep Shinde
Senior Scientist,
1Cell.Ai Pvt Ltd., Wakad,
Pune

Patron

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Chancellor, OPJU

Conference Chairman

Dr. R.D. Patidar

Vice Chancellor, OPJU

Conference Vice Chairman

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Dr. Shivam Pandey

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Ms. Sumitra

Ms. Monadeepa Sengupta

Mr. Hemant Kumar

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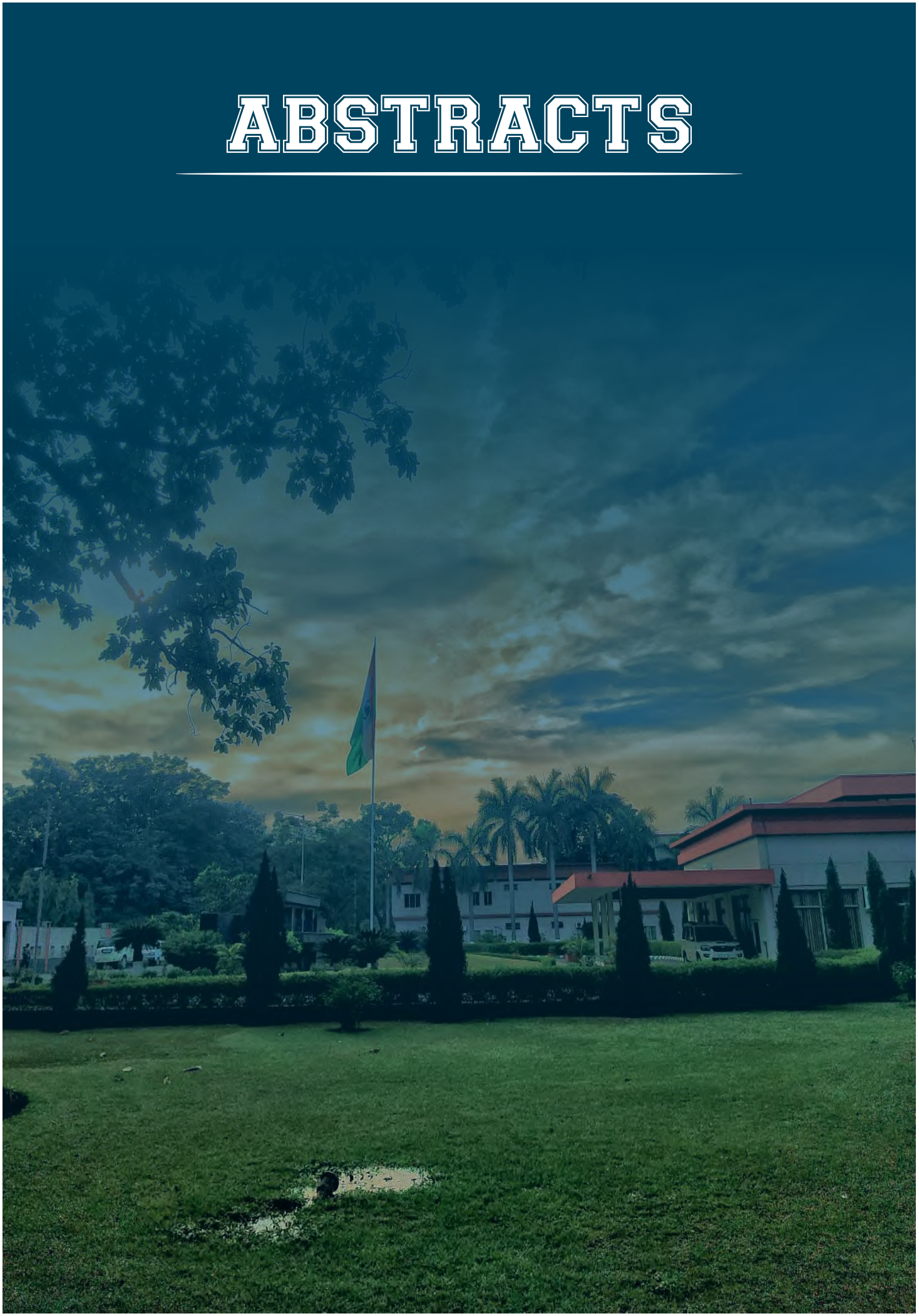
ABSTRACTS



Emerging Meta-Materials and Their Applications in Engineering and Technology

Dr. Prashant S. Alegaonkar

Professor, Department of Physics, Central University of Punjab, Bathinda, Punjab

ABSTRACT

The meta era is revolutionizing engineering and technology, with meta-materials and meta-surfaces offering unprecedented control over waves and physical interactions. This invited talk will explore their historical development, fundamental principles, and broad applications across fields like acoustics, electromagnetics, thermal engineering, geo-physics, bio-imaging, and sensing technologies. Additionally, their role in defence and security, particularly in stealth, surveillance, and communication systems, will be discussed. The talk will highlight emerging trends and future directions, showcasing how these advanced materials are shaping next-generation innovations.

Radiopharmaceuticals Probes for Diagnosis and Treatment of Multiple Diseases

Sandip S. Shinde

Senior Scientist, 1Cell.Ai Pvt Ltd., Wakad, Pune

ABSTRACT

Positron emission tomography (PET scans using radiopharmaceuticals enable rapid and precise monitoring of whole-body disease lesions, thus allowing accurate patient stratification in a noninvasive way. Syntheses of radioprobe for PET typically require several steps, including extraction of radiofluoride from $H_2[^{18}O]O$, elution, and drying, prior to nucleophilic substitution reaction, being a laborious and time-consuming method. In presentation we explain our tri-(tert-butanol)-methylammonium iodide (TBMA-I), a quaternary ammonium salt serving as the PTC for radiofluorination reactions. The favorable elution efficiency of radiofluoride using TBMA-I was demonstrated with aprotic and protic solvents skipping drying conditions.

Biotechnological Solution to Electronic Waste (e-Waste) by Using Actinobacteria

A.M. Deshmukh

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Osmanabad 413501 (M.S.) India

ABSTRACT

It is believed that biotechnology is one of the most promising technologies in metallurgical processing. For many years, bioleaching has been used for the solubilization of metals from ores. Bioleaching is useful for treating ores with low concentrations of metals; it is also simple and cheap to operate. It has been successfully applied toward the leaching of metals from ores, though it has not yet been commercially applied toward the recovery of metals from printed circuit boards (PCB). Several authors have recently published studies on the bioleaching of metals from electronic waste. The aim of the study was to formulate microbial consortium for solubilization of metals from waste PCB and evaluate its efficacy. For this purpose, a microbial consortium from bauxite and pyrite ore samples was obtained using a simple 'top down' approach. Essentially, printed circuit boards (PCB) were obtained and used as representative samples of e-waste. Various concentrations (1–5%) of PCB powder were subjected to bioleaching, and the effects on metal solubilization, changes in pH and concentration of ferrous iron produced were assessed. It was observed that a maximum of 96.93% Cu and 93.33% Zn was solubilized by microbial consortium from 10 g/L of PCB powder, whereas only 10.26% Ni was solubilized from 30 g/L of PCB powder. For lead, only 0.58% solubilization was achieved from 20 g/L of PCB powder. An analysis of the precipitate formed during bioleaching using scanning electron microscopy with energy dispersive X-ray analysis revealed the presence of Tin (59.96%), Cu (23.97%), Pb (9.30%) and Fe (5.92%).

Semiconductor Science and Technology: Strategy for Sustainable Development

Dr. Bijoy Kumar Sahoo

Professor of Physics, National Institute of Technology Raipur, India

ABSTRACT

Semiconductor has revolutionized all sphere of technology. Academy and industrial participation can boost Indian domestic production for a steady economic growth. Demand of domestic product will show upward trend of rupee value. Despite its fundamental role in the development of the clean energy economy, semiconductor production comes with a significant environmental cost. The semiconductors industry is resource-intensive, using plentiful energy and water to manufacture its chips. Sustainability in semiconductor manufacturing paves the way for an eco-friendlier technology sector. Semiconductors are components present in many electronic devices such as PCs, tablets, smart phones or TVs. They also find an outlet in energy generation and industrial applications, such as the solar cell, automotive industry or lighting. The demand for semiconductors has increased in recent years, which leads to an increase in carbon emissions from the semiconductor industry.

One of the key issues toward achieving semiconductor sustainability is the use of renewable energy sources. Most semiconductor manufacturing facilities require large amounts of electricity for the manufacturing process. By using renewable energy, such as wind or solar power, companies can reduce their carbon footprint, and many semiconductor companies are already followed this path. The reduction of waste and the efficient use of resources are also fundamental to the sustainable development. A possible solution is the circular economy, which involves the recycling and reuse of semiconductor and the correct disposal of waste. Companies can adopt sustainable packaging practices to reduce the amount of waste. The semiconductor industry is also exploring new materials obtained from renewable sources and technologies to reduce the environmental impact. Within manufacturing operations, many processes or tools may need to be replaced by greener alternatives, some of which are still in early development. By adopting sustainable practices both in manufacturing and throughout the supply chain, and by investing in the research and development of sustainable solutions, semiconductor companies can reduce their impact and gain competitive advantages in an increasingly environmentally sensitive global market.

Biowaste to health: Sustainable valorization biowaste for unlocking functional nutraceuticals for cancer prevention

Shivraj Hariram Nile

BRIC-National Agri-Food and Biomanufacturing Institute(Formerly National Agri-Food Biotechnology Institute) (NABI), Sector-81, Mohali-140306, Punjab, India

ABSTRACT

The fruit-based food processing industry generates large volumes of biowaste that could be used to produce value-added products and their utilization become an important issue for bioeconomy. This fruit processing results in tremendous losses of valuable non-nutritional, nutritional, and functional bioactive components, and other secondary metabolites. However, it is possible to recover important bioactive components from waste generated during the industrial processing of various fruits and vegetables like onion, apple, citrus and soybean products by applying various extraction and analytical methods. In most cases, the wasted by-products can present similar or even higher contents of bioactive compounds than the final product. The aim of this this research is to promote the production and processing of different fruits and vegetables biowaste including citrus, apple, onion, and soybean waste highlighting the possibility of the integral exploitation of by-products rich in bioactive compounds and having health benefits. The nutraceuticals and functional compounds extracted from different fruit biowaste possessed the greatest antioxidant and anti-inflammatory effects in vitro and exhibited significant cytotoxic effects in HeLa cells in a dose-and time-dependent manner. Flow cytometric analysis indicated that these bioactives induced cell cycle arrest at the S phase in a time-dependent manner by altering cyclin-dependent kinase. Moreover, it induced apoptosis via chromosomal DNA degradation and increased reactive oxygen species generation. Furthermore, they altered the apoptosis-associated protein expression in the cells by activating caspase-9/-3, downregulating anti-apoptosis protein B-cell lymphoma (Bcl)-2 expressions and up regulating the pro-apoptotic Bcl-2-associated X protein. BH3-interacting domain death agonist cleavage occurred prior to the degradation of an anti-apoptotic Mu-2-related death-inducing gene involved in cell death signaling. Consequently, these bioactives from fruit waste holds promise as an anti-inflammatory and anticancer agent for treating cervical cancer. Further, evaluation of their performance within the human cells using various in vitro and in vivo models against treatment of various diseases like diabetes, gout, and neuroprotection with higher bioavailability.

Keywords: Biowaste; Bioactive Compounds; Fruits; Antioxidants; Inflammation; Cancer

Unlocking Student Success in Undergraduate Physical Chemistry Courses: Applications of Computational Chemistry Lessons

Subha Pratihar
Assistant Professor of Chemistry, Department of Mathematical and Physical Sciences
School of STEM, Arkansas Tech University, AR 72801

ABSTRACT

Undergraduate physical chemistry presents a significant academic challenge due to its mathematically intensive and conceptually abstract nature. To address persistent learning obstacles and enhance student success, this study explores the integration of computational chemistry lessons into the physical chemistry curriculum. By applying molecular modeling software, visualization tools, and quantum chemical calculations students gain an interactive, applied understanding of core topics such as quantum mechanics, thermodynamics, and kinetics. Results from this pedagogical approach implementation to Physical Chemistry courses showed enhanced student engagement and better student performance in assessments. Short computational projects that provide students with the opportunity of independent literature review and data generation and analysis fostered critical thinking. The outcome strongly supports that computational chemistry is a valuable teaching tool for undergraduate physical chemistry courses.

Sustainable Mass Transit

Thomas Abdallah
Lecturer; Deputy Vice President and Chief Environmental Engineer, MTA New York City Transit

ABSTRACT

The theme of the talk will explore how mass transit represents one of the most sustainable solutions available to cities, states, and countries in the fight against toxic pollution and greenhouse gas emissions. While mass transit does carry its own carbon footprint, the industry has made significant strides over the past two decades to adopt more sustainable practices across vehicles, infrastructure, and facilities. With over 38 years of experience, Thomas Abdullah has dedicated his career to advancing the sustainability of trains, buses, and transit-related infrastructure through innovative design and environmentally conscious capital project development.

Agnihotra and Homa Farming - Tools for a Sustainable Development on Planet Earth

Dr. Ulrich Berk

President, German Association of Homa Therapy, 78357 Mühlingen, Germany

ABSTRACT

Environmental Pollution and Climate Change are the big challenges of our time. All live on this planet – plant kingdom, animal kingdom, and humans – are affected. The Covid pandemic has shown how vulnerable we are.

We have to change our lifestyles and find sustainable ways in order to basically save our planet.

What can be the solution for this universal problem?

One such solution is Homa Therapy with Agnihotra, a daily pyramid fire at sunrise and sunset, as its basic tool. It comes from ancient Vedic Knowledge and has wide-reaching beneficial effects on our whole environment, means on our atmosphere, on the soil, and on our water resources, and also biodiversity is increased.

Agnihotra purifies our environment and thus offers a solution for a sustainable future where humans live in Harmony with Nature, with plants and animals and keep this planet, our Mother Earth, alive and thriving.

In this presentation first the method of Agnihotra and Homa Therapy will be explained.

Then I will give an overview on the research done so far and the research currently being carried out about how Agnihotra and Agnihotra Ash help to mitigate problems of the pollution of our atmosphere, the soil, and water resources and thus lead to sustainable agriculture and horticulture.

Besides that, Homa Organic Farming can help a lot to sequester large quantities of CO2 from the atmosphere which helps in controlling Climate Change.

As Homa Organic Farming has been shown to be more profitable than conventional farming, this also is an important example of how we can bring ecology and economy together.

Also, quite some research has been done in the field of microbiology and biotechnology – e.g. showing that Agnihotra reduces the bacterial load in the air, it purifies water from microbiological pollution, multi drug-resistant bacteria can be controlled, and the virulence of pathogenic bacteria is reduced. Also, Biodiversity is restored.

More research in all these fields is suggested, and I hope that the School of Science, O. P. Jindal University, Raigarh (C.G.), will in future be part of this research to study the impact of Agnihotra in the different areas.

Differential Equations and Qualitative Research

Prof A. K. Tripathy

Department of Mathematics, Sambalpur University, Sambalpur - 768019, India

ABSTRACT

Differential equations form the analytical foundation for modeling dynamic systems across various disciplines, including physics, biology, and engineering. This work explores the significance of differential equations in understanding population dynamics, particularly through delay differential and neutral differential systems. Beginning with basic population models, the paper evolves into more realistic frameworks involving time delays and interdependent factors such as matured male and female populations. These models are expressed as systems of functional differential equations, capturing the complexities of growth, immigration, and emigration. The paper emphasizes the use of qualitative research focusing on the behavior of solutions rather than explicit solutions, to study oscillatory, bounded, or asymptotic properties. Such methods are crucial when exact solutions are difficult to obtain, particularly in high-dimensional systems. This approach has notable implications for fields like space dynamics and mathematical biology, where understanding the nature of solutions is often more critical than solving the equations directly.

Paper ID: 1.1

Pollution Level of Kelo River

Reenu Mishra[a], Vandana Jangde, Archna Asatkar

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ABSTRACT

At present study we analyse water sample from 8 different sampling spot of Kelo river at Raigarh City. We analyse the effect of domestic effluents, agricultural run-off, sewage, industrial effluents and analyse physico-chemical condition of Kelo river water. It was found that drains adversely affect the river water quality. Sewage and pollutants were dumped in river without pre-treatment. Irrigation, industrial effluent, domestic waste and surface run-off adversely affects river water quality. At present study it was found that, several water quality parameters like, TDS, Hardness, Turbidity, had higher than permissible limit, DO, BOD and COD value also indicates pollution. Presences of bacteriological parameters also confirm pollution.

KEYWORDS: Kelo river, TDS, turbidity.

Paper ID: 1.2

Imine-functionalized highly ordered porous organic polymer with high iodine uptake capacity and catalytic activity for microwave-assisted Knoevenagel condensation reaction

Preeti Kumari[a], Vivek Sharma[b]

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ABSTRACT

In light of the potential uses of nuclear energy, proper handling and storage of radioactive wastes are crucial. Handling volatile radioactive wastes (such as iodine radioisotopes ^{129}I and ^{131}I) during the reprocessing of spent nuclear fuel calls for extra caution. Due to their extreme toxicity, both radioisotopes necessitate the loading of iodine filters with effective adsorbents in order to retain them almost quantitatively from fume streams. Therefore, the development of materials with effective iodine capture capacities is required. In order to achieve this goal, an imine linked porous organic network (I_POF) was manufactured through microwave assisted

synthesis. A thorough characterization of the polymer was conducted employing powder X-ray diffraction study, N_2 sorption, FT-IR and FE-SEM. The polymer showed great promise in iodine capture from vapor phase at increased temperature (75°C: 5520mgg^{-1}) and ambient temperature (25°C: 3341mgg^{-1}). Furthermore, the capture capability of I_POF is not significantly compromised, making it a recyclable adsorbent. Also, I_POF was used as a reusable heterogeneous base catalyst for solvent-free Knoevenagel condensation reaction.

KEYWORDS: Radioactive Waste Management, Iodine Adsorption, Porous Organic Framework (I_POF), Microwave-Assisted Synthesis, Knoevenagel Condensation.

Paper ID: 1.3

Designing of a Self-Assembling Ultrashort Peptide for Antibacterial Application

Samiksha S. Thakur[a], Suruchi Behra[b], Deepak Mahant[b], Ankur Rastogi[a], Pramod K. Gavel[b*]

[a]*Department of Chemistry, OP Jindal University Raigarh*
[b]*Department of Chemistry, Kirodimal Govt. Arts and Science College Raigarh 496001, Chhattisgarh.*
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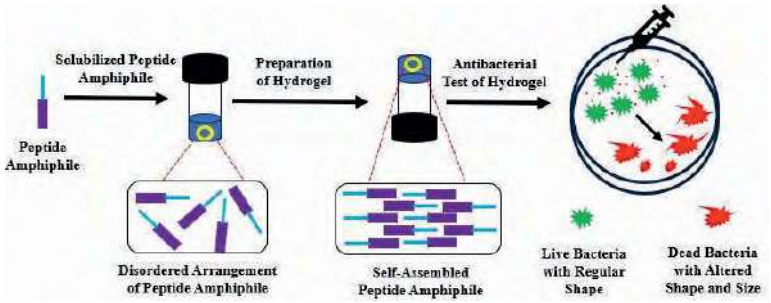
ABSTRACT

Nowadays researchers are extensively synthesizing self-assembling peptides by placing the hydrophobic and planar moiety in the N-terminal of first of amino acid.[1] After coupling with second amino acid using liquid phase peptide synthesis self-assembling peptides are prepared for various applications including antibacterial, anti-inflammatory, wound healing, biocatalysis, biosensing and drug delivery applications. Various hydrophobic and planar moieties are used for the synthesis of self-assembling peptide building blocks comprises Fmoc (9-fluorenylmethyloxycarbonyl), Amoc (9-anthracenemethyloxycarbonyl), Nmoc (naphthalene-2-methoxycarbonyl), and Cbz (benzyloxycarbonyl).[2] Additionally, the aliphatic N-terminal protecting group Boc (tert-butyloxycarbonyl) is widely used due to their excellent hydrophobicity, ease of protection and stability of Boc in extremely basic pH. Furthermore, aromatic amino acids such as phenylalanine, tyrosine, and tryptophan are strategically incorporated to increase the self-assembling tendency of peptides.[1,2] The aggregation of peptides leads to entrap the large quantity of solvent molecules either water or organic solvents depends upon the design of peptides. If the design peptides encapsulate the water molecule, then the resulted structure is called hydrogel and similarly peptides encapsulate the organic solvent is called organogel.[1,2]

Herein, we have hypothesized to design the self-assembling peptides by incorporation of aromatic protecting group at N-terminal of self-assembling peptides which will entrap the large amount of water and form self-assembled structures. This self-assembled structure will further used for antibacterial applications owing to their bacterial membrane destabilizing activity (**Scheme 1**).



Scheme 1: Diagrammatic representations of self-assembly and antibacterial activity of the peptide-based hydrogel showing alteration of cellular structure of bacteria after gel treatment.

KEYWORDS: Self-Assembling, Hydrogel, Organogel, Peptides, Antibacterial hydrogel

Paper ID: 1.4

Luminescence properties of $CaZr_4(PO_4)_6$: RE (RE= Sm^{3+}, Tb^{3+}) phosphor for ecofriendly lighting application

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ABSTRACT

Solid state synthesis was used as a method to prepare $CaZr_4(PO_4)_6$: RE (RE= Sm^{3+}, Tb^{3+}) phosphor. X-ray diffraction (XRD) and the photoluminescence phenomenon were used to evaluate the synthesised phosphor. Three emission peaks, located in the orange and red regions of the wavelength spectrum at 564, 600, and 647 nm, were found for $CaZr_4(PO_4)_6$ phosphor doped with Sm^{3+} ion at an excitation of 403 nm. When excited at 378 nm, the Tb^{3+} doped $CaZr_4(PO_4)_6$ phosphor emits strong green emission (545 nm) and relatively weak blue emission (483 nm) emissions. The photoluminescence spectra suggest that UV light may be an effective way to excite the phosphor and produce a desirable orange-red and green emission that is consistent with the widely used NUV LED chip. Therefore $CaZr_4(PO_4)_6$: RE (RE= Sm^{3+}, Tb^{3+}) phosphor may be applied in the field of solid state lighting.

KEYWORDS: Lanthanide, Solid state synthesis, X-ray diffraction.

Paper ID: 1.6

Design and Evaluation of Artemisinin Derivatives via Docking and Pharmacokinetic Profiling Against Plasmodium falciparum

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ABSTRACT

With around two million fatalities each year, malaria remains a serious global health concern. Malaria parasites have developed resistance to the most effective artemisinin derivatives used in combination therapy and existing approved drugs. Additionally, artemisinin has a short half-life, a high clearance rate, and shows limited action on mature gametocytes and the hepatocytic stage of malaria. Several studies demonstrate the neurotoxicity of artemisinin, highlighting the urgent need for developing new potent antimalarial drugs [1-5]. To address this issue, an extensive pharmacokinetic and molecular docking analysis was conducted on artemisinin-based compounds. This study aims to identify viable candidates to combat the deadly malaria parasite Plasmodium falciparum. Thirty sulfur and selenium-substituted artemisinin molecules were screened and subjected to docking and pharmacokinetic analyses. Toxicity analysis, ADME characteristics, and drug-likeness assessments were performed to evaluate their pharmacological potential. Our efforts yielded three compounds demonstrating superior potency compared to artemisinin, with better distribution, lower clearance, longer half-life, and reduced toxicity. They also exhibited strong binding affinity and high antimalarial potential. Further structural activity relationship studies conducted using the PASS web server confirm their antiparasitic activity.

KEYWORDS: In-silico drug discovery, Antimalarial drug, ADMET, Docking, QSAR.

Paper ID: 1.8

Synthesis, Characterization and Theoretical Evaluation of Biologically active Hydroxypyridine derivative: Molecular Docking and ADMET Study

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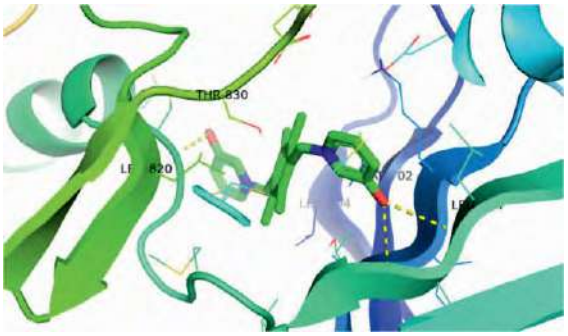
ABSTRACT

In today's world, the development of effective drugs is crucial to improving human health and quality of life. Chemists play a key role in this process by designing, synthesizing, and analyzing new compounds that could one day become life-saving medicines. This study focuses on the synthesis of a new Hydroxypyridine based compound, 1,1′-((2,3,5,6-tetramethyl-1,4-phenylene)*bis*(methylene))bis(3-hydroxypyridin-1-ium) bromide, and explores its potential as a future drug candidate. The compound was synthesized in the lab and its structure was confirmed using infrared (IR) and nuclear magnetic resonance (NMR) spectroscopy. To understand how it might behave in a biological setting, we used molecular docking techniques to predict how well this compound might bind to an anticancer protein target. Interestingly, it showed a stronger binding affinity (−5.41 kcal/mol) than a commonly used standard drug, suggesting promising anticancer activity. In addition, ADMET (Absorption, Distribution, Metabolism, Excretion, and Toxicity) analysis indicated that the compound has favorable drug-like properties and a good safety profile. Altogether, these findings point to the potential of this newly synthesized molecule as a promising lead for future drug development. With further biological testing and validation, it could open new doors in the search for effective anticancer agents.



KEYWORDS: Hydroxypyridine, NMR, Binding affinity, ADMET

Paper ID: 1.9

Adsorptive Removal of Reactive Blue 21 Dye and Treatment of Effluent Sample on AAFA

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ABSTRACT

In this study, an organic dye, Reactive Blue 21 (RB 21), commonly used in textile industries, is removed from textile dye solution along with the simultaneous reduction of several key water quality parameters, including total solids (TS), total dissolved solids (TDS), total suspended solids (TSS), turbidity, dissolved oxygen (DO), pH, and temperature, using acid-activated fly ash (AAFA). Fly ash was studied using Fourier Transform Infrared Spectroscopy (FTIR), X-ray diffraction (XRD), and Scanning Electron Microscopy (SEM) techniques after being treated with N/2 H2SO4 to improve its surface area and adsorption capabilities. Batch mode adsorption processes were carried out at room temperature to assess the impact of various parameters, including mixing duration (30-510 minutes), initial dye concentration (10-100 mg/l), pH (2-9), and adsorbent dose (5-70 g/l). Adsorption efficacy of AAFA per unit mass for the dye RB21 improved with longer mixing times, higher initial dye concentrations, and lower adsorbent doses. The Langmuir and Freundlich adsorption isotherm models were used to evaluate the adsorption equilibrium; of the above two isotherm models, the Langmuir isotherm model provided a superior result. The highest adsorption capacity of AAFA was found to be 51.02 mg/g, and the regression coefficient (R^2) was 0.977, highlighting AAFA's potential as a low-cost, sustainable material for textile wastewater treatment.

KEYWORDS: Reactive Blue 21, Adsorption; Acid Treated Fly ash; Adsorption Isotherm; Textile Effluent.

Paper ID: 1.10

Experimental Study of MeltingStearic Acid in latent Heat Thermal Energy StorageusingInternal & External Longitudinal fins

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ABSTRACT

The energy storing ability of latent heat energy storage systems is more as a result these systems are more effectual among all other thermal heat storage. This study experimentally investigates the charging of stearic acid ($C_{18}H_{36}O_2$) in the finned triplex pipe heat exchanger. The experiments were conducted for heat transfer fluid flow rate of 0.11, 0.22, 0.3 and 0.45 Kg/s during the melting process and for 0.6, 0.7, 0.8, 0.9 Kg/cm^2.The results showed that; the melting time of the PCM falls from 80 min to 45 min as the flow rate of HTF increases from 0.11 kg/s to 0.45 kg/s. Also the heat transfer rate during melting initially decreases rapidly with increasing time, then it stays constant during the phase change process. Average effectiveness of triplex tube heat exchanger also evaluated & showed that the average effectiveness occurs between 0.86 to 0.87 as effectiveness is less sensitive to mass flow rate. The effectiveness remains high as long as phase change occurs efficiently & available surface area for heat exchange. Energy storage capacity of PCM slightly decreases with increase in mass flow rate from 0.11 kg/s to 0.45 kg/s.

KEYWORDS: Triplex pipe heat exchanger; phase change material; melting; solidification; effectivenes

Paper ID: 1.11

Electrical conductivity of sodium carboxymethylcellulose (NaCMC) in aqueous-organic mixed solvent media- A Review

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ABSTRACT

This review evaluates the electrical conductivity of an aqueous polyelectrolyte solution, considering dynamic scaling laws to understand polymer conformations across various concentration levels in solvents such as methanol, acetonitrile, ethylene glycol, and IPA. It addresses the influence of salt on the conductivity of polyelectrolyte solutions, the chemical structure and synthesis, the behavior of polyelectrolytes in binary mixed solvent systems, and the physicochemical properties of sodium carboxymethylcellulose, along with various transport properties. Additionally, prior research attempted to clarify the results using Manning's counterion condensation theory; however, significant discrepancies were noted, and the potential reasons for these inconsistencies have been thoroughly discussed. Experimental conductivity data were evaluated based on a new model for semi-dilute regimes, as described by Colby et al., employing a scaling framework proposed by Dorbrynin et al. regarding polyelectrolyte chain configurations. The previous study revealed the consequences of solvent choice, polyion-counterion interactions, transference numbers, polyion dielectric properties, association constants, and solvation behavior. The applications of carboxymethylcellulose were also examined in detail, alongside various classifications of polyelectrolytes, conductivity across concentration regimes, transport properties, Manning's counterion condensation theory, theoretical fundamentals, and key equations pertaining to scaling theory. Moreover, the scaling approach was compared to the observed electrical conductivity values for different polyelectrolytes in aqueous solutions across a broad concentration range, from dilute to semi-dilute regimes.

KEYWORDS: Polyelectrolyte; electrical conductivity; sodium carboxymethylcellulose; counter- ion; Manning theory, Scaling theory; Mixed solvent.

Paper ID: 1.12

Deep Dive into Raman Spectroscopy: A Review

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ABSTRACT

Raman spectroscopy is an effective characterization technique for the detection of a wide range of analytes (pesticides, biomolecules, pharmaceuticals, industrial dyes *etc.*)due to its potential to provide figure-print spectra of a variety of molecules by detecting the inelastic scattering of incident photons. It is complementary to infrared absorption spectroscopy(IR), although both techniques detect the vibrational modes of the molecules. For IR measurement molecules should undergo change in dipole moment, whereas for Raman analysis the molecules should undergo change in polarizability. The advantages of this techniques that, it is non-destructive/non-invasive, requires minimal sample preparation, highly sensitive(small amount of sample provides meaningful information) and more importantly biologically and water loaded samples can be analyzed easily; because of no water interference in the results. Furthermore, from the past few decades due to the advancement in optics, handheld and portable Raman Spectrometers has been fabricated in order to ease the on-field containments detection.

KEYWORDS: Raman scattering; Rhodamine 6G; Sensing; Inelastic Scattering; Stokes shift.

Paper ID: 1.13

Characterization of Cellulose Nanocrystals Produced by Acid Hydrolysis from Sugarcane Bagasse as Agro-waste

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ABSTRACT

This study focuses on the preparation of cellulose nano crystals (CNCs) from sugarcane bagasse, an agriculture waste product. Cellulose nano crystals are the tiny crystal like particles formed through acid hydrolysis process. This process uses a strong acid (like sulfuric acid) to break down the long cellulose molecules into smaller, more manageable pieces. Cellulose nano crystals(CNCs) are strong, renewable, flexible bio-based nanomaterial that is useful in various fields such as biomedical engineering, renewable energy, cosmetics, energy storage and nanotechnology due to their natural origin and unique properties such as high strength,

stiffness, and biocompatibility. Sugarcane bagasse, a readily available and resource is used to produce CNCs. Cellulose nano crystals (CNCs) are a sustainable eco-friendly and cost-effective alternative to traditional materials making them suitable for various applications. The study analyzes the properties of Cellulose Nanocrystals(CNCs) , including size , shape, crystallinity and surface characteristic using techniques like Scanning Electron Microscope (SEM) and X-ray Diffraction. This research focuses on the sustainable potential of using Agro waste, particularly sugarcane bagasse to create valuable nanomaterials, contributing to environmental protection and resource.

KEYWORDS: Cellulose nanocrystals, sugarcane bagasse, acid hydrolysis, biocompatibility, Scanning Electron Microscope (SEM), X-Ray Diffraction (XRD).

Paper ID: 1.14

Comparative Study of Palm Oil, Free Fatty Acids Quantitatively and Sugar Profiling in Commercial Biscuit Products: Implications for Quality Control and Consumer Health

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ABSTRACT

The research determines extraction levels of palm oil during biscuit testing through assessment of both sugar composition and Free Fatty Acid concentration. A solvent extraction technique yielded entire palm oil before titration measured the FFA levels. Testing of complete sugar helped identify the sugar breakdown within all biscuit samples. The research creates its conclusion but simultaneously delivers information about palm oil properties in biscuits thus affecting both food industry processes and consumer taste preferences. Food production and handling and usage of palm oil content are influenced by the research findings. Strong evidence suggests that cardiovascular disease and diabetes and obesity developed from consuming excessive quantities of added sugars and palm oil. The study adds further information about the total sugar levels alongside palm oil quality which exists inside baked products. Quality control procedures that exist in food manufacturing led to positive outcomes hence the consumption of healthy food options should be strongly advocated.

KEYWORDS: Health concerns, free fatty acid, sugar composition, biscuits, palm oil, and quality levels.

Paper ID: 1.15

Composition and Adulteration Analysis of Different Brands of Milk Samples & Milk Products

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ABSTRACT

Milk is a vital source of nutrition, but it's quality and safety are frequently compromised due to adulteration. This study focused on composition and adulteration analysis of different brands of milk sample collected from different dairy shops. Quantitative tests including Fat%, total solid, solid not fat. Quantitative tests using Gerber machine (like a centrifuge) and Hot air oven. Also, Qualitative tests including to detect the presence of common adulterants such as water, starch, detergent, sugar, urea, neutralizer, and formalin. Significant differences between brands were found in the compositional analysis, with many samples departing from the guidelines set forth by the Food Safety and Standards Authority of India (FSSAI). Finally, some qualitative analysis has come out which proves that the milk purchased was not in accordance with the legal standard. Adulterants added to milk reduce its nutritional value and may pose a threat to public health.

KEYWORDS: Composition, Adulteration, Fat%, Gerber machine, Total solid, Hot air oven, Solid not fat, FSSAI Parameters, Adulterants.

Paper ID: 1.16

Quantitative and Qualitative Analysis of Dairy Products (Ghee, Butter & Curd)

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ABSTRACT

Dairy product study plays important role in ensuring food safety, quality assurance and nutrient identification. Any products such as ghee, butter and curd play an important role in human health nutrition, contribute essential fats, proteins, vitamins and minerals. This study aims to investigate the chemical composition. This study illustrates a comprehensive qualitative and quantitative analysis of dairy products, particularly curd, ghee, and butter. The purpose of the study of nutritional composition, iodine value, solids-not-fat(SNF)in curd, determination of titratable Calcium, Magnesium in curd, butter and ghee and measurement of free fatty acids (FFA).This study also used advanced analytical technique such as inductively coupled plasma

mass spectrometry (ICP-MS) to identify and quantify specific connections. The results can be used to develop quality control measurements, improve product develop and improve consumer satisfaction according to FSSAI values.

KEYWORDS: Free fatty acids; Inductively Coupled Plasma Mass Spectrometry (ICPMS), Iodine value, Quality analysis.

Paper ID: 1.17

Extraction, Characterization, and Anti-Microbial Application of Curcumin from Raw Turmeric Rhizome

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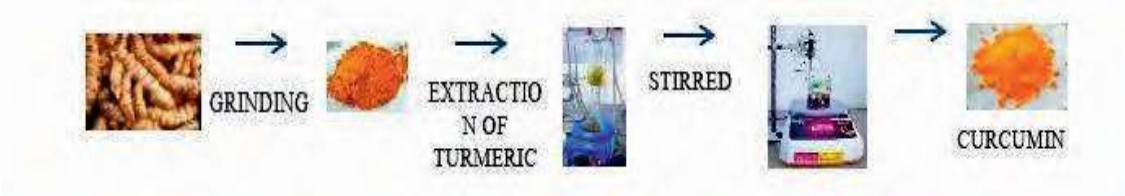
ABSTRACT

Curcumin, an essential bioactive compound found in turmeric, is renowned for its vibrant color and significant therapeutic properties. This study focuses on the extraction and characterization of curcumin derived from turmeric powder obtained from raw turmeric rhizomes using the Soxhlet extraction method with ethanol as the solvent. The extracted curcumin was refined through centrifugation and subsequent treatment with hexane to produce a powdered form. . This powder is the curcumin powder.

The extracted curcumin demonstrated notable antimicrobial activity against both Gram-positive and Gram-negative microorganisms. Characterization techniques including X-ray Diffraction (XRD) and Scanning Electron Microscopy (SEM) were utilized to analyze the structural and morphological features. XRD revealed intense peaks indicative of crystallographic properties, while SEM confirmed a cylindrical morphology of the curcumin.



KEYWORDS: Turmeric, Curcumin, anti-microbial, cylindrical morphology.

Paper ID: 1.18

Treatment of Rice Mill Effluent by Advance Oxidation Process

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ABSTRACT

The waste that comes out from the rice mill contains organic matter and suspended particles in large quantities. Due to which this wastewater is becoming harmful for the environment. Conventional treatment techniques often fail to completely eliminate these resilient contaminate. This study focuses on the use of Advance Oxidation Process as a more effectively treatment method for RME. This process investigation was conducted on raw wastewater discharged from RM, targeting the reduction of Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD). Examine factors like DO (2*ppm*), COD (640mg/L), BOD (108mg/L) and pH (6) change before and after treatment to DO(5ppm), COD (192mg/L), BOD (25mg/L).

Findings indicate that AOPs substantially improve the breakdown of organic pollutants in RME. Enhancing its safety for reuse or discharge. This method shows great potential as an efficient and eco- friendly alternative to traditional treatment option for rice mill.

KEYWORDS: Treatment of wastewater, Advance Oxidation Process , Rice mill effluent , UV radiation

Paper ID: 1.19

Comparative Chemical and XRD Analysis of Cement

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ABSTRACT

From the past few decades cement is a most important binding material used for construction. Its composition is responsible for strength durability and overall performance. In this project PPC (Portland Pozzolana Cement) has been mostly used because of its low price and strength compared to other cement types. Different cement samples are collected from shop. Among the various components, percentage of Calcium Oxide, Silicon dioxide and Aluminium oxide is mostly responsible for its strength and hydraulic properties. This study focusses on chemical (lime, Silica, Alumina) analysis of different brands of cement. The selected cement sample results are following: UltraTech Cement- CaO (56%), Silica (22%), Alumina (5%**);** Birla Gold Cement- CaO (51.02%), Silica (21.3%), Alumina (5.51%); ACC Cement- CaO (44%), Silica

(21%), Alumina (4.59%); Duraguard Cement-CaO (43%), Silica (20%), Alumina (4.77%). Additionally, in this project XRD Analysis technique involve studying the crystallographic structure of different samples of cement. The result is for understanding of cement quality and its capacity in construction application.

KEYWORDS: Cement, PPC, lime, Silica, Alumina, XRD, Construction.

Paper ID: 1.20

Development and Characterization of the Alkali Activated Controlled Low Strength Material Using Red Mud

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ABSTRACT

Controlled low strength materials (CLSM) are the materials which are flowable and self-compacting in nature. These materials are used in various civil engineering applications such as backfill in trenches abutments and retaining walls, void fills in abandoned structures and cavities, conduit bedding, and many more. The strength of CLSM materials is less than 8.3MPa. CLSM is generally made of Portland cement, fine aggregate, fly ash, and water. Many researchers have studied the performance of CLSM using different industrial by-products such as quarry dust, foundry dust, shredded rubber tire, and many others. Alkali-activated materials have emerged as a promising alternative to traditional Portland cement-based concretes, offering significant environmental and economic benefits. In this study, various mix proportion made up of red mud, blast furnace slag, fly ash, and alkali activators are used to study the engineering properties of CLSM. Considering flow value as one of the important parameters of CLSM, firstly, the amount of water content required for the desired flow value was determined. After finding the water contents, each mix proportion was tested for other engineering properties such as unconfined compressive strength, bleeding, density, and durability. The results primarily show that these geomaterials can be used as a CLSM material with further study of its environmental impact on the adjacent soil.

KEYWORDS: CLSM, red mud, alkali activator, flow value, unconfined compressive strength, bleeding.

Paper ID: 1.21

Comparative study of XRD analysis of CuO Nanoparticle of expired paracetamol vs paracetamol

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ABSTRACT

Nanoparticles have various application in different fields such as biotechnology, catalysis, and medicine. Conventional methods of synthesizing nanoparticles often involve toxic chemicals and high energy consumption. This study presents a comparative analysis of copper oxide (CuO) nanoparticles synthesized from expired and standard paracetamol using a thermal decomposition method. With the growing concern over pharmaceutical waste and its environmental impact, this research explores the potential of expired drugs as alternative precursors for nanomaterial synthesis. The crystalline structure, phase purity, and average crystallite size of the synthesized CuO nanoparticles were characterized using X-ray diffraction (XRD) analysis. The XRD patterns confirmed the formation of monoclinic CuO in both samples. However, notable differences were observed in peak intensity, crystallinity, and particle size distribution. CuO nanoparticles derived from expired paracetamol exhibited slightly broader peaks, suggesting smaller crystallite sizes and possible lattice strain due to chemical degradation in the precursor. The study highlights that expired pharmaceutical, often regarded as waste, can serve as viable precursors for functional nanomaterials with comparable structural integrity. This opens a sustainable route for recycling pharmaceutical waste while contributing to the advancement of green nanotechnology.

KEYWORDS: Nanoparticle, expired paracetamol, X-ray diffraction

Paper ID: 1.22

Integrated Characterization of Coal Grades from Gare Pelma 4/2&3 Mines Using Proximate, Ultimate and XRD Analysis

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ABSTRACT

Coal is a fossil fuel mainly comprised of carbon formed from ancient plant material subjected to heat and pressure over millions of years. In this world four types of coal are found and they

are classified by carbon content and energy output: lignite (lowest quality), sub-bituminous, bituminous, and anthracite (highest quality).). In the power industry, coal is crucial as it is one of the most widely used fossil fuels for power generation. Its abundance and relatively low cost make it a key energy source for power generation. In this study four different grade of subbituminous coal samples are collected from Gare Pelma 4/2&3 Mines and we studied it'smoisture content, ash percentage, volatile matter content. We took four different grade samples of grade-17, grade-15, grade-13, grade-11, out of these four samples, sample number 04 has highest carbon percentage with highest Gross Calorific Value (GCV)-4143 Kcal/Kg, moisture % 4.59, ash % 38.15, volatile matter % 26.27 so this coal is considered as the best coal for power generation. We also studied the elemental composition also known as Ultimate analysis by SEM/EADX and chemical structure of coal by XRD. This study helps in optimizing the combustion efficiency, reduce emission and also ensure cost effective energy production.

KEYWORDS: Fossil fuel , Subbituminous coal , Gross Calorific Value, SEM , EDAX, XRD.

Paper ID: 1.23

Synthesis, Characterization and Applications of Ag-Fe3O4 Nanoparticles using Aegle Marmelos (Bael Patra)

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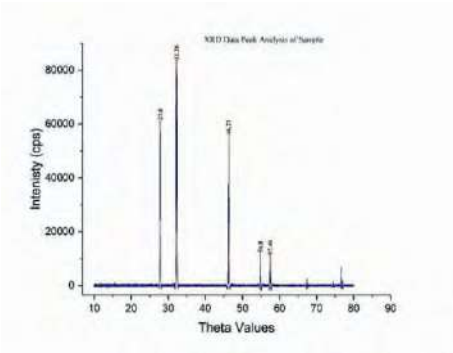
ABSTRACT

Bimetallic nanoparticle synthesis has emerged as a cutting-edge field with diverse applications. In this study, silver-iron (Ag-Fe_3O_4) bimetallic nanoparticles were successfully synthesized using silver nitrate ($AgNO_3$) and ferric chloride ($FeCl_3$) as metal precursors, with an aqueous extract of Aegle marmelos (Bael Patra) serving as a natural stabilizing and reducing agent. The nanoparticles were characterized using scanning electron microscopy (SEM), X-ray diffraction (XRD). The green synthesis approach not only ensures eco-friendliness but also enhances the nanoparticles' unique properties, making them highly effective for antibacterial and catalytic applications. Notably, Ag-Fe_3O_4 demonstrated significant antibacterial activity, underscoring its dual therapeutic potential in microbial treatment. Additionally, its role as an active catalyst was confirmed through the efficient photodegradation of methyl red and methyl orange in dye-contaminated water, with enhanced catalytic performance attributed to the immobilization of silver on Fe_3O_4 at 40 °C. This work highlights the sustainability of green synthesis in developing advanced nanomaterials with superior functionalities.

KEYWORDS: Bimetallic nanoparticles; Green synthesis; Ag-Fe_3O_4 nanoparticles; Photocatalysis; Antibacterial activity.



The result of X-ray diffraction

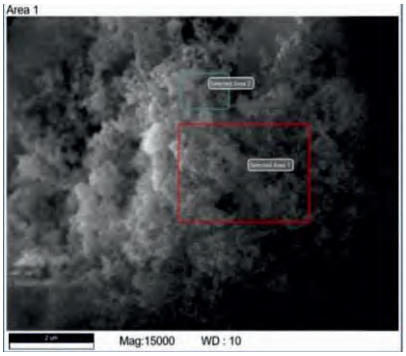


Image of scanning electron microscope

Paper ID: 1.24

Quantitative and Qualitative Analysis of Different Types of brands in Spices with Fssai Standard

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ABSTRACT

Spices have long been used by people to impart sensory appetizing elements including flavor and color to food and beverages in an effort to enhance their palatability. this study based on quantitative and qualitative analysis of different types of adulteration in different types of brands in spices by detecting standard parameters like moisture content, total ash, insoluble ash, added colors, heavy metals, which is follow by Fssai (Food Safety Standards Authority). After this, the data obtained is compared with the guidelines of Fssai to detect adulteration, and by this study we found that which brand of (turmeric, chili powder, coriander powder) are good for human health, and for cost reduction and we can save the environmental damage. adulteration and heavy metal concentrations it is also found out where cheaper or harmful ingredients are added to increases volume or appearance, is concern because it deceives consumers and can pose health risks. with the help of this research, we can spread awareness about food safety and consumer protection among people. The techniques used in this research are titration, chromatography and inductive coupled plasma mass spectrometry and some basic procedures. In this research, work has been done on different brands of spices (turmeric powder, coriander powder chili powder) like good life, catch, Everest etc. By doing quantitative and qualitative analysis of all these, according to fssai guidelines adulteration has been explained and which factor cause adulteration has also been explained. Along with this, by

doing comparative analysis of heavy metals and moisture content which brand of spices has beneficial property for human health and safe from economic damage has been explained and it also detected the health problems that could be caused by the local brands of spices that's have different type of ingredient that is not good for human health and also break the trust of consumer. It this analytical method we found from the result that good life brand turmeric powder contains different adulterants like yellow lead, Matalin yellow which are toxic for human health. With the help of this we can found the best brand of spice that is good for human health. Our study helps identify these adulterants in turmeric powder, chili and coriander powder.

KEYWORDS: Adulteration, spices, chalk powder, toxic substance like lead chromate and metanil yellow, Fssai Guidelines, Heavy Metal, Mass Spectrometry, Titration.

Paper ID: 1.25

Quantitative and Qualitative Comparative Analysis of Different Types of Sweetening Agent with Fssai Standard

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ABSTRACT

The aim of this research is to do quantitative and qualitative analysis of different types of adulteration in sweetening agents by detecting standard parameters like moisture content, total ash, insoluble ash, sucrose factor reducing sugar, heavy metals, which is given by Fssai (Food Safety Standards Authority). After this, the data obtained is compared with the guidelines of Fssai to detect adulteration, and with the help of this study, by comparing sucrose factor and heavy metal concentrations it is also found out which sweetener has beneficial properties from the perspective of people's health. Through this research, we can spread awareness about food safety and consumer protection among people. The techniques used in this research are acid-base titration, chromatography and inductive coupled plasma mass spectrometry and some basic procedures. In this research, work has been done on different types of sweetening agents like honey, brown sugar, jaggery, table sugar, mishri, etc. By doing quantitative and qualitative analysis of all these, according to fssai guidelines, adulteration has been explained and which factor cause adulteration has also been explained. Along with this, by doing comparative analysis of heavy metals and sucrose factor, which sweetening agent has beneficial property for human health has been explained and it also highlights the health problems that could be caused by sweeteners which have high percentage of sucrose factor, and also it highlights why table sugar is only used in most of the products instead of having high percentage of sucrose.

And why the sweeteners which have low percentage of sucrose percentage and are beneficial for health are not used in all products.

KEYWORDS: Adulteration, Fssai Guidelines, Sweetning Agents, Sucrose Factor, Heavy Metal, Mass Spectrometry, Acid-Base Titration.

Paper ID: 1.26

Prediction and reduction method of clinker formation in boiler

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ABSTRACT

Thermal power plant is a power generation system with relatively low operating costs because the working medium uses air. Boiler is a device that functions to convert air into superheated steam which has high temperature and pressure. One of the obstacles that occur at power steam plant itself is a decrease in boiler performance caused by the slagging phenomenon that forms on the walls of the boiler. This phenomenon arose even due to low quality of fuel or operational faults like improper oxygen level, improper combustion or inadequate boiler maintenance. This factor can lead to the fusion of ash, resulting in clinkers that hinder boiler performance and efficiency by doing elemental analysis of bottom ash with the help of elemental composition AFT is obtained which determines the rate of clinker formation to reduce the rate of clinker formation, we do coal blending which increases the AFT rate and less clinker is formed.

KEYWORDS: Boiler, slagging, AFT, clinker.

Paper ID: 1.27

Characterization and assessment of antibacterial properties of Iron Oxide nanoparticles synthesized via different approaches

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ABSTRACT

This study explores the synthesis of iron(II) oxide (FeO) nanoparticles using three distinct approaches: (i) a conventional chemical method involving ferrous sulfate ($FeSO_4$) and sodium

hydroxide (NaOH), (ii) a green synthesis technique utilizing Withania Somnifera (Ashwagandha) extract as a reducing agent, and (iii) another eco-friendly approach employing Tagetes Erecta (Marigold) flower extract. Characterization via X-ray diffraction (XRD) confirmed the crystalline structure and phase purity of the nanoparticles, while Scanning Electron Microscopy (SEM) revealed their predominantly spherical morphology. The nanoparticles comprised oxide (39.3%) and iron (60.2%), with particle sizes ranging from 30 to 60 nanometers. Their antimicrobial potential was assessed using the agar well diffusion method against bacterial strains, with all three samples demonstrating positive activity. Notably, the green-synthesized nanoparticles exhibited enhanced antimicrobial effects, highlighting their promise as environmentally friendly antimicrobial agents.

KEYWORDS: Withania Somnifera, Tagetes Erecta, XRD, SEM, FeO nanoparticles, antimicrobial activity.

Paper ID: 1.28

FSSAI-Compliant Quantitative Analysis and Heavy Metal Detection in Cereal Using ICP- Mass Spectrophotometer

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ABSTRACT

Food adulteration poses a significant threat to consumer health and overall food quality. This study investigates the detection of adulterants in various carbohydrates containing cereal products using mass spectrometry—a highly sensitive analytical technique capable of identifying trace contaminants in food.

Samples from different brands and sources were examined for common adulterants as per as FSSAI norms. By comparing the moisture content, total ash content, ash insoluble in HCl, alcoholic acidity and gluten levels of different types of local and branded cereals with the standards set by FSSAI. i.e. (moisture: Not more than 14%, Total Ash: Not more than 2.0% on dry basis, Ash insoluble in HCl: Not more than 0.15% on dry basis, Alcoholic Acidity: Not more than 0.18%on dry basis, Gluten: Not less than 7.5% on dry basis), we can conclude whether the various samples of Local Wheat Flour, Branded Wheat Flour and Semolina raise concerns about potential health risks or not.

This study highlights the efficacy of mass spectrometry for identifying the presence of heavy metal in the above used sample. Now by comparing the heavy metal contents (lead, copper, Arsenic, tin, cadmium, Mercury, Iron, Zinc) of local wheat flour, branded wheat flour, semolina, and refined wheat flour with the permissible limit set by FSSAI i.e. (lead – not more

than 0.2ppm, copper – not more than 30ppm, arsenic- not more than 1.1ppm, tin – 250 ppm, Cadmium – not more than 1.5ppm, mercury – not more than 1), we can draw some important conclusions like if the sample values are less than the FSSAI limits the sample is safe and raise no health risks and can be considered fit for consumption and if the sample values exceed the FSSAI limits, the sample is non- compliant, unsafe and indicates potential health hazards.

KEYWORDS: Food adulteration, cereals, Gluten, mass spectrometry, wheat flour, Semolina, Refined Wheat Flour, food safety, FSSAI.

Paper ID: 1.29

Determination of the Citric Acid Concentration in Brand Fruit Juices

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ABSTRACT

Citric acid is used as an additive in different kinds of drinks to improve flavor and taste. However, higher concentration may cause damage to tooth enamel. Citric acid is a weak, colorless, odorless, tricarboxylic acid that occurs naturally in citrus fruits and other foods. The objective of this study was to determine the citric acid level in different drinks by using titration. Citric acid was determined in soft drinks, juice drinks & energy drinks. The higher concentration was recorded for energy drinks and lowest in soft drinks. Citric acid is also used as a cleaning agent and in personal care products.

KEYWORDS: Citric acid, fruit juices, health.

Paper ID: 1.30

Extraction of Organic Acids and Polarimetric Analysis of Citrus Fruits

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ABSTRACT

This looks at examines the elimination of organic acids and the polarimetric observe of citrus culmination—orange, lemon, and guava—to evaluate their chemical makeup primarily based on acidity and optical activity. natural acids have been extracted thru aqueous extraction and through acid-base titration the use of standardized sodium hydroxide for you to determine overall acidity. Lemon juice exhibited the highest acidity, followed by using guava, additionally orange. Guava juice, particularly, showed a particular acidity range of 0.3% to 0.5%. This changed into expressed as citric acid equivalents.

Juice samples were filtered as well as examined for optical interest evaluation the usage of a digital polarimeter. The optical rotation measured for orange juice become +0.039°, equalling a specific rotation of +470.25°, showing a giant concentration of optically lively sugars. Lemon juice found out an optical rotation at a decrease +0.020°, along a selected +17.675° rotation, which changed into reflecting acid and decrease sugar content. Guava juice recorded an optical rotation dimension of +0.040°, with a specific rotation estimate of +250°, suggesting the presence of slight sugar content relative to each orange and lemon.

The examine highlights a clean inverse courting that exists between acidity and optical activity in the citrus samples and shows that there is effectiveness for titration and polarimetry as complementary strategies inside the evaluating

KEYWORDS: Organic acid, Polarimetry, Citrus acids, Optical rotation, unique rotation, Acid-base titration.

Paper ID: 1.31

Characterization of Fly Ash and Bottom Ash for Soil Improvement

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ABSTRACT

Fly ash and bottom ash, by-products which are generated during coal combustion in a coal-fired power plant. The two types of ashes are distinguished by their physical, chemical and geotechnical properties, while Fly ash is a fine powdery material, bottom ash is a coarser, heavier material. There are several applications of these ashes in commercial and real estate industries. Fly ash is a cost-effective replacement for cement in concrete, providing improved workability and durability, as a soil stabilizer, and also as an additive to asphalt. It can also be used to fill depressions in the landscape, reduce erosion, and improve soil fertility. Whereas, Bottom ash also has many applications, which includes forming bricks and other building materials, it can also be used as a soil conditioner to improve soil fertility. Therefore, this project focuses on improving soil quality using fly ash and bottom ash based on their different properties.

KEYWORDS: Soil Stabilizer, Additive, Coal-fired power plant, Fly ash, Bottom ash

Paper ID: 1.32

Quantitative analysis of different types of oils with special reference to iodine value and acid value

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ABSTRACT

The present study is aimed at quantitative analysis of different edible oils by measuring two important physicochemical parameters i.e iodine value, acid value, saponification value, moisture, BT, BR (Butyro Refractometer) value. The iodine value is a measure of unsaturation of fatty acid, the acid value represents free fatty acids, a parameter of oil deterioration. The oils of different varieties like coconut, sunflower, mustard oil and soya oil were subjected to titration test to standard methods. The results manifested that unsaturated oils such as sunflower and mustard oil had high iodine values as opposed to saturation. By contrast, oils of high acid

values, especially aged oils would indicate increased hydrolytic rancidity. These parameters are important to determine oil quality, shelf-life and nutritional value, both for consumer and food industry.

KEYWORDS: Saponification, Butyro Refractometer, Unsaturation, Physiochemical, Deterioration, Hydrolytic Rancidity.

Paper ID: 1.33

The synthesis of Biodegradable bioplastics from potato and banana peels with their comparative studies

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ABSTRACT

The increasing environmental concern over synthetic plastic pollution has driven the search for sustainable and biodegradable alternatives. This study focuses on the synthesis of bioplastics using two common agricultural wastes: potato peels and banana peels. Both waste materials were processed into plastic-like films through gelatinization and plasticization techniques using glycerol as a plasticizer and acetic acid as a crosslinking agent. The resulting bioplastics were then subjected to a comparative analysis based on four key parameters: flexibility, biodegradability, water resistance, and mechanical strength. Observations indicated that bioplastics derived from potato peels exhibited higher tensile strength and better water resistance, whereas banana peel-based bioplastics showed superior flexibility and faster biodegradation in soil. This research highlights the potential of kitchen waste as a raw material for eco-friendly packaging and contributes to the advancement of sustainable materials in green chemistry.

Paper ID: 1.34

Atom Economy: The minimization and Prevention of Pollution

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ABSTRACT

Chemists, like many others, are increasingly concerned about environmental pollution. This concern has led to the emergence of a discipline known as green chemistry, which focuses on minimizing the use of harmful and toxic substances in chemical synthesis by adopting environmentally friendly methods. One of the key principles of green chemistry is atom economy, which involves designing chemical reactions to maximize the proportion of reactants that are converted into the desired final product. In reactions of the type A + B → C + D, two products are inevitably produced, with C being the target product and D classified as a by-product. Given that a primary objective of green chemistry is to enhance the efficiency of reactants while reducing waste, it is essential that D has a useful application, is eliminated, or is rendered as harmless and minimal as possible. Ideally, in a chemical process, the quantity of starting materials or reactants should equal the total amount of products formed, ensuring that no atoms are wasted. Atom economy is a crucial concept within the philosophy of green chemistry and serves as one of the most prevalent metrics for assessing the environmental friendliness of a process or synthesis. The principles of green chemistry, along with their various advantages, have been explored to highlight the necessity of transitioning from traditional synthetic methods to green chemistry approaches. To illustrate this, the synthetic method for producing dibenzalacetone has been examined and compared.

KEYWORD: green chemistry, chemical hazards, atom economy, environmental pollution, eco-friendly, Conventional, dibenzal-acetone.

Paper ID: 2.1

Computational Study of Thermoelectric Potential of Ca_2CdP_2 Through First Principal Calculations

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ABSTRACT

The increasing demand in energy in the present modern world due to the decrease of fossil flues forced the researchers across the global to look for renewable energy sources. Thermoelectricity is one such source where one can see a direct conversion between thermal and electrical energies. Zintl phases have shown thermoelectric prospect to put the waste heat to good use with promising thermoelectric efficiency. In the present study, we focus on the thermoelectric properties zintl compound Ca_2CdP_2. This compound is crystallising in the orthorhombic space group Cmc21 with space group number 36. It has two crytallographically independent Ca atoms, one Cd atom and two P atoms among which one Cd atom coordinates with four P atoms to form a CdP_4 tetrahedra. The optimise structure is probed for electronic, phonon and thermoelectric properties. The calculated computational band gaps using PBE and MBJ functional of compound is very close to experimental value. We have calculated and discussed seebeck coefficient, electrical conductivity, electronic as well as lattice thermal conductivities and power factor using BoltzTraP2 and AMSET codes.

KEYWORDS: Zintl Phase; Thermoelectric Properties, Layered Compound, Ca_2CdP_2, PBE and MBJ functional

Paper ID: 2.2

Influence of Sr doping on Structural & magnetic properties of $NdMnO_3$

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ABSTRACT

The $Nd_{1-x}Sr_xMnO_3$ (x = 0.3, 0.4, and 0.5) (NSMO) samples were synthesized using the Sol-gel method with glycine as fuel and ethylene glycol as surfactant. The X-Ray Diffractometer (XRD) graph confirms the formation of a phase-pure orthorhombic perovskite structure identified by the space group Imma (No. 74). The crystallite size obtained from the Halder Wagner Langford's (HWL) plot is increased with the increase in the amount of Sr in NSMO samples. Rietveld refinement analysis was carried out for NSMO samples using Full Prof Program with pseudo voigt shape fitting to estimate unit cell parameters. The Goldschmidt tolerance factor values confirm the stability of perovskite structure. The bending (Mn – O – Mn) mode and Stretching (Mn – O or Mn – O – Mn) mode from FTIR spectra confirms the formation of MnO_6 octahedra in the perovskite structure. These modes increase with the increase in Sr doping. The room temperature Vibrating sample magnetometer (VSM) and Electron paramagnetic resonance (EPR) curves of the NSMO samples show that they are in paramagnetic state. The analysis of the X-Ray Photoelectron Spectra (XPS) survey prove the existence of all the elements in the NSMO samples. The relative proportion of Mn^{4+} / Mn^{3+} ions in all samples are assessed by examining the areas beneath the deconvoluted Mn2p spectra. The overall unit cell volume shows a contraction in NSMO samples with the increase in Sr doping, such a decrease in unit cell volume can be attributed to the increase in Mn^{4+} (average ionic radius 0.53 Å) at the expense of Mn^{3+} (average ionic radius 0.65 Å). This valency ratio of Mn^{4+} / Mn^{3+} ions affect the structural and magnetic properties of Sr doped $NdMnO_3$.

KEYWORDS: NSMO, sol - gel, perovskite, HWL and XPS.

Paper ID: 2.3

Carbon Quantum Dot Induced Fluorescence Enhancement in Bioactive Azo Dyes for Bio-Imaging Applications

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ABSTRACT

The interaction of newly synthesized novel bio-active azo dye molecules namely, 5-[(E)-(1,5-dimethyl-3-oxo-2-phenyl-2,3-dihydro-1H-pyrazol-4-yl)diazenyl]-6-hydroxy-4-methyl-2-oxo-1,2-dihydropyridine-3-carbonitrile (A1), 5-[(E)-(1,5-dimethyl-3-oxo-2-phenyl-2,3-dihydro-1H-pyrazol-4-yl)diazenyl]-6-hydroxy-1,4-dimethyl-2-oxo-1,2-dihydropyridine-3-carbonitrile (A2) and (E)-5-((1,5-dimethyl-3-oxo-2-phenyl-2,3-dihydro-1H-pyrazol-4-yl)diazenyl)-6-hydroxy-4-methyl-2-oxo-1-propyl-1,2-dihydropyridine-3-carbonitrile (A3) with the carbon quantum dots (CQD's) has been investigated by steady state and time resolved spectroscopic techniques. The two CQD's were synthesized using a microwave-assisted method with two precursor ratios (5:1 referred as AC and 1:1 referred as BC), resulting in two different CQD's with remarkable difference in both absorption and emission characteristics. The absorption maxima were observed at 344 nm for AC CQD's and 405 nm for BC CQD's, while the emission maxima were recorded at 450 nm for AC CQD's and 511 nm for BC CQD's, respectively. Further, the synthesized CQD's were characterised by X-ray diffraction (XRD) technique. The fluorescence enhancement of azo dyes has been observed by the addition of two different CQD's. The time resolved fluorescence techniques were applied to elucidate the nature of interaction of azo dyes with CQD's. It has been found that fluorescence enhancement factor depends on the type of CQD's and a dye molecule. The possible mechanisms of fluorescence enhancement are discussed. The present study unveiled the significant potential of dye-CQD system for bio- imaging applications, laying the foundation for further research in bio-imaging and bio-sensing applications.

KEYWORDS: Azo dyes, Microwave assisted method, Carbon quantum dots, Fluorescence enhancement.

Paper ID: 2.4

"Fluorescence-Based Detection of Hazardous Nitroaromatic Compounds Using a Coumarin Derivative"

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ABSTRACT

This study examines the interaction between four nitroaromatic compounds (NACs) and the spectroscopic characteristics of the coumarin derivative 1-(4-Methoxy-phenoxymethyl)-benzo[f]chromen-3-one (4MPBCO). The detection of hazardous nitroaromatic compounds namely nitrobenzene (NB), 2-nitrotoluene (2NT), 4-nitrotoluene (4NT) and 2,4,6-trinitrophenol (TNP) is of great environmental significance due to their pollutant nature. Coumarin derivatives are known for their excellent fluorescence properties and serve as promising candidates for fluorescence-based sensing applications. This study explores the modifications in fluorescence of 4MPBCO in the presence of NB, 2NT, 4NT and TNP. The fluorescence quenching of 4MPBCO has been observed in the presence of NACs. Steady-state and time-resolved fluorescence measurements, Stern-Volmer analysis and the sphere of action static quenching model are employed to elucidate the quenching mechanisms. The S-V plots reveal distinct behaviours for NB, 2NT and 4NT exhibit positive deviation whereas TNP shows negative deviation. Key quenching parameters, such as the collisional quenching constant (K_{SV}), quenching rate constant (k_q) and static quenching constant (V) are determined using the extended Stern-Volmer equation providing valuable insights into the quenching dynamics. The analysis hints that 4MPBCO can be used in fluorescence-based sensing of NACs. Among the studied nitroaromatic compounds, nitrobenzene exhibits the highest quenching effect on 4MPBCO highlighting its strong interaction with the fluorophore.

KEYWORDS: Coumarin derivative, Nitroaromatic compounds, Fluorescence Quenching,

Paper ID: 2.5

Synthesis, structural and dielectric properties study of Y_2BaCuO_5 layer perovskites at elevated temperature

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ABSTRACT

In the present work, the polycrystalline Y_2BaCuO_5 powder was successfully synthesized via solid state reaction route using Y_2O_3, $BaCO_3$ and CuO as precursors chemicals (AR grade).Perovskites and layered cupper oxides (Y-Ba-Cu-O system) exhibit a wide variety of interesting properties, such as high electrochemical stability, catalytic activity, low electric resistivity, and low thermal conductivity. The layer oxide perovskite compound Y_2BaCuO_5 often occurs as an accompanying phase of the well-known high-temperature superconductor $YBa_2Cu_3O_7$ is considered to study because of its easily identifiable green coloration characteristic, is often referred to as 'green phase' or 'Y-211' and electrical insulating behaviour. In this work, Y_2BaCuO_5 phase is characterised by XRD, SEM, EDS and is studied in detail of frequency response of its dielectric permittivity and ionic conductivity properties at different temperatures. XRD data confirms the formation of single orthorhombic crystal phase with Pbnm space group of the prepared Y_2BaCuO_5 sample. From the SEM image it is observed that the prepared sample is slightly porous in nature with well-defined micron size grain growth occurs due to the crystallization of the sintered Y_2BaCuO_5 sample pellet. EDS spectra showed the existence of Y, Ba, Cu and O elements in the prepared Y_2BaCuO_5 sample pellet which is closely matches with the standard stoichiometry of theY_2BaCuO_5. From impedance data analysis, it is observed that the magnitude of Z' decreases with the increase in both frequency as well as temperature indicating an increase in ac conductivity with the rise in temperature and frequency. The result in details will be presented and discussed.

KEYWORDS: Y_2BaCuO_5 powder;XRD; SEM; dielectic response and ionic conductivity

Paper ID: 2.7

Spectroscopic Insights on the Interaction of Sulfa Drugs with Silver Nanoparticles

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ABSTRACT

The spectroscopic insights on the interaction of sulfa drugs namely Sulfadiazine (SDZ), Sulfamerazine (SMZ) and Sulfamethazine (STZ) with silver nanoparticles has been carried out by steady state absorption and fluorescence spectroscopic techniques. The silver nanoparticle (AgNPs) was synthesized by chemical reduction method. The optical absorption peak of AgNPs is observed at 410 nm. Further, the synthesized AgNPs were characterized by X-ray diffraction (XRD) and Scanning electron microscope (SEM) techniques. The absorption spectra of sulfa drugs show isosbestic points with addition of AgNPs indicating the presence of two species in equilibrium. The fluorescence spectra of SDZ and SMZ shows significant enhancement in fluorescence intensity with increasing the concentration of AgNPs. To evaluate the capacity of AgNPs for metal-enhanced fluorescence (MEF) in sulfa drugs (SDZ and SMZ), the fluorescence enhancement factor (FEF) is determined. Notably, fluorescence intensity is enhanced, with SDZ showing a remarkable 14-fold enhancement and SMZ displaying a 6-fold enhancement. The difference in fluorescence enhancement is explained based on the structural difference in sulfa drugs and the distance between the sulfa drugs and AgNPs. The observed fluorescence enhancement in sulfa drugs highlights their potential for bioimaging applications.

KEYWORDS: Sulfa drugs, Fluorescence enhancement, Silver nanoparticle.

Paper ID: 2.9

Zinc oxide nanoparticles: A comprehensive review on their synthesis and properties

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ABSTRACT

Zinc oxide (ZnO) nanoparticles have attracted significant interest due to their remarkable physical, chemical, and biological properties, making them suitable for use in electronics, optics, sensors, and medical applications. This presentation focuses on the superior results obtained through green synthesis techniques for the production of ZnO nanoparticles compared to other methods. Each method is analyzed based on its procedure, benefits, limitations, and the characteristics of the resulting nanoparticles. Special focus is given to eco-friendly green synthesis methods using biological agents, which provide a sustainable alternative to conventional chemical processes. A comparative analysis highlights the suitability of each method depending on desired particle size, morphology, purity, and application, offering insights into selecting the optimal synthesis route.

Paper ID: 2.10

Synthesis and Characterization of doped Copper Oxide Nanomaterial on flexible Substrate

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ABSTRACT

The demand for lightweight, flexible, and high-performance materials in energy storage and sensing applications has driven interest in metal oxide based nanocomposites. In this study, a novel nanocomposite comprising zinc (Zn) and copper oxide (CuO) was successfully synthesized on a flexible carbon cloth substrate via a controlled electrochemical deposition method. The setup consisted of carbon cloth as the working electrode, Ag/AgCl as the reference electrode, and a platinum wire as the counter electrode, with $CuSO_4 \cdot 5H_2O$ and $Zn(NO_3)_2 \cdot 6H_2O$

as the electrolyte. The synthesis process was conducted under constant potential conditions, enabling uniform deposition and strong adherence of the composite to the substrate. X-ray diffraction (XRD) analysis confirmed the formation of crystalline CuO and the incorporation of Zn, while the flexible carbon cloth provided excellent conductivity and mechanical stability. The choice of a lightweight, conductive, and bendable substrate makes the composite ideal for emerging technologies in energy storage, including supercapacitors and flexible batteries. Additionally, the material holds potential for applications in environmental sensing and photocatalysis due to the synergistic effects of Zn and CuO.

Paper ID: 2.11

Enhancement of Corrosion Resistance in Mild Steel via Cuprous Oxide Coating

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ABSTRACT

Corrosion of mild steel is a vital problem. Hence, research and development in area of corrosion protection coatings for ongoing. In this work, electrodeposition method was adopted to coat Cu_2O on to mild steel substrate. Corrosion property of the coated material was investigated by electrochemical potentiodynamic measurements (Tafel plots). So that Cu_2O coating improves the corrosion resistance of mild steel with corrosion inhibition efficiency around 95.2 %. Thus, this study is promising for the development of coating technology for corrosion protection of mild steel in future.

Paper ID: 2.12

Effects of Electromagnetic Wave on Human Health

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ABSTRACT

The research examines the health perils that electromagnetic field (EMF) radiation poses to human wellness as the globe speeds up implementation of 5G mobile technology. There are ongoing scientific doubts about how EMF exposure affects both biology and environment although no final conclusion exists. Literature reviews established the potential effects of 5G radiation which Include skin irritation along with neurological disturbances, fertility reduction,

hormonal imbalance and alterations in gene expression. The paper examines how 3G, 4G and 5G technology compares regarding their harmful effects yet shows 5G's adverse effects are increased because of its utilization of high-frequency millimeter waves along with its dense antenna network. In addition, exposure mitigation strategies along with predicting safer technology prospect by discussing Quantum Optical Communication (DOC) has been discussed. It is concluded that current studies exploring potential health threats are inconclusive and researchers need to conduct more extensive analyses of how EMF exposure from cell phone networks affects human health.

KEYWORDS: Electromagnetic field, 5G mobile technology, Quantum Optical Communication.

Paper ID: 2.13

Comparative Study of Optical and Structural Properties of ZnO Synthesized Using Different Plant Extracts.

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ABSTRACT

This research study focused on how the incorporation of Moringa and Tulsi plant extracts during the synthesis of zinc oxide (ZnO) nanoparticles impacted their optical and structural properties. We synthesised ZnO using these plant extracts and evaluated the alterations through X-ray diffraction and UV-Vis spectroscopy analysis. The findings indicated that the incorporation of Moringa and Tulsi extracts led to the formation of ZnO particles with different morphologies and diverse sizes. These extracts influenced the light absorption capabilities of the ZnO, varying with the light wavelength. This investigation is useful in broadening the knowledge on the impact of plant materials in influencing the properties of ZnO and their potential applications.

KEYWORDS: ZnO, nanoparticles, moringa extract, tulsi extract, optical properties, structural properties, comparative study.

Paper ID: 2.14

Tooth cavity analysis using laser speckle technique

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ABSTRACT

Tooth decay, or dental cavities, is a common oral health problem that requires early and accurate detection for effective treatment. This study examines the Laser Speckle Technique (LST) as a non-invasive and real-time method for identifying and analysing cavities. The technique works by shining a laser onto the tooth surface, creating speckle patterns that change based on surface roughness and internal structural defects. By studying variations in these patterns, we can determine the depth, size, and severity of the cavities.

Compared to traditional diagnostic methods like X-rays and visual inspection, LST offers several advantages—it is highly sensitive, free from radiation exposure, and provides rapid imaging. Experimental findings suggest that LST can successfully distinguish between healthy and decayed areas, highlighting its potential as a reliable tool for early cavity detection. Future advancements will focus on improving image processing techniques and incorporating AI to enable automated diagnosis and classification of cavities.

KEYWORDS: Tooth decay, dental cavities, Laser Speckle Technique (LST), non-invasive diagnosis, cavity detection, real-time analysis, image processing, automated classification.

Paper ID: 2.15

Modelling and Simulation of PEDOT: PSS Based Hole Transport Layer Integration in CIGS Solar Cells

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ABSTRACT

This work investigates the integration of a PEDOT:PSS-based hole transport layer (HTL) into Copper Indium Gallium Selenide (CIGS) solar cells through numerical simulation using wxAMPS. Key structural and material parameters—such as the thickness, doping concentration, and bandgap of the CIGS absorber, alongside PEDOT:PSS layer properties—were systematically varied to assess their impact on device efficiency. The incorporation of PEDOT:PSS was found to mitigate charge carrier recombination, enhance hole mobility, and

increase quantum efficiency from 70% to 80%. These improvements led to a notable rise in overall power conversion efficiency, reaching 31.33%, up from a baseline of 28.03%, with corresponding increases in open-circuit voltage (VOC), short-circuit current density (JSC), and fill factor (FF).

Importantly, the efficiency remained relatively unaffected across a PEDOT:PSS thickness range of 0.1 µm to 0.4 µm, demonstrating manufacturing tolerance and practical integration feasibility. Due to its low-cost, solution-processable characteristics and beneficial electronic properties, PEDOT:PSS stands out as a promising HTL material for future high-performance CIGS photovoltaic devices. These results contribute to the advancement of scalable, cost-efficient solar cell technologies.

KEYWORDS: CIGS; PEDOT:PSS; hole transport layer; solar cell simulation; device optimization

Paper ID: 2.16

Laser Speckle Technique: A Novel Approach to detect Brain Cancer

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ABSTRACT

Early detection of brain tumor is many times prevented by non-specific symptoms, especially in persuasive brain regions where open surgery for tissue sampling is impossible. This restriction increases the risk of misidentification due to tumor variety stereotactic biopsies. Label free diagnostic method including surgically probes and cellular origin analysis techniques, hold ability for enhance diagnostic accuracy polarization based offers precious details of the polarization things of biomedical samples, yet it may not totally expose precise construction quality. The explanatory scope of polarization-based data is sometimes constrained by the restriction of existing decomposition methods. On the other hand, dynamic laser speckle analysis, a grow rapidly technique, not only report for the polarization based credit but also is known for follow only the temporal activity of the moving samples. This study overpasses these space by synergizing usual polarization based imaging with dynamic laser speckle analysis for a completely analysis of sample polarization things. The effectuality of our system is manifest by analysing the group of polarization-based images of different tissue samples, utilizing a variation of modify numerical and graphical analytical post techniques. It is concluded that, Laser speckle technique can be used for brain cancer detection with the help of suitable image processing algorithms. It is concluded that, Laser speckle technique can be used for brain cancer detection with the help of suitable image processing algorithms.

KEYWORDS: Laser speckle technique, Image processing algorithms, Brain Tumor

Paper ID: 2.17

Comparative Study of Optical and Structural Properties of CuO [Different Extract]

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ABSTRACT

The green synthesis of copper nanoparticles (CuNPs) from plant-based materials presents an environmentally responsible approach instead of traditional chemical approaches. The research group created an effective biosynthetic method for CuNP synthesis by utilizing aqueous extracts from Azadirachta indica (Neem) and Psidium guajava (Guava) flowers. Phytochemicals found in both extracts performed two functions by acting as reduction agents and stabilizing agents that helped convert Cu^{2+} ions into stable CuNPs. Experiments were made to maximize both nanoparticle production and stability during the reaction phase. The researchers tracked the synthesis process of CuNPs through UV–Vis spectrophotometry measurements. UV-Vis spectroscopy alongside SEM and XRD confirmed that successful synthesis of CuNPs occurred together with precise determination of their structures and crystalline quality and morphological characteristics. The findings from this research demonstrate how Neem and Guava flower extracts create a productive combination for sustainable production of copper nanoparticles.

KEYWORDS: Nanoparticles, Phytochemicals, XRD, UV-Vis spectroscopy, SEM.

Paper ID: 2.18

A Study on Scattering Properties of Home-Made Solution and Biological Material Using Laser Light

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ABSTRACT

This work presents a practical investigation into the scattering properties of various home-made and biological solutions using laser light, aiming to deepen the understanding of light-matter interaction in different types of mixtures. The study specifically focuses on true solutions, colloids, and suspensions-each characterized by distinct particle sizes and optical behaviors. A red laser pointer is employed as a coherent and monochromatic light source to examine how light scatters when passing through these media. By preparing simple mixtures using easily accessible substances such as sugar, refined flour, and natural plant extracts, the experiment highlights the differences in scattering behavior, particularly the Tyndall effect observed in colloidal systems. The setup is designed to be low-cost and educational, making it ideal for academic demonstrations and foundational research in optics. This study underscores the broader relevance of light scattering in scientific and technological contexts, including spectroscopy, environmental sensing, medical diagnostics, and the development of optical instruments.

KEYWORDS: Light Scattering, Laser Light, Tyndall Effect, True Solution, Colloid, Suspension, Optical Properties, Biological Materials, Light–Matter Interaction, Spectroscopy, Optical Physics.

Paper ID: 3.1

TRASHTRON: An Automated Garbage Picker with AI-Driven Detection and Sensor-Based Segregation

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ABSTRACT

Waste management is a cornerstone of urban sustainability, yet traditional methods are increasingly inadequate in addressing rising volumes of waste. Population growth, rapid urbanization, and evolving consumption patterns have overwhelmed existing waste collection methods, which largely depend on manual labor and scheduled pick-ups. Inefficient routing, unpredictable waste accumulation, and limited sorting capabilities contribute to environmental pollution and increase operational costs. Trashtron - The autonomous robot is designed to navigate urban areas, detect and classify waste in real-time, and efficiently collect it, segregating it into metal and non-metal categories. TrashTron promises to enhance the timeliness and accuracy of waste collection and reduce dependency on manual labor, leading to significant cost savings and a lower environmental footprint. Through TrashTron, waste management can become a seamless, sustainable process, paving the way for cleaner, smarter cities.

KEYWORDS: Waste Management, Urban Sustainability, Automation, Computer Vision, Autonomous Robot, Waste classification.

Paper ID: 3.2

Distance Magic Labeling on Regular Graphs

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ABSTRACT

In this paper, I study D-distance magic labeling (D-DML) of simple undirected regular graphs for a distance set $D \subseteq \{0,1,2,\ldots d\}$, where d is a diameter of graph G.

A D-DML of G with n vertices is a bijection g from a vertex set V(G) to {1, 2, …, n} such that for any $v \in V(G)$, $\sum_{u \in N_D(v)} g(u)$ is constant, say k which is called as magic constant (where $N_D(v) = \{u \in V / d\,(u, v) \in D)\}$.

I study D-DML of disjoint union of cycles, complete graphs and r-regular graphs. Also, study D-DML of non-isomorphic regular graphs.

KEYWORDS: Magic labeling; Disjoint union of graph; Ddistance magic labeling; r-regular graphs

Paper ID: 3.4

Coefficient Estimates and Geometric Analysis of a New Bi-Univalent Function Class

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ABSTRACT

In this paper, we introduce a new subclass $\mathcal{F}_{\sum}(n, \gamma, k)$ of bi-univalent functions in the unit disk $\mathbb{U}$. A function $f(z) = z + \sum_{n=2}^{\infty} a_n z^n$, $z \in \mathbb{U}$ belongs to $\mathcal{F}_{\sum}(n, \gamma, k)$ if it satisfies the conditions $f \in \Sigma$ and $\left|\arg\left(\frac{(1-\alpha) I_\lambda^n f(z) + \alpha I_\lambda^{n+1} f(z)}{z}\right)\right| < \frac{\gamma\pi}{2}$, $z \in \mathbb{U}$, & $f \in \Sigma$ and $\left|\arg\left(\frac{(1-\alpha) I_\lambda^n g(w) + \alpha I_\lambda^{n+1} g(w)}{w}\right)\right| < \frac{\gamma\pi}{2}$, $w \in \mathbb{U}$, where $g(w)$ is the inverse function of $f(z)$. The operator $I_\lambda^n f(z)$ known as the generalized Sălăgean operator, is defined as $I_\lambda^n f(z) = z + \sum_{k=2}^{\infty} (1 + \lambda(k-1))^n a_k z^k$, $z \in \mathbb{U}$, $\lambda \geq 0$, $n \in \mathbb{Z}$. Specifically, here we establish results related to coefficient estimates, inclusion relations, and distortion properties. Additionally, we analyse the geometric behaviour of functions under this new operator.

KEYWORDS: Analytic functions, Bi-univalent functions, Generalized Sălăgean operator, Coefficient bounds, Inclusion relations, Distortion properties, Geometric function theory.

Paper ID:3.6

Analyzing a COVID-19 Spread Model with Fractional-Order Derivatives via the Elzaki Transform

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ABSTRACT

In this study, we investigate several new results, including the presence of a solution to a fractional order prototype that confirms that the effect of immigration on the spread of the most recent COVID-19 outbreak has been underestimated. It has been proven that the fixed point theory approach is the subject of this in-depth examination. We discovered several series type results after applying the Elzaki transformation to the qualitative result, which was considered as a prototype. The result discussion includes the predicted results of the solution of the prototype data with different scenarios.

KEYWORDS: Fractional Calculus, Elzaki Transform, COVID-19

Paper ID: 3.10

Exploring the Efficacy of Convolutional Neural Networks in Skin Disease Classification

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ABSTRACT

In dermatology, precise identification and categorization of skin conditions is essential because it substantially influences how patients recover and heal. This research examines how convolutional neural networks (CNNs) can significantly enhance dermatological diagnostics by achieving superior accuracy compared to traditional approaches. Our study utilized advanced CNN models like ResNet, Inception, and VGG along with a complete dermatoscopic image dataset covering multiple skin conditions. The models received thorough training

together with validation and testing to establish their robustness and generalizability. We applied data augmentation methods to solve the frequent issues of class imbalance and overfitting encountered in medical image analysis. Model evaluation incorporated measurements of accuracy alongside sensitivity and specificity as well as the area under the receiver operating characteristic curve (AUC-ROC). Our team conducted qualitative assessments through Grad-CAM to increase understanding of how CNN models make decisions within clinical environments. The study demonstrates that CNNs outperform traditional methods in terms of both accuracy and efficiency in diagnosing skin diseases. The research demonstrates deep learning as a feasible tool for dermatological applications while identifying necessary challenges and prerequisites needed for clinical practice integration. The process requires comprehensive validation with clinical standards, together with practical usability tests to confirm ethical implementation. Our research contributes to the growing understanding that integrating AI into dermatology can enhance diagnostic accuracy and patient care by facilitating faster and more accessible identification of skin diseases.

KEYWORDS: Convolutional Neural Networks (CNNs), Dermatological Diagnostics, Dermatoscopic Images Analysis, Skin Disease Classification

Paper ID: 3.11

Learning Model Comparisons & Techniques Evaluating Classification, Clustering, and Dimensionality Reduction Methods

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ABSTRACT

Healthcare analytics has gained considerable interest because of its ability to improve patient care, streamline treatment planning, and optimize survival prediction. The present study explores a diverse set of machine learning and deep learning approaches to predict patient survival status, identify patient demographics, and optimize feature selection processes. The present study implements classification models such as Logistic Regression, Decision Trees, and Random Forests to estimate the probability of patient survival. The observations show that, while traditional machine learning models yield high accuracy rates for the majority class, they are encounter the obstacle of predicting outcomes for the minority class because of the extreme class imbalance. The present research emphasizes the importance of utilizing class balancing methods and assessing different model configurations to overcome this issue.

Deep learning algorithms like Artificial Neural Networks (ANNs) and Recurrent Neural Networks (RNNs) are also examined for predictive accuracy. The results of performance show that ANNs exhibit a stable validation accuracy, while RNNs show overfitting behavior with increasing training. To enhance model generalization and stability, it is recommended to use regularization techniques, hyperparameter tuning, and early stopping techniques.

Aside from classification, the study concentrates on unsupervised learning methods, i.e., K-Means clustering, with a view to grouping the patients based on clinical features. Nonetheless, results show that the clusters are lacking clear differentiation, and other methods such as DBSCAN or Gaussian Mixture Models could offer superior insights. Ultimately, dimension reduction methods such as Principal Component Analysis (PCA) are employed to study feature distributions and reduce computation. Results demonstrate that while PCA is helpful to visualize the data in lower-dimensional space, non-linear methods such as t-SNE or UMAP could more effectively separate patient groups.

Generally, the study highlights challenges and opportunities for predictive healthcare analytics, emphasizing the need for highly balanced datasets, proper model choice, and advanced feature engineering. Repercussions of the study offer a cornerstone to improve predictive accuracy and elevate patient stratification in real-world clinical practice.

KEYWORDS: Healthcare analytics; Machine learning; Deep learning; Survival prediction; Classification models; Class imbalance; Artificial Neural Networks (ANNs); Recurrent Neural Networks (RNNs); Feature selection; Principal Component Analysis (PCA).

Paper ID: 3.12

A Machine Learning Framework for Early Detection and Prognostic Assessment of Lung Cancer Using CT Imaging

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ABSTRACT

Lung cancer remains a leading cause of cancer-related mortality worldwide, necessitating advanced methods for early detection and prognosis to improve patient outcomes; this study proposes an integrated machine learning system that leverages Computed Tomography (CT) scans for lung nodule detection and predicts postoperative survival rates through a multi-stage analytical approach. The system begins with advanced image preprocessing and segmentation techniques to isolate lung nodules, followed by feature extraction optimized using a Genetic Algorithm (GA) to enhance discriminative power, and employs a Convolutional Neural Network (CNN) for accurate malignancy classification. Additionally, the framework incorporates a prognostic module utilizing a Multi-Layer Perceptron (MLP) trained on postoperative clinical data—including histopathological, demographic, and treatment-related

variables—to predict patient survival likelihood, thereby enabling personalized treatment planning. Experimental validation on thoracic oncology datasets demonstrates the system's effectiveness in both diagnostic accuracy and predictive performance, offering clinicians a reliable decision-support tool that bridges automated image analysis with data-driven prognostic insights. By combining early detection capabilities with survival prediction, this approach addresses critical gaps in lung cancer management, reducing diagnostic subjectivity and facilitating timely interventions while highlighting the transformative potential of artificial intelligence in oncology.

KEYWORDS: Lung Cancer Detection, Computed Tomography (CT) Imaging, Machine Learning, Image Processing and Genetic Algorithm.

Paper ID: 3.14

Causal Relationship Between Stock Market and Exchange Rate, Foreign Exchange Reserves and Value of Trade Balance: A Case Study for India

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ABSTRACT

This paper investigates the nature of the causal relationship between stock prices and macroeconomic aggregates in the foreign sector in India. By applying the techniques of unit–root tests, cointegration and the long–run Granger non–causality test recently proposed by Toda and Yamamoto (1995), we test the causal relationships between the BSE Sensitive Index and the three macroeconomic variables, viz., exchange rate, foreign exchange reserves and value of trade balance using monthly data for the period 2014 to 2024. The results suggest that there is no causal linkage between stock prices and the three variables under consideration.

KEYWORDS: Macroeconomic Aggregates, Stock Price Index, Granger Causality, and Efficient Market Hypothesis.

Paper ID: 3.16

Diabetes Prediction using Machine Learning

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ABSTRACT

Diabetes is a health condition marked by high blood sugar levels, which presents a significant worldwide health concern. Without proper management it can result in serious complications such as heart disease, kidney dysfunction, and harm to other critical organs. Its timely identification and proactive measures are essential to reducing these risks and enhancing the pa-tent's health. Traditional diagnostic methods, such as fasting blood sugar tests and HbA1c measurements are effective but often require manual interpretation and can be time consuming.

To address these limitations, machine learning techniques have gained significant attention for their ability to automate and enhance the accuracy of diabetes prediction. Our research did extensive Exploratory Data Analysis (EDA) to understand feature distributions, detect outliers, and identify correlations among variables. Following data preprocessing, four machine learning algorithms Logistic Regression, Support Vector Machine, Random Forest and Decision Tree were implemented and evaluated. These models were assessed based on various performance metrics. Our research utilized machine learning to analyze a reliable system for the early detection of diabetes. Among all the models, the Decision Tree Classifier yielded the best performance, demonstrating its effectiveness in capturing non-linear relationships within the dataset. The findings thus emphasize the potential of machine learning to tackle global health issues and improve the precision of diabetes prediction systems, ultimately contributing to better healthcare solutions.

KEYWORDS: Logistic Regression, Support Vector Machine, Random Forest, Decision Tree, Machine Learning.

Paper ID: 3.17

Financial Fraud Detection

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ABSTRACT

Credit card fraud is a significant issue in the realm of digital finance. In order to determine whether this approach is more effective at spotting credit card transaction fraud, this study analyzes two approaches: Recurrent neural networks (RNN) and Logistic Regression. To Simulate actual transactions, we use a fictitious dataset from the PaySimxsimulator. Our aim is to compare the performance of RNN and Logistic Regression in detecting fraudulent transactions. We employ a step-by-step procedure to accomplish this. We beginxby gathering the data and preparing it in a way that our models can interpret. Then, we evaluate both models using a variety of criteria, including accuracy and precision. Our findings demonstrate that RNN, which excels at comprehending the time of transactions, is more effective than logistic regression in spotting fraudulent behavior. This implies that taking into account transaction timing is essential for fraud detection, particularly in mobile money transfers. In conclusion, thisxresearch helps to improve our understanding of how to spot credit card fraud. We believe that RNN is an effective instrument for this job, and our work could increase the security of online financial.

KEYWORDS: RNN, Logistic Regression, Credit Card Fraud Detection.

Paper ID: 3.18

Skin Disease Detection Using Machine Learning

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ABSTRACT

Skin diseases affect millions of people across the globe, thus making their early and accurate detection vital for efficacious treatment. Conventional diagnostic approaches rely on dermatologists conducting visual examinations, which can be cumbersome, subjective, and prone to errors [1]. Furthermore, this may lead to delays. This research investigates the application of machine learning (ML) models to automate the detection and classification of skin diseases, offering a more efficient and reliable alternative [2].Three ML algorithms—

Support Vector Machine (SVM), Random Forest (RF), and k-Nearest Neighbours (KNN)—are evaluated based on their accuracy, precision, recall, and F1-score [3]. The dataset comprises labelled images of various skin diseases, which undergo preprocessing, feature extraction, and classification [4][5]. Results should indicate how ML-based diagnosis tools can significantly improve early skin disease detection, ultimately leading to better patient outcomes [6]. This research highlights the impact of machine learning on revolutionizing dermatological diagnoses and its potential for integration into practical real-world medical uses [1][7].

KEYWORDS: Machine learning, Skin disease classification, Support Vector Machine, Random Forest, k-Nearest Neighbour, Feature extraction.

Paper ID: 3.19

Optimization of Multi-Objective Transportation Problem Using Fuzzy Programming Approach

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ABSTRACT

This study proposes a way for transforming a fuzzy multi-objective transportation problem (FMOTP) into crisp multi-objective transportation problem. The Zimmermann technique has been used to fine the solution for crisp multi-objective transportation problem (CMOTP). This study contrasts outcomes of employing hyperbolic and pentagonal membership functions with those of utilising exponential membership functions. The study demonstrates how real-world issues with inaccurate parameters can be modelled using fuzzy numbers. The study shows how to solve transport problems with competing aims by turning fuzzy problems into deterministic ones.

KEYWORDS: Fuzzy multi-objective LPP; Fuzzy programming technique; Pentagonal fuzzy number; Ranking function; Exponential membership function.

Paper ID: 3.20

Comparative Analysis on Artificial Intelligence (AI-Assisted) and Personalized Learning Approaches in Grade 10 Mathematics

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ABSTRACT

The integration of technology in education continues to reshape teaching and learning, particularly in mathematics where innovative approaches like Artificial Intelligence (AI)-assisted and personalized learning are gaining traction. This study examined the test scores of Grade 10 students in the topic of Probability of Compound Events, comparing the effectiveness of AI-assisted and personalized learning approaches. Anchored on the principles of educational equity and adaptability, the research employed an embedded mixed-method design using a two-group quasi-experimental pretest-posttest design, complemented by student interviews. Pretest scores showed minimal difference between groups: the AI-assisted group had a mean score of 47.6%, while the personalized group scored 45%, both translating to a transmuted score of 71 and classified as "Did Not Meet Expectations." An independent t-test confirmed no significant difference ($p = 0.523$), indicating comparable academic readiness. Posttest results revealed an increase for both groups, with the personalized group scoring a higher mean of 65.96% versus 57.4% for the AI-assisted group. However, the difference was not statistically significant ($t = 1.585$, $p \approx 0.12$). Qualitative data highlighted students' appreciation for AI's self-paced and instant feedback features but also noted limitations such as technical issues and misalignment with classroom instruction. In contrast, personalized learning provided consistent teacher guidance and alignment with curriculum, contributing to improved performance. The study emphasizes the importance of integrating AI as a supplementary tool, supported by policies that ensure teacher involvement, technical training, and curriculum coherence. By fostering adaptive and data-informed instruction, educational institutions can enhance student engagement, support diverse learning needs, and strengthen instructional outcomes in mathematics.

KEYWORDS: AI-Assisted, Educational Technology, Mathematics Education, Personalized Learning, Probability of Compound Events, Student's Perception.

Paper ID: 3.21

Strategic Efficiency and Productivity Analysis of India's Private General Insurers- using SBM-DEA and the Malmquist Index

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ABSTRACT

After COVID-19, the Indian general insurance industry, which is essential to maintaining economic stability, saw significant changes that call for thorough efficiency analyses in order to handle growing operating expenses, technological disruptions, and changing consumer demands. This study uses the Malmquist Productivity Index (MPI) and Slack-Based Measure Data Envelopment Analysis (SBM-DEA) to assess the technical efficiency and productivity trends of 19 private general insurance companies in India from 2020 to 2024. Three inputs—commission, operating costs, and equity capital—and three outputs—premiums received, investment income, and claims incurred—are examined using the Constant Returns to Scale (CRS), Variable Returns to Scale (VRS), and scale efficiency frameworks, using data from IRDAI annual reports. Significant scale inefficiencies are indicated by the SBM-DEA results, which show an average technical efficiency of 55.8% under CRS and 82.2% under VRS (average scale efficiency: 68.1%). Due to their strategic focus and efficient use of resources, top performers like Bajaj Allianz, IFFCO Tokio, and Shriram General Insurance regularly achieved full efficiency (CRS=1.0). On the other hand, companies such as Magma HDI (CRS=0.39) and Acko General Insurance (CRS=0.11) demonstrated inefficiencies, mainly as a result of underutilized equity and excessive operating costs. The Malmquist Index also shows that, on average, TFP grew by 26.5% annually, primarily due to technological advancements (Techch=1.36), with efficiency regress (Effch=0.93) slightly offsetting gains. Notably, Reliance General Insurance saw a decline as a result of operational inefficiencies, while Navi General Insurance saw the highest TFP growth (141.4%), driven by innovation. Using SBM-DEA and MPI approaches in a post-pandemic setting, this study adds to the body of knowledge on insurance efficiency while providing practical advice for boosting competitiveness in India's ever-changing general insurance market, also SBM-DEA and MPI analysis reveals significant efficiency gaps and technology-driven productivity gains, offering actionable insights for forging a more resilient, sustainable Indian general insurance sector.

KEYWORDS: Indian Private General Insurance, Malmquist Index, SBM-DEA, Scale Efficiency, Technical Efficiency.

Paper ID: 3.22

Integer Ninja: Evaluating the Efficacy of Game-Based Application in Improving Student Attitudes and Numeracy Skills

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ABSTRACT

Game-based learning has emerged as a promising instructional strategy in mathematics education, particularly in addressing challenges related to student engagement and conceptual understanding. This study evaluated the efficacy of Integer Ninja, a locally developed game-based application, in improving numeracy skills and student attitudes toward integer operations among Grade 7 learners of Nagpayong High School in the Philippines for S.Y. 2024–2025. Anchored in Game-Based Learning Theory, Affective Domain Theory, Self-Determination Theory, and Constructivist Learning Theory, the application aimed to provide an interactive and motivational learning experience that integrates gameplay with the mastery of integer concepts. Employing a mixed-method, quasi-experimental post-test-only design, the study involved two groups—users (experimental) and non-users (control)—to examine differences in post-test performance and attitudinal outcomes. Findings revealed that the users of Integer Ninja achieved a higher Mean Percentage Score (MPS) of 70.2, corresponding to a transmuted grade of 81 that falls under the Satisfactory, while non-users obtained an MPS of 43.5, with a transmuted grade of 70 that falls under Did Not Meet Expectations. A statistically significant difference was observed between the groups ($p < 0.001$), indicating the application's positive impact on academic performance. In terms of student attitudes toward learning integers, the users showed a higher mean score of 3.42 compared to 2.89 among non-users, with a p-value of 0.008, confirming a significant attitudinal difference. Qualitative feedback from users further highlighted increased motivation, confidence, and enjoyment in learning mathematics through gameplay. These results affirm the effectiveness of Integer Ninja in enhancing both numeracy skills and student attitudes, underscoring the value of game-based learning tools in Philippine mathematics education.

KEYWORDS: Affective Outcomes, Cognitive Outcomes, Game-based Learning, Integer Ninja, Integer Operations, Mathematics Education, Numeracy Skills, Student Attitudes

Paper ID: 3.23

Novel Pythagorean Fuzzy Knowledge Measure with Multi-Criteria Decision-Making Applications

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ABSTRACT

Entropy is often used to express the level of uncertainty surrounding a random variable in numerical form. However, a knowledge measure can be used to quantify the knowledge connected to any fuzzy set. Fuzzy knowledge measures are thought of as the opposite of fuzzy information measures. In fuzzy system the concept of Pythagorean fuzzy sets (PFSs) are useful and effective tool to tackle decision-making issues.The **Pythagorean fuzzy sets (PFSs)**, with their dual membership functions (degree of membership and non-membership), offer a richer representation of uncertainty compared to traditional fuzzy sets. By developing the PF-Knowledge measure, your study contributes a new tool to assess the amount of knowledge contained within a fuzzy set. There is very less study on PF Knowledge measure has been proposed by any researcher so far. Thus the concept which is introduced in the current study is dual measure of Pythagorean fuzzy (PF)-entropy i.e. PF-Knowledge measure. We propose PF-Knowledge measure and prove some of its properties. By a comparison analysis, we additionally demonstrate the consistent result of the proposed PF-Knowledge measure. We also show how the proposed knowledge measure may be used to solve Multi-Criteria Decision Making (MCDM) issues.

KEYWORDS: Entropy; Pythagorean fuzzy set; Knowledge measure; MCDM

Paper ID: 3.25

Smart Crowd Monitoring System Using Computer Vision

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ABSTRACT

Crowd disasters still account for massive loss of life around the world, with more than 10,000 deaths between 1980 and 2012. This paper introduces a holistic framework for Smart Crowd Monitoring Systems (SCMS) that combines various technologies to promote public safety without compromising individual privacy. Our suggested architecture includes computer vision, IoT sensors, AI algorithms, and privacy-preserving techniques in a layered framework. The system meets key challenges of crowd density estimation, behavior analysis, flow prediction, and risk evaluation in a wide range of implementation settings. We analyze the system based on simulated crowd density data and show how our privacy protection through multiple layers maintains the effectiveness of monitoring while ensuring privacy of personal information. The implementation strategies range across urban areas, events and places, religious places, and tourist spots, and include an elaborate case study of ITE&C, India. Our results show that the combined method greatly surpasses conventional crowd management practices while being strictly compliant with ethics and compliance standards. This work adds to the new paradigm of intelligent public safety systems through the presentation of a scalable, privacy-oriented infrastructure for crowd monitoring that has the potential to significantly lower the frequency of crowd disasters.

KEYWORDS: crowd, deep learning, machine learning

Paper ID: 3.26

A study on Internet Security Protocols in Cryptography

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ABSTRACT

The rapid growth of the internet has brought about unprecedented opportunities for communication, commerce and information exchange. However, this increased connectivity has also introduced significant security risks, including data breaches, cyberattacks and online

surveillance. Cryptography plays a crucial role in mitigating these threats by providing secure communication protocols and protecting sensitive information.

The primary goals of internet security protocols in cryptography are: The Confidentiality: protect sensitive information from unauthorized access, ensuring that only authorized parties can read or modify the data, The Integrity: ensure that data is not tampered with or altered during transmission, maintaining its accuracy and consistency, Authentication: verify the identity of communicating parties, ensuring that data is sent and received by legitimate entities, Non-repudiation: provide proof of the origin and receipt of data, preventing parties from denying involvement in a communication, Availability: ensure that authorized parties have access to data and services when needed, preventing disruptions or denials of service.

This presentation will explore the fundamental cryptographic protocols that underpin internet security, including SSL/TLS protocol (Secure Sockets Layer/Transport Layer Security protocol), TCP/IP (Transmission Control protocol/Internet protocol) and Email security protocol such as PGP (pretty Good Privacy) and S/MIME (Secure/Multipurpose Internet Mail Extensions) which provide end-to-end encryption and authentication.

KEYWORDS: Internet security, Cryptography, SSL/TLS, TCP/IP, email security, PGP, S/MIME, Integrity, Authentication, Confidentiality, Secure communication protocols for internet.

Paper ID: 3.27

Tumour Growth Mathematical Modelling

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ABSTRACT

Mathematical modelling is a critical tool in cancer research, enabling systematic analysis of tumour growth, progression, and therapeutic response. Deterministic models, such as exponential, logistic, and Gompertz frameworks, provide predictive insights into biological processes, treatment efficacy, and optimization of therapeutic strategies. In this paper, we examine the application of these models in oncology, addressing their limitations and roles in chemotherapy, radiotherapy, and immunotherapy. It highlights current gaps in modelling approaches and explores emerging trends, including artificial intelligence integration, digital twins, and personalized medicine, to advance precision oncology.

KEYWORDS: Tumour growth models, deterministic modelling, chemotherapy optimization, AI driven cancer research.

Paper ID: 3.28

Mathematical Models for Infectious Disease and its Comparison

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ABSTRACT

In this paper a brief study on epidemiological model have been discussed. Infectious disease models are essential tools for epidemiology, as this tool helps researchers for understanding the transmission dynamics of diseases and assess intervention strategies. These models are mathematical frameworks to simulate the spread of pathogens within a population, considering many factors like transmission rates, recovery rates, immunity, and external influences like vaccination or public health measures. The most popular models in compartmental models are SIR and SEIR, which may solve various health statuses in order to forecast disease outbreaks and inform policy decisions. Advances in computational modelling, including agent-based models and statistical approaches, have further enhanced predictions and real-time decision-making. These models play a vital role in mitigating public health crises, guiding healthcare responses, and shaping preventive strategies against infectious diseases.

KEYWORDS: Infectious disease; Epidemics; mathematical modelling; Compartmental model; SIR model; SEIR Model.

Paper ID: 3.29

An EOQ Model for Deteriorating Items with Weibull Demand

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ABSTRACT

In this present paper, we propose an economic order quantity (EOQ) inventory model for deteriorating products to improve the inventory management. Considering that the products are temperature-sensitive, the deterioration rate is exponential function in this proposed model . In addition, the transportation cost, which is a function of the quantity ordered, is considered in this study. This article aims to find the optimal value of the total profit, selling price, and the length of the ordering cycle. Numerical examples are provided; the sensitivity analysis shows that the total profit is much more sensitive to transportation costs, compared with ordering and holding costs.

KEYWORDS: Inventory model; Deterioration; EOQ; Weibull Demand; Transportation cost.

Paper ID: 3.30

An EOQ Model for time dependent Deteriorating Items with Exponential Demand Rate

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ABSTRACT

The present paper deals with an EOQ model for time-dependent deteriorating items with exponential demand rate. Shortages are allowed and completely backlogged in this model. The suggested model incorporates the idea of penalty cost because many perishable goods do not degrade for a while before gradually deteriorating and losing their worth wholesalers and retailers, this loss may be incurred as a penalty fee. In every corporate setting, the penalty cost plays a significant role for unique seasonal and short-lived products kinds. Hence, by optimizing the demand rate and lowering cost plays a significant role for unique seasonal time period, the product's overall cost can be decreased. Our research aims to optimize the overall cost of variable inventories. The created model's applicability is demonstrated through a numerical example as well.

KEYWORDS: Inventory Model, Time dependent deterioration, penalty cost and exponential demand rate.

Paper ID: 3.31

A study of Cantor's theorem and its application

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ABSTRACT

The Cantor set is a unique structure in mathematics, which is created by a special process. To create this set, the middle third of a given segment (0, 1) is repeatedly removed. This process is repeated infinitely, creating a set that is self-similar, made up of infinitely many points, but still has a total measure of zero.

The Cantor set is used in various fields of mathematics, such as topology, measure theory, and fractal geometry. In addition, it also plays an important role in computer science, information theory, and signal processing. This set is a useful tool in chaotic systems and mathematical analysis. This article discusses the structure of the Cantor set, its applications.

KEYWORDS: Cantor Set, Fractal Geometry, Measure Theory, Self-Similarity, Signal processing, Information Theory.

Paper ID: 3.32

An Economic Order Quantity Model for constant Deteriorating Item with Exponential Demand Rate

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ABSTRACT

The present paper deals with an Economic Order Quantity model for constant deteriorating item with exponential demand rate. In this model shortages are not allowed, and single item is considered. We use crisp Model to formulate the inventory. The numerical example is solved using MATLAB and sensitivity analysis are also discussed.

KEYWORDS: Inventory Model, Time dependent deterioration, penalty cost and exponential demand rate.

Paper ID: 3.33

Structural Comparison Between Zeckendorf and Tribonacci Decomposition Methods

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ABSTRACT

This research explores the statistical properties of Zeckendorf decompositions, which uniquely represent every positive integer as a sum of non-consecutive Fibonacci numbers. Using computational methods, we analyzed the number of summands involved in these decompositions over a large range of integers. We extended this analysis to Tribonacci decompositions, a generalized form using a faster-growing recurrence sequence. By comparing the distributions of summands, we found that Tribonacci decompositions generally require fewer terms due to the rapid growth of the sequence. These findings highlight interesting

patterns in number representations and open avenues for further exploration in combinatorial number theory and its applications.

KEYWORDS: Zeckendorf decompositions, Tribonacci, summands.

Paper ID: 3.34

Mathematical modelling of diabetes

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ABSTRACT

Diabetes mellitus is a chronic metabolic disorder characterized by abnormal blood glucose regulation, posing a major global health burden. This project explores the application of mathematical modelling to understand, analyse, and predict blood glucose dynamics in individuals with diabetes. Through compartmental models, differential equations, and statistical analysis, the study simulates physiological processes such as insulin production, glucose absorption, and utilization. It incorporates factors like carbohydrate intake, insulin dosage, and physical activity to model real-life scenarios. Special attention is given to the role of continuous glucose monitoring (CGM) data and dietary strategies in enhancing diabetes management. The work also highlights the epidemiology of diabetes globally and within India, underlining regional disparities and public health challenges. By mathematically modelling the glucose-insulin regulatory system, the study aims to contribute to more effective and personalized treatment strategies, demonstrating the power of mathematics in tackling complex biomedical problems.

KEYWORDS: Diabetes mellitus, glucose dynamics, compartmental models, glucose-insulin regulatory system.

Paper ID: 3.35

A study on Function Space and its Application

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ABSTRACT

Function spaces form a fundamental framework in modern mathematical analysis, offering a structured approach to studying collections of functions with shared properties. They are

particularly essential in the study of differential equations, harmonic analysis, and functional analysis. The concept of a function space generalizes familiar ideas from calculus and linear algebra, allowing functions to be treated as points in infinite-dimensional spaces. This perspective opens the door to powerful analytical techniques, including inner product structures, norms, and topological considerations that enable convergence, compactness, and continuity to be rigorously defined in abstract settings.

This paper presents a comprehensive exploration of function spaces within the framework of mathematical analysis, emphasizing their foundational role in functional analysis and their wide-ranging applications. We begin by introducing key concepts such as normed vector spaces, metrics, and inner product spaces, laying the groundwork for a deeper study of Banach and Hilbert spaces.

KEYWORDS: Banach space, Hilbert space, Inner product space.

Paper ID: 3.36

Machine Learning to enhance Cryptographic Security

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ABSTRACT

Cryptography is fundamental to securing digital communication, sensitive information and maintaining data integrity in the modern technological landscape. The paper discusses how Machine Learning enhance the Cryptographic security by using supervised and unsupervised learning techniques such as Support Vector Machine (SVM), Random Forest and Convolutional Neural Network (CNN). We discuss how Machine Learning algorithms can be employed for anomaly detection in encryption traffic, identifying potential attacks and intrusions in real-time. Also we examine the use of Machine Learning in vulnerability detection. The application of Machine Learning for dynamic key management, adaptive security protocols and the generation of Cryptographically secure pseudo-random number is also explored. The paper highlight the transformative potential of integrating Machine Learning with Cryptography to create more intelligent, adaptive and ultimately more secure Cryptographic systems for future.

KEYWORDS: Cryptography, Machine Learning, Security, Attack, Algorithms, Neural Network.

Paper ID: 3.37

Review of EOQ Model with Non-linear Holding costs and Hybrid Demand

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ABSTRACT

A traditional EOQ model presumes a consistent holding cost to prevent inventory deterioration and linear variations in market demand as time progresses. However, in truth, product demand is not always stable. The suggested model includes steady degradation and a non-linear rise in holding expenses over time. The model additionally takes into account hybrid demand, where both price and time affect demand, and it considers sale.

KEYWORDS: EOQ, Deterioration, Holding Cost, Hybrid Demand, Sensitivity Analysis.

Paper ID: 3.38

Exploring the Role of Fractional Calculus in Biomedical and Bioengineering Applications

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ABSTRACT

This paper provides a comprehensive review of the application of fractional calculus in addressing complex challenges within bioengineering and biomedical sciences. By utilizing fractional differential equations, which effectively capture memory and hereditary properties, researchers are able to model biological systems with greater accuracy. The paper introduces the fundamental concepts of fractional calculus and explores its diverse applications, including physiological system modelling, medical imaging enhancement, biomechanical property analysis, and the study of biological transport phenomena.

KEYWORDS: Fractional Calculus; Bioengineering; Biomedical Sciences; Fractional Differential Equations.

Paper ID: 3.39

Applications of Wavelet Transform in Science and Engineering: Current Problems and Challenges

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ABSTRACT

Wavelet transform (WT) has become a fundamental tool in the fields of signal processing, data analysis, and engineering due to its ability to provide multi-resolution analysis. This paper reviews the diverse applications of Wavelet Transform across various domains, including communications, biomedical engineering, image processing, and environmental monitoring. Furthermore, we discuss the current problems and limitations of Wavelet Transform, such as computational complexity, real-time application hurdles, and interpretability challenges. By highlighting recent advancements and identifying key issues, this paper aims to provide insights into future directions and potential solutions.

KEYWORDS: Wavelet Transform, Signal Processing, Engineering, Computational Complexity, Real-time Processing, Applications.

Paper ID: 3.40

Application of Cardinality in Advancement of Topology

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ABSTRACT

In this paper we study the cardinality plays a critical role in understanding the size and structure of topological spaces cardinality refers to the number of elements in a set and is often used to describe the “size” of sets that are involved in topological considerations. These abstract aims to highlight the multifaceted role in cardinality in the study of topological spaces. Under scoring its importance in distinguishing between various space type understanding their inherent properties and contributing to the advancement of topology as a mathematical field.

KEYWORDS: Cardinality, Topological Space, Inherent Properties, Mathematical Field

Paper ID: 3.41

A study on Complete Metric Space and its Application

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ABSTRACT

In this study, an analysis of full metric spaces is presented with attention to their important place in modern analysis and topology. When a metric space is such that its Cauchy sequences converge to the limit that is also located at the space, it is referred to as complete. This feature has a major influence on theoretical and applied mathematics. Our report begins with exact definitions of metric and complete metric spaces and only after that we set to discuss concerns of convergence and those properties of Cauchy sequences. We then talk about completeness in the Crucial theorems, i.e. the Banach Fixed Point Theorem and the Baire Category Theorem, highlighting their application.

A significant part of this paper is dedicated to the development of constructions of completions for incomplete metric spaces, where techniques of isometric embedding and the usage of Cauchy sequence equivalence classes can be distinguished. We also provide concrete examples including the shift from rational to real numbers, demonstrations of completion processes in normed vector and function spaces. The paper explores the effects of compactness, total boundedness and completeness on each other to show how their interaction improves the constructability and functional aspect of a space.

Furthermore, completeness implications in fixed point theory are explored by the study revealing its central role to iterative convergence and establishment of solutions uniqueness in functional and differential situations. Completeness is an essential concept, and the paper proves it by careful and relevant proofs, concrete examples, and counterexamples, which ground the topic and make it relevant to several branches of mathematics. The aim of this study is to contribute to the current discussions by making certain foundational principles transparent, providing new insight into established theories and suggesting exploration directions in generalized metric spaces and the surrounding areas.

KEYWORDS: Complete metric space, Cauchy sequence, Banach Fixed Point Theorem, Baire Category Theorem, convergence, normed space, isometric embedding, compactness, total boundedness, mathematical analysis.

Paper ID: 3.42

Mathematical Analysis and Simulation of Sustainable Harvesting in Sardine Populations Using Logistic Growth

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ABSTRACT

Sardine numbers in Kerala have taken a big hit since 2010, messing up the sea's balance and troubling people who fish for a living. We dug into catch records from 2000 to 2023 and used a logistic growth model to figure out what might happen by 2040. We looked at three possibilities: leaving things as they are, sticking with today's rules, or stepping up with tougher steps—like giving young sardines a break and cutting fishing time in some seasons. If nothing changes, stocks won't even touch 50,000 tons. With current efforts, they might climb to about 80,000 tons. Stronger action could get us to 150,000 tons, though that's still less than the old healthy mark of over 230,000 tons a year. This tells us Kerala needs solid, science-backed plans to keep its fisheries alive and help coastal folks thrive.

KEYWORDS: Sardine fishing, Overfishing, Climate change, conservation rules.

Paper ID: 3.43

A Study on Quantum Encryption with Certified Deletion

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ABSTRACT

The development of Quantum technologies results in emerging safeguard methods which focus particularly on encryption solutions. Quantum encryption with certified deletion provides one of the most promising advancements because it makes use of quantum information properties to ensure complete irretrievable deletion of sensitive data. Quantum encryption utilizes the non-cloning theorem to protect its cipher text against duplication because this theory makes state duplication impossible. This feature provides strong evidence to authenticate that plain text has been permanently destroyed no matter what adversaries achieve with their decryption access. In this work, we propose a quantum encryption method which protects data from

unauthorized access along with preventing any recovery of deleted content from all parties including the recipient. After the deletion process the originator can verify through a classical proof that the recipient effectively surrendered all access rights to the plain text. The employed quantum devices function with current technology due to their ability to perform single qubit operations and measurements. The security of our scheme stands resilient against noise while also having an analysis based on finite communication lengths which supports practical implementation of secure protocols. This research establishes important achievement in uniting encryption and certified deletion protocols which creates revolutionary security principles for data privacy across the quantum age.

KEYWORDS: Quantum Encryption, Certified Deletion, Quantum Information, Non-Cloning Theorem, Data Privacy, Secure Communication, Irretrievable Data Deletion, Quantum Security Protocols, Single Qubit Operations, Finite-Length Analysis.

Paper ID: 3.44

ASSESSING THE FAILURES OF BIO DEGRADABLE MATERIAL PAVER BLOCKS BY USING MACHINE ALGORITHM

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ABSTRACT

Plastic wastes not only endanger marine life but also intoxicate human beings. The proper disposal of plastic waste is a major concern due to its slow decomposition and widespread presence in the environment. The utilization of recycled plastic in the production of paver blocks presents a cost-effective solution for plastic waste disposal. Paver block pavements offer versatility, aesthetic appeal, functionality, and affordability. The driving force behind this project is the innovative approach of using LDPE plastic waste to combat pollution and promote environmental conservation. They can be easily manufactured, transported, installed, and maintained, and can be quickly replaced if necessary. The samples with varying kaolin content and the others with varying sand content respectively. The kaolin percentage from 0 - 10 gms and sample of plastic adding should be taken 5-15%. The research aimed at determining the melting point and subsequent effects of temperature on polyethylene as well as determining the mix ratio of the material components that gives the highest compressive strength.

KEYWORDS: LDPE plastic, kaolin, paver block, compressive strength

Paper ID: 3.45

Leveraging Cloud Computing and Digital Technologies to Promote the 3R (Reduce, Reuse, Recycle) Principles in Fashion Management Among Young Students in Lucknow for Environmental Sustainability

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ABSTRACT

The integration of cloud computing and digital technologies presents transformative opportunities to advance the 3R (Reduce, Reuse, Recycle) principles in fashion management among young students in Lucknow, fostering environmental sustainability. By combining innovative tools with educational strategies, this approach addresses the urgent need to mitigate the fashion industry's environmental impact while empowering the next generation of designers and consumers. Cloud computing and digital technologies are transforming how organizations implement the "Reduce" principle of the 3Rs (Reduce, Reuse, Recycle), particularly by enhancing resource efficiency and minimizing waste. In summary, cloud computing and digital technologies are essential enablers of the "Reduce" strategy within the 3Rs framework. By providing real-time analytics, supporting virtual prototyping, and enabling automated, data-driven operations, these technologies help organizations minimize resource use, cut waste, and operate more sustainably. The integration of these digital tools not only supports environmental goals but also enhances operational efficiency and competitiveness in an increasingly resource-conscious world.

Paper ID: 4.1

Pigmented Rice as a Functional Ingredient useful as Bioactive and Food Industry Applications

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ABSTRACT

There are numerous varieties of rice, including white, red, black, and brown. White and brown rice are the most prevalent types of rice on the market. Red and black rice are not accessible to the general public due to limited production. Black rice is a super food due to its strong antioxidant activity, and its use as a component in other food products can result in very nutritious dishes. Coloured rice is a kind of rice that offers a number of intriguing health advantages. Anthocyanin, the major pigment in coloured rice, has piqued the interest of scientists due to its strong antioxidant activity, health advantages, and natural colouring capabilities for usage in various culinary applications. Consuming coloured rice has been proven to be advantageous for those who experience allergic reactions to other cereal grains and also lowers the chance of acquiring diabetes, obesity, and cardiovascular illnesses. To fully explore its advantages, coloured rice must be used as a unique component in food processing.

KEYWORDS: Rice, Antioxidant activity, Food processing, Coloured.

Paper ID: 4.2

Isolation, assessment, identification and characterization of the effective phyto-compounds for the management of groundnut beetles infesting stored Groundnut (*Arachis hypogaea L.*)

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ABSTRACT

The effectiveness of various botanicals was tested against the major pests of shelled groundnuts, the red flour beetle *Tribolium castaneum* (Tenebrionidae) and the khapra beetle, *Trogoderma granarium*, (Coleoptera), under artificial infestation, in Laboratory conditions for one year. Essential Oils isolated by Clevengers Apparatus , @1%v/w of *Pongamia glabra*

(Karanja Oil), *Azadirachta indica* (Neem Oil), *Brassica campestris* (Mustard Oil) , Crown oil (Resin of *Shorea robusta*) , *Cymbopogon nardus* (Citronella) oil , *Dalbergia sisso* (Sisso Oil), *Oryza sativa* (Rice bran oil), *Helianthus annus* (Sunflower Oil) , *Ricinus communis* (Castor Oil), *Aegle marmelos* (Bael Oil), *Sesamum indicum* (Til Oil), etc were tested for their bioefficacy against the major pests, of shelled groundnuts, *Tribolium castaneum* & *Trogoderma granarium*, under artificial infestation, in Laboratory conditions for one year. Out of all these plant products *Cymbopogon nardus* (Citronella) oil and Crown oil (Resin of *Shorea robusta*) gave 100 % pod/Kernel protection for one year. The LD_{50} values were found out to be - 0.5% v/w . Spectroscopic GC MS analysis of **Citronella oil (*Cymbopogon nardus*),** lead to the identification of **D-Limonene , Neral, Citral and 2,6-octadien-1-ol,3,7-dimethyl acetate (Z)** as essential main constituents . Spectroscopic GC MS analysis of Crown oil (Resin of *Shorea robusta*) are identified as **2-Ethyl-oxetane** (RT 2.223), as the major product. It may be due to the strong aromatic nature of these phyto-products. Hence these phyto-products may be used as fumigants or insect repellants against *Tribolium castaneum* and *Trogoderma granarium* and can be included in the package of practices to save stored groundnut in storage.

KEYWORDS: Clevengers Apparatus, *Tribolium castaneum*, *Trogoderma granarium, Cymbopogon nardus,* Citronella oil and LD_{50} .

Paper ID: 4.3

Investigation of Single Nucleotide Polymorphisms (SNPs) of Human VDR gene and their subsequent effects on the receptor structure and function by in silico methods.

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ABSTRACT

Polymorphisms in the vitamin D receptor (VDR) gene play a crucial role in regulating bone mass at the genetic level. Osteoporosis is primarily associated with mutations in functional regions of the VDR gene, which significantly disrupt mineral metabolism, particularly calcium ion homeostasis. This study aims to assess the impact of missense single nucleotide polymorphisms (SNPs) in the human VDR gene using in silico approaches and publicly available databases. Various computational tools, including SIFT, VEP, PROVEAN, SNPs & GO, and PANTHER, were employed to predict the functional consequences of these mutations. Additionally, I-Mutant 2.0 and Project HOPE were utilized to analyse their effects on protein stability and three-dimensional structural integrity. GeneMANIA was used to explore the interactions of the VDR gene with 20 other related genes. Our findings highlighted how amino

acid substitutions affect protein structure and function based on sequence homology, amino acid properties, and comparative physical attributes. Furthermore, we predicted the potential consequences of these mutations on protein activity. This comprehensive study provides an in-depth analysis of clinically significant missense SNPs in the VDR gene, offering a valuable resource for understanding their functional implications.

KEYWORDS: Vitamin D receptor (VDR), Osteoporosis, Single Nucleotide Polymorphism (SNP), in silico analysis, dbSNP, SIFT, PROVEAN, SNPs & GO, I-Mutant 2.0, HOPE

Paper ID: 4.4

Phytochemical Profile and Nutritional Composition of Oyster Mushrooms Cultivated by Producers in Gujarat, India

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ABSTRACT

The global food supply is grappling with some serious challenges, particularly malnutrition and undernourishment, which hit vulnerable populations the hardest due to poverty and limited access to quality food. Enter oyster mushrooms they could be a game changer in tackling these issues, thanks to their impressive nutritional and medicinal benefits. They have the potential to help reduce nutritional deficiencies and boost food security. This study set out to dive into the phytochemical makeup and nutritional values of three oyster mushroom species: *Pleurotus ostreatus*, *Pleurotus florida*, and *Pleurotus sajor caju*. Fresh samples of these mushrooms were collected, dried over four days, and then extracted using a Soxhlet extractor with three different solvents: double distilled water, methanol and ethanol at 70% . We conducted both qualitative and quantitative analyses on the extracts, and evaluated the nutritional values from the dried samples. Methanol yielded the highest extraction rates (16.10%, 15.02%, and 14.06%), with ethanol coming in second. Double distilled water was the champion for extracting proteins, saponins, and tannins, while methanol and ethanol excelled in pulling out alkaloids, flavonoids, and glycosides. Among the species, *P. sajor caju* boasted the highest levels of tannins, alkaloids, and flavonoids (2.7 mg/ml, 100.7 mg/g, and 0.6 mg/g), while *P. ostreatus* had the highest concentrations of phenols, saponins, and glycosides (48.15 GAE/g, 1.5 mg/g, and 5.05 mg/g). *P. florida* led the pack in steroid content (2.35 mg/g). Oyster mushrooms are packed with protein, fiber, carbohydrates, vitamins, and minerals, all while keeping their lipid and fat content low. Each of the three species has its own unique nutritional profile, offering distinct

bioactive compounds that can play a crucial role in enhancing nutrition and supporting food security.

KEYWORDS: Nutritional, Oyster mushroom, phytochemical, extracts, medicinal, food.

Paper ID: 4.5

Unravelling the Link Between Fatty Acid Composition and Inflammation in Type 2 Diabetes Mellitus

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ABSTRACT

Diabetes is a multifaceted metabolic disorder affecting the glucose status of the human body. Diabetes remains a significant public health challenge in India. As of 2025, approximately 101 million individuals in India are living with diabetes. Fatty acid composition plays a crucial role in modulating inflammation, a key factor in the development and progression of diabetes. Imbalances in saturated, monounsaturated, and polyunsaturated fatty acids can trigger pro-inflammatory pathways, contributing to insulin resistance, oxidative stress, and metabolic dysfunction. In individuals with diabetes, chronic inflammation driven by altered lipid metabolism exacerbates disease complications, including cardiovascular risks and organ damage. This study explores the relationship between the fatty acid composition and inflammatory markers such as High senstivite C-Reactive Protein (hsCRP) and Interleukin-6 (IL-6) in normal and diabetic patients. Emerging research highlights the potential of fatty acid profiles as biomarkers for early diagnosis in diabetes. Understanding the intricate relationship between fatty acids and inflammatory markers offers new insights into potential therapeutic interventions.

KEYWORDS: Fatty acid; Diabetes; Insulin; hsCRP, Interleukin-6.

Paper ID: 4.8

Ultrasonic-Assisted Green Synthesis of TiO_2 Nanoparticles Using *Raphanus Sativus* Leaf Extract and their Bioactivity

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ABSTRACT

Nanotechnology is emerging as a rapidly growing field with diverse applications in science and technology. Nanostructures serve as crucial tools in various research domains due to their unique physicochemical properties. Metal and metal oxide nanoparticles (NPs) have garnered significant research interest owing to their exceptional electrical, optical, magnetic, catalytic, and pharmacological characteristics. Among metal oxides, titanium dioxide (TiO_2) plays a pivotal role in applications such as self-cleaning surfaces, gas sensors, and environmental remediation. Titanium dioxide exists in three primary polymorphs: anatase, rutile, and brookite, each exhibiting distinct properties. TiO_2 nanoparticles can be synthesized using various methods, including hydrolysis, thermolysis, sol–gel, hydrothermal, and flame synthesis. In recent years, phytomediated synthesis of nanomaterials has gained prominence due to its advantages, such as being clean, rapid, eco-friendly, and non-toxic. Plant extracts act as natural reducing and capping agents, making the synthesis process more sustainable. In continuation of our previous studies, the present work aims to synthesize TiO_2 nanoparticles using *Raphanus sativus* leaf extract for the first time. To enhance the efficiency of the synthesis process, ultrasonic-assisted synthesis was employed. The key mechanism involved in ultrasonic-assisted material synthesis is acoustic cavitation, which facilitates improved nucleation and particle formation. The synthesized TiO_2 nanoparticles were characterized using various analytical techniques, including X-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM), energy-dispersive X-ray spectroscopy (EDX), Fourier-transform infrared spectroscopy (FT-IR), and UV–Vis spectroscopy. Furthermore, the antimicrobial activity of the synthesized nanoparticles was evaluated against pathogenic microorganisms, including *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Aspergillus niger*, and *Candida albicans*.

KEYWORDS: TiO_2 nanoparticles; *Raphanus sativus;* ultrasound; antimicrobial activity

Paper ID: 4.9

Enzymes as a Biomarker to Predict the Duration of Diazepam Consumption

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ABSTRACT

Diazepam (Dz) is a benzodiazepine whose major function is to reduce anxiety disorders. Due to its fast-long lasting nature Clinically, Dz used as an anxiolytic and anti-convulsant. Dz targets the $GABA_A$ receptors through mimicking the natural ligand of the receptor i.e. GABA (γ-Aminobutyric acid), GABA is an inhibitory neurotransmitter which control the chloride ion gated channel. Although Dz has safe profile, but it may cause dependency either due to intentionally or unintentionally. This study was aiming to evaluate the potential of Tartrate-resistant acid phosphatase type 5(ACP5), Alanine Transaminase (ALT), Aspartate Aminotransferase (AST), Glutathione S-transferase A1 (GSTA1) and D-Lactate Dehydrogenase (D-LDH) as a biomarker in a mice model. The hypothesis behind this work was that levels of these enzymes in serum may be directly linked with duration of Dz consumption. The result of this study aptly suggests that enzymes specially ACP5, AST, ALT have direct co-relation with duration of Dz abuse and may be used as a collaborative biomarker for the prediction of duration of Dz consumption.

KEYWORDS: Diazepam, Biomarker, Dependency, Enzymes.

Paper ID: 4.10

In vitro and in silico antimicrobial assessment of *Stachytarpheta jamaicensis* isolated from Koraput, Odisha

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ABSTRACT

Ethnomedicinal plants play a crucial role in healthcare, benefiting both humans and livestock, particularly in tribal communities. Several unexplored regions hold valuable plant species with

traditional therapeutic uses, potentially contributing to modern drug development. Extensive research has demonstrated that various plant-derived compounds possess potent antimicrobial properties, making them promising candidates for tackling resistant bacterial strains. This study, which was conducted in remote tribal regions, documented numerous medicinal plants used by indigenous communities to treat ailments. These findings highlight the need to preserve traditional knowledge while advancing pharmacological research. Herein, *Stachytarpheta jamaicensis* as potential as an antimicrobial agent, validated through both *in vitro* and *in silico* methodologies. The plant extract demonstrated considerable antibacterial activity, particularly against *K. pneumoniae* and *E. coli*, with inhibition zones exceeding 13 mm at a minimal concentration of 6.25%. Molecular docking studies further substantiated its therapeutic potential, with certain lead phytocompounds exhibiting significant binding affinities (-8.9 kcal/mol) to bacterial proteins.

KEYWORDS: Herbal medicine, Secondary metabolites, Ligand, Molecular docking, antimicrobial activity

Paper ID: 4.11

Paddy straw mushroom (*Volvariella volvacea)* stalk waste diet supplementation provides defense against metamifop induced oxidative stress in freshwater teleost *Labeo rohita* (Hamilton)

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ABSTRACT

Paddy straw mushroom (*Volvariella volvacea*) is a commonly found mushroom in India. It is enriched with various biologically active compounds that provide several health perks, hence is used as a dietary supplement. However, paddy straw mushroom harvest generates waste in form of mushroom stalk waste (MSW) as the stalk ends are often discarded. This MSW can be repurposed as a nutritional addition in production of fish feed. Paddy fields use various herbicides one of which is metamifop (MET), a post-emergent herbicide used to weed out grassy unwanted plants. But MET has been known to induce numerous negative effects including oxidative stress in fish. This investigation was conducted to examine if mushroom stalk waste supplemented fish feed could minimize the oxidative stress caused by metamifop exposure in *Labeo rohita* (Hamilton). Laboratory acclimatized fingerlings of *Labeo rohita* were divided into 9 groups – 3 control & 6 experimental. Control groups were not exposed to MET and were fed with basal diet (BD), 5% MSW supplemented diet (5% MSW) and 10% MSW supplemented diet (10% MSW) respectively. Next three groups were exposed to sub-

lethal concentration I (SL-I) i.e. 1/10th of 96 hours LC_{50} of MET for 90 days and fed similarly as the control groups. The last three groups were exposed to sub-lethal concentration II (SL-II) i.e. 1/5th of 96 hours LC_{50} of MET for 90 days and fed the same way. After the exposure period, results showed oxidative stress in fish exposed to MET. Lipid peroxidation (LPO) and Superoxide dismutase (SOD), both were maximum for the group exposed to the highest concentration of the herbicide. The experimental diets (5% MSW & 10% MSW) fed groups presented improved values when tested for stress markers. The obtained results indicated that MET induced oxidative stress can be mitigated by MSW supplemented diet.

KEYWORDS: Mushroom Stalk waste, Diet supplementation, Oxidative stress, *Labeo rohita,* Herbicide, Metamifop

Paper ID: 4.13

Nutritional and Health benefits of different seeds.

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ABSTRACT

The seeds like Flax, pumpkin, sesame, and sunflower seeds have many nutritional benefits and contribute to health and sustainability. Flax seeds contain omega-3 fatty acids, fiber and lignans promotes heart health and digestive wellbeing. Pumpkin seeds are a good source of magnesium, zinc, and antioxidant properties which enhance immune function and reduce inflammation. Sesame seeds are rich in essential nutrients like calcium, magnesium, iron, and B vitamins. The seed contains monounsaturated and polyunsaturated fats, which are beneficial for cardiovascular health. Sunflower seeds offer vitamin E, selenium, and healthy fats, supporting skin health and cellular protection. These seeds are environmentally sustainable, requiring less water and fewer pesticides than many other crops, making them an eco-friendly choice. This study was conducted as a secondary survey to evaluate the nutritive properties of these seeds. A biochemical analysis was performed to identify essential nutrients in the seeds. The findings are valuable for understanding the nutritional benefits of these seeds and their role in promoting sustainability.

KEYWORDS: Flax seeds, pumpkin seeds, sesame seeds, sunflower seeds, eco-friendly crops

Paper ID: 4.15

Agri-Tech Usage for Sustainable and Profitable Agriculture

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ABSTRACT

Indian GDP significantly depends on agriculture, which accounts for a share of about 18.3%, employing almost 70% of the national workforce which directly or indirectly depends for livelihood on it. Thus, agriculture and allied sector is rightly regarded as the backbone of the country's economy, which hitherto agrarian, is fast changing into secondary and tertiary sectors as well. Due to the long historical background of agriculture from Mohenjo-Daro and Harappa period thousands of years ago, it has a dominating and everlasting effect on the social and economic psyche of India since it is considered as a part and parcel of our cultural landscape much beyond the realm of economic enterprise. With high-end scientific research led by the Green Revolution and the present day Rainbow Revolution coupled with extensive array of agricultural extension through Krishi Vigyan Kendras (KVKs) and its extension education mechanism, overall agricultural yield and production in the Indian context has increased six-folds from an insignificant 50.82 million tonnes during independence time, in the backdrop of the PL 480 era, to an impressive 332.98 million tonnes in 2023-24 projected to reach an enviable figure of 341.55 million tonnes during 2024-25. With the country's burgeoning population accounting for 18% of the global population having limited access to about 4% of the Earth's water resources and 2.4% of agricultural land, use of modern-day technology is the sine qua non for achieving such levels of sustainable agricultural mechanisms, keeping the sustainable development goald (SDG) to which India is also a signatory. But, intensive agriculture, which is necessarily required for quantum jump in yield in agriculture, has its own inherent malaises in the form of extensive use of water, fertilizer, insecticides and pesticides. Thus, the imminent dangers to concurrent environmental degradation with the indiscriminate employment of intensive agricultural practices need to be combated with a more balanced approach, which is quite possible with Agri-Tech engagement using Artificial Intelligence, Machine Learning, Deep Learning, Internet of Things, sensors, High Resolution Smart Drones, Variable Rate Technology (VRT) for Precision Water Management, Precision Pesticide Management, Precision Nutrient Management for targeted use of resources.

Thus, AI-enabled Agri-Tech usage possessing proven transformative potential will harbinger optimal resource use, enhanced crop yields, while minimizing environmental impact with corresponding nutrient load and consequent carbon footprint reduction, whereby enabling to combat the present-day challenge of climate change with simultaneous nutritional security management, leading to achieving the ultimate aim of Viksit Bharat.

KEYWORDS: Artificial Intelligence (AI), Internet of Things (IoTs), Sustainable Agriculture, Climate Change, Precision Agriculture

Paper ID: 4.16

Comparative Analysis of Bamboo and Sugarcane Bagasse for Biofuel Production: A Life Cycle Assessment

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ABSTRACT

This review paper provides a comparative analysis between bamboo and sugarcane bagasse, which are nowadays promising sources of renewable biomass for biofuel production as with the rise of global warming, the world is shifting to more sustainable methods to control the global warming. Among the different alternative methods used to reduce the production of green gases, one of the methods is production of biofuels from different lignocellulosic biomass, with each offering distinct advantages and disadvantages like Bamboo, with its high lignocellulose content, widely distribution and fast growth rate, is optimized through various pre-treatment methods for enzymatic hydrolysis. Sugarcane bagasse, a byproduct of sugar production, also offers a high carbohydrate content suitable for biofuel conversion after pre-treatment. It provides information about biomass and how different biofuel products like bioethanol and biomethane produced from it in detail and it also analysed different types of pretreatments and provide recommendations for optimizing biofuel yields and processing techniques. The review also showcases diverse conversion processes, including enzymatic hydrolysis, fermentation, pyrolysis, and anaerobic digestion, to yield bioethanol, biogas, bio-oil, and biochar. The efficiency of these processes is determined by factors such as pre-treatment methods, enzyme types, fermentation conditions, and the composition of the biomass. There is also a comparison on the basis of production, yield, and other requirements.

Keywords: Bamboo; SCB; Biofuel; Lifecycle

Paper ID: 4.17

Bioremediation of acidic agriculture soils using sulphate reducing bacteria of acid mine drainages of open coal mine soils

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ABSTRACT

To compete with the world in all-around development, industrialization, and sufficient food production, both are very important, and they will play a major role in considering the nation's strength. To achieve the results in the above aspects, the Nation must use the available non-renewable resources such as coal, petroleum products, and natural gas to meet the power consumption for industrialization. The coalmine soils have acid mine drainages in which the sulphur reducing bacteria, nitrate reducing bacteria are observed. On another hand, to get high yields in food crops, people are using chemical fertilizers such as Super Phosphate, DAP, Sulphate, Potassium, and urea irrespective of the requirement of the soil. This leads to the accumulation of Heavy Metals such as As, Cd, Cr, Cu, Hg, Pb, Zn in the soils. Especially excess usage of nitrogen based fertilizers such as Urea, ammonium nitrate, anhydrous ammonia, ammonium sulphate causing acidification of the soils. The decreased pH causes leaching of other heavy metals and minerals present in the soil and it disables the growth of the plants and leads to crop reduction. To overcome this problem, inoculating the acidified agriculture soils with the most promising sulphur reducing bacteria (Desulfobulbus, Desulfovibrio, Desulfomicrobium) and nitrate reducing bacteria (Bacillus spp, pseudomonas spp, Moraxella spp) available in the AMD of open coal mine soils is the best solution. This study shows the possibility of using sulphur reducing bacteria and Nitrate reducing bacteria in the open coal mine. Acid mine drainages for bioremediation of acidic agriculture soils by converting the nitrates into ammonia and the sulphates into H2S, which later precipitate all other heavy metals and helps in increasing the pH.

KEYWORDS: Industrialization, Chemical fertilizers, Heavy metals, acidification, Acid mine drainage, and Agriculture soils, Coal Mine soils, Bioremediation.

Paper ID: 4.18

Analysis of the linkage between luminescence duration and age of the blood stain on different types of wooden surfaces

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ABSTRACT

This study evaluates the impact of various wood surface characteristics on the efficacy of luminol, a chemiluminescent reagent commonly used for presumptive blood tests. Blood samples were applied to four different wood surfaces: polished wood, barked wood, debarked wood, and heartwood obtained from the *Mangifera indica* (Mango) tree. The samples were then tested by luminol with blood stains of different ages i.e. fresh, 6 hours, 12 hours, 24 hours, 48 hours, 120 hours, and 240 hours. The study focused on observing the persistence and intensity of the chemiluminescent reaction at each interval, assessing how different wood textures and compositions influence luminol's effectiveness with changing age of blood stain. Initial results indicate that the surface characteristics of the wood significantly affect the luminescence duration (LD), with variances in chemiluminescence persistence and intensity across the different substrates and time intervals. This research underscores the importance of considering substrate properties when interpreting luminol test results in forensic investigations involving blood detection on wooden surfaces.

KEYWORDS: Blood, Luminol, Chemiluminescence, Presumptive blood test, Wood surfaces, luminescence time.

Paper ID: 4.20

Plastic Degradation: Role of gut microbial flora of Super worms (Larvae of *Zophobas atratus*)

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ABSTRACT

Because plastic lasts a long time in the environment, it poses a persistent risk to people and a variety of other creatures, especially those who live in terrestrial and aquatic environments. Traditional methods of decomposing plastic trash, such as disposing using landfills and employing chemical processes, have been shown to be ineffective and significantly harm the sustainability of the environment. When plastics are left to their own devices, they show a strong resilience to breakdown. Currently, insect degradation of polymers has no real-world applications. Although the idea that insects break down plastics is well known, it is still unclear exactly how this process takes place. Additionally, using insect larvae to break down plastics has the benefits of being inexpensive and producing no secondary pollution. The main objective of this review is to shed light on the summary of the most recent studies, particularly examine how insects and microbes break down plastic.

KEYWORDS: Larvae of *Zophobas atratus*, Super worms, gut flora, Plastic

Paper ID: 4.22

Assessment of the Cytotoxic Properties of Silver Nanoparticles Made from Andrographis Paniculata

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ABSTRACT

The increasing need for green nanotechnology has triggered research on plant-mediated nanoparticle synthesis due to its environmentally friendly, cost-effective, and biocompatible nature. Andrographis paniculata, a well-known medicinal herb with excellent reputation as an anti-inflammatory, antidiabetic, antiviral, and anticancer agent, has been used in biosynthesis of silver nanoparticles (AgNPs),

which presents a great substitute for the conventional chemical method. One of the leading causes of mortality in affluent countries is cancer. Since most patients don't exhibit any symptoms until the disease affects nearby organs, cancer is a silent killer. For cancer patients to survive, early detection and treatment are essential. Cancer can be treated with a wide variety of methods.

The synthesis of silver nanoparticles utilising an aqueous extract of the leaves of the Andrographis paniculate plant and their assessment for anti-cancer action have been the main objectives of this work. So, this study investigates the cytotoxic effect of A. paniculata-synthesized silver nanoparticles against various human cancer cell lines. Biosynthesized AgNPs were confirmed by UV-Vis spectroscopy, FTIR, XRD, and SEM to be stable, crystalline in nature, and nanoscale in size. Cytotoxicity was assessed using MTT assay; crystal violet and wound healing assays were conducted in MCF-7 (breast cancer) cancer cell lines to measure their migratory capacity. The result showed significant, dose-dependent cytotoxic effects and it suggested that A. paniculata-mediated AgNPs exhibit potent anticancer activity that they may find application in cancer therapy. The study reveals the dual benefit of green synthesis and biomedical efficacy, providing a platform for further in vivo studies and clinical trials of plant-derived nanoparticle systems for oncology.

Paper ID: 4.23

Smart Water Quality Monitoring for Small-scale Soilless Agricultural Applications

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ABSTRACT

Soilless agriculture, particularly aquaponics and other ecosystem-based techniques, requires vigilant water quality management. Poor water quality can result in nutrient deficiencies and microbial imbalances, directly affecting productivity and system viability. However, small-scale soilless agricultural systems often face economic challenges due to limited access to reliable water quality data and technology. This study presents a microcontroller-based data acquisition and monitoring system designed to bridge this gap. The system integrates pH, DS18B20 temperature, TDS, and MQ-135 gas sensors with an Arduino Uno microcontroller. Reliable and sensing techniques are used for state estimation from minimal sensor input. Real-time data is processed and transmitted to an ESP32-based control unit for actuation and shared wirelessly to a Firebase-managed webpage for remote monitoring. The methodology ensures consistent monitoring of pH, water temperature, TDS, air temperature, and ammonia levels—

parameters critical to both plant and aquatic health—using cost-effective sensors within a modular, scalable communication architecture. A comparative analysis with benchmarks from existing literature confirms the reliability of the results. This system enhances decision-making and promotes sustainability in small-scale soilless agriculture by providing accessible insights into water quality. The findings underscore the potential of affordable IoT solutions in improving the efficiency and resilience of decentralized agricultural practices.

KEYWORDS: Soilless agriculture; water quality monitoring; IoT; ESP32; pH sensor; ammonia sensor; aquaponics; hydroponics

Paper ID: 4.29

Sustainable use of concrete using recycled course aggregate

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ABSTRACT

This review study looks on the long-term use of recycled coarse aggregate (RCA) in concrete manufacturing instead of natural coarse aggregate (NCA). Given the building industry's massive resource depletion and waste generation, employing construction and demolition waste (C&DW) as recycled aggregate is a promising solution to sustainable development. This study presents current research findings on the physical and mechanical properties of RCA concrete, as well as its durability, optimization approaches, and practical applications. The analysis demonstrates that, while RCA concrete has worse mechanical properties than conventional concrete, these disparities can be substantially reduced with appropriate mix design modifications and treatment procedures. Furthermore, the environmental and economic advantages of employing RCA outweigh the technological challenges, making it a promising option for sustainable construction. This paper provides valuable insights for researchers, engineers, and legislators seeking to promote sustainable concrete construction processes.

KEYWORDS: Recycled coarse aggregate; Sustainable concrete; Construction and demolition waste; Mechanical properties; Durability; Environmental impact

Paper ID: 4.30

Screening of Lead-Tolerant Bacteria from Industrial Effluent for Bioremediation Applications

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ABSTRACT

Heavy metal lead-tolerant bacteria were isolated from industrial effluent samples and supplemented for one week with 10 ppm/L Lead Acetate Trihydrate before being serially diluted and plated on Nutrient Agar media (w/v) containing 500 ppm Lead Acetate. were incubated at 37° C for 48 hours. The tolerated colonies on 500 ppm lead were given 1000 ppm and 2000 ppm of lead in plate culture conditions. The isolates LH-1, LH-2, and MH strains demonstrate tolerance up to 2000 ppm/L on plate test and FTIR indicates the modification of functional groups. AAS shows lead remediation in 1000 ppm in MSM media: LH1(A2) 63.23%, MH 72.39%. The results of the same will be presented.

KEYWORDS: Lead-tolerant bacteria, Industrial effluent, Bioremediation, AAS, FTIR

Paper ID: 4.31

Assessment of Ecological parameters of Trees Outside Forest for Environmental Sustainability in Arid and Semi-arid region of India, Patan District: A Case Study of an Academical Landscape

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ABSTRACT

Trees Outside Forest (TOF) contribute significantly to ecological resilience in arid and semi-arid regions, yet their conservation status within academic institutional landscapes remains

poorly documented. While existing literature often emphasizes their potential in carbon storage and socio-economic importances for human wellbeing, ecological indicators such as species diversity, native-exotic ratios, and dominance structures are often neglected. This could lead to a lack of data on the ecological structure of TOF landscapes, thus hampering their sustainable management. This research contributes in addressing that gap by assessing the woody flora of Gokul Global University (GGU) in Patan district, North Gujarat, India. A full floristic inventory was conducted over a 2-month period across seven land-use blocks, with species identified through field observation and herbarium consultation. Key ecological parameters including the Importance Value Index (IVI), Shannon-Wiener Index (H′), Simpson's Index (D), and Pielou's Evenness (J′) were calculated. Results revealed 2494 individuals representing 132 species across 45 families. Native species dominated (61%), with a native-to-exotic ratio of 4.6:1. Meliaceae and Apocynaceae were the dominant families (23 % and 11% respectively) where *Azadirachta indica* species had the highest IVI (145.42), follow by *Alstonia scholaris* (IVI = 45.36), *Aegle marmelos* (IVI = 4.56). while diversity indices were low (H′ = 0.592; D = 0.278; J′ = 0.285). Analyses of Variance (ANOVA) showed significant differences in species abundance (p = 0.041) and dominance (p = 0.031). Despite an apparently good distribution of native species, these findings emphasize the ecological value and vulnerability of institutional landscapes in arid zones, highlighting the need for species diversification and native-focused conservation planning.

KEYWORDS: Academical Landscape; Arid zone; Ecological Parameters; Biodiversity conservation; Trees Outside Forest

Paper ID: 4.32

Green Disposal Solutions: Sustainable handling of Solar Panel E-Waste

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ABSTRACT

Solar cells play a vital role in our global society, which are used as a non-conventional form of energy, and it is a green revolution in the energy sector minimising the uses of non-renewable energy. Solar cells are classified as 4th types of generation that are used in various energy sectors.

Solar cells have different layers and these layers contains silicon wafers, glass substrates, aluminium wafers, and various metals, such as silver, copper, and tin. The exposure of solar cells to the various ways of use and their lifespan continues to about 20 to 25 years, these are green energy, but after completion of their lifespan, its EOL (end-of-life) could not be extended and they can be the red signal for our environmental impact during decomposing the materials

and they are discarded. These discarded materials start reacting with the nature, and it causes natural impact like environmental issues due to their presence in elemental gases, and it also causes health issues, and react releases hazardous gases; it can react with the atmosphere and affects it as a breathtaking problem and can cause skin problems.

Pyrolysis method can reduce the hazardous gases due to their closed-loop cycle process, and it doesn't react with oxygen; the elemental composition and gases can be characterised, and their morphology structure can be determined by scanning electron microscopy (SEM), elemental dispersive X-ray (EDX), and Fourier transform infrared spectroscopy (FTIR). The materials from pyrolysis can be used in bricks and concrete materials.

KEYWORDS: Pyrolysis, Green Energy, Discarded Solar cell, Environmental impact, Handling

Paper ID: 4.33

Evaluation of Indigenous Bacterial Isolates for Bioremediation

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ABSTRACT

One of the biggest environmental concerns nowadays is the rising incidence of petroleum hydrocarbon contamination brought on by urbanisation, industrialisation, and oil-related activities. It contains different toxic compounds such as hydrocarbons, heavy metals, and other organic and inorganic pollutants. Complex hydrocarbons found in oil-pollutants, include harmful polycyclic aromatic hydrocarbons (PAHs), which are persistent in ecosystems are of significant concern due to their toxic, mutagenic, and carcinogenic properties and present major risks to aquatic life, human health and the environment. By taking advantage of microorganism's natural metabolic potential, bioremediation provides a sustainable, economical, and environmentally friendly alternative for traditional cleanup techniques. This study aimed to isolate and characterize bacterial strains from oil-contaminated soil and evaluate their hydrocarbon-degrading potential. *Streptomyces maritimus* was identified as a key strain by 16S rRNA sequencing. Gas chromatography-mass spectrometry (GC-MS) was used to quantitatively assess the efficiency of diesel degradation by this isolate. These variations highlight the possibility of employing a variety of microbial species for successful bioremediation techniques. These findings validate the use of environmental bacterial strains for hydrocarbon degradation. The study offers significant insights into the development of scalable and sustainable microbial remediation techniques for oil-contaminated sites, aligning with global efforts in ecosystem restoration and green technology.

KEYWORDS: Bioremediation, Oil-Pollution, Hydrocarbon-degrading bacteria, Sustainable Development, GC-MS analysis

Paper ID: 4.34

Biochemical and Ecological Characterization of Freshwater and Industrially Contaminated Water *Chlorophyceae*, Insight into Their Bioremediation Potential

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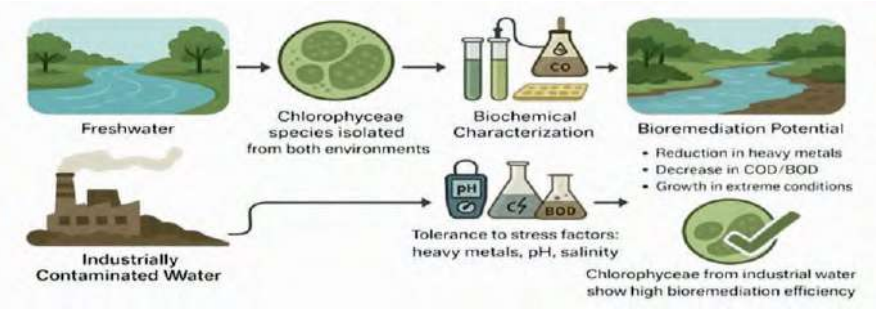
ABSTRACT

The present research aims to examine the ecological and biochemical characteristics for the *Chlorophyceae* that thrive in freshwater and industrially contaminated aquatic habitats in Kelo River, Raigarh, focusing on their bioremediation potential. Four representative sites from freshwater and wastewater areas have been selected, including lotic and lentic systems. *Hydrodictyon* (Freshwater lotic), *Rhizoclonium* (Freshwater lentic), *Mougeotia* (Wastewater lotic), and *Spirogyra* (Wastewater lentic) were found to be the dominant genera of *Chlorophyceae* in all habitats by microscopic analysis. Based on pigment analysis, wastewater algae had higher chlorophyll content (*Spirogyra*: 4.355 µg/mL; *Mougeotia*: 4.478 µg/mL) as compared to freshwater algae (*Rhizoclonium*: 2.706 µg/mL; *Hydrodictyon*: 2.631 µg/mL), which indicates adaptive responses to nutrient-rich conditions. *Chlorophyceae* of Freshwater have the highest DNA content (ranging from 71 to 177.67 µg/mL), which was correlated with solid algal growth; on the other hand, the wastewater *Chlorophyceae* have the highest protein content (ranging from 10.13 to 18.46 µg/mL), highlighting their physiological adaptation. Biochemical parameters of water, like BOD, COD, nitrate, and phosphate, indicate various pollution levels. As industrially polluted water exhibits higher BOD (16.56 µg/mL) and COD (74 µg/mL) levels, indicating high organic pollution, it reduces the dissolved oxygen level of water. Additionally, the water samples have low nitrate and high phosphate. Specifically, wastewater *Chlorophyceae*- *Spirogyra* and *Rhizoclonium* are the viable source for phytoremediation due to their tolerance and metabolic responses towards pollutants. These results expand our knowledge of resilience and application of algae in the eco-restoration of polluted freshwater ecosystems.



KEYWORDS: *Chlorophyceae*, Bioremediation, Freshwater Ecosystem, Industrial Wastewater, Lotic System, Lentic System.

Paper ID: 4.35

Soil Health Enhancement of Uncultivated Land of OPJU Adopted Village Through In Vitro Soil Carbon Sequestration Using Inorganic, Organic and Microbial Amendments.

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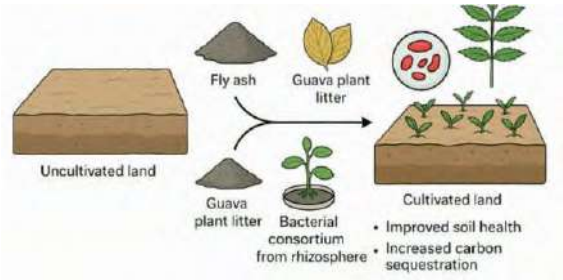
ABSTRACT

Soil health is defined as the soil's continued capacity to function as a living ecosystem, It is an important aspect for ensuring plant productivity, biodiversity, and ecological stability. This study aimed to restore such soils by evaluating the in vitro potential of carbon sequestration through organic and biological amendments. Four uncultivated soil samples collected from Tumidih (OPJU's adopted village)-D1, D2, D3& D4 were treated with eight compositions (including control): plant litter (Guava dried leaves), fly ash, bacterial consortium from the rhizosphere of Neem plant, and their combinations. Soil health was assessed using indicators such as carbon mineralization, humification reaction, microbial organic carbon, and total organic carbon (TOC). Gram seeds *(Cicer arietinum)* were cultivated in all treatments to study seed germination, shoot and root length, number of branches, leaves, and internodes as biological markers. Results disclosed that the combination of soil sample + plant litter + fly ash + bacterial consortium provided the most significant improvement in soil properties and plant growth across all soil types followed by soil sample + plant litter + bacterial consortium then soil sample + fly ash + bacterial consortium. This composition maximized carbon retention and microbial activity, showing a synergistic effect. In conclusion, integrating organic matter amendments, and microbial inoculants offers an effective, sustainable strategy to improve uncultivated soil health and carbon sequestration potential-facilitating environmentally sound agricultural rehabilitation.



KEYWORDS: Soil Health, Carbon Sequestration, Amendments, Fly Ash, Guava Plant Litter, Rhizosphere

Paper ID: 4.36

Microbial Remediation of Heavy Metals and Their Impact on Leguminous Crop Growth and Soil Enzyme Activity

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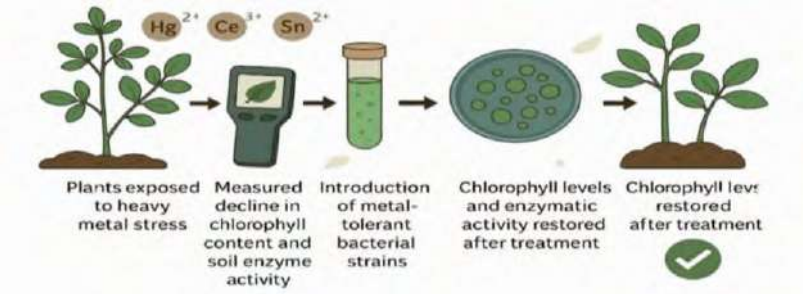
ABSTRACT

Heavy metals enter the soil ecosystem from both natural sources and anthropogenic activities, and subsequently become available to the plants. This present work focuses on assessing the effects of cerium, stannous, and mercury on the morphological and biochemical characters of two leguminous crops, Black chickpeas (*Cicer arietinum L*), and fenugreek (*Trigonella foenum-graecum.* In parallel, the study evaluates the potential of microbial remediation using Gram-negative bacteria isolated from the wastewater to mitigate the toxic effects of these heavy metals. Plants were grown for 15 days in treated and untreated soil samples to analyze the growth responses and chlorophyll content. Notably, mercury exposure completely inhibited seed germination in both crops. In contrast, fenugreek plants showed the most improvement in root, shoot, and leaf growth in soil amended with bacteria, However, black chick peas express their better morphological traits in untreated soil. Among the heavy metals, stannous and cerium exhibited comparatively less detrimental effects on plant growth than mercury. The chlorophyll content (total chlorophyll, chlorophyll a and chlorophyll b) was highest in both plants grown in the untreated soil and a decreasing trend was observed with increasing heavy metal concentration. No clear pattern was observed in the chlorophyll content for bacterial-amended soil, indicating complex plant-microbe-metal interactions. Soil amylase and cellulase activity were also assessed. Bacterial-treated soil significantly displayed higher enzyme activities on 15 days of plant growth, except for cerium-treated fenugreek plants, where soil cellulase activity was recorded in untreated soil. The findings suggest that bacterial remediation holds promises in reducing heavy metal toxicity in soil. Future studies should be carried out to explore genetic modification in both plants and microbes to enhance resistance to heavy metal stress.



KEYWORDS: Leguminous plant, Heavy Metals, Bioremediation, Chlorophyll content, Soil enzymes.

Paper ID: 4.37

Isolation, Characterization and Molecular Identification of Amylase-Producing Potential Bacteria from Industrial Soil of Punjipathara, Raigarh

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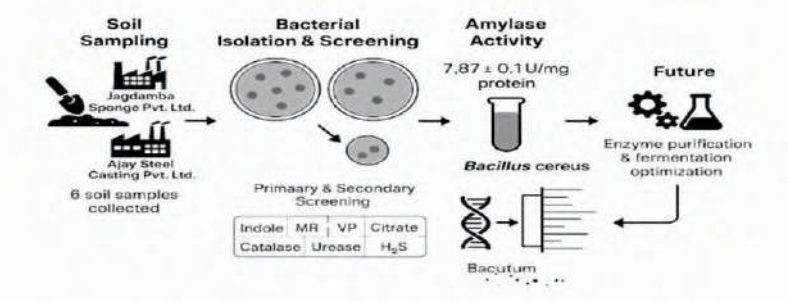
ABSTRACT

This study focuses on the isolation, biochemical characterization, and Molecular Identification of amylase-producing bacteria from the soil of the unexplored industrial site of Punjipathra, Raigarh, Chhattisgarh. Six soil samples were collected from two industrial sites (Jagdamba Sponge Pvt.Ltd & Ajay Steel Casting Pvt. Ltd) and 14 morphologically distinct bacterial colonies were isolated. Primary screening on 1% Starch agar revealed two amylase enzyme-producing isolates from Ajay Steel Casting Pvt. Ltd indicated by a clear zone of hydrolysis. Secondary screening confirmed one highly efficient isolate exhibiting significant enzyme activity of 7.87 ± 0.1 U/mg protein under optimal conditions of 37 °C and pH 7 after 5 minutes of incubation. Comprehensive biochemical characterization for the isolate was conducted using standard tests such as Indole, Methyl Red, Voges-Proskauer, Citrate utilization, Catalase, Urease, and Hydrogen Sulfide production. Molecular identification through 16S rRNA gene sequencing confirmed the isolate as Bacillus *cereus*. These findings suggest that bacteria inhabiting industry-polluted environments have adaptive enzymatic potential and underscore their applicability in industrial-scale amylase production. Future work will focus on enzyme purification and optimization of fermentation conditions for commercial application.



KEYWORDS: Industrial Sites, Amylase-Producing Bacteria, Enzyme Activity Assay, Biochemical Characterization, 16S rRNA Sequencing

Paper ID: 4.38

Enhancing Plant-Based Protein Content and Stability through Natural Elicitation and Biopolymer Encapsulation in *Vigna radiata* and *Pisum sativum* Sprouts.

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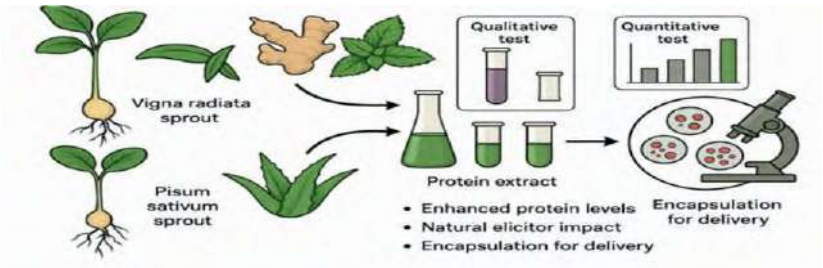
ABSTRACT

The rising demand for sustainable alternatives to animal-derived proteins has spotlighted Plant-derived protein, yet with broader adoption is constrained by challenges such as unpleasant sensory characteristics, instability, and short shelf life. This study addresses these limitations through a dual approach—natural elicitation to enhance protein content, and Agarose encapsulation to improve the stability and extended shelf life. Sprouts of *'Pisum sativum*' (pea) and *'Vigna radiata'* (mung bean) were treated with various elicitor combinations. The 1:1:1: 1:1 blend of aloe vera, ginger, mint, lemongrass, and curry leaves proved most effective in the significant increase in protein concentration, as measured by the Lowry method. Compared to their respective controls, Pea sprouts exhibited a remarkable 419.65% increase in protein content (from 3.419 to 17.767 µg/mL) while mung sprouts by a 41.70% increase in protein content in mung (from 10.814 to 15.323 µg/mL), highlighting the effectiveness of this elicitor blend. Biochemical assays confirmed protein structure integrity: the "Biuret test" confirmed the native structure of proteins (minimal denaturation); the "Bradford test" (595 nm shift) detected that neutral protein concentrations are higher than acidic and basic proteins; and the "Xanthoproteic test" (yellow-orange coloration) indicated the presence of high aromatic amino acids like tyrosine and tryptophan. Agarose encapsulation effectively protected proteins from degradation and facilitated controlled release of bioactive compounds. Integrating this technology with natural elicitation, a synergistic approach emerges that overcomes key challenges in plant-based protein utilization. This scalable, clean-label approach offers promising applications in functional foods and nutraceuticals, addressing the growing demand for sustainable, nutrient-rich ingredients with extended shelf life.



KEYWORDS: Agarose Encapsulation**,** Elicitation, Plant-based Protein, Shelf-Life Enhancement.

Paper ID: 4.39

Development of Zinc based nano material using *Sphagneticola trilobata* and *Bougainvillea glabra* and examining its biomedical application

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ABSTRACT

This research aims to understand green synthesis protocols and characteristics of zinc oxide nanoparticle prepared using plant extract. Green synthesis is a way of ecofriendly synthesis, which aims to minimize the environmental impact. Zinc acetate are vital or essential compound with various applications in cosmetics, pharmaceuticals, environmental and catalysis. This zinc oxide also found to have wound healing properties . Conventional method involves the use of hazardous chemicals which are responsible for environmental degradation. This research presents a green synthesis approach as reducing agents. This green synthesis helps in decreasing the toxic impact of the metals by integrating the metals with plant which is a ecofriendly method. Aqueous extract of *Sphagneticola trilobata* (Singapore daisy) and *Bougainvillea glabra* (Paper flower) were used to reduce zinc ions, which resulted in the formation of zinc acetate nanoparticle. The optical and structural properties of nanoparticles were explored by ultra-violent-visible spectrophotometer (UV-vis), X-ray diffraction (XRD) and Scanning electron microscopy (SEM). The UV showed the peak at 300nm. X-ray diffraction confirmed a polycrystalline nature with peak at 32 , 34 and 37. The Zinc oxide nanoparticles conjugate showed excellent antimicrobial inhibition of 74% against the bacterial growth. In EDAX the atomic% is 5.4 and 4.4 and weight% is 19.9 , 16.8 of Zn compound out of 100%. According to SEM characterization, the particle had a consistent surface morphology. The *Sphagneticola trilobata* and *Bougainvillea glabra* mediated nanoparticle showed strong antibacterial activity against the microbes compared to the lower doses of commercially available antibiotics. Plant based nanoparticle are best and excellent for the environment's sustainability and environmental degradation. These plant extract offers cost effectiveness and are easily available and are grown in any conditions, temperature, and seasons. The future prospects include cancer therapy, drug delivery, heavy metal degradation, crop protection and cosmetics.

KEYWORDS: Green synthesis , environmental degradation , integrating sustainability , reducing agent , SEM , UV visible spectroscopy , XRD , EDAX , antibacterial

Paper ID: 4.40

Biogenic Synthesis of Cerium Oxide Nanoparticles Using *Amorphophallus Paeoniifolius* for Therapeutic Applications

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ABSTRACT

The creation of sustainable nanomaterials has attracted a lot of attention. We present the production of cerium oxide nanomaterials (CNPs) from *Amorphophallus paeoniifolius* crude extract. By using a less energy-intensive procedure and avoiding dangerous chemicals, this synthesis pathway represents a sustainable alternative. In order to create biocompatible CNPs and address safety concerns, a number of bio-directed techniques have recently been used to synthesize them using natural and organic matrices as stabilizing agents. This has created the ideal environment for their successful application in biomedicine. *Amorphophallus paeoniifolius* crude extracts stimulate the nucleation of CNPs and exhibit distinct physicochemical characteristics by acting as stabilizing and reducing agents at the same time. To describe the morphology and purity, techniques such as UV-Vis spectroscopy, scanning electron microscopy (SEM), and energy-dispersive X-ray spectroscopy (EDX) were employed. The successful synthesis of crystalline CNPs was confirmed by UV-Vis spectroscopy which exhibited a characteristic peak at 340 nm. The produced nanoparticles had an average size of 66 nm, according to SEM. Energy dispersive X-ray (EDX) measurements reveals high-intensity peaks attributed to Ce and oxygen and further proved the creation of CNPs. Excellent antifungal and antibacterial activity is demonstrated by the CNP nanomaterial conjugates, which reduce the growth of *A. niger* fungi by 40.45% and the growth of *E. coli* bacteria by 69.09% and anti-oxidative effect was 86%- Superoxide Dismutase mimetic activity. Overall, the CNP describes the important accomplishments of CNPs as novel therapeutic agents for different microbial infections and conditions. Future potential uses include environmental cleanup, cancer treatment, biomedical imaging, antioxidant therapy, and cosmetics.

KEYWORDS: Cerium Oxide Nanoparticals, *Amorphophallus paeoniifolius*, Biomedicine, Antifungal, Antibacterial, Therapeutic Agents.

Paper ID: 4.41

Fabrication of biopolymers based Nanogel and evaluating its application for drug delivery and packaging material

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ABSTRACT

Traditional drug delivery and packaging techniques lack eco-degradability, bio-tolerance, and responsiveness. Formulating stable and versatile nanogels that resolve these drawbacks. Nanogel is an innovative combination of nanomaterials and hydrogels with the effective features of a nanosized configuration. These biopolymer-based nanogels were developed using chitosan, starch, and polyvinyl alcohol (PVA), incorporated with cerium dioxide nanoparticles (CNPs) to improve utility. Glycerol worked as a plasticizing agent, and glutaraldehyde functioned as a crosslinker. The synthesis was achieved through techniques that generate particle morphology and size. Physical and operational properties were evaluated through XRD. XRD analysis showed a broad diffraction peak around 20° (2θ), indicating an amorphous structure. UV-visible spectroscopy displayed a peak in 200-250nm wavelength range, it shows that this material is nanogel. The formulated nanogel indicated adaptive swelling at pH 6, sensitive in slightly acidic areas. Nanogel showed 70.83% antibacterial activity against E. coli. Due to its superior biological compatibility, the fabricated nanogel is highly likely to be used in targeted drug delivery. Moreover, incorporating cerium nanoparticles not only boosts the structural integrity of the nanogel but also provides beneficial antioxidant and antimicrobial properties. These features expand the use of nanogel, and packaging protects from microbial contamination. Together, these properties showcase the multifunctional potential of the developed biopolymer-derived nanogel. It is a beneficial and sustainable drug delivery and packaging system. This research generates new prospects for applying smart nanomaterials in biomedical and environmental areas, contributing to a global shift towards environmentally responsible and efficient materials.

KEYWORDS: Nanogel, Cerium nanoparticles, Biopolymers, Drug delivery, Packaging, Incorporated, Biocompatibility.

Paper ID: 4.42

Green root based Cerium Oxide Nanomaterial Synthesis and Characterization for Antimicrobial

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ABSTRACT

The rising global issue of antimicrobial resistance highlights the need for new therapeutic alternatives with wider spectrums of activities with limited environmental impact. In this study, we undertook a biogenic approach to synthesize cerium oxide nanoparticles using a traditional medicinal plant, *Phyllanthus amarus* - and its aqeuous root extract, in which the extract is rich in phytochemicals which acted as the reducing and stabilising agents during the synthesis process. After synthesis, the nanoparticles underwent calcination and then post-synthesis conjugation to enhance the crystallinity and functional surface properties. The final nanocomposite was structurally and functionally characterised and the final conjugation and formation of the nanocomposite was successful and the results of Scanning Electron Microscopy (SEM) indicated a consistent surface morphology with nanoscale particles and EDAX elemental analysis supported cerium-rich composites which had a clear, predominant cerium (Ce) signal (69.5 wt%) and also large oxygen content (22.2 wt%) which is consistent with CeO_2stoichiometry. The results also indicated trace elements such as carbon and niobium, which indicates incorporation of phytochemical residue and possible synergistic combinations of the composites. The biogenic Cerium oxide nanoparticles with *P. amarus* nanocomposite had enhanced antimicrobial activity above the microbial activity of the individual components in this study, with marked effectiveness against *Aspergillus niger* indicating a synergistic mode of action. The observed anti- microbial activity was observed to be 83% and it can be hypothesized to occur via a dual mechanism of action; the cerium core which is redox-active, reacts to form reactive oxygen species (ROS), while phytochemicals adhered to the cerium surface may contribute by disrupting microbial membranes.Due to the synergistic effects the antioxidative activities were observed to be 75% - Catalase mimetic activity; 44 % - Super oxide Dismutase mimetic activity. The green synthetic pathway outlined in the present work can provide a large scale and eco-friendly approach to the development of advanced bio-nanocomposites with enhanced benefits including lower environmental toxicity, and lower possible resistance. Future work should focus on cytotoxicity profiling and possibly elucidating the mechanistic pathway at the molecular level to support clinical translation.

KEYWORDS: Cerium oxide nanoparticles, *Phyllanthus amarus,* antimicrobial resistance, green synthesis, nanobiotechnology, reactive oxygen species, bio-nanocomposite, phytochemicals.

Paper ID: 4.43

Formulation of Nano biofertilizer using conjugate of Cerium oxide and *Arthrospira platensis*

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ABSTRACT

Eco-friendly fertilizers were developed for agricultural use because sustainable farming practices gained increased demand while requiring efficient performance and low environmental effects. A research work via protocols of seed germination test were formulated to describe the development of a new nanobiofertilizer in order to demonstrate the biofertilizer impact a comparative study plan was framed in which four sample pits were prepared having commercial fertiliser, spirulina, conjugated nanomaterial respectively in each pit to assess the growth of sample plant. Soxhlet apparatus extracted phytochemicals from Spirulina material to produce an enriched extract that combined with CeO_2nanoparticles to improve functionality and stability. The antimicrobial activity of nanobiofertilizer conjugates was tested through bactericidal and fungicidal inhibition tests. Compared to their individual counterparts, CeO_2 nanoparticles and Spirulina extract have significant inhibitory effects against the bacteria *Escherichia coli* and the fungi *Aspergillus niger*, with inhibition rates of 72.18% and 66.14%, respectively. An absorbance peak at 350nm revealed by UV-visible spectroscopy verified the presence of CeO2 nanoparticles. Size characterization showed that the particles were uniformly 85 nm in size. The combination of $CeO_2$with Spirulina demonstrates effective multiple benefits toward promoting plant growth while managing plant pathogens which implies significant promise for biofertilizer systems based on nanotechnology. Research on agronomic performance and environmental compatibility of the nanobiofertilizer proceed through studies that monitor plant growth, crop yield enhancement,stress tolerance, nutrient delivery, sustainable agriculture and plant disease management applications.

KEYWORDS: Green synthesis, Spirulina, Cerium oxide nanoparticles, SEM, EDX, UV-Vis, Antibacterial, Antifungal.

Paper ID: 4.44

Investigating antioxidative redox behaviour of synthesized zinc based nanomaterial using *Ixora* coccinea and *Aegle marmelos* for potential biomedical application.

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ABSTRACT

The burgeoning field of nanotechnology has witnessed remarkable advancements in recent years, yielding a diverse array of functional materials with unprecedented properties. Among the vast array of nanomaterials, zinc oxide nanoparticles (ZnO NPs) have garnered significant interest due to their multifunctional characteristics, including antimicrobial, catalytic, and optical properties. Ordinary fabrication techniques include harmful chemicals and energy- intensive forms that posture dangers to both the environment and living life forms. To tackle these issues, this study emphasizes on the eco-friendly techniques for synthesizing ZnO nanoparticles using leaf extracts from *Aegle marmelos* and *Ixora coccinea* where they are used as phytoreductants and surface-modifying agents that stabilizes the particles. The biosynthesized nanoparticles were analyzed through UV-visible spectroscopy, X-ray diffraction (XRD), Scanning Electron Microscopy (SEM), and Energy-Dispersive X-ray spectroscopy (EDX). The confirmation of ZnO NPs was supported by an assimilation peak observed at 373 nm, as verified by UV-Vis analysis. The XRD analysis revealed strong, intense peaks between 30-40 nm, indicating a highly crystalline and phase-pure material, thus confirming successful synthesis. EDX structural analysis showed the sample's high purity, with oxygen and zinc present at 10.2% and 70.0%, respectively. Additionally, SEM images revealed that the particles, measuring 75 nm, are somewhat agglomerated. The conjugated nanoparticles demonstrated antibacterial properties by decreasing microorganism multiplication by 71.92%. as anticipated due to the dual antioxidative property the synergistic effect showed enhanced antimicrobial activity of 83%- Catalase mimetic activity and 68%-Super oxide Dismutase mimetic activity. Hence this method for fabricating nanoparticles is appropriate for biomedical applications .The produced nanoscale particles are intended to enhance photocatalytic technologies, microbe-resistant coatings, and medicinal delivery systems. This study demonstrates the potential of medicinal herbs in the fabrication of nanoparticles and advances sustainable nanotechnology.

KEYWORDS: Green synthesis, *Ixora coccinea* and *Aegle marmelos*, Zinc oxide nanoparticles, Antibacterial assay, SEM, XRD, UV-VIS, EDX.

Paper ID: 4.45

Evaluating the efficacy of medicinal plant-based toothpaste against oral pathogen using biogenic TiO2 nanomaterial

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ABSTRACT

Chronic exposure to non-bacterial acids leads to irreversible dental erosion, characterized by demineralized surfaces, reduced microhardness, and structural defects like cupped cusps or shallow lesions. The research aimed to develop a herbal toothpaste and evaluate its performance against commercial products by measuring qualities such as color, foamability, spread ability, and antibacterial activity. A sustainable method for producing TiO_2 nanoparticles uses crude extracts of Azadirachta indica, which provide an eco-friendly alternative by reducing energy use and eliminating hazardous chemicals. In this green synthesis, Azadirachta indica acts both as a reducing agent, converting titanium precursors into TiO_2, and as a capping or stabilizing agent, preventing particle aggregation and ensuring nanoparticle stability. This approach leverages the plant's phytochemicals to facilitate nanoparticle formation, resulting in crystalline, stable TiO_2 with minimal environmental impact. The synthesized samples were analyzed using UV-visible spectroscopy (UV-Vis). Absorption peaks within the 220-400 nm range were detected. These spectral features align with TiO_2's bandgap energy and surface oxidation properties. Scanning electron microscopy (SEM) was employed to investigat the surface morphology of the samples. High-resolution images revealed distinct microstructural features, including particle size distribution and agglomeration patterns, which correlate with the material's synthesis conditions. The herbal toothpaste formulation showed notable antimicrobial activity against *S. aureus*, with a 19.7 mm zone of inhibition at 25 µg/mL, compared to ciprofloxacin's 24.5 mm at 6.25 µg/mL. These results suggest the toothpaste has promising potential for supporting dental health through its antimicrobial properties.

KEYWORDS: Toothpaste, Azadirachta indica, antibacterial, dental, herbal component, comparative analysis.

OPJU at a Glance

Infrastructure

50 Acre Land Area

5,00,000 Sqft.
Build up Area

1000
Capacity
Hall of Residence 1 & 2

350
Capacity
Hall of Residence 3

1000Mbps
(1:1) Connectivity
Fully Wi-fi Campus

1000+
Networked
Computer
Systems

45
Well Equipped
Laboratories

Central
Library

Research & Publication

90
Referred
International
Journals

38
Referred
National
Journals

Library

30,000+
Books

5000
Titles

15,000
E-journals

2,50,000
E-books

Students

2200+
Students

60%
Boys

40%
Girls

80% UG

20% PG

Student from
20+ states

3500+
Alumni

1 : 15
Faculty-Student
Ratio

35 Average age
of the Faculty
Members

Faculty and Staff

110 Faculty

80% PhD

20% PG

70% Male

30% Female

80%
Faculty
Qualification
from IIT, IIIT,
NIT & IIM

20%
Faculty
with global
experience

100+ Non-teaching
Staff

Placement Statistics

Year 2023-24

100+ Campus
Drives

84% Students
Placed

6.7 Lacs
Average Package

Collaboration & MoUs

45
National

10
International

About the O. P. Jindal University

Founded by the Jindal Education and Welfare Society, O. P. Jindal University (OPJU) was set up to bring high quality education to its students based on a world class curriculum, the latest teaching methodology and committed faculty members. This multidisciplinary university aims to develop young professionals and future leaders who will not only power growth and development in the state, but also make a mark globally. At the core of the university's philosophy and approach lies the belief that students learn best when exposed to real world situations and when nurtured through enriching interactions with practitioners and professors. With its continuous efforts and dedication, O. P. Jindal University has been graced with many awards like Emerging University of India, India's Most Trusted Technical University and secured 6th rank amongst India's Cleanest Higher Education Institutions. This university is promoted by Jindal Steel and Power, India's fastest growing Steel and Power Company.

About the School of Science

The School of Sciences started functioning in 2018, with the challenge of imparting good quality theoretical and practical education in science disciplines; and plays a significant role in development of the University. The School of Science includes the Departments of Biotechnology, Physics, Chemistry, Mathematics, and Humanities. Each department is actively involved in groundbreaking research and in educating students at the Undergraduate, Postgraduate, and Doctoral levels. The present curriculum of School of Science is structured to provide a common, broad-based foundation, imparting fundamental concepts and principles in science to develop students' intellect, research aptitude and ability to work collaboratively. The school offers B.Sc. programmes in Physics, Chemistry, Mathematics, Biotechnology, and Data Science & Analytics, as well as M.Sc. programmes in Physics, Chemistry, Mathematics & Computing, and Industrial Biotechnology. The school also offers Doctoral programmes in Physics, Chemistry, Mathematics and Humanities.

Program Offered by School of Science

Bachelor of Science (B.Sc.) 4 Years

- B.Sc. (Hons.) Physics
- B.Sc. (Hons.) Chemistry
- B.Sc. (Hons.) Mathematics
- B.Sc. (Hons.) Biotechnology
- B.Sc. (Hons.) Data Science & Analytics

Master of Science (M.Sc.)

- M.Sc. in Physics
- M.Sc. in Chemistry
- M.Sc. in Mathematics & Computing
- M.Sc. in Industrial Biotechnology

Ph.D.

- Physics
- Chemistry
- Mathematics