MAHARISHI MARKANDESHWAR
(DEEMED TO BE UNIVERSITY)
Mullana-Ambala, Haryana
(Established under Section 3 of the UGC Act, 1956)
(Accredited by NAAC with Grade 'A++')

ICRAAS-2025

3rd INTERNATIONAL CONFERENCE ON RECENT ADVANCES IN APPLIED SCIENCES (ICRAAS - 2025)

MAHARISHI MARKANDESHWAR
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ABSTRACT BOOK

3rd INTERNATIONAL CONFERENCE ON RECENT ADVANCES IN APPLIED SCIENCES (ICRAAS - 2025)

28th-29th March, 2025

EDITOR : Dr. BHAWNA PAREEK

Organized By

DEPARTMENT OF CHEMISTRY, MMEC, MM(DU), MULLANA

Abstract Book

of

3rd International Conference on Recent Advances in Applied Sciences

(ICRAAS-2025)

on

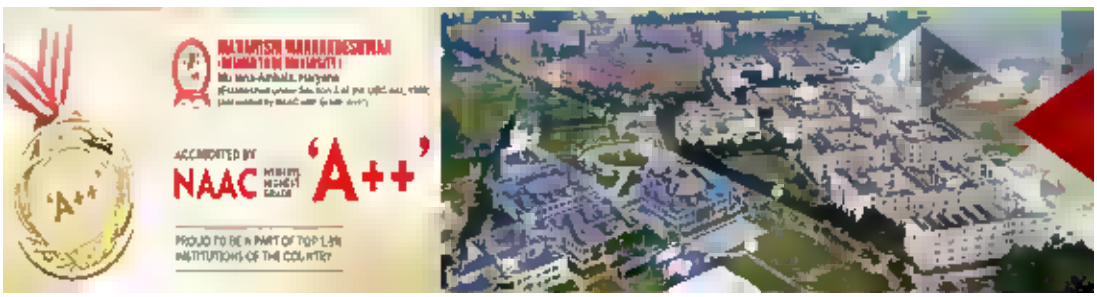
28-29th March 2025

(Hybrid Mode)

Organized by

DEPARTMENT OF CHEMISTRY

MMEC, MAHARISHI MARKANDESHWAR (DEEMED TO BE UNIVERSITY), MULLANA-133207



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About the Maharishi Markandeshwar (Deemed to be University), Mullana-Ambala, Haryana (India), 133207

Maharishi Markandeshwar (Deemed to be University) is the first self-financing university established by the M.M. Trust, which aims to boost the education as well as research sector. It is located at the "Holyland" of Maharishi Markandeshwar and has wonderful architecture along with great infrastructure which is situated adjacent to the bank of sacred river Markanda. Medicinal sciences, dental sciences, physiotherapy, nursing, pharmacy, engineering and technology, management, hotel management, agriculture, computer technology, and law are just some of the many fields in which the institution provides undergraduate, graduate, and research degrees.

The MM(DU) is known for excellently imparting value-based, career-oriented professional education. NAAC has accredited MM(DU) with the highest Grade 'A++' and is proud to be part of the top 3% of institutions in India. MM(DU) has built its goodwill as the best university in North India by NIRF ranking (ranked 71st among the top Universities in India), QS World University ranking (ranked 174 Southern Asia region), Times Higher Education (THE) World University ranking (Worldwide rank band 601-800 amongst the Top universities and worldwide rank band 201-250 amongst the top Clinical & Health Universities) with a rich legacy of excellence in research, innovation and skill development. MM(DU) incorporates the best of both worlds by presenting a synergy of curricula from both the UGC model of education and the leading schools from around the world.

About the M.M. Engineering College, MM(DU), Mullana-Ambala

MMEC is India's leading, globally recognized Engineering College which offers courses developed by the most experienced technical experts, professors, and industry leaders. MMEC has trained many brilliant minds and created technical experts in the fields of sciences (Chemistry, Physics, Mathematics and Biosciences), IT, Technology, Engineering, and many more!

Upon completion of the course(s), the candidate(s) can select a job based on the area of expertise in which they aspire to reach heights. Vast opportunities in various sectors such as IT, construction, automobile, electronics, and engineering sector await you if you choose MMEC as your study destination.

About the Department of Chemistry, MM(DU), Mullana-Ambala

The Department of Chemistry in MMEC is well-reckoned for highly experienced and qualified faculty who focus on exposure-driven and quality education that makes students experts in their forte, right from the very start. The Department of Chemistry came into existence in 2007 to provide skill-based quality education. The Department organizes numerous special sessions, industry meets, conferences, lectures, and expert talk every year for the holistic growth of the students.

The Department is committed to cultivate creative and innovative research in various fields of Chemical Sciences. The Department currently offers B.Sc. (Med., Non-med., Hons), M.Sc. Chemistry (Inorganic / Organic / Physical) and Ph.D. programs. The Department has attracted extramural funding and is currently engaged in many innovative projects.

About the Conference (ICRAAS-2025)

After the grand success of ICRAAS-2022 and 2024, this is the third conference of the series. This conference aims to provide opportunities for the delegates to exchange new ideas and their experiences face to face, establish research relations, and find global partners for future expertise.

People need clean air to breathe, fresh water to drink, and places to live that are free of toxic substances and hazards. Therefore, human well- being is inextricably linked to environmental health.

Environmental sustainability is responsible for conserving natural resources and protecting global ecosystems for current and future health and well- being. However, rapid population growth has resulted in increased farming, which increases Because of industrial and greenhouse gas emissions and deforestation.

Technological advancements, we require more power than ever before. Yet our planet is reaching a breaking point. We are beginning to see the consequences of global warming on ecosystems and communities. The aim of the conference is to provide a platform for working professionals, academicians, related industry people, field engineers, researchers, and students to share their experiences and knowledge related to environmental pollution control and sustainable development.

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WEBSITE: www.mmumullana.org ; E-Mail: info@mmumullana.org

Programme Schedule

Day 1 (28th March 2025) **Venue: CSED Conference Hall, Ground Floor, Engineering Block-1, MM(DU) Mullana**		
09:00 - 09:45 am	**Spot Registration**	
09:45 - 10.00 am	**Inauguration ceremony**	**Welcome of Guests**
10.00 - 10.10 am		**Lamp Lightning & Saraswati Vandana**
10.10 - 10.15 am		Welcome address by Prof. Bhawna Pareek, Head, Department of Chemistry
10.15 - 10.30 am		Keynote address by Chief Guest Honorable Prof. Harish Kumar Sharma
10.30 - 10.40 am		**Address by Guests of Honor**
10.40 - 10.50 am		**Souvenir Release**
11:00 - 11:40 am	**Session 1**	**Invited Talk - 1** Speaker: Prof. Sanjay Sharma, JECRC, University, Jaipur. **Theme:** Environmental sustainability with green chemistry
11:50 - 12:30 pm	High Tea	
12:40 - 01:20 pm	**Session 2**	**Invited Talk - 2** Speaker: Prof. Arvind Kumar, CSIR-ICMCRI, Gujrat. **Theme:** Ionic liquids and biomass processing
01:20 - 02:00 pm	**Lunch Break**	
02:00 - 02:40 pm	**Session 3**	**Invited Talk - 3** Speaker: Prof. Ajay Kumar Mishra, Durban University of Technology, South Africa Theme: Water Research with Nanotechnology
02:40 - 04:10 pm	**Session 4: Oral session /Poster**	
	TRACK-1	CSED Conference Hall, G. Floor, Block-1
	TRACK-2	Room. No. 170, G. Floor, Block-1
	TRACK-3	CSED Conference Room, F. Floor, Block-1
	TRACK-4	L.T.254, F. Floor, Block-1
	TRACK-5	Computer Lab 147, Block-1
	TRACK-6	Reading Room, II-Floor, Block-1

<table>
<tr><th colspan="3">Day 2 (29th March 2025)
Venue: CSED Conference Hall, Ground Floor, Engineering Block-1, MM(DU) Mullana</th></tr>
<tr><td>09:00 - 09:40 am</td><td>Session 5</td><td>Invited Talk - 4
Speaker: Dr. Prem Prakash Sharma, Cergy Paris University, France.
Theme: Electromembrane Process, Energy Conversion/Storage</td></tr>
<tr><td>09:50 - 10:30 am</td><td>Session 6</td><td>Invited Talk - 5
Speaker: Dr. Ashok Kumar S.K, VIT, Vellore, India, TN, India.
Theme: Supramolecular chemosensors for environmental contaminants</td></tr>
<tr><td>10:40 - 11:20 am</td><td>Session 7</td><td>Invited Talk - 6
Speaker: Prof. Amalendu Pal, CSIR Emirate Professor, Kurukshetra University, India
Theme: Polyelectrolyte in ionic liquid media</td></tr>
<tr><td>11:30 - 12:00 am</td><td colspan="2">High Tea</td></tr>
<tr><td>12.00 - 12.30 pm</td><td>Session 8</td><td>Invited Talk - 7
Speaker: Dr. Himanshu Aggarwal, Executive Editor, Asian Journal of Chemistry
Theme: Factors Influencing Researchers' Scientific Productivity and their Outcomes</td></tr>
<tr><td>12:30 - 01:15 pm</td><td colspan="2">Lunch Break</td></tr>
<tr><td rowspan="6">01:15 - 02:45 pm</td><td colspan="2">Session 9: Oral session /Poster</td></tr>
<tr><td>TRACK</td><td>VENUE</td></tr>
<tr><td>TRACK-7</td><td>CSED Conference Hall, G. Floor, Block-1</td></tr>
<tr><td>TRACK-8</td><td>Room. No. 170, G. Floor, Block-1</td></tr>
<tr><td>TRACK-9</td><td>CSED Conference Room, F. Floor, Block-1</td></tr>
<tr><td>TRACK-10</td><td>L.T.254, F. Floor, Block-1</td></tr>
<tr><td>TRACK-11</td><td>Computer Lab 147, Block-1</td></tr>
</table>

	TRACK-12	Reading Room, II-Floor, Block-1
2:45 - 3:00 pm	**Result Compilation**	
3:00 - 3:45 pm	**Valedictory Ceremony**	**Certificates Distribution**
3:45 - 4:00 pm		Vote of Thanks by Dr. Nadeem Sharma, Co-convener, ICRAAS-2025
THANKS		

Dr. TARSEM GARG

Hon'ble CHANCELLOR

It gives me immense pleasure to know that the Department of Chemistry, MM Engineering College, Maharishi Markandeshwar (Deemed to be University), Mullana-Ambala is organising the 3rd International Conference on "Recent Advances in Applied Sciences" (ICRAAS-2025) on 28-29th March 2025 in Hybrid Mode.

This prestigious conference will serve as a dynamic platform for distinguished scholars, researchers, and industry experts from around the world to engage in meaningful dialogue and exchange innovative ideas. I am confident that the deliberations and insights shared during this event will significantly contribute to the advancement of applied sciences and inspire collaborative efforts across various disciplines.

I extend my warmest wishes to the organizing committee, speakers, participants, and everyone involved in making this Conference a grand success. May this conference pave the way for transformative research and foster enduring academic and professional relationships.

Dr. TARSEM GARG

Dr. L.C. GUPTA

MANAGING DIRECTOR

It is a matter of great pleasure to know that the Department of Chemistry, MM Engineering College, a constituent institute of Maharishi Markandeshwar (Deemed to be University), Mullana-Ambala, is organizing the 3rd International Conference on "Recent Advances in Applied Sciences" (ICRAAS-2025) on March 28-29, 2025 through Hybrid Mode.

This conference will provide an excellent platform for researchers, academicians and professionals to exchange ideas, present their latest findings and explore advancements in applied sciences. Such academic endeavors play a crucial role in fostering innovation, interdisciplinary collaboration and scientific excellence.

I extend my heartiest congratulations to the organizing committee and participants with best wishes for the grand success of this Conference.

Dr. L.C. GUPTA

Prof. H.K. Sharma

VICE-CHANCELLOR

I extend my warmest greetings to all participants, researchers, and esteemed guests of the 3rd International Conference on Recent Advances in Applied Sciences (ICRAAS-2025). Organized by the Department of Chemistry, Maharishi Markandeshwar Engineering College, MM(DU), this conference serves as a platform for innovation, collaboration, interdisciplinary discussions and knowledge-sharing in the realm of applied sciences.

The theme of ICRAAS-2025 resonates deeply with the contemporary scientific landscape, as it brings together scholars, industry professionals, and young researchers to explore novel solutions in chemistry, material sciences, and environmental sustainability. The exchange of ideas and research findings at this conference will undoubtedly contribute to the collective pursuit of a greener, more sustainable future.

MM(DU) has always been committed to academic excellence, research, and technological innovation. Our institution takes pride in providing a platform that nurtures scientific inquiry and facilitates the growth of budding researchers. I extend my sincere appreciation to the organizing committee and all contributors for their dedication in making ICRAAS-2025 a grand success. May this conference ignite curiosity, foster meaningful dialogue, and pave the way for a brighter and more sustainable future.

Best wishes for a fruitful and engaging conference!

Dr. H.K. Sharma

Prof. Sumit Mittal

Registrar

It is a matter of immense pride and honor to welcome all distinguished delegates, eminent scientists, researchers, academicians, and students to the 3rd International Conference on Recent Advances in Applied Sciences (ICRAAS-2025), organized by the Department of Chemistry, Maharishi Markandeshwar Engineering College, MM(DU), Mullana.

ICRAAS-2025 stands as a testament to our commitment to fostering innovation, knowledge exchange, and scientific advancements. This conference serves as a dynamic platform for experts from diverse disciplines to come together, share their pioneering research, and engage in discussions that shape the future of applied sciences. The theme of this conference aligns with the global mission of sustainability, environmental consciousness, and technological innovation, which are crucial in addressing contemporary challenges in science and society.

Maharishi Markandeshwar (Deemed to be University) has always been at the forefront of promoting high-quality education and research. With its NAAC 'A^{++}' accreditation and a legacy of academic excellence, MM(DU) is dedicated to creating opportunities for intellectual growth and professional development. ICRAAS-2025 exemplifies this vision by bringing together thought leaders and young researchers to collaborate, inspire, and contribute towards a sustainable and progressive future.

I extend my heartfelt gratitude to the organizing committee, esteemed speakers, and all participants for their invaluable contributions in making this conference a grand success. May this

event spark new ideas, forge lasting collaborations, and pave the way for groundbreaking discoveries in applied sciences.

I wish the conference a great success.

Dr. Sumit Mittal

Prof. Vishal Bharti

Principal

It is a matter of happiness and pride that the Department of Chemistry, Maharishi Markandeshwar Engineering College, MM(DU) Mullanais going to organize the 3rdInternational Conference on "Recent Progress in Applied Sciences" (ICRAS -2025) from 28 to 29 March, 2025. This prestigious conference stands as a testimony to our commitment to academic excellence, scientific research, and innovation in the field of applied sciences.

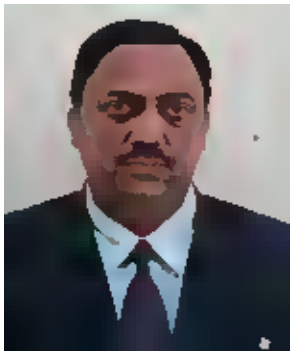
The Department of Chemistry plays a pivotal role in addressing the challenges of our time, ranging from environmental sustainability and renewable energy to advancements in material science and healthcare. With rapid developments in chemistry and its allied fields, industries continue to evolve, enhancing human life and redefining how we interact with the world. The Department, through this conference, provides an ideal platform to engage with these advancements, share cutting-edge research, and promote collaboration that can lead to transformative scientific and technological innovations. By fostering discussions around these critical areas, the department continues to contribute significantly to the progress and application of chemistry in tackling global challenges.

ICRAAS-2025 will bring together the world's reputed researchers, academicians, industry experts and young scholars, to be a part of practical discussions, and discover innovative solutions for modern challenges. The enlightening lectures by renowned researchers, technical sessions based on various research domains, and interactive panel discussions, knowledge and progress will prove to be a significant milestone in our collective research.

I would like to take this opportunity to extend my heartfelt gratitude to the Department of Chemistry for their unwavering dedication in organizing this significant conference. Their hard work, combined with the contributions of our esteemed speakers and participants, will undoubtedly ensure the success of this conference. Wishing everyone a fruitful and inspiring experience at the conference!

Best Regards

Dr. Vishal Bharti



Prof. J K Sharma

Dean, Student Welfare

It is with great pleasure that I extend my heartfelt congratulations to the Department of Chemistry, Maharishi Markandeshwar Engineering College, MM(DU), Mullana, for hosting the 3rd International Conference on Recent Advances in Applied Sciences (ICRAAS-2025).

This prestigious conference serves as a dynamic platform for academicians, researchers, and industry professionals to exchange knowledge, share groundbreaking ideas, and explore innovations in the field of applied sciences. Such initiatives not only contribute to academic excellence but also inspire young minds to pursue impactful research.

I am confident that ICRAAS-2025 will foster insightful discussions, meaningful collaborations, and significant contributions to scientific advancements. I extend my best wishes for the grand success of this conference and commend the organizers for their dedication and efforts.

Best regards

Prof. J K Sharma

Prof. Bhawna Pareek

Head of Department's Desk

Warm and Happy greetings to all. I am delighted to share that the Department of Chemistry is organizing two-day International Conference on Recent Advances in Applied Sciences (ICRAAS-2025) on 28th & 29thMarch 2025 which aims to bring together leading academic scientists, researchers, and research scholars to exchange and share their experiences and research results on all novel aspects of Science and Technology and Humanities. It also provides a premier interdisciplinary platform for researchers, practitioners, and educators to present and discuss the most recent innovations, trends, concerns, practical challenges encountered, and solutions adopted in the fields of Science and Technology and Humanities.

The conference's theme about Recent Advances in green materials for sustainable engineering is very appropriate. The conference would explore multifaceted concepts with a multidimensional approaches and recent advancements in various fields of sustainable engineering. I hope this conference will provide a platform for academicians, researchers, and industrialists to share their knowledge and experience regarding recent advancements in sustainable engineering development.

I appreciate the active interest and participation shown by the Department of Chemistry faculty members in organizing International Level conferences and maintaining the research ambiance in the department.

On behalf of the organizing committee, we want to extend our heartfelt thanks and gratitude to Tarsem Garg, Chancellor-MM(DU); Vishal Garg, Vice President MM(DU); Prof. Harish Kumar Sharma, Vice-

Chancellor-MM(DU); Prof. Vishal Bharti, Principal MMEC and for providing us all the required support in organizing ICRAAS-2025. We thank the various Institutions, Industries, and Research organizations for deputing delegates to participate in the Conference. We thank all the sponsors for their valuable contribution to this event. We thank the National and International Advisory Committees for their valuable suggestions and the organizing committee members for their contributions to the Conference.

I wish the department the best in its sustained pursuits for excellence and earnest efforts to make this conference a grand success.

I extend my best wishes for the conference. May this Conference run in the spirit of open communication among all participants and yield scientific profit to all of us.

Dr. Bhawna Pareek

Prof. Vipin Saini

Director RAAC

Dear Students, Participants, and Organizers,

I am delighted to extend my warm greetings to you all for the 3rd International Conference on Recent Advances in Applied Sciences (ICRAAS-2025). This prestigious event provides a unique platform to explore the latest developments in critical fields that shape our world, from waste management and the environment to functional nanomaterials and sustainable future technologies.

As we gather to discuss innovative solutions across various impactful issues, to encourage each of you to fully engage in the exchange of knowledge and ideas. Waste Management and Environment is crucial for addressing global challenges related to pollution and resource conservation. while Functional Nanomaterials highlights the vast potential of nanotechnology in medicine, biotechnology, and beyond. Advanced Materials for Sustainable Future emphasizes the role of innovation in creating eco-friendly, long-lasting solutions. Conference will also include importance of cutting-edge technologies in tackling issues of climate change, agriculture, whereas mathematical and statistical tools, reflects the power of data-driven decisions for advancing scientific progress.

I commend the students, participants, and organizers for your contributions to this endeavour. I am confident that your passion, dedication, and insights will make ICRAAS-2025 a resounding success, paving the way for future breakthroughs in applied sciences.

Best regards,

Dr. Vipin Saini

Prof. Adesh Kumar Saini

Director, Research & Development

With enormous pleasure, I welcome all esteemed guests, keynote speakers, researchers, and participants to the 3rd International Conference on Recent Advances in Applied Sciences (ICRAAS-2025), organized by the Department of Chemistry, MMEC, Maharishi Markandeshwar (Deemed to be University), Mullana.

This conference serves as a dynamic platform for the exchange ideas and thoughts on cutting-edge research, fostering collaborations, and advancing scientific knowledge in applied sciences. The interdisciplinary nature of ICRAAS-2025, covering topics from sustainable materials, nanotechnology, energy conversion, environmental science, and advanced functional materials**,** underscores our commitment to addressing global challenges through innovative solutions. The conference covers major goals of UN-SDG.

I extend my sincere appreciation to the organizing committee, distinguished speakers, and participants for their contributions in making this conference a grand success. I am poised that the deliberations, discussions, and interactions over the two days will pave the way for impactful scientific advancements and meaningful collaborations.

Wishing you all a fruitful and intellectually stimulating conference.

Dr. Adesh Kumar Saini

KEYNOTE SPEAKERS

Dr. Prem Prakash Sharma
Cergy Paris University,

Dr. Ajay Kumar Mishra
Durban University of Technology,

Dr. Amalendu Pal
CSIR Emirate Professor,

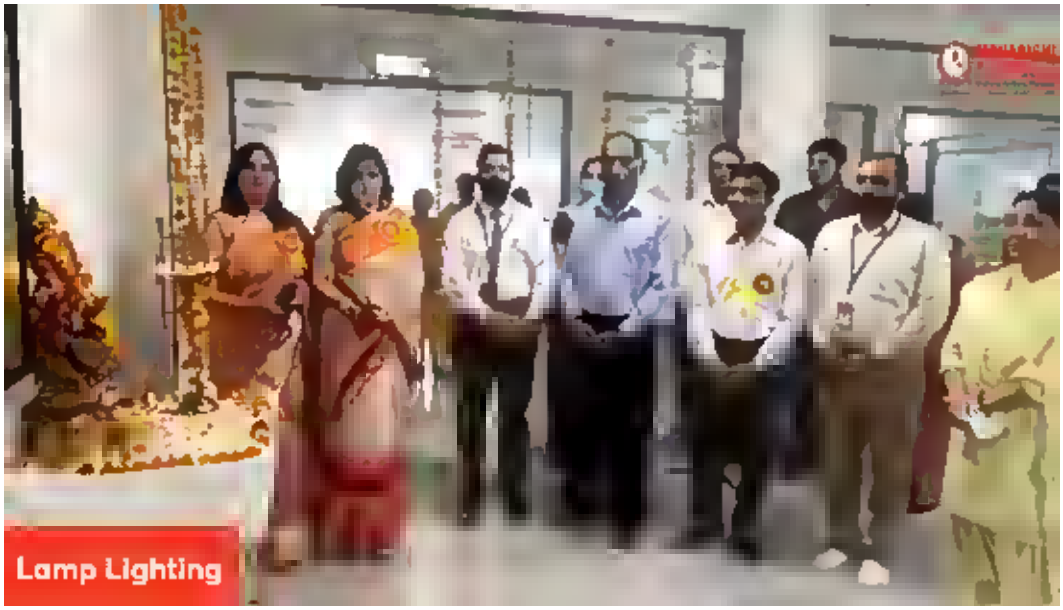
Prof. Arvind Kumar
Chief Scientist, ICMCRI, Gujrat

Prof. S. K. Ashok Kumar
Vellore Institute of Technology,

Prof. Sanjay Sharma FRSC
JECRC, University, Jaipur

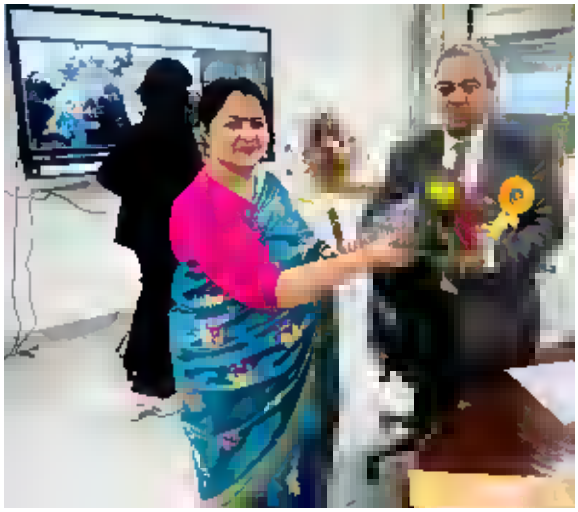
Dr. Himanshu Agarwal
Executive Editor of Asian Journal of Chemistry

Highlights of ICRAAS 2022




LIVE
8

Highlights of ICRAAS 2024



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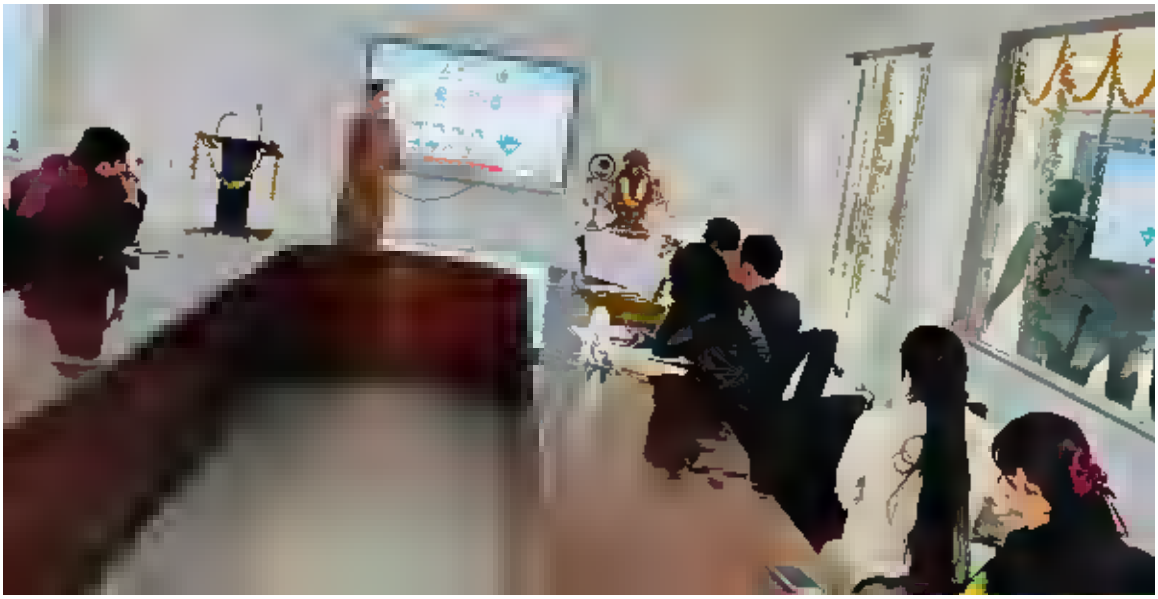


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2nd INTERNATIONAL CONFERENCE
ON RECENT ADVANCES IN APPLIED SCIENCES
(ICRAAS - 2024)

LIST OF ABSTRACTS

Keynote Speakers

Abstracts

ET-1

Micellization behavior of anionic surface active ionic liquid 1-butyl-3-methyl imidazolium dodecylbenzenesulphonate in the presence of cationic polyelectrolyte poly(diallyldimethylammonium chloride) [PDADMAC] and non-ionic polyelectrolyte polyvinylpyrollidone (PVP): Insights into competing mechanisms.

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Abstract

In the present study, we have reported a comprehensive assessment of interactional behavior of surface active ionic liquid (SAIL) 1-butyl-3-methylimidazolium dodecylbenzenesulfonate [C_4mim][DBS] in the presence of cationic polyelectrolyte poly(diallyldimethylammonium chloride) [PDADMAC] solution and non-ionic polyelectrolyte polyvinylpyrollidone (PVP) in aqueous solution. Various techniques such as surface tension, isothermal titration calorimetry (ITC), conductivity, dynamic light scattering (DLS) and turbidity have been employed to get insight into interactions among these systems. Various surface parameters such as surface excess concentration (Γ_{cmc}), surface pressure at interface (Π_{cmc}), minimum area occupied by one molecule of SAIL at interface (A_{min}), adsorption efficiency (pc_{20}) and surface tension at critical micelle concentration (cmc) (γ_{cmc}) have been calculated from tensiometric measurements. Thermodynamic parameters i.e. standard free energy of micellization (ΔG_m°), standard enthalpy of micellization (ΔH_m°) and standard entropy of micellization (ΔS_m°) have been evaluated from conductivity measurements. The size of complexes formed have been characterized using DLS and turbidimetry.

Keywords: Ionic-liquid; Electrolyte; Cationic ILS.

ET-2

Harnessing Wisdom: The Role of Indian Knowledge Systems in Promoting Environmental Sustainability

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Abstract

The Indian Knowledge System (IKS) presents a compelling framework for environmental sustainability, deeply rooted in its rich philosophies, traditions, and ecological practices. Central to IKS is the principle of Ahimsa, or non-violence, which underscores the importance of biodiversity conservation and harmonious coexistence-a theme echoed in foundational texts like the *Upanishads* and the *Bhagavad Gita*. Indigenous water management techniques such as stepwells (baolis), check dams (johads), and tank irrigation have effectively demonstrated sustainable water resource management for centuries. Vedic agricultural practices, including organic farming, crop rotation, and using natural fertilizers like *panchagavya*, not only enhance soil fertility but also ensure long-term agricultural productivity. Ayurveda advocates for the conservation of medicinal plants, while sacred groves known as Devrai and revered temple forests serve as essential biodiversity reserves. Architectural wisdom from Vastu Shastra informs the design of energy-efficient structures, actively reducing environmental impact and promoting sustainability in our living environments. Additionally, texts such as the *Arthashastra* and *Rigveda* emphasize responsible forest management, encouraging the mindful use of natural resources. Tribal and rural communities contribute significantly through traditional agroforestry and shifting cultivation practices (jhum), diligently working to maintain ecological balance. By integrating ethics with scientific knowledge, the Indian Knowledge System not only addresses contemporary environmental challenges but also provides pathways toward a sustainable and resilient future. Embracing these insights can help foster a world where harmony with nature becomes not just an aspiration, but a lived reality.

Keywords: Indian Knowledge System, Environmental Sustainability, Ancient Indian Philosophy, Water Conservation, Medicinal Plants, Agricultural Productivity.

ET-3

Ionic Liquids and Deep Eutectic Solvents based Ionic Nanoreactors for Advanced Applications in Colloidal Chemistry and Biomass Processing

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Abstract

Ionic liquids (ILs) are the organic analogues of inorganic molten salts with melting temperature < 100°C, whereas deep eutectic solvents (DESs) are formed from a eutectic mixture of Lewis or Brønsted acids and bases which can contain a variety of anionic and/or cationic species and now widely acknowledged as a new class of ionic liquid (IL) analogues because they share many characteristics with ILs in terms of solvent properties such as low volatility, high thermal stability, wide liquid range and good solvating ability. Superior physicochemical properties distinguish ILs and DESs from conventional organic solvents, and fast replacing these in several chemical applications.

The presentation is mainly focused on synthesis and application of ILs/DESs in authors laboratory and is divided in two parts. First part will cover formulation of colloidal systems using surfactant like ILs and ILs/DESs as dispersion medium. Applications of such systems in materials synthesis and preservation of biomaterials at elevated temperatures will be discussed. We have shown that IL based colloidal structures are highly thermally stable. These formulations have been used as as nanoreactors for preservation of biomaterials at elevated temperatures and as templates for preparation of shape/size-controlled nanomaterials/quantum dots, metal organic frame works (MOFs) with enhanced quantum efficiency for light harvesting and also for gas adsorption/storage for energy applications.

Second part of presentation deals with the use of ILs in biomass processing for clean separation of biopolymers (cellulose, hemicellulose and lignin) and recovery of other value-added chemicals. We have developed strategies to depolymerize the biopolymers at ambient conditions, for example lignin has been valorized efficiently using metal based ionic liquid systems in order to convert value added chemicals. Biopolymers dissolved in ILs/DESs have been utilized to prepare ionogles for diverse applications.

Keywords: Ionic liquids; Electrolyte; Biopolymer.

ET-4

Recent Advances in Materials for Wastewater Remediation, Detection, and Anticancer Agents

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Abstract

The first part of my presentation begins by providing an overview of water pollutants and their removal technologies. The exploration of new renewable biomass coconut spathe (**CS**) for the development of activated carbons (**CSAC,** surface area =1500 m^2/g), its characterization with various spectroscopic techniques. The study utilized **CSAC** for the removal of various phenolic compounds, with an efficiency of qmax ranging from 77 to 400 mg/g. Further, **CSAC** utilized for impregnating n-Ag/ZnO on **CSAC** for the removal of pathogenic bacteria's present in water. The same **CS** was used for the development of paper and the use of cellulose to impregnate photocatalytic material (**CS@Ag_2S/ZnS**) for 97% rhodamine dye degradation in 1 h. In the second part of presentation, I will focus on presenting a rhodanine-based chemosensor (L1) for detecting putrescine and cadaverine, as well as exploring meat preservatives. Further, development of 6,6, substituted 2,2 bipyridyl-based Schiff base (**L2**) for the detection of Al^{3+} (11 nM) and In^{3+} (110 nM) ions. More importantly, the potential application of probe **L2** could be used to quantify Al^{3+} and In^{3+} in water samples and Al^{3+} in DrG cells and a zebrafish. In the third part of my discussion, the intermediate compounds prepared from **L2** were tested for anti-cancer potency in MCF-7 and HeLa cancer cell lines, with IC_{50} values of 1.28 μM and 1.81 μM, respectively.

Key words: Coconut spathe, CSAC@Ag/ZnO, CS@Ag2S/ZnS, biogenic amines and anti-cancer potency

ET-5

Nanotechnology for environmental sustainability

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Abstract

Environmental pollution more specially the water pollution became a major problem today due to contamination discharge by industrial waste. Industrial effluent is the main wastewater pollutants due to their ability to persist in the environment. Variety of materials and techniques are being investigated for the treatment of effluents in wastewater. Green nanocomposites are one of the materials gaining attention due to its excellent physical, chemical, and mechanical properties. Green nanocomposites always act as eco-friendly materials and most favourable materials in current research. The current talk will provide an overview of the current state of nanotechnology-based devices with applications in environmental science, focusing on nanomaterials and polymer nanocomposites. The talk will also pay special attention to those nanotechnology-based approaches that promise easier, faster, and cheaper processes in environmental monitoring and remediation. The talk will highlight the research efforts to enhance the role of the nanocomposite materials in synthetic and wastewater treatment.

Keywords: Nanotechnology; Nanocomposite; Green Chemistry

ET-6

Factors Influencing Researchers' Scientific Productivity and their Outcomes

Himanshu Agarwal

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Abstract

Faculties at Indian universities are facing increased pressure from the demands of juggling various responsibilities, which extend beyond teaching and research coordination to include numerous non-essential tasks. Nonetheless, certain challenges hinder research efficiency, resulting in a diminished level of research results. In this talk, we will discuss about the factors and how various organizational and personal factors affect research productivity. Being a reviewer and editor, my vast experience regarding about the publication of the articles in various journals, I found that lack of significant research skill, language obstacles, and total time spent on research substantially impacted respondents' research productivity, despite their positive attitudes and comprehension of the significance of research. Furthermore, the study's findings made it clear that academic staff members' research output was negatively impacted by excessive non-teaching responsibilities, an absence of scholarly resources, and inadequate research funding. Finally, we will discuss some factors regarding about the quality of publication using minimizing resources which can make the big differences.

Keywords: Journal; Scientific Productivity; Research.

Oral Presentation

Abstracts

OP01

Graphene based nanocomposites used in photocatalytic purification of water

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Graphene, the recently discovered allotrope of carbon, is a single atom layered aromatic carbon material which is tightly packed into a two-dimensional hexagonal crystal lattice. It is the thinnest material known to man and has a huge application in various fields of science and technology. However, despite having excellent characteristics, the use of pure graphene sheets has limited application. Graphene-based composites offer a considerable potential in the field of environmental remediation for the efficient removal of biological contaminants. Therefore, a comprehensive review of the antibacterial property of the graphene-based nanocomposites and advancements in this field is of significant value for the scientific community. In the present review, firstly, a concise overview about graphene, its exceptional chemical and physical features, and different fabrication and characterization techniques employed for graphene-based nanocomposites are discussed. Then, a comprehensive discussion was performed on the disinfectant property of binary, ternary, and complex metal oxide-graphene and graphene derivatives-based composites, along with the mechanistic models of disinfection. Furthermore, the future prospects and the remaining challenges in utilizing graphene nanocomposites in energy and environmental disciplines is discussed by giving a precise conclusion and a prospective outlook.

Keywords: Nanocomposite; Graphene; Photocatalyst; Water Treatment.

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OP02

Bio-waste resource mediated ZnO nanoparticle synthesis for Sun-light driven photocatalytic degradation

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The growing accumulation of bio-waste presents an environmental challenge while also offering a valuable resource for sustainable material synthesis. This study explores the biosynthesis of zinc oxide nanoparticles (ZnO NPs) using bio-waste-derived extracts as natural reducing and stabilizing agents. Alcoholic and aqueous extracts from bio-waste were employed to facilitate nanoparticle formation, providing a cost-effective and eco-friendly alternative to conventional chemical methods. The bio-mediated ZnO nanoparticles were characterized using X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), and EDS to assess their structural and morphological properties. It was observed that the average particle of Nps size 22.69 nm with the elemental composition of carbon, zinc and oxygen atoms. The photocatalytic performance of the synthesized ZnO nanoparticles was evaluated for the degradation of methylene blue dye under sunlight irradiation. It was observed that maximum degradation was observed at 75 mg Np dose, pH 9 and 5 ppm concentration of dye. This study highlights the utilization of bio-waste in nanotechnology, promoting waste valorization and bio-waste resource mediated synthesis approaches for sustainable development.

Keywords: Bio-resource materials; zinc oxide nanoparticles, green synthesis; Photocatalysis; Sunlight-driven degradation

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OP03

AI and Electronic Waste: The Double-Edged Sword of Progress

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Artificial Intelligence (AI) has emerged as a transformative force across various industries, driving innovations and efficiencies that were once unimaginable. However, as with any technological advancement, AI's growth brings with it a dual-edged sword, particularly concerning its impact on electronic waste. E-waste or electronic waste is defined as any electrical or electronic component which has been discarded by the owner without any intention of reusing it. One of the primary ways AI contributes to the growing e-waste problem is through the rapid turnover of technology. AI systems require high-performance hardware to function efficiently, leading to the frequent obsolescence of older devices. The demand for more powerful processors, enhanced memory, and specialized chips like Graphics Processing Units (GPUs) has skyrocketed, leading to the quicker replacement of

electronic devices. This cycle of upgrading accelerates the accumulation of e-waste, as consumers and businesses alike discard outdated hardware to stay competitive in an AI-driven world. The current paper is an attempt to identify the dual effect of Artificial Intelligence on electronic waste. Ironically, AI powered Information Technology sector is the reason for creation of heaps of e-waste, and it is the major sector which can provide solutions for dealing with it. With the advent of AI in all spheres of life, AI is creating an impact in the field of e-waste management as well. The role of AI in management of e-waste can be understood by adoption of AI-powered software, predictive maintenance powered by AI-driven data analysis, AI-driven image recognition, AI-powered sorting machines, mobile robotic systems, integration of machine learning with IoT, convolutional neural network (CNN), AI based Decision Support System and using AI assistance for urban mining. AI-driven solutions can enhance the efficiency of e-waste management processes, making it easier to sort, recycle, and repurpose electronic components. The domain of AI is very vast and can be catalyst in shaping the landscape for e-waste management. Furthermore, AI can play a role in designing more sustainable electronics. Through advanced simulations and modeling, AI can help engineers develop devices that are easier to recycle, contain fewer hazardous materials, and are more energy-efficient. These design improvements can contribute to reducing the overall environmental footprint of electronic devices. The impact of AI on e-waste is indeed a two-sided coin. While the rapid technological advancements driven by AI contribute to the growing e-waste problem, AI also offers innovative solutions to mitigate this issue. To truly harness AI's potential in reducing e-waste, it is essential for stakeholders, including manufacturers, policymakers, and consumers, to adopt a holistic approach. This involves promoting sustainable design, encouraging responsible consumption, and investing in AI-driven recycling technologies. By balancing the scales, AI can be a force for both innovation and sustainability in the electronic age.

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OP04

Queer Eco-Linguistics: Exploring the Representation of Environmental Themes and Queer Identities in the Works of Shyam Selvadurai and Janice Pariat

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The current literary landscape reveals useful knowledge about ecological justice along with sexual equality through studies of environmental elements and queer identities. This research examines how environmental contents appear in Shyam Selvadurai's *Funny Boy* and Janice Pariat's *The Nine-Chambered Heart* while investigating how natural environment ties to both queer identity building processes. The research uses queer theory alongside eco-linguistics to examine how various natural areas like rural areas and urban spaces and the ocean environment represent the protagonists' fight against social constraints and subconscious repression. The study demonstrates that nature functions like personal transformation symbolism but additionally provides space for marginalized queer characters to determine their identities. This research advances the recently emerging discipline of queer eco-linguistics through its comparative analysis which establishes both ecological and sexual justice as connected systems for promoting equal status between environmental and sexual distinctiveness.

Keywords: Queer communities; Postcolonial literature; Environmental justice; Social injustice, Intersectionality.

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OP05

Sustainable Narratives: The Intersection of Environmental Themes and Futuristic Materials in Dystopian Literature

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Society has relied on dystopian writings for decades to examine their political systems because these texts show human concerns about both environmental problems and modern advancements. The author studies current dystopian fiction which incorporates sustainability themes with futuristic materials to present multiple viewpoints about ecological duty and scientific advancement. This paper uses Margaret Atwood's *Oryx and Crake* and Paolo Bacigalupi's *The Windup Girl* to study how environmental destruction relates to sustainable solutions and scientific materials through analytical investigation. Literature serves two purposes which this study examines: it offers sustainable visions of our future while it raises danger warnings about ecological destruction. The paper demonstrates how present challenges find reflection in dystopia through literary study comparisons and thematic evaluation that generate sustainable options.

Keywords: Dystopian Literature, Sustainability, Futuristic Materials, Environmental Themes, Eco-Criticism, Science Fiction

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OP06

A Review of Synthesis, Biological, and Analytical application of Schiff Base and their Ru metal complexes

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This article focuses on recent advancements in ruthenium Schiff bases, which are easily manipulable in electrical and stereochemical properties using the appropriate condensing aldehydes or ketones, primary amines, and their Ru metal complexes. These Ru complexes have plenty of biological activities, such as anticancer, antibacterial, antifungal, antioxidant, and molecular docking, and are characterized by IR, UV, NMR, TGA, XRD, and so on. Researchers provide an overview of work over the past few years on the development of ruthenium compounds in this review.

Keywords: Schiff base synthesis, application, characterization, biological activity, Anti-cancer, antioxidant

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OP07

Silica Supported Biosynthesized Silver Nanoparticles as Effective Adsorbent and Photocatalyst for Removal of Methylene Blue from Water

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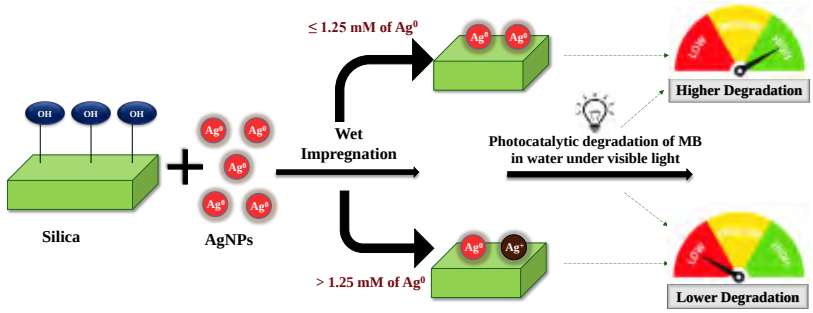
The silica supported silver nanoparticles (Ag@SG) were prepared by wet impregnation of silica gel (SG) using different concentrations of biogenic silver nanoparticles (AgNPs; 0.25-5 mM) solution, prepared from *Cicer arientinum* pod extract. Among them, the Ag@SG

composite prepared by using 1.25 mM AgNPs solution (Ag1.25@SG) was found to contain only Ag^0 species as nanoparticles, whereas the samples prepared by higher concentrations contained Ag^0 as well as Ag^+ (silver oxide) species. All the Ag@SG composites including SG, exhibited good adsorption capacity for a cationic dye (methylene blue; MB) in water. However, Ag1.25@SG having only Ag^0 species exhibited higher photocatalytic activity for degradation of MB under visible light irradiation as compared to other composites. The study reveals that the plasmonic Ag^0 species supported on silica are catalytically more active than Ag^+ species. Furthermore, the AgNPs (Ag^0) in supported form exhibits much higher (~5-fold) photocatalytic activity than unsupported AgNPs. The synergistic effect of adsorption property of silica surface and plasmonic photocatalytic activity of AgNPs in the synthesized composites was found to be effective for the removal of MB. In addition, the fine dispersion of AgNPs on internal surface of silica provides better activity for photocatalysis. The study shows that this material is a promising adsorbent as well as photocatalyst for the removal of dyes from water.



Keywords: Silver nanoparticles; Silica; Adsorption; Methylene blue; Photocatalysis.

OP08

Biological Significance of Scaffold Heterocyclic-Linked Moieties: A Pathway to Novel Therapeutics

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Heterocyclic scaffolds serve as fundamental structural frameworks in medicinal chemistry, significantly influencing drug development. The integration of heterocyclic-linked moieties into bioactive molecules enhances pharmacokinetic properties, target selectivity, and

therapeutic potential. These compounds exhibit a wide range of biological activities, including antimicrobial, anticancer, anti-inflammatory, and antiviral effects, making them valuable candidates for pharmaceutical research. Structural modifications of heterocyclic scaffolds can improve bioavailability and receptor binding affinity, leading to the discovery of potent therapeutic agents. Recent advancements in synthetic methodologies and structure-activity relationship (SAR) studies have further expanded their applications in drug discovery. This presentation will explore the biological properties of scaffold heterocyclic-linked moieties, emphasizing their role in modern therapeutics and potential future developments in medicinal chemistry.

Keywords: Heterocyclic, Anti-tubercular, Anticancer, Anti-inflammatory

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OP09

Differential Scattering Cross Sections for Low Energy Collisions of Electrons from Hydrogen Fluoride

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In this paper, we report elastic differential cross sections (DCS) for the scattering of electrons from Hydrogen Fluoride (HF) molecules in the energy range of 6 to 30 eV. There is a paucity of theoretical and experimental electron impact cross-section data for this molecule. In view of this, we have calculated differential scattering cross sections for *e*–HF interaction using a parameter-free Spherical Complex Optical Potential (SCOP) model in the fixed nuclei approximation. In the SCOP model, the complicated interaction between the electron and molecule system is composed of real and imaginary potentials. The real part of the interaction consists of three local and real terms, namely the static, the exchange, and the polarization. The imaginary part is the absorption potential. In the present model potential

approach, all these potentials are generated, once the target static charge density is known. We determine charge density from single-center wave functions with enough terms in the expansion of each bound orbital. We compared our DCS results with the available theoretical results and experimental measurements.

Keywords: Electron; Charge density; Potential; Scattering.

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OP10

Layered double hydroxides for efficient removal Arsenic: A Sustainable Solution

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The World Health Organization (WHO) has identified arsenic as the most toxic chemical with carcinogenic properties and has set a maximum permissible limit in drinking water. While selecting an adsorbent, high selectivity and removal efficiency are crucial factors. Hydrotalcite and hydrotalcite-like materials have attracted significant attention for treating arsenic-contaminated water. Layered double hydroxides (LDHs) are particularly notable due to their large surface area and high anion exchange capacity. This study highlights the growing significance of LDHs in mitigating oxyanion pollutants in water, a concern that has intensified with increasing environmental pollution. The review focuses on the synthesis and characterization of LDHs, their potential for arsenic removal, and the safety of the treated water for consumption. Various factors influencing oxyanion adsorption on LDHs, including pH, dosage, and temperature, are examined. Additionally, the reusability of LDHs is assessed. The study also explores the effectiveness of iron-based hydrotalcite in arsenic removal and evaluates whether the adsorbent poses any health risks.

Keywords: Fe-hydrotalcite, layered double hydroxides (LDHs), maximum adsorption capacity, safe drinking water

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OP11

Analysis of parallel and biserial queuing model with time independent service

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This research examines the steady state behaviors in a stochastic environment of a sophisticated representation of a queue network with parallel and biserial service channels. The arrival of service pattern follows poison laws. Calculus principles, generating function technique, and differential equations are used to find the unique queuing features. To ensure the model's use, a general mathematical formulation of the queuing model has been provided. Behavioral examination of the model indicated noteworthy effects on the system achievement measures. A numerical example shows how useful the approach is for controlling congestion.

Keywords: Parallel and biserial queuing model, Generating function technique, Performance Transient behaviour Numerical illustration, Variance.

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OP12

Study of Bicriteria in Queueing Models with Two Serial Channels

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Queueing theory is the research area that mainly focused on the flow of people, information, and things in a queue. It is very significant in nature because it helps to find the queue characteristics and provide tools for queue optimization. This paper examines a feedback queue model incorporating priority mechanisms and explores its behavior within a stochastic environment. This model contains of two serial service channels. Priority is applied only on the first service channel i.e. the customer arrives in the system with low and high priority. Feedback is taken from every service channel of the model to all its predecessor service

channels including the same service channel also. The feedback is allowed maximum one time only for the customer's satisfaction with service. The input unit follows the Poisson distribution and the service unit adheres to an exponential distribution. The Steady-state differential equations are derived, and the generating function technique, along with classical calculus laws, is employed to solve these equations. The queue performance metrics such as total queue length, variance of queues, and average waiting time of customers are computed. The model's behaviour is well illustrated both graphically and numerically with a focus on the impact of changing one parameter while holding all others remains constant. A practical application is also discussed to demonstrate the real-world relevance of the model.

Key words: Queueing, Feedback, Priority, Serial Channel, Heterogeneous Server.

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OP13

Nanocellulose-Supported Dual S-Scheme $SnWO_4/Cu_2O/Ag_2WO_4$ Heterojunction for Enhanced Photodegradation of Amoxicillin

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A dual S-scheme nanocellulose-based $SnWO_4/Cu_2O/Ag_2WO_4$ (NC-SCA) heterojunction photocatalyst was synthesized via ultrasonication followed by a hydrothermal method for the efficient photodegradation of amoxicillin (AMX). Under UV–vis light irradiation, the NC-SCA photocatalyst exhibited an impressive 97.40% AMX degradation within 30 min, attributed to its improved optical absorption and superior charge migration. The characterization techniques, including XRD, FTIR, PL, and UV–vis spectroscopy, confirmed the successful integration of nanocellulose with $SnWO_4/Cu_2O/Ag_2WO_4$. XPS and ESR analyses provided insights into the S-scheme charge migration mechanism within the heterojunction. Further, the trapping experiments identified hydroxyl (•OH) and superoxide ($O2^{-}$•) radicals as the primary reactive species. The photocatalyst displayed a specific surface area of 115.9 m^2/g, offering a large active surface for photodegradation. Operational parameters such as the photocatalyst dosage, pH, and AMX concentration were systematically optimized. The NC-SCA photocatalyst exhibited high stability, retaining around 85% efficiency after seven cycles. This study presents an innovative strategy for

designing high-performance photocatalysts addressing the limitations of conventional materials.

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OP14

Exploration of novel ionic liquids as corrosion inhibitors with computational evidence

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Corrosion continues to be a persistent issue in industrial applications, requiring the creation of efficient and eco-friendly inhibitors. Ionic liquids (ILs) have become appealing corrosion inhibitors owing to their versatile physicochemical properties, thermal stability, and environmental friendliness. This work examines novel ILs as corrosion inhibitors, integrating experimental results with computational data to enhance the understanding of their inhibition mechanisms. Density functional theory (DFT) calculations and molecular dynamics (MD) simulations were employed to assess the electrical properties, adsorption behavior, and interaction energies of specific ILs on metallic surfaces. Quantum chemical parameters, including frontier molecular orbitals, electronegativity, and Fukui indices, were employed to examine the correlation between structural characteristics and inhibitory effectiveness. The findings indicate that ILs adsorb robustly via electrostatic and chemical interactions, forming a protective barrier that decreases metal dissolution. This study provides comprehensive insights into IL-based corrosion inhibition, facilitating the rational design of next-generation corrosion inhibitors with enhanced efficacy.

Keywords: Ionic liquids, corrosion, computational study, and sustainability

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OP15

Extraction and Characterization of Mixed Essential Oils: A Comprehensive Analyses Using Gas Chromatography-Mass Spectrometry (GC-MS)

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This study presents the extraction and characterization of mixed essential oils derived from the flowers of selected angiospermic plants: *Prosopis cineraria* (Shami plant), *Jasminum sambac* (Motia flower), *Nyctanthes arbor-tristis* (Parijat), and *Cestrum nocturnum* (Rat ki Rani). Essential oils are concentrated hydrophobic liquids composed of volatile organic compounds known for their distinctive aromas and diverse biological activities, including antimicrobial, antioxidant, and anti-inflammatory properties. These oils were extracted using the hydrodistillation method with a Clevenger apparatus, a technique recognized for its efficiency in isolating thermally stable volatile compounds. The chemo-profiling process involved the identification and quantification of bioactive constituents through gas chromatography-mass spectrometry (GC-MS). This technique allowed for the detailed analysis of chemical compositions based on retention times, mass spectral data, and comparison with standard reference libraries such as the NIST/EPA/NIH and Wiley spectral databases. GC-MS analysis revealed the presence of key compounds, including linalool, β-caryophyllene, α-pinene, eugenol, benzyl alcohol, and methyl salicylate. These constituents contribute significantly to the oils' distinctive aromatic profiles and therapeutic potentials, exhibiting properties such as antimicrobial efficacy, anti-inflammatory activity, and antioxidant capabilities. The study also highlighted the potential synergistic interactions between the compounds in the mixed essential oil, suggesting enhanced bioactivity compared to individual oils. This synergism may amplify the pharmacological effects, making the mixed oil more effective in therapeutic applications.

The mixed essential oil demonstrated promising applications in various fields, including antimicrobial formulations, anti-inflammatory therapies, aromatherapy, cosmetic products, and as natural preservatives in the food industry. Its bioactive properties support potential uses in pharmaceuticals for treating microbial infections and inflammatory conditions, while its aromatic profile makes it suitable for cosmetic and wellness products. This comprehensive chemo-profiling not only provides insights into the phytochemical diversity of these essential oils but also underscores their versatility and potential for diverse pharmacological, aromatic, and industrial applications.

Keywords: Hydrodistillation, chemo-profiling, gas chromatography-mass spectrometry, synergistic, phytochemical

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OP16

A Comprehensive Analysis of the Spectrophotometric and Medicinal Aspects of Ruthenium as its Coordination Compounds

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Numerous scientific groups have been actively working on inorganic antitumor drugs for a long time and they have developed a number of metal complexes, particularly those involving ruthenium in different oxidation states. Due to their low systemic toxicity and selective antimetastatic effects against animal models, ruthenium complexes are currently a hot topic in medicinal chemistry. Ruthenium (Ru) compounds seem to bind to DNA and enter tumor cells fairly well. Besides their antitumor activity, ruthenium complexes are also being evaluated against other diseases such as type 2 diabetes, Alzheimer's disease, HIV, etc. Ru coordination and organometallic chemistry have seen tremendous expansion and assessment in recent years. The primary focus in the analytical measurement of Ru and potential as bioactive agents in medicine of the coordination complexes of ruthenium with various ligands, stems from its unique properties and its status as a valuable platinum group metal. The formation of Ru-based complexes and their extensive applications in the fields like biology, nanoscience, medicine, photoactive materials, production of solar cells, catalysis, incorporation into platinum and palladium alloys and redox have been the subject of numerous publications in recent years. Ru's special capacity to exist in several oxidation states may be connected to these developments. For these reasons, a wide array of analytical methods including UV/VIS spectrophotometric determination has been successfully developed and implemented for its quantification and are put together in the present article. The review also examines the ruthenium complexes with potential medicinal applications.

Keywords: Ruthenium, complexes, anti-cancer, anti-oxidant, anti-microbial

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OP17

A benzopyran based optical sensor for the selective trace determination of Pd(II): Analytical investigation and computational calculations

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Determination of palladium is essential owing to the element's toxic ecological effects on biological systems. Due to the element's noxious and amiable characteristics, there has been a great deal of interest in identifying and detecting its presence in a variety of natural as well as commercial samples. Hence, a thorough spectrophotometric investigation is conducted regarding the trace Pd(II) determination in organic phase *via* its reaction with 3-hydroxy-2-phenyl-4*H*-chromen-4-one, a chromogenic reagent derived from benzopyrans. The optimal reaction conditions for formulation of the intricate structure of the developed complex are depicted, in order to ensure the element's determination. The foundation of this study is based upon colour complexation between Pd(II) and 3-hydroxy-2-phenyl-4*H*-chromen-4-one (HPC) that resulted into a stable binary yellow complex with a λmax at 417-432 nm. Stoichiometric ratio of the studied Pd(II)-HPC complex as deduced from Job's continuous variations and mole ratio approach has been 1:2 [M:L]. Analytical findings, support a square planar geometry of the investigated coordination complex. A variety of complex samples have been analysed with remarkable sensitivity, selectivity, accuracy, and precision, under the set conditions of the procedure. High reproducibility of the outcomes is further supported by statistical evidences, including attenuation coefficient (ε=1.9159 $\times 10^4$ L mol^{-1} cm^{-1}), standard deviation (SD=±0.00184), Sandell's sensitivity (S=0.0055 μg cm-2), detection limit (LOD=0.1122 μg mL -1) and regression coefficient (r=0.9975). The theoretical studies have been conducted to enhance our comprehension of the complex's molecular geometry and structural attributes. Density Functional Theory (DFT), a computational approach for quantum chemical computations, successfully assisted in identifying and interpreting chemical behaviour of the acquired Pd(II)-HPC complex elucidating the chemical interactions, its stability and reactivity trends. DFT, has a strong correlation with the analytical research, proving that the studied complex behaves as a strong antioxidant.

Keywords: Palladium, Chromen-4-one, Analytical studies, Computational behaviour, Antioxidant potential

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OP18

Flavonols derived Platinum Group Metal Complexes as Potential Chemotherapeutic Agents

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Platinum group metal (PGM) complexes have attracted a lot of interest in medicinal chemistry, especially in the treatment of cancer because of their strong cytotoxic qualities. Platinum-based complexes, such as cisplatin, carboplatin, and oxaliplatin, are essential chemotherapeutic medicines that have transformed the treatment of cancer. In the present work, the two chromogenic reagents derived from flavonol family *viz.* 3-hydroxy-2-(4-methoxyphenyl)-4*H*-chromen-4-one (HMPC) and 3-hydroxy-2-tolyl-4*H*-chromen-4-one complex (HToC) have been selected to prepare platinum and iridium complexes. The anti-proliferative potential of three complexes related with PGMs, were investigated against HaCat cancer cell line by applying MTT reduction assay. HaCaT cancer cell line is keratinocyte cell line derived from adult human skin. A comparison between the examined complexes indicated that platinum metal in its divalent state coordinated with HToC and HMPC have proven to be more potent anticancer agents as compared to iridium in its trivalent state. The results finally suggested that PGM complexes with a logical design may help create next-generation anticancer medications that are more effective than the existing ones.

Keywords: Flavonols, Anti-proliferative, Platinum group metals, Chromogenic reagents, Anticancer

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OP19

Multi-Criteria Decision-Making Method Applied to Pattern Recognition with Fuzzy Information Measures

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Divergence measures are widely used in probability distributions and more effective at differentiating between pairs of objects in mediacal diagnonsis, image segmentation, computer sciences, pattern recognition, supplier selection, and decision-making issues.In the present paper, suggested divergence measure is cobination of Jensen inequality and Sine entropy proposed in the enviornment of fuzzy sets. Further, these are generalized in fuzzy sets and propose two new measures namely Jensen-Sine fuzzy divergence measure and Sine fuzzy entropy. Some of their major properties along with establishing the validity are examined. Then the application of the suggested Jensen-Sine fuzzy divergence measure is used in pattern recognition. Further, MOORA and TOPSIS technique is introduced to deal with multi-attribute decision making (MADM) problems under the fuzzy framework. Finally, a practical example to open new shoping mall in a city and a comparative analysis with other TOPSIS methods is developed.

Keywords: Fuzzy sets, Divergence Measure, Fuzzy Entropy, Multi-attribute Decision Making (MADM), TOPSIS.

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OP20

An Approach to Poultry Waste Management System with Interval-Valued Fuzzy Information Measure

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The poultry industry plays a significant role in global food production but is also a major contributor to environmental pollution, particularly through emissions such as hydrogen sulfide H2S, methane CH4 and carbon dioxide CO2 from manure storage, animal housing, and land application. These pollutants exacerbate environmental contamination and contribute to global warming, affecting both the climate and the health of ecosystems. Mitigating these emissions while maintaining the availability of animal protein is a critical

challenge that requires innovative strategies. Reducing emissions not only helps address the pressing issue of global warming but also improves indoor air quality, which is vital for the health and wellbeing of both the animals and the workers involved in poultry farming. By creating safer, healthier working environments, the risks to human health can be significantly reduced. In addition to the environmental and health considerations, the poultry industry faces significant uncertainty and complexity in the management of these pollutants. The interaction of various factors, such as the rate of emissions, environmental conditions, and management practices, adds ambiguity to the assessment of pollution levels and mitigation effectiveness. Traditional methods of addressing such challenges may be insufficient in capturing the complexities of real-world scenarios. This is where fuzzy logic, and in particular, inter-valued fuzzy measure, come into play. Fuzzy sets are a valuable tool for managing uncertainty, allowing for more flexible and accurate modelling of situations where data is imprecise or vague. This work explores the application of fuzzy measures for managing the pollution in the poultry industry. Despite the growing interest in fuzzy set theory as a way to handle uncertainty, there are still unresolved issues surrounding its application, particularly when it comes to measuring and assessing fuzzy information. The goal is to develop a more refined and effective fuzzy based approach that could help mitigate the poultry industry's environmental impact while safeguarding public health, improving worker safety, and ensuring sustainable food production practices.

Keywords: Fuzzy Set ·Interval Valued Fuzzy Set ·Fuzzy Information Measure·Interval valued Fuzzy Entropy ·MADM.

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OP21

Design, Synthesis, and Structural Characterization of Mn and Zn Complexes for Benzyl Alcohol Oxidation

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The oxidation of benzyl alcohol using the synthesized metal complexes of Mn and Zn as catalysts was studied under mild conditions with H_2O_2 as the oxidant. The reaction was monitored by gas chromatography. Benzaldehyde was found to be the primary product,

while benzoic acid and benzyl benzoate were identified as side products. Among the two metal complexes of Schiff base derived from salicylaldehyde and ethyl 2-(2-amino-1,3-thiazol-4-yl) acetate, the Mn complex exhibited the higher catalytic activity for benzyl alcohol oxidation. The study was investigated by varying key reaction parameters like reaction time, catalyst load, oxidant-to-substrate ratio and temperature during the oxidation of benzyl alcohol, with the aim of optimizing conversion efficiency and product selectivity. The results underscore the potential of these complexes as sustainable catalysts in fine chemical synthesis, offering an eco-friendly route to valuable aldehyde products.

Keywords: Schiff base, metal complexes, catalytic oxidation, benzyl alcohol

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OP22

SG-lightlike submanifolds of a locally bronze semi-Riemannian manifold with (l,m)-type connection

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This paper introduces the SG (Screen Generic)-lightlike submanifolds of a locally bronze semi-Riemannian manifold endowed with an (l,m)-type connection. The characterization theorems on geodesicity of such submanifolds with respect to the integrability and parallelism of the distributions have been derived. The non-existence of coisotropic, isotropic or totally proper SG-lightlike submanifold of a locally bronze semi-Riemannian manifold has been proved.

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OP23

Role of Heteropolyacid salts in the dehydration of alcohol: Heterogeneous catalysis approach

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The dehydration of alcohols constitutes a pivotal reaction within the realm of organic chemistry, predominantly employed for the synthesis of alkenes or other useful products. Nonetheless, conventional acid catalysts exhibit certain limitations, including elevated energy consumption and significant environmental implications. This study explores the application of heteropolyacid (HPA) salts as environmentally friendly and efficient catalysts for alcohol dehydration. HPA salts are recognized as exceptional catalysts for this process due to their potent Brønsted acidity. Their elevated selectivity effectively minimizes side reactions, rendering them superior to traditional mineral acids. Furthermore, their adjustable acidity and substantial surface area substantially augment catalytic efficiency, making them particularly suitable for industrial applications. HPA salts present a sustainable and efficient alternative for dehydration reactions, thereby contributing to more environmentally considerate chemical processes. This review article presents a comprehensive examination of alcohol dehydration reactions, focusing on the diverse optimum conditions achievable in the presence of heteropolyacid salts.

Keywords: Heteropolyacid salt, Catalysis, Alcohol, Dehydration

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OP24

Green Synthesis of Fluorescent Carbon Dots from Biodegradable Waste Materials

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Carbon Dots (CDs) are zero-dimensional carbon nanomaterials that have recently garnered significant attention due to their remarkable optical properties, biocompatibility, nontoxicity, uniform particle size, high photostability, cost-effective synthesis, and strong photoluminescence. These unique features have enabled CDs to be widely applied in various fields, including sensing, photocatalysis, bioimaging, solar cells, light-emitting diodes, and drug delivery, positioning them as promising alternatives to conventional fluorescent dyes. CDs can be synthesized from their precursors through both top-down and bottom-up approaches. Recently, there has been growing interest in synthesizing CDs from natural resources and waste materials due to their low cost, non-toxic nature, straightforward synthesis processes, and environmental sustainability. This approach not only reduces

production costs but also converts waste into valuable products. Plant residues such as peels, leaves, and flowers are being actively explored as sustainable precursors. In this study, CDs were synthesized from biodegradable kitchen waste, specifically coriander leaves, lemon peels, and cucumber peels, using three different methods: hydrothermal, solvothermal, and microwave-assisted synthesis. The resulting carbon dots exhibited fluorescence under UV light. The fluorescence emission spectra and UV-visible spectra of the CDs synthesized from different sources and methods were recorded to characterize the products.

Keywords: Carbon Dots, Green Synthesis, Fluorescent, Waste Materials

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OP25

Effect of substituents on mutual induced-fit controlled hydrogen-bonded capsule formation

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Molecular cavities created by π-conjugated components often collapse in the absence of guest molecules, particularly in solution, due to strong π•••π interactions between the elements. Recently, we investigated how the mutual induced-fit effect can address this challenge. In this report, we demonstrate how substituents influence the efficiency of the mutual induced-fit mechanism in an artificial system.

Keywords: Mutual induced-fit; π•••π interactions; hydrogen-bond; molecular capsule, dynamic self-assembly.

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OP26

Sustainable Management of Horticultural Waste

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The need to guarantee nutrition security for a vast population is becoming a critical global issue, which is driving attention to production growth, quality enhancement, food safety assurance, and processing techniques. The majority of our daily food is made up of nutrient-dense horticultural crops. Depending on their nature and how they are processed, these products are ingested in various ways. As a result, a lot of waste is produced in the home kitchen, horticulture commodity supply chain, and processing sectors, which has resulted in substantial nutritional and financial losses as well as environmental pollution and a heavy landfill burden. It is clear that waste management has begun to attract public attention. As a result, questions have been raised about where waste is coming from and what can be done from both a top-down (government level) and bottom-up (consumer level) perspective. This presents both a challenge and an opportunity for the management of biodegradable garbage. A significant portion of today's waste production comes from horticulture, which calls for efficient management and planning in order to account for the waste's potential for use as a resource. Yet, because they are a rich source of various phytochemicals and bioactive substances, these wastes demonstrated remarkable potential for repurposing in a variety of businesses. Therefore, thorough research into sustainable extraction techniques and utilization strategies is warranted. The alternatives for generating horticultural waste, sustainable recycling techniques, and the potential of recycled products in many industries for population improvement with the guarantee of a green environment and sustainable ecology are all illustrated in this review article.

Keywords: Horticultural waste, environmental sustainability, biofuels, recycling, compost, waste management.

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OP27

Multi attribute decision making based on novel information measure in hesitant fuzzy environment

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Hesitant fuzzy sets represent and process uncertainty far more effectively than fuzzy sets or intuitionistic fuzzy sets. The degree to which hesitant fuzzy sets differ from one another in terms of information is measured by information measures. To evaluate the difference between hesitant fuzzy sets, researchers have proposed a variety of distance measures and entropies; however, a number of these contradict the basic principles of entropy measure and yield inconsistent findings in real-world scenarios. The novel information measure for HFSs on the topic of (R, ζ) norm information measure is presented in this work. The measure criterion both checks its properties and satisfies the priori concept of HFSs. A number of instances are provided to demonstrate the efficacy of (R, ζ)-norm information measure in comparison to entropy metrics that are currently available in literary works. The comparative results demonstrate that our information measure is better than most existing approaches, more direct, and easier to comprehend. After that, utilizing the TOPSIS technique, we construct an algorithm to address the multi-attribute decision making problem. In order to show the usefulness and effectiveness of the proposed norm, a real-world example is provided at the end. In order to handle unclear and indeterminate information, the study's results show that the suggested information measure yields the most consistent and trustworthy rating.

Keywords: (R, ζ)-norm information measure, Entropy, Hesitant fuzzy set, Prospect theory, Multiattribute decision-making

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OP28

Reviews on Spectrophotometric trace determination of Cerium along with its biological studies

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Cerium, most abundant rare earth element about 0.0046% of the earth's crust found in minerals like allanite, monazite, bastnaesite, cerite and samarskite out of which monazite and bastnaesite 22are main source of cerium. It was used in glass industry, nuclear reactor, microwave devices, agriculture, forestry, animal husbandry as well as for environmental pollution assessment and in studies of biochemical processes. Several techniques have been used for micro determination of cerium like potentiometric, spectrofluorimetric, flow injection, voltammetry, fluorescence and UV-visible spectrophotometry for determination of cerium. These techniques have different advantages and disadvantages of their own in terms of time, amount, selectively, cost and procedure. Spectrophotometric determination requirement was simple and at the same time it has high sensitivity for trace amount determination of cerium. There was still need for the development and study of cerium trace determination which are extremely selective, sensitive and cost-effective. Cerium salts are widely used now days in biomedical sciences for anticancer, antifungal and antibacterial studies because of their decreased toxicity to mammalian cells.

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OP29

DETERMINATION OF SCATTERING CROSS SECTIONS FOR THE ELECTRONS COLLIDING WITH SILVER AND GOLD ATOMS

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The interaction processes of electrons with atoms are of great interest in various fields for many years (McNamara *et al*, 2018; Kumar *et al*, 1994; Kelemen *et al*, 2010; Msezane *et al*, 2010). We have studied electron scattering with very precious metallic atoms such as silver (Ag) and gold (Au). These targets find extreme practical importance in several applications. These metals are commonly used as excellent catalysts [Fürstner, 2009]. As the world of electronics become smaller, nanoparticles are important components in the chip design. Gold nanoparticles are being used to connect resistors, conductors, and other elements of an electronic chip [Huang *et al*, 2003]. A semi-relativistic approach is employed to calculate

elastic differential cross sections for the scattering of electrons from gold and silver atoms in the energy range 30 to 100 eV. It is well known that Dirac equation includes intrinsically the spin – orbit interaction along with other relativistic corrections. The total interaction between electron atom system is composed of three local and real terms, namely the static (V_{st}), the exchange (V_{ex}) and polarization (V_p) potentials. The total optical potential is then used in the solution of the Dirac equation for the scattered electrons. The calculated cross sections are compared with available theoretical calculations and experimental measurements in this energy region. Other details along with results will be discussed.

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OP30

RADIATVE HEAT AND MASS TRANSFER IN PERISTALTC FLOW OF A NON-NEWTONIAN NANOFLUID

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The research analyzes radiative heat together with mass transfer mechanisms in peristaltic movements of non-Newtonian nanofluids. A study evaluates how heat from sources cause thermal radiation which impacts on fluid movement patterns. Thermal radiation raises fluid temperature at the same time it reduces nanoparticle distribution within the fluid. The non-Newtonian behavior of the fluid creates modifications in velocity distribution and pressure distribution and complete flow characteristics. Studies of peristaltic motion regulation improve the understanding of biomedical processes such as blood flow and drug transportation alongside industrial procedures requiring peristaltic motion and heat transfer.

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OP31

Immobilized-2-(4-thiazolyl)benzimidazole catalysts for the oxidative transformation of benzyl alcohol

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The present work relates to the field of catalysis, specifically to the development of polymer-supported metal catalysts for the oxidation of benzyl alcohol while addressing catalyst reusability. We have investigated the oxidation of benzyl alcohol using chloromethylated polystyrene supported 2-(4-thiazolyl) benzimidazole metal catalysts. These heterogeneous catalysts were synthesized by anchoring 2-(4-thiazolyl) benzimidazole on chloromethylated polystyrene and then loading Cu^{II}, V^{IV}, Fe^{III}, Ni^{II} and Mn^{II} ions on it. Metal loading (mmol per gram of resin) in different catalysts was found to be 0.96-1.39. Catalytic activity and selectivity of the polymer supported catalysts were evaluated for the liquid phase oxidation of benzyl alcohol using hydrogen peroxide and tert-butylhydroperoxide as oxidants. The influence of concentration of the catalyst, reaction time and temperature for the oxidation of benzyl alcohol were systematically investigated. 67.8 % conversion rate was achieved utilizing a nickel catalyst under TBHP as the oxidant, whereas 88.1 % selectivity for benzaldehyde formation was attained with nickel catalyst using TBHP as an oxidant. The mechanism of the oxidation of benzyl alcohol in presence of the synthesized catalyst has also been proposed. Spectroscopic results showed no alterations even after multiple reuses under optimal conditions (0.15 g catalyst; 6 h reaction time and 65° C temperature). Metal contents determined by AAS after leaching, demonstrated slight loss by the fourth recycle. These results suggest the catalysts maintain their integrity and effectiveness through multiple uses. Overall, the results highlight the potential of chloromethylated polystyrene-supported-2-(4-thiazolyl) benzimidazole metal catalysts as sustainable and effective catalysts for oxidation reactions in organic synthesis.

Keywords: Polymeric support, heterogeneous catalyst, recyclability, hydrogen peroxide, *tert*-butylhydroperoxide, oxidation

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OP32

Experimental, spectroscopic, and theoretical investigation on structural and anti-proliferative efficacy of Schiff bases derived from o-phenylenediamine and phthalic anhydride

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Cancer is a global health issue, with millions of new cases diagnosed annually and one of foremost reason for loss of life. Schiff-base complexes have garnered interest in cancer research because of their anti-proliferative characteristics and possible therapeutic applications. The spark for this research came from aforementioned fact, in this research article author have reported the metal-templated synthesis of Schiff-base complexes obtained from condensation of o-phenylenediamine and phthalic anhydride using divalent metal salts. Newly synthesized complexes were characterized by various spectroscopic techniques like IR, UV, LCMS, elemental analysis, conductivity, magnetic susceptibility measurements. As well the complex of divalent copper chloride has been analysed by powder-XRD studies, which reveals the nanocrystalline phase of complex. *In vitro* antiproliferative studies of complexes have been carried out against the prostate cancer cell line (PC3) and normal human embryonic kidney cell line (HEK) employing MTT assay. The outcome shows dose-dependent decrease in cell viability at higher doses on PC3 and HEK cells after 24hrs of treatment for metal complexes. Molecular docking simulations studies were also performed with all the synthesized metal complexes to obtain more insights on potential anticancer activities of these compounds along with standard DNA fragment obtained from pdb bank. The outcome revealed a significant binding affinity of these compounds with target protein.

Keywords: Schiff-bases, Spectral studies, Powder-XRD studies, Antiproliferative efficacy, Molecular docking.

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OP33

Green Sustainability and Scalability of Metal-Organic Frameworks (MOFs)

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Metal-Organic Frameworks (MOFs) have emerged as highly versatile materials with significant potential for sustainable technologies due to their unique properties, such as high surface area, tunable porosity, and structural versatility. These materials have shown promise in various environmental and energy-related applications, including CO_2 capture, water purification, and energy storage. However, their widespread adoption hinges on addressing two critical challenges: green sustainability and scalability. This review explores the green synthesis approaches for MOFs, emphasizing environmentally friendly methods that minimize the use of toxic solvents, reduce energy consumption, and incorporate renewable resources. It also discusses the use of abundant, non-toxic metals and bio-based ligands, further enhancing the sustainability of MOFs. Additionally, the paper examines the scalability challenges in MOF production, highlighting barriers to large-scale manufacturing, such as high costs, energy-intensive processes, and difficulties in ensuring reproducibility. Furthermore, recent advances in scalable synthesis methods, including continuous-flow reactors and automated production techniques, are reviewed. By assessing the life cycle of MOFs and comparing them to traditional materials, this paper underscores the need for multidisciplinary approaches to overcome these challenges. Ultimately, this review provides a comprehensive overview of the current state of MOF sustainability and scalability, offering insights into their future potential as green materials in industrial applications.

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OP34

Morphological and Functional group Characterization of fine particulate matter ($PM_{2.5}$) in Rohtak and Delhi

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This paper presented a study conducted to investigate the morphology and characterization of functional groups of fine particulate matter ($PM_{2.5}$) in Delhi and Rohtak, Haryana. $PM_{2.5}$ Samples were collected at both sampling sites from 22nd October 2024 to 16th November 2024 during Diwali Period. On Diwali night, the 12- hour $PM_{2.5}$ concentration raised to 343.68 µg/m^3, nearly four times the Diwali daytime $PM_{2.5}$ concentration (92.95 µg/m^3) at Delhi. The average 24h $PM_{2.5}$ concentration were 183.799 µg/m^3 and 154.54 µg/m^{3}during Pre-Diwali, 212.075 µg/m^3 and 218.319 µg/m^3 during Diwali and 291.417 µg/m^3 and 333.573 µg/m^3 during Post-Diwali period at Rohtak and Delhi, respectively. The $PM_{2.5}$ concentrations at Rohtak and Delhi were higher than the National Ambient Air Quality Standards (NAAQS) prescribed limit of 60 µg/m^3 for 24h given by CPCB. The functional group (organic/inorganic and aliphatic/aromatic) present in $PM_{2.5}$ were identified using FT-IR analysis to investigate the presence of inorganic constituents and organic compounds. The morphological characteristics of $PM_{2.5}$ were studied using SEM-EDX to examine the particle size distribution (shape variations, including irregular, spherical, cluster, flake, and chain shapes) and elemental composition (Cl, Al, K, Mg, Ba, Na, Ca, S, Si, O). This study concluded the high levels of $PM_{2.5}$ in Delhi and Rohtak sampling sites which highlights the urgent need to design effective mitigation strategies for air quality.

Keywords: Air Quality, FT-IR, SEM-EDX, Morphology, fine particulate matter ($PM_{2.5}$)

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OP35

To synthesize Novel 8-Hydroxy-triphenylamine-CHO based fluorescent probe for the detection of Cu^{2+} and Th^{4+} ion in bio-imaging studies

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A simple and novel thorium and copper sensor (HQ-TPA) Schiff-based probe was designed and synthesized, which integrated the highly emitting characteristic of the AIE effect. A triphenylamine (TPA) derivative fluorescent probe, based on the HQ-TPA, has been synthesized by reaction of 8-hydroxy quinoline carbohydrazide under simple Schiff base

conditions, which is characterized by different spectroscopic methods using UV-vis/FL, FTIR, NMR, and mass analysis successfully. Probe HQ-TPA exhibits excellent selectivity over other tested ions in the DMSO: H_2O (8:2, v/v) medium. The free probe HQ-TPA shows distinct dual fluorescence emission at 441 and 556 nm upon excitation at 380 nm. Upon interaction with Cu^{2+} and Th^{4+}, the emission intensity was quenched and showed turn-off fluorescence at 556 nm. The HQ-TPA forms a 1:1 and 2:1 stoichiometric complex with both Cu^{2+} and Th^{4+} ions, respectively. Further, the HQ-TPA forms a complex with an estimated association constant of 6.64×10^4 M^{-1} and 1.10×10^5 M^{-2}, with Cu^{2+} and Th^{4+} ions, respectively. The detection limit of HQ-TPA towards Cu^{2+} and Th^{4+} was found to be 16.79 and 39.9 nM, respectively. The binding mechanism of HQ-TPA with Cu^{2+} and Th^{4+} ions was fully studied by using FTIR, NMR, EPR, and ESI-Mass analysis in support of density functional theory-based computational calculations. Further, the probe HQ-TPA was applied for the real-time detection of Cu^{2+} and Th^{4+} ions in various water samples and real-time samples.

Keywords: HQ-TPA; Water samples; Fluorescence; Chemosensors; real-time samples.

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OP36

Adapting Farming Systems to a Changing Climate: Strategies for Climate-Resilient Agriculture

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CRA refers to the application of mitigation, adaptation, and other agricultural methods that improve the system's ability to withstand harm and bounce back swiftly from a variety of climate-related disruptions. Such perturbations and disturbances can include events such as drought, flooding, heat/cold wave, erratic rainfall pattern, long dry spells, insect or pest population explosions and other perceived threats caused by changing climate. In short it is the ability of the system to bounce back. Climate resilient agriculture includes an in-built property in the system for the recognition of a threat that needs to be responded to, and also the degree of effectiveness of the response. CRA will essentially involve judicious and improved management of natural resources viz., land, water, soil and genetic resources through adoption of best bet practices.

Keywords: Climate, Climate resilient agriculture, drought and cold wave

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OP37

Next-Generation Lab-on-Paper Diagnostics: Streamlining Blood Sample Analysis for Global Health

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Lab-on-paper systems offer innovative, cost-effective diagnostic solutions, particularly valuable in resource-limited settings. By integrating microfluidic principles with paper substrates, these portable devices enable rapid, economical point-of-care testing (POCT), reducing dependence on expensive equipment and specialized personnel. The advancements in lab-on-paper platforms for blood sample analysis, focusing on fluid transport, fabrication techniques, structural designs (2D and 3D), and detection methods such as colorimetry, electrochemical, and fluorescence-based approaches. These compact systems facilitate accurate, low-cost diagnostics by integrating sample pretreatment processes like separation, extraction, and concentration directly on-chip, improving analyte detection from complex biological samples.

Recent innovations have enhanced the sensitivity and specificity of biomarker identification in blood-based diagnostics, demonstrating the scalability and adaptability of lab-on-paper platforms for diverse healthcare applications. These advancements hold promise in reducing healthcare disparities by offering accessible diagnostic tools for underserved populations. However, challenges such as material durability, environmental stability, and digital integration remain. Addressing these issues will be crucial to realizing the full potential of lab-on-paper technologies, which are poised to revolutionize diagnostic practices by providing efficient, equitable healthcare solutions worldwide.

Keywords: Lab on paper, Blood, Colorimetry, Electrochemical, Fluorescence

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OP38

A Review on Removal of fluoride from Drinking Water by Using Carbon – Based Adsorbent

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Fluoride contamination in drinking water due to natural and man-made activities has been recognized as one of the major problems worldwide and poses a serious threat to human health issues such as dental and skeletal fluorosis. Defluorination is needed when the naturally occurring fluoride level exceeds recommended limits. Among several treatment methods for fluoride removal, the adsorption process has been explored widely and offers satisfactory results, especially with carbon-based adsorbents. Carbon-based adsorbents have emerged as an efficient, cost-effective, and environmentally friendly approach for fluoride removal. This review investigates the effectiveness of a variety of carbon-based materials, including activated carbon, graphene oxide, biochar, and carbon nanotubes in adsorption of fluorides. The review highlights recent advancements, challenges, and future perspectives in developing high-performance carbon-based materials for fluoride removal. Additionally, the regeneration potential and reusability of carbon-based adsorbents are studied to assess their long-term feasibility. Overall, this study provides insights into the potential of carbon-based adsorbents as sustainable solutions for ensuring safe drinking water.

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OP39

Advancements in Metal-Organic Frameworks (MOFs) for Enhancing Therapeutic Efficacy in Infectious Disease Treatment and Prevention

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Metal-Organic Frameworks (MOFs) represent a class of highly porous materials that have garnered significant attention for their potential in enhancing therapeutic efficacy,

particularly in the treatment and prevention of infectious diseases. Due to their exceptional structural features, such as large surface area, tunable pore size, and ease of functionalization, MOFs are well-suited for various biomedical applications. This review focuses on recent advancements in the utilization of MOFs to improve therapeutic outcomes against microbial pathogens, including bacteria, viruses, and fungi. MOFs can be engineered to deliver antimicrobial agents in a controlled and sustained manner, thus increasing the bioavailability and efficacy of drugs while minimizing systemic toxicity. Moreover, their intrinsic antimicrobial properties, owing to metal ion coordination and surface functional groups, provide an additional avenue for combating infections, especially against multidrug-resistant pathogens. Recent studies have demonstrated the ability of MOFs to enhance the performance of vaccines and improve diagnostic assays for infectious diseases. This paper discusses the mechanisms by which MOFs interact with microbial cells, the challenges in translating MOF-based therapies to clinical settings, and the ongoing research to optimize their safety and biocompatibility. The integration of MOFs into infectious disease therapeutics offers a promising strategy to address the growing threat of antimicrobial resistance and improve treatment outcomes in global health.

Keywords: metal−organic frameworks, infectious disease, vaccines, macromolecule protection, antiviral, antibacterial, drug delivery, Individual protective apparel

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OP40

Reusable Metal Bound Polystyrene-Anchored Thiophene-2-Carboxaldehyde Catalysts for Efficient Oxidation of Benzyl Alcohol

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Cross-linked amino-polystyrene was reacted with thiophene-2-carboxyldehyde followed by the reaction with different metal salts (Cu^{II}, Mn^{II}, V^{IV}, Fe^{III} and Ni^{II}) to form new heterogeneous polystyrene-anchored catalysts. The structures of the immobilized catalysts have been established on the basis of CHNS, DRS, FTIR, AAS, EDX and EPR techniques. The catalytic activity of polystyrene-anchored catalysts was estimated for the oxidation of

benzyl alcohol using tert-butyl hydroperoxide and hydrogen peroxide as oxidants. The influence of different reaction parameters like temperature, time, oxidant and the quantity of catalyst on the oxidation reaction were investigated. Under optimized condition, the results show that TBHP as oxidants resulted in 90% conversion rates with the nickel catalyst. The copper catalyst, when used with TBHP, demonstrated the highest selectivity for benzaldehyde, reaching 98%. Under optimum conditions, the catalysts can be reused four times without considerable loss in its activity.

Keywords: Polymeric support, functionalized polymer, catalyst, recyclability, styrene, oxidation.

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OP41

Selective sensing of Hg^{2+} ion by N-bridged ligand

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Mercury is one of the most dangerous metal ions from environmental, health and agricultural point of view. Therefore, selective sensing of mercury is very crucial and challenging task. In this presentation, we will discuss about selective sensing of Hg^{2+} ion by N-bridged neutral ligand from mechanistic point of view. In the present sensing, the original ligand is fluorescent and only in the presence of Hg^{2+} ion the yellow colour solution of ligand turns to violet colour and thus it works in switch-off mode.

Keywords: N-bridged ligand; mercury sensing, switch-off sensing.

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OP42

Confirmation of Anti-fungal confounding factors (azoles) in urine using LC-MS/MS

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Anti-fungals are the substances which are used in the medical treatment for fungal infections. These antifungal substances present mainly in the anti-fungal creams. These are easily available in the markets; some of them have been involved as confounding factors in human doping. Confounding factors (CFs) are the substances which alter the human urinary steroid profile. For example: Ethyl Glucuronide (marker for alcohol intake), Azaoles (ketoconazole, fluconazole & miconazole). The analytical method for confirmation of anti-fungal confounding factors (CFs) in human urine was developed and validated in accordance to International Standard for Laboratories (ISL), relevant technical documents (TD) and WADA technical note (TN) on analytical method validation. The analytical method and confirmation procedure are based on dilute and shoot technique. This method validation data and validation results for anti-fungals (*-azoles*, described in technical document (TD) Endogenous anabolic androgenic steroid (EAAS) confirmation analysis in human doping control urine. The method validation was performed for performance characteristic evaluation of the method for the purpose of qualitative analysis and estimation of concentration using single point calibrator. The validation results indicate that the methods are fit for the intended purpose as per the requirements of international standards. Confirmation analysis of a CFs in a dope sample is performed using this procedure as per part of CFs confirmation during a steroid profile confirmation analysis as per effective TDEAAS. The concentration of target CFs should be estimated and reported the value if detected ≥ applicable reporting limit (RL) in urine during steroid profile confirmation procedure (CP) analysis without a need for reporting associated uncertainty as per WADA TDEAAS. If not present or determined below RL, it shall be reported as 'Negative'.

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OP43

Catalytic potential of Schiff base metal complexes in oxidation reactions

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Schiff base metal complexes were synthesized through the condensation of various aldehydes and amines, followed by metal ion coordination. This mini review explores the

catalytic potential of Schiff base metal complexes in oxidation reactions. Schiff base ligands, known for their versatility and ease of synthesis, form stable complexes with various transition metals. The excellent thermal and moisture stabilities of numerous Schiff base complexes were advantageous features for their use as catalysts in high-temperature reactions. They exhibit remarkable catalytic activity in oxidation reactions, which are crucial in both industrial and environmental applications. The review systematically examines the structural characteristics, mechanistic pathways, and catalytic efficiencies of these complexes. Emphasis is placed on recent advancements and innovative approaches that enhance their catalytic performance. The findings emphasise the significance of Schiff base metal complexes as promising catalysts, paving the way for future research and development in sustainable oxidation reactions.

Keyword: Schiff base, Metal complexes, catalytic activity, oxidation reaction.

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OP44

Carbon Quantum Dot as Water Remediation

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Carbon quantum dots are zero-dimensional carbon nanomaterials having a size of less than 10 nm with sp2 -/sp3 -hybridized carbon atom containing a variety of functional groups at basal plane and periphery. Carbon quantum dots are a new class of carbonaceous material which are recently developed and attracted appreciable importance due to their superlative properties and significant applications in different fields. By virtue of their unique optical, electronic, and efficient light harvesting, tunable photoluminescence, and up-conversion

property, carbon quantum dots displayed huge applications in bio-sensing, bio-imaging, drug delivery, photocatalysis, photovoltaics and optoelectronics. Today, contamination of water is one of the biggest and most alarming problems that demands an immediate solution, and non-availability of economical method for water treatment makes it more significant. The potential pollutants of water pollution are heavy metal ions, sewage, pesticide, pharmaceutical waste, and industrial waste. The most abundant carbon as photocatalytic nanomaterial could be a better choice among previously reported conventional photocatalyst and quantum dots.

Keywords: Carbon quantum dots · Graphene quantum dots · Photocatalyst · Nanocomposites · Up-conversion · Water purification

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OP45

Thermodynamic properties of binary liquid mixtures containing ionic liquid and ethers: Excess molar volumes and Isentropic compressibilities changes of mixing by Graph theory

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Speeds of sound, u and density data of ionic liquid (i) + ethers (j) binary mixtures have been measured as a function of composition at 298.15 to 308.15K. Speeds of sound and density of (i+j) binary mixtures have been utilized to determine isentropic compressibility changes of mixing K_S^E , and excess molar volumes V^E. The observed data have been analyzed in term of Graph theory. It has been observed that K_S^E and V^E values predicted by Graph theory compare well with their corresponding experimental values.

Keywords: Excess Molar volumes, V^E and isentropic compressibilities changes of mixing, K_S^E , interaction parameter, χ. connectivity parameter of third degree $^3\xi$.

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OP46

Design, Molecular docking and ADMET studies of novel heterocyclic derivatives as Antidiabetic agent

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Background: An emerging impetus has driven the development of a variety of diminutive compounds for management of type 2 diabetes. With advent of novel heterocyclic derivatives, an expansive field of pharmacological endeavors has opened up to stimulate Glucokinase (GK) activation. Current research confirms that GK presents itself as an appropriate pharmaceutical intervention for treating diabetes. The enzyme glucokinase which manages blood glucose levels becomes defective within the body of type 2 diabetic patients. The innovative pharmaceutical strategy uses heterocyclic derivatives to activate GK enzyme because these compounds work as potent agents that effectively enhance diabetes management.

Objective: This research had a specific goal to develop therapeutic compounds which both activated glucokinase function and reduced adverse effects from typical diabetes drugs for more effective type 2 diabetes treatment.

Methods: The structures generated by ChemBioDraw Ultra through this method were docked meticulously using Auto Dock Vina 1.5.6. Online log P predictions were also made possible by the Swiss ADME algorithm. PKCSM software was used to assess the potential toxicity of the leading compounds.

Results: Auto Dock Vina 1.5.6 was used to dock heterocyclic derivatives. Compounds with the greatest binding affinity to glucokinase (GK) were found in the majority of the compounds. Based on the superior binding capabilities of the top eight molecules compared to Dorzagliatin (the standard drug) and MRK (the co-crystallized ligand), the top eight molecules were chosen. Following a pharmacokinetic profile enhancement and compliance with Lipinski's rule of five, these eight candidates were further evaluated using ADMET analysis. As a result, AM35 displayed the greatest binding affinity with -11.6 kcal/mol. In contrast to the standard drugs Dorzagliatin (GKA) and MRK (co-crystallized ligand), AM35 showed no skin sensitization, AMES toxicity, or hepatotoxicity using PKCSM.

Conclusion: The computational drug design research indicates that drug candidate AM35 deserves specific examination for in vitro evaluation due to its optimal binding potential and beneficial pharmacokinetic properties coupled with minimal toxicity. The therapeutic value of the drug requires more extensive investigation to understand its potential within type 2 diabetes research by using Streptozotocin-induced diabetic rats as in-vivo models.

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OP47

Time Dependent Analysis of Queuing Model having Multiple Servers with Environment Effects and with Retention of Impatient Consumers

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A definite latent similar queuing model with restive clients and the action of absorbing irritated clients in two distinct settings is examined in this work. The Matrix Approach is used to obtain the model's stable position results, and then the transient state analysis is conducted.

Keywords: Matrix Approach, Transient, Retention, Multiple servers, Impatience.

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OP48

Xanthan gum-based hydrogel grafted with methacrylic acid for the degradation of dye

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Wastewater contains heavy metals and harmful dyes; removal of these pollutants is crucial part for the treatment of wastewater. There is a need for the cost effective and eco friendly method for the wastewater treatment. As xanthan gum is biocompatible, biodegradable, non-toxic, eco-friendly and cost effective, it is a better option to be opted for the removal of

various harmful contaminants from wastewater. Here we report the synthesis of XG based hydrogel for the waste water treatment. The hydrogel was prepared using XG, a monomer, an initiator and crosslinker by optimizing different factors. The synthesized hydrogel exhibited good swelling ratio around 1000%. The prepared hydrogel was characterized using XRD, SEM and FT-IR for the crystal structure, surface imaging and composition of material. The performance of the hydrogel was examined for the absorption and degradation of dye. The absorption of the dye was investigated by UV-Vis spectroscopy. The swelling behavior and adsorption capacity of the xanthan gum-based hydrogel was examined in various conditions.

Keywords: Xanthan Gum, hydrogel, dye removal, wastewater treatment.

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OP49

Antimicrobial and Antifungal Evaluation of Some Novel Thiazolidin-4-one Scaffold Bearing Compounds

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A series of novel hybrid Thiazolidinone derivatives 4, 5 (a-e) were designed and synthesized by combining more than one bioactive scaffold. All synthesized compounds were evaluated for their *in vitro* antimicrobial activity against gram-positive bacteria and gram-negative strains such as *S. aureus* (MTCC-737), *P. aeruginosa* ((MTCC-424), *Salmonella typhi* (MTCC531). The antifungal activity was also screened for fungal strain *C. albicans* (MTCC-3378) against the reference drug Ciprofloxacin. Compounds 1, 3, 8, and 9 were proved to show the highest activity against all bacterial and fungal strains at 500 µg/mL with Zone of Inhibition 15.22±0.08 - 19.93±0.09. The substitution with electron-donating groups on the phenyl ring decreases the antimicrobial activity whereas the presence of the nitro group has shown no antifungal activity. Chloro-substituted compounds 3 and 8 exhibited significant inhibition.

Keywords: Thiazole, Thiazolidinone, Antimicrobial activity, Bacterial strain, Antifungal.

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OP50

Uranium in groundwater: Sources, health effects and determination in drinking water

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Uranium is utilised as nuclear fuel in a variety of military and civil applications, which pollutes the environment. There are no known vital biological roles for uranium (U). It is also widely known for its cancer-causing potential. At high exposure levels, kidney damage may also be associated to chronic exposure to low-level U isotopes (radionuclides). Uranium exposure can have harmful effects on the reproductive organs at certain dosages, modes, and times. Resulting in histopathological changes and a reduction in conceiving rates, as well as harming the overall health. U is a redox catalyst that is active in the reaction between H_2O_2 and DNA. This paper focuses on the U distribution in the sources of drinking water related health and environmental issues. It also expores the diffferent techniques of uranium detection and quantification in ground water.

Keywords: Radioactivity; Uranium; Environment; Geology; Drinking water; Fluorimetry; ICP-MS

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OP51

Smartphone-Assisted Colorimetric Chemosensor for Point of Care Detection of Indium Ions using Diaminomaleonitrile Schiff base Probe

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A novel quinoline-diaminomaleonitrile-based probe, 2-Amino-3-[(8-hydroxy-2-quinolinyl) methylene] amino]-2-butenedinitrile (HQ-DAMN) was successfully synthesized and

extensively characterized using a range of spectroscopic techniques. The sensing ability of HQ-DAMN towards multiple cations was investigated using colorimetric analysis, paper strips, an RGB model, alginate beads, and a UV-visible spectrophotometer in acetonitrile. Upon interaction with In^{3+} ions, the colorless solution of HQ-DAMN immediately transforms into orange, while no visible color change was observed with other metal ions. Spectroscopic studies revealed that HQ-DAMN exhibits a strong absorption peak at 374 nm and a weak absorption peak at 266 nm, attributed to ligand-to-ligand charge transfer (LLCT). Upon binding with In^{3+} ions, new peaks emerge at 472, 358, and 292 nm, indicative of ligand-to-metal charge transfer (LMCT). The stoichiometry of the HQ-DAMN–In^{3+} complex was determined to be 2:1, with an association constant of 7.70×10^{-3} M^{-2}, as established through Job's plot and Benesi–Hildebrand (B–H) analysis. The probe operates effectively within a pH range of 4.0-7.0, exhibiting high selectivity even in the presence of competing ions. Moreover, it demonstrates exceptional sensitivity, with detection limits as low as 66.7 nM using spectrophotometric methods and 0.68 μM with the RGB model. The binding mechanism between HQ-DAMN and In^{3+} ions was elucidated using detailed analyses, including ^{1}H NMR titration, ESI mass spectrometry, and FT-IR spectroscopy, supported by theoretical computational studies. These results underline the robust potential of HQ-DAMN as a colorimetric and chromogenic sensor for In^{3+} ions.

Keywords: Diaminomaleonitrile, Quinoline, Colorimetric, Chemosensors, Alginate beads, Smartphone, RGB.

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OP52

Bio-Based hydrophobic coating on the cotton fabric for self cleaning application

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Animal species and their particular parts, such as fish scales and water strider legs, as well as natural materials like peanut or lotus leaves, have the ability to roll off water droplets from their surfaces without being wet. This particular characteristic is regarded as superhydrophobic. The superhydrophobic properties of many artificial surfaces, which draw inspiration from natural materials, are being developed for a variety of applications, including self-cleaning, oil/water separation, anti-icing, anti-fouling, and anti-corrosion.

This work used eggshell powder as a bio-based material to create a unique superhydrophobic coating. Eggshell, which is mostly made of calcium carbonate, was functionalized to improve its hydrophobic qualities while preserving its biodegradability and natural abundance. A low surface energy layer was produced by the combination of Bio based materials, signifying exceptional water repellency. Because the manufactured coating repelled water droplets and avoided surface contamination, it demonstrated exceptional self-cleaning qualities. Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), elemental mapping, energy dispersive X-ray spectroscopy (EDS), and other methods are examples of characterization techniques were used to evaluate the coating's surface morphology and chemical composition. The findings show the great potential of this bio-based superhydrophobic coating for use in protective coatings, self-cleaning surfaces, and sustainable material engineering.

Keywords: Super hydrophobicity; Fabrication; Bio based; Self-cleaning

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OP53

Theoretical and Biological Evaluations of Vanadium, Cobalt, and Copper Chelates: DFT, Molecular Docking, and Antimicrobial Investigations

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New biologically active complexes of V(IV), Co(II) and Cu(II) were synthesized and extensively characterized by CHNS, FTIR, DRS and EPR techniques. In the methodology, first ligand precursor [N,N'-(1,2-phenylene)bis(1-(thiophen-2-yl)methanimine)] was synthesized by the reaction between *o*-phenylenediammine and thiophene-2-carbaldehyde which was subsequently coordinated with metal ions (V, Co, and Cu) to synthesize the complexes with general formula $[M(C_{32}H_{24}CuN_4S_4)](X)_2$ [M = VO, Co, Cu; X = Cl, SO_4^{2-}]. The coordination process followed a 2:1 (ligand-to-metal) stoichiometry for vanadium(IV), cobalt(II) and copper(II) complexes. Structural analysis suggested a square pyramidal geometry for vanadium, an octahedral arrangement for cobalt, and a square planar configuration for copper. Additionally, density functional theory (DFT) calculations were

performed to evaluate key quantum descriptors of both the ligand and its metal complexes. Antibacterial screening against E. coli, S. aureus, B. subtilis, and P. aeruginosa revealed that all complexes exhibited significantly enhanced antimicrobial activity compared to the free ligand. Furthermore, in-silico predictions confirmed their drug-like properties, reinforcing their potential as bioactive agents.

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OP54

Synthesis, Characterization of Fe(III), $Zr(OH)_2$(IV), MoO_2(IV) and Cd(II) complexes, Biological Activity, DFT and Molecular Docking Studies

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A series of novel metal complexes of Fe (III), $Zr(OH)_2$(IV), MoO_2(IV) and Cd(II) were synthesized through the condensation reaction of a Schiff base, derived from thiosemicarbazide and p-chlorobenzaldehyde with their respective metal salts. The synthesized ligand and its metal complexes were characterized using FT-IR, UV-Vis, ^{1}H NMR and mass spectroscopy. Additionally, molar conductivity, magnetic moment measurements and elemental analyses were conducted to further confirm the structures. The molecular structures of the ligand and its complexes were optimized using Gaussian 09 and the resulting structural parameters were analyzed. Quantum chemical properties of these compounds were predicted and discussed in detail. Furthermore, the antimicrobial activity of the synthesized compounds was evaluated against fungal and bacterial strains. Molecular docking studies were performed with DNA and human serum albumin (HSA) using Autodock4 to investigate their potential biological interactions.

Keywords: Schiff base, thiosemicarbazone, metal complexes, antibacterial activity, antifungal activity, molecular docking.

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OP55

Photocatalytic Remediation of Pharmaceutical drug Waste: Advances in Doped metal oxide Nanocomposites for Enhanced Degradation

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The increasing accumulation of pharmaceutical drug waste in water bodies poses serious environmental and health risks due to its persistence in nature. Conventional wastewater treatment methods often fail to effectively degrade these complex organic pollutants, necessitating the development of advanced remediation processes. Photocatalytic degradation, driven by semiconductor-based nanomaterials, has emerged as a highly efficient and sustainable approach for breaking down pharmaceutical drug waste into non-toxic by-products. Among these, doped metal oxide nanocomposites have gained considerable attention due to their superior charge separation, extended light absorption range, and enhanced surface activity. The incorporation of dopants such as transition metals, non-metal elements, carbon-based dopants or metal-organic frameworks into metal oxide matrices has been shown to significantly improve photocatalytic performance. The present study investigates the latest advancements in doped metal oxide nanocomposites and their mechanism of action in the remediation of pharmaceutical drug waste.

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OP56

Preparation and characterization of plant extract-infused chitosan biopolymeric edible films: UV-barrier and antioxidant activity

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Chitosan is a biodegradable, non-toxic, and eco-friendly biopolymer with excellent film formation ability for edible coatings. However, the antioxidant activity of chitosan is low, which is highly essential to prevent oxidation of fruit contents to increase their shelf-life. In this study, chitosan-based edible films were prepared with the incorporation of bioactive

molecules from plant extract. Microstructural, spectral, UV blocking, and antioxidant and UV blocking properties of the prepared films were examined with the use of specific characterization analysis. Compared to the control film, plant extract-incorporated chitosan films exhibited efficient UV-barrier and antioxidant activity. The better interaction between phenolic compounds of plant extract and functional groups of chitosan attributed to the improvement in the properties of chitosan-based edible films.

Keywords: Edible films; Fruit shelf-life; Antioxidant activity; Chitosan.

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OP57

Recent developments in technological aspects of Waste Management

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Waste disposal has emerged as one of the major concerns worldwide as a result of the ongoing urbanization process, which had a significant impact on human production, living conditions, and social and ecological health. Various scientists and other organizations worldwide have come up with ideas and developed technologies to slow down the process in response to the issue of growing waste. The sociological as well as the technological aspects of waste management are the focus of contemporary solutions. On a much larger scale, scientists can impact ecological consciousness and awareness through the Internet and social media platforms. This paper explores constraints in waste management and potential paths to overcome this within the framework of the circular economy. Additionally, a range of contemporary solutions that have evolved in recent years are presented, along with their effects on waste management. A few sustainable development objectives can be met through the application of contemporary waste management techniques.

Keywords: waste management; recycling; technology; circular economy; pollution; developments

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OP58

Microbial insecticides: A sustainable alternative to chemical pesticides

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Microbial insecticides have evolved as a more environmentally friendly and effective alternative to chemical pesticides for agricultural insect pest management. Microbial pesticides, which are primarily made from naturally occurring bacteria, fungi (including some protozoa and yeasts), and viruses, have received widespread attention due to their advantages in target specificity, environmental safety, efficacy, biodegradability, and applicability in integrated pest management programs. Microbial insecticides, also called bio pesticides. Bio pesticide agents are formulations made from live organisms or the compounds they produce to manage pests or diseases. Bio pesticides are formulations that kill or inhibit agricultural pests by utilizing living organisms (fungi, bacteria, insect viruses, genetically modified organisms, natural enemies, etc.) or their metabolites (pheromones, auxin, etc.). They are designed to be used as standard insecticide sprays, dusts, liquid drenches, liquid concentrates, wettable powders, or granules. The use of microbial pesticides in agricultural settings necessitates careful evaluation of the target pest, crop, and environmental circumstances. Successful implementation entails tailoring the timing, frequency, and mode of administration to maximize pest control while reducing environmental damage. Microbial insecticides have emerged as a possible approach to this problem. These naturally occurring microorganisms or their derivatives have insecticidal capabilities that can be used to effectively manage pests.

Keywords: Biopesticides, fungi, sustainability, bacteria, insects

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OP59

Comparative Analysis of Darcy and Darcy-Forchheimer Models for Hybrid Nanofluid Flow Under Natural Convection and Thermal Radiation Effects

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This study compares the Darcy and Darcy-Forchheimer models for hybrid nanofluid flow through porous media, considering natural convection and thermal radiation effects. Using the Tiwari-Das model for thermal conductivity and viscosity, the mathematical framework integrates the Boussinesq approximation for buoyancy-driven flow and the Rosseland approximation for radiative heat transfer. The dimensionless governing equations are solved numerically with the finite difference method (FDM). The influence of parameters such as permeability, Forchheimer number, and radiation parameter on velocity, temperature distribution, and heat transfer is examined. Results reveal that the Darcy model is suitable for low-velocity flows, while the Darcy-Forchheimer model better accounts for inertial effects in high-flow scenarios, offering insights for optimizing heat transfer in energy, biomedical, and industrial applications.

Keywords: Darcy and Darcy-Forchheimer, Hybrid nanofluid, Tiwari-Das model, Finite difference method (FDM).

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OP60

Nanocomposite 3D bio-sponge Air Electrode: A Sustainable Approach for Wearable and Biodegradable Zinc-Air Batteries

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Bio-inspired polymers have garnered significant interest due to their structural diversity, tunability, and eco-friendly characteristics, making them promising candidates for energy storage applications. Metal-air batteries, particularly zinc-air batteries (ZABs), are an attractive solution for next-generation energy storage due to their high performance, safety, and environmental compatibility. This study presents a novel approach for synthesizing a conductive and porous nanocomposite 3D bio-sponge using natural starch, graphite, and graphene through a bio-inspired process. Additionally, a bio-sponge derived from *Plantago ovata* (psyllium) husk was developed, exhibiting a mesoporous structure with a pore diameter of 19.909 nm, a BET surface area of 48.5 m^2g^{-1}, and low crystallinity (12.9%).

Structural and chemical characterizations (XRD, Raman, XPS) confirmed the presence of diverse phytochemicals. A proof-of-concept flexible ZAB utilizing MnO_2 nanoparticles as a catalyst and a *Plantago ovata*-derived alkaline hydrogel electrolyte were further examined, and multiple electrochemical analyses were carried out to assess its effectiveness as an air electrode in a flexible zinc-air battery. The battery demonstrated excellent flexibility and biodegraded over 95% within 64 days. This bio-sponge-based ZAB design offers a promising pathway for sustainable, flexible, and biodegradable energy solutions.

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OP61

Enhancing Flexural and Split Tensile Strength of Concrete through Synergistic Use of Alccofine and Porcelain Waste Aggregate

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Concrete is a widely used construction material, and its mechanical properties, such as flexural strength and split tensile strength, are critical for structural applications. The incorporation of supplementary cementitious materials (SCMs) and waste materials in concrete has gained attention due to environmental sustainability and improved performance. This study investigates the effect of incorporating 16% Alccofine as a cement replacement and Porcelain Waste Aggregate (PWA) as a partial replacement for coarse and fine aggregates at varying percentages (1% to 5%). This research is to evaluate the influence of 16% Alccofine and varying percentages of PWA (1% to 5%) on the flexural strength and split tensile strength of concrete. The study aims to identify the optimal replacement level of PWA that enhances the mechanical properties of concrete, contributing to sustainable construction practices. Concrete mixes were prepared by replacing cement with 16% Alccofine and coarse and fine aggregates with PWA at 1%, 2%, 3%, 4%, and 5%. The mechanical properties, including flexural strength and split tensile strength, were evaluated through standardized testing methods. Specimens were cured for 7, 28, 56 & 90 days, and the results were compared with a control mix without Alccofine or PWA. The experimental results demonstrated that the incorporation of 16% Alccofine and 3% PWA yielded the highest improvement in flexural strength and split tensile strength. The 3% PWA replacement level showed a significant enhancement in mechanical properties compared to other percentages.

Keywords: Alccofine, Porcelain Waste Aggregate (PWA), Supplementary Cementitious Materials (SCM), Flexural strength and Split Tensile Strength.

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OP62

Exploring the Synergy of Enhanced Concrete Strength and Sustainable Construction Practice

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This research explores the synergy between improved concrete strength and sustainable construction by incorporating industrial by-products as partial replacements for conventional materials. The study focuses on the use of Alccofine, a supplementary cementitious material, at 16% replacement of cement, and porcelain waste aggregate (PWA) at varying percentages (1%, 2%, 3%, 4%, and 5%) as a substitute for coarse aggregate. The primary problem addressed is the high carbon footprint associated with cement production and the increasing accumulation of non-biodegradable porcelain waste, which poses environmental concerns. This research is to evaluate the mechanical properties, particularly compressive strength, of concrete mixes incorporating these sustainable alternatives. This indicates a synergistic interaction between Alccofine's pozzolanic properties and the particle packing effect of PWA, enhancing concrete's structural performance. The combination of 16% Alccofine and 3% PWA yields optimal compressive strength, outperforming other mixes. This highlights the potential of utilizing industrial by-products to achieve both enhanced concrete performance and sustainable construction practices. The synergistic use of Alccofine and porcelain waste aggregate not only addresses environmental challenges but also contributes to the development of high-strength, eco-friendly concrete, paving the way for greener construction methodologies.

Keywords: Alccofine, Porcelain Waste Aggregate (PWA), Sustainability

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OP63

Transesterification of sunflower waste cooking oil using Heteropolyacid salts: A comparative report

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Biodiesel emerges as an eco-friendly and sustainable alternative to conventional fossil fuels, offering a promising avenue for mitigating environmental impacts. Derived from diverse feed-stocks, including readily available waste cooking oil, this renewable energy source presents a cost-effective and abundant solution. The intricate process of biodiesel production unfolds through the transesterification reaction, wherein heteropolyacid salts serve as catalysts, exemplifying a clean and moderately priced approach. Therefore, we have tried to put a comparative analysis of two such catalysts: Cerium(III)ironmolybdophosphate (CeFeMoP) and Cerium(III)aluminomolybdophosphate (CeAlMoP). These catalysts possess substantial surface areas, with (CeFeMoP) registering at 144.965 m^2/g and (CeAlMoP) at an even more impressive 204.763 m2/g. This exploration unfolds the backdrop of various reaction conditions, shedding light on the catalytic process of each. A comparative assessment of results for both catalysts provide a good understanding of their impact on biodiesel characteristics. Numerous optimal conditions [1, 2, 3, & 4 (w/v) %] for catalyst utilization are elucidated, out of which a catalyst concentration of 3(w/v) % and a balanced 1:10 ratio of oil to methanol gave the best outputs. Various reaction parameters have been compared to find the best selection out of these. The best selected sample was operated at a reaction temperature 80 ℃ for duration of 3 hrs. Provided % yield of biodiesel—96.02 % and 98.35 % for (CeFeMoP) and (CeAlMoP), respectively. Calorific values of these biodiesels using sunflower waste cooking oil were found to be 5204 Kcal/kg in both the cases. These findings underscore the efficacy of waste cooking oil with advanced catalysts, positioning biodiesel as a formidable contender in the sustainable energy landscape.

Keywords: Cerium(III)ironmolybdophosphate; Cerium(III)aluminiummolybdophosphate; Fatty acid methyl esters; Transesterification, Heteropolyacid salts.

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OP64

Fugacity-based Multimedia Assessment of Carboxin

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A greater understanding of the environmental fate of pesticides can help assure their use in a safer and more efficient manner. The fungicide called Carboxin is used to treat seeds and stop fungal diseases in crops. Carboxin is analyzed in terms of its environmental fate utilizing a fugacity-based multimedia approach, EQC Level III. As part of the examination, the relevant partitioning and reactive qualities are assessed. In the event of equal emissions to soil, air, and water, carboxin levels in the air and sediment are predicted to be very low (<1%). The pesticide is predicted to be present predominantly in water 95% with minor amounts in soil 4.8%. It has been predicted that the most common way to remove Carboxin from soil, water, and air compartments is by reaction. Intermedia transport rates have been determined and show that air to soil transport rates is approximately nine-fold to that of air to water transport rates.

Keywords: Carboxin, EQC Level III, Fugacity

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OP65

Role of National Green Tribunal in Protection of Minorities in India: An Environmental Issue

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A specialized court in India, the National Green Tribunal (NGT) was created by the National Green Tribunal Act, 2010 with the goal of resolving environmental issues as quickly as possible. The NGT seeks to balance the needs of development and environmental protection by offering efficient legal remedies for environmental problems. Although addressing

ecological issues is the tribunal's main responsibility, it also plays a vital role in defending the rights of vulnerable and marginalized groups, such as minorities, who are frequently disproportionately impacted by climate change and environmental degradation. By addressing ecological concerns that disproportionately affect marginalized groups, the NGT upholds the principles of environmental justice thereby contributing to the broader framework of human rights and social equity in India. The study critically assesses landmark NGT judgments and their impact on environmental protection and conservation of forests and natural resources. While it's primary focus is on environmental issues, its role indirectly contributes to the protection of minorities communities in India, who are often disproportionately affected by environmental degradation.

Keywords: Climate, Minorities, Environment, People, NGT, NGOs

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OP66

Synthesis and characterizations of bioactive diorganotin(IV) complexes

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In inorganic chemistry, Schiff bases continuously capture researchers' interest due to their exceptional physical and chemical properties. Organotin complexes have also become a subject of interest because of their various biological and industrial applications such as the treatment of microbial growth, viral infections, catalyst, pest control and, more. In the present work, we have synthesized an organotin(IV) complex from 3-Methylflavone-8-carboxylic acid precursor. Due to their stability, 3-Methylflavone-8-carboxylic acid demonstrates excellent affinity for complexation. Initially, 3-Methylflavone-8-carbohydrazide was synthesized from flavone carboxylic acid, and then hydrazide was reacted with 2'-Hydroxy-5'-methoxyacetophenone to form a Schiff base. Subsequently, diorganotin(IV) complexes were prepared by refluxing synthesized Schiff base with R_2SnCl_2. The characterization of synthesized compounds was done by multinuclear NMR spectroscopy. It is anticipated that synthesized compounds will contribute to the development of new leads.

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OP67

BRIDGING LITERATURE AND SCIENCE: ADVANCED MATERIALS FOR A SUSTAINABLE WORLD

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Climate change has emerged as one of the most pressing global crises, threatening biodiversity, disrupting ecological stability, and demanding urgent scientific and technological interventions. The quest for sustainability necessitates advanced materials that mitigate environmental degradation while fostering long-term ecological balance. Recent reports, such as Stepping Back from the Precipice: Transforming Land Management to Stay Within Planetary Boundaries (2024), emphasize the role of sustainable land management in maintaining Earth's ecological stability and highlight the interconnections between land use, climate biodiversity, and water systems. Literature serves as a vital medium for engaging with environmental crises. Barbara Kingsolver, an acclaimed environmental writer and scientist, integrates ecological consciousness with storytelling, offering a crucial literary perspective on climate change. Her novel Flight Behavior explores the impact of climate-induced habitat disruptions through the anomalous migration of monarch butterflies, exposing the intersection of ecological instability and socio-economic struggles. The novel aligns with discussions on biodegradable polymers, carbon sequestration technologies, and regenerative agricultural practices, emphasizing the need for sustainable solutions. This paper examines Flight Behaviour in conjunction with advancements in sustainable materials science, illustrating how interdisciplinary perspectives enhance environmental consciousness and innovation. By bridging scientific research and literary representation, the study underscores the necessity of integrating technological advancements with broader socio-cultural awareness to combat climate crises. Flight Behavior functions as a literary catalyst for ecological responsibility, advocating for the fusion of science and sustainability.

Keywords: Climate change, sustainability, advanced materials, ecological crisis, environmental literature, regenerative agriculture

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OP68

Next-Gen Materials & Human Rights: How Tech Innovations are Reshaping NGO Strategies

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The intersection of next-generation materials and digital innovation is revolutionizing the way non-governmental organizations (NGOs) engage in human rights advocacy. Advanced materials, such as graphene, nanomaterials, and bioengineered polymers, are not only transforming industries but also creating new opportunities for NGOs to enhance their impact. Simultaneously, the digital revolution—driven by artificial intelligence, blockchain, and big data—has enabled NGOs to operate with greater efficiency, transparency, and accountability.

This paper explores how emerging technologies are reshaping NGO strategies in the human rights domain. The integration of smart materials in wearable technology, for instance, allows for real-time monitoring of human rights violations, providing activists and journalists with innovative tools for documentation and protection. Additionally, sustainable materials are contributing to environmentally friendly solutions in humanitarian aid, from advanced water purification systems to self-sustaining shelters for displaced populations.

The digital transformation of human rights work, facilitated by decentralized technologies such as blockchain, ensures data integrity and security, particularly in regions where governments attempt to suppress evidence of abuse. Artificial intelligence-driven analytics empower NGOs to detect patterns of violations and predict crises before they escalate. Furthermore, the use of digital fabrication, such as 3D printing with advanced materials, is revolutionizing disaster relief and medical aid.

Ultimately, the synergy between next-generation materials and digital technology is reshaping human rights advocacy, enabling NGOs to operate with unprecedented precision, resilience, and impact. As these technologies continue to evolve, their role in safeguarding human rights will become even more critical in the years to come.

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OP69

Recent developments in the antimalarial potential of transition metal complexes

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Malaria is one of the many illnesses for which metal-based compounds have shown great promise in control and therapy. Transition metal complexes have drawn interest recently as possible antimalarial drugs because of their quick optimization and efficient drug design. More than 200 million cases and hundreds of thousands of deaths from malaria occur annually, making it a serious worldwide health concern. Numerous variables, including genetic predisposition, environmental circumstances, and mosquito-borne transmission, affect the disease. Malaria causes a variety of symptoms as it spreads through the body in stages, beginning in the liver and progressing to the circulation. Medical imaging and diagnostic technologies are essential for early detection and treatment. Schiff bases are among the many ligands that have been created with the potential to combat malaria. The antimalarial properties of several ligands and associated transition metal complexes, including Co(II), Ni(II), Cu(II), and Zn(II), are highlighted in this study, along with their significance in the fight against malaria. Globally, researchers have made considerable strides in developing antimalarial drugs using transition metal complexes, but further progress is required to fully unlock their potential in treating malaria.

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OP70

Innovating Justice: Advanced Materials for Future Tech and Scientific Solutions in Sexual Crime Investigations

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The integration of advanced materials into forensic science represents a transformative opportunity for enhancing sexual crime investigations. This research explores the potential of cutting-edge materials—such as nanomaterials, smart polymers, and bioengineered substances—in improving evidence collection, analysis, and crime scene reconstruction. Nanomaterials, with their high surface area and enhanced sensitivity, enable the capture and preservation of trace biological evidence, while smart materials like hydrogels and antimicrobial coatings offer significant improvements in sample integrity and contamination prevention. Additionally, graphene-based sensors and lab-on-a-chip technologies are advancing DNA profiling capabilities, making forensic analysis faster, more precise, and

less reliant on expensive laboratory equipment.These innovations also extend to crime scene reconstruction, with technologies like 3D-printed biomechanical models and smart forensic mannequins offering greater insights into injury patterns and the dynamics of sexual offenses. While these materials promise revolutionary advancements, their application in forensic science must be balanced with ethical considerations, such as privacy, consent, and access to technology across different regions. Furthermore, ensuring the judicial system's acceptance of these new methods is essential for their integration into legal proceedings.This study underscores the potential of advanced materials to overcome existing forensic limitations, providing law enforcement and legal professionals with more accurate, reliable, and efficient tools for sexual crime investigations. As research in this field progresses, collaboration across disciplines—material science, forensic expertise, law, and ethics—will be crucial in shaping the future of forensic technologies. Ultimately, these advancements aim to not only improve investigative practices but also deliver more just and equitable outcomes for victims of sexual offenses.

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OP71

Electronic Waste Management in the Banking Industry: Challenges, Strategies, and Sustainable Solutions

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The rapid digital transformation of the banking industry has led to a significant increase in electronic waste (e-waste), including outdated ATMs, computers, servers, and mobile banking devices. Improper disposal of these electronic assets poses environmental and cyber security risks while contributing to global e-waste concerns. This paper examines the challenges of e-waste management in the banking sector and explores sustainable disposal practices aligned with global environmental regulations. Through case studies of leading financial institutions, we analyze strategies such as responsible recycling, refurbishment, and secure data destruction. Additionally, we discuss the role of regulatory compliance, circular economy principles, and corporate social responsibility (CSR) initiatives in mitigating e-waste impact. The study emphasizes the need for a structured e-waste policy framework that integrates environmental sustainability with operational efficiency in the banking industry. Our findings provide actionable insights for policymakers, financial institutions, and technology providers to implement robust e-waste management strategies, ensuring a greener and more sustainable banking ecosystem.

Keywords: E-waste management, banking industry, sustainability, electronic asset disposal, cyber security, circular economy

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OP72

Corporate Growth vs. Environmental Responsibility: The Path to Sustainability

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The environment is facing severe degradation due to rapid industrialization, pollution and modern materialistic viewpoints. Climate change, biodiversity loss, and ecosystem collapse are among the most pressing issues, driven by deforestation and unsustainable resource consumption. While the growing industry in the novel initially represents progress and prosperity, its unchecked expansion results in environmental contamination, contribute to unforeseen health crises. This message resonates with contemporary environmental concerns, as modern industries continue to pollute air, water, and soil in pursuit of economic gain. Richard Powers' novel *Gain* presents a critical exploration of the effect of these issues on both human lives and the natural world which are becoming increasingly evident over time, illustrating how economic growth often comes at the expense of environmental and public health. This paper examines the moral lessons conveyed in *Gain* and argues for a transition toward more environmental friendly processes to mitigate further ecological harm. It is an attempt to explore possible solutions, including reaching out to stakeholders, implementing stricter environmental regulations, and investing in green technologies. By integrating these ethical considerations into real-world environmental policies, it urges a shift in the human perspective, advocating for a more harmonious relationship with nature to promote society to move towards a more sustainable future to preserve the resources of nature for the coming generations.

Keywords: Environment, pollution, sustainability, ecological, degradation, modern, challenge, economic growth

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OP73

µPAD coupled PhotoMetrix app based portable device for quality assurance of Isoniazid in pharmaceutical formulations

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A novel and portable method for quantily assurance of isoniazid (INH), the most frequently prescribed antibiotic for tuberculosis, has been invented. The method involved a smartphone-based PhotoMetrix application that detected color variations on a microfluidic paper analytical device (µPAD) with different INH concentrations. Initially, INH reacted with the Meldrum activated furan (MAF) through a furan ring opening mechanism, resulting in the formation of donor-acceptor Stenhouse adduct which was red in color with the absorption maxima of 529 nm found by spectrophotometry. This app decomposed colored digital images into RGB color histograms and created a calibration curve. Central composite design (CCD) for response surface methodology (RSM) was used for the multivariate optimization to establish simultaneous standard conditions for each variable, MAF concentration (X_1) and time (X_2) to achieve the highest possible absorbance intensity. Under optimal conditions, using present invention, Beer's law was followed within a concentration range of 2-10 µg mL^{-1} of isoniazid with a correlation coefficient of determination, 0.959. The limit of detection (LOD) and the limit of quantification (LOQ) were determined to be 0.13 µg mL^{-1} and 0.39 µg mL^{-1} respectively. The sturdiness of the method was evaluated statistically using accuracy and precision within the appropriate range. Using various excipients enabled the current invention to demonstrate high selectivity. The two methodologies were compared using various analytical parameters and no significant differences were found between them. Isoniazid was accurately quantified in diverse pharmaceutical formulations utilizing this simple and portable smart device in areas lacking nearby analytical laboratories.

Keywords: Isoniazid, Meldrum activated furan, µPAD coupled PhotoMetrix application colorimetric device, pharmaceutical formulations

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OP74

Comprehensive analysis of trimethoprim binding with cyclodextrins in aqueous solutions: Experimental and computational insights

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Cyclodextrins are widely recognized for their ability to form inclusion complexes with various molecules due to their hydrophobic internal cavity. In this study, the binding interactions of trimethoprim (TMP) with native α-, β-, and γ-cyclodextrins (CDs) were extensively investigated through a combination of isothermal titration calorimetry (ITC), UV-visible spectroscopy, NMR spectroscopy, dynamic light scattering (DLS), and molecular modeling. The stability of TMP-CD inclusion complexes followed the order: α-CD < γ-CD < β-CD, indicating that TMP molecules fit most effectively into β-CD, as evidenced by similar binding affinities measured using UV-visible spectroscopy and ITC. NMR analysis showed the largest change in TMP diffusion rates with β-CD, followed by γ-CD. Molecular modeling and DLS further confirmed the stronger interaction between TMP and β-CD. The transfer values ($\Delta_t V_2^o$) were positive, increasing with the complexity of CDs in the order of α < β < γ, suggesting that β-CD and γ-CD exhibit a greater capacity to interact with TMP compared to α-CD.

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OP75

Xanthan Gum and Chitosan based chemically crosslinked hydrogel incorporated with fluorescent Nitrogen-doped graphene quantum dots for the sensing of Heavy Metal ions

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Hydrogels provide a unique medium for sensing applications since they combine the advantages of liquid and solid sensing platforms. Incorporation of fluorescent nanoparticles into the hydrogel matrix results in the formation of 3D nanocomposites capable of interacting

with water soluble analytes facilitating quantitative sensing application. Here we report the synthesis of chemically crosslinked fluorescent hydrogel based on Xanthan Gum (XG) and Chitosan (CS), embedding fluorescent Nitrogen-doped graphene quantum dot (N-GQDs) for the sensing of heavy metals. N-GQDs were prepared using hydrothermal method. Then the hydrogel was prepared using a simple and facile approach. The prepared hydrogel was characterized using XRD, FT-IR, SEM, XPS and Fluorescence spectroscopy to confirm its structural, surface and fluorescent properties. The results from fluorescence spectroscopy demonstrated that the prepared hydrogel exhibited strong fluorescence peak at 440 nm and a prominent fluorescence quenching was observed in the presence of heavy metal ions. The performance of the hydrogel has been evaluated by studying the sensing efficiency of hydrogel under different pH conditions. The hydrogel demonstrated pH dependent fluorescence intensity and sensitivity.

Keywords: Hydrogel, Quantum-Dots, Sensing, Heavy Metals

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OP76

Biogenic synthesis of CuAl-LDH nanoparticles using *Eucalyptus* plant extract and their photocatalytic degradation against Crystal Violet dye

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Eucalyptus plant extract was used to synthesize CuAl-LDH nanoparticles through a simple one step hydrothermal process, without the need of an external energy source or surfactant. The synthesised nanoparticles were characterised by X-ray diffraction (XRD), UV-Vis spectroscopy, FT-IR and X-ray photoelectron spectroscopy (XPS). The XRD analysis confirmed the crystal structure of CuAl-LDH nanoparticles and other structural parameters like crystallinity and average grain size. XPS analysis confirms oxidation state, binding energy, and other chemical characteristics of CuAl-LDH nanoparticles, which is crucial for understanding their stability and reactivity. UV-Vis spectroscopy shows maximum absorbance at 289 nm and 360 nm. Using a Tauc plot, the band gap of CuAl-LDH was calculated to be 5.42 eV, indicating that they have the potential to be used in photocatalytic applications. The synthesised Cu-Al LDH nanoparticles were then evaluated for their photocatalytic activity in the degradation of Crystal Violet dye. The UV-Vis absorption

spectra show significant degradation of the dye under sunlight exposure, showing a marked decrease in absorbance after varying durations of exposure. After 210 minutes, the percentage of degradation was determined to be 91.7%. According to these results, the CuAl-LDH nanoparticles made from Eucalyptus plant exhibits promising photocatalytic qualities and can be used in a variety of environmental remediation processes, most notably the treatment of wastewater.

Keywords: *Eucalyptus*, Hydrothermal, Green synthesis, Photocatalytic activity, Crystal Violet dye

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OP77

Fabrication of $NiFe_2O_4/AgTaO_3$ heterojunction for photocatalytic dye degradation

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Efficient photocatalytic materials are in high demand due to growing environmental concerns about organic dye contaminants in wastewater. This study reports the fabrication of $NiFe_2O_4/AgTaO_3$ heterojunction and its application in photocatalytic dye degradation under visible light irradiation. Nickel ferrite or $NiFe_2O_4$ is a promising spinel ferrite material for photocatalysis due to its magnetic and effective charge transfer properties. On the other side, silver tantalate or $AgTaO_3$ is a perovskite-type oxide with efficient visible light absorption and a high dielectric constant, facilitating effective charge separation. The structural, morphological, and optical properties were analyzed using X-ray diffraction (XRD), Scanning Electron Microscopy/Energy Dispersive X-ray Spectroscopy (SEM/EDX), and UV-Vis Spectroscopy, respectively. The XRD scan confirmed the effective coupling of $NiFe_2O_4/AgTaO_3$ heterojunction as two sets of peaks corresponding to $NiFe_2O_4$ and $AgTaO_3$ phases are observed. The UV-Vis spectroscopy of materials showed a good absorbance range within 300-800 nm. The band gap of materials was obtained at 1.55 eV for $NiFe_2O_4$ and 3.4 eV for $AgTaO_3$ through a tauc plot, confirming their ability to form a good heterojunction for photocatalytic activity. The photocatalytic activity of the heterojunction in the degradation of methylene blue dye was then investigated, leading to increased efficiency. The synergistic effect of $NiFe_2O_4$ and $AgTaO_3$ in heterojunction formation provides a viable method for sustainable wastewater treatment.

Keywords: $NiFe_2O_4$, $AgTaO_3$, Heterojunction, Photocatalysis, Degradation.

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OP78

Synthesis of $CuBi_2O_4/CaTiO_3$ heterojunction for improved photocatalytic dye degradation

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This work outlines the synthesis of heterojunction of $CuBi_2O_4$ and $CaTiO_3$ for the dye degradation application. $CuBi_2O_4$ or copper bismuth oxide is an important spinel oxide and a promising material that shows its excellent potential in photocatalytic applications because of its narrow band gap, good charge separation and good visible light absorption. $CaTiO_3$ or calcium titanate is a perovskite material, if combined with other materials then it forms heterojunctions which shows enhanced photocatalytic properties. The as synthesised samples were characterised by UV-Vis spectroscopy, X-ray diffraction (XRD), and field emission-scanning electron microscopy (FE-SEM). The UV-Vis spectroscopy of $CuBi_2O_4$ showed that sample has good absorbance in the range of 400-800 nm and that of CaTiO3 was maximum at 375 nm. The band gap of $CuBi_2O_4$ was obtained at about 1.75 eV and that of $CaTiO_3$ at 3.4 eV, by using a Tauc plot, and this confirmed their potential to construct the heterojunction for the photocatalytic applications. The heterojunction was then studied for their photocatalytic activity in the degradation of crystal violet dye which resulted in improved efficiency. This work shows that the $CuBi_2O_4/CaTiO_3$ heterojunction have best photocatalytic properties, with various applications in environmental remediation, especially in the wastewater treatment.

Keywords: $CuBi_2O_4$, $CaTiO_3$, heterojunction, dye degradation, photocatalytic performance.

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OP79

Combustion-assisted synthesis of $Fe_2(MoO_4)_3$ nanoparticles and their photocatalytic activity against Crystal Violet dye

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The present study outlines the synthesis of iron molybdate $Fe_2(MoO_4)_3$ nanoparticles through the combustion method at 700° C. The produced nanoparticles were characterized by different spectroscopic techniques including X-ray diffraction (XRD), UV-visible spectroscopy (UV-Vis), FT-IR, and X-ray photoelectron spectroscopy (XPS). The XRD analysis confirms the monoclinic crystal structure of synthesized $Fe_2(MoO_4)_3$ nanoparticles. The elemental composition, oxidation state, and binding energy of the $Fe_2(MoO_4)_3$ nanoparticles were all revealed by XPS analysis, which is crucial for comprehending their stability and reactivity. According to UV-visible spectroscopy, the absorbance reaches its maximum at 209.5 nm. The band gap of the $Fe_2(MoO_4)_3$ nanoparticles was calculated to be 4.67 eV by using a Tauc plot, confirming their potential for photocatalytic applications. The synthesized nanoparticles were then evaluated for their photocatalytic activity in the degradation of crystal violet dye. The UV-Vis absorption spectra show significant degradation of the dye under sunlight exposure, showing a marked decrease in absorbance after varying durations of exposure. The percentage of degradation was calculated to be 87.1% in 6 hours. These results suggest that the $Fe_2(MoO_4)_3$ nanoparticles produced by the combustion process exhibit potential photocatalytic qualities, which have various uses in wastewater treatment and environmental remediation.

Keywords: Iron Molybdate, Combustion, Composition, Photocatalytic activity, Crystal Violet

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OP80

Molecularly Imprinted Polymer-Based Optical Sensors: Innovations in Fabrication, Mechanisms, and Applications for Disease Diagnosis and Monitoring

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Molecularly imprinted polymers (MIPs) have emerged as highly selective synthetic receptor materials designed to recognize and bind specific target molecules, including biomolecules,

small organic compounds, and metal ions. The molecular imprinting process involves polymerizing monomers in the presence of a template molecule, resulting in tailored recognition sites that mimic the molecular shape and chemical properties of the target analyte. This ability has positioned MIPs as a powerful tool in diverse fields such as biosensing, environmental monitoring, and diagnostics. In optical sensing, MIPs are integrated as thin films or coatings onto solid substrates, enabling the detection of analytes through various signal transduction mechanisms, including optical absorbance, fluorescence, and surface plasmon resonance (SPR). Upon target binding, measurable changes in optical properties such as absorbance, emission intensity, or refractive index facilitate precise analyte quantification. These MIP-based optical sensors offer distinct advantages, including enhanced specificity, high sensitivity, cost-effectiveness, and reusability. The application of MIP-based optical sensors in disease diagnosis and health monitoring has gained significant attention due to their ability to detect disease-specific biomarkers with exceptional accuracy. Their integration into point-of-care devices further underscores their potential in clinical diagnostics and personalized medicine. This paper provides a comprehensive overview of MIP-based optical sensors, detailing their fundamental principles, fabrication strategies, and functionalization techniques. Additionally, various signal transduction mechanisms are explored, alongside recent advancements in their application for disease detection and healthcare monitoring. Emerging research trends and prospects in the field of molecularly imprinted polymer-based optical sensors are also discussed.

Keywords: Molecularly Imprinted Polymers, Optical Sensing, Biosensors, Disease Biomarkers, Surface Plasmon Resonance, Fluorescence Sensors, Diagnostic Technologies

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OP81

Theoretical and Experiment Correlation of Gamma Ray Shielding Properties of Tellurium Doped Bismuth and Borate Based Melt Quenching Glass System

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This research explores the impact of TeO_2 doping on the structural and gamma-ray shielding characteristics of bismuth borate glasses. Important key properties such as mass attenuation

coefficient (MAC), half-value layer (HVL), density, optical behaviour, and elastic parameters were calculated. Experimental MAC values, measured using a ^{137}Cs source (4.5 µCi, 662 keV), closely aligned with theoretical predictions from XCOM NIST software. We observe that the mass attenuation coefficient increases at gamma-ray photon energy of 662keVfrom S1 to S6 with decrease in tellurium oxide and increase of phosphorous pentoxide due to the dominance of Compton scattering at this energy. The reduction of TeO_2 and the addition of P_2O_5, along with a high weight percentage of Bi_2O_3 and PbO, lead to an increase in glass density and electron density, enhancing gamma-ray interactions. The S6 sample, with the lowest TeO_2 concentration, exhibited superior shielding efficiency with the highest MAC ($0.09678312 cm^2/g$) and the lowest HVL (1.52412 cm at 662 keV). A smaller HVL value indicates that the material is more effective for radiation shielding in terms of thickness requirements. The reduction in TeO_2 resulted in an increase in density, which decreased the molar volume. The combined effects of high-density Bi_2O_3 and PbO outweigh the loss of TeO_2. It can be approximated that as the P2O5 content rises in small amount and due to high wt% of Bi_2O_3 and PbO throughout S1 to S6, the optical band gap (E_g) falls from 2.9 to 2.72eV, suggesting a increase in non-bridging oxygens within the glass system. On the other hand, the refractive index increases and cation polarizability decreases due to rise in molar refraction, indicating structural variations. Poisson's ratio analysis suggested that TeO_2-less rich samples (S4-S6) formed are becoming denser, more compact, and structurally flexible, improving both gamma-ray shielding performance and mechanical durability. When compared to conventional barite concrete and some other materials, bismuth borate glasses demonstrated superior radiation shielding capabilities, positioning them as potential materials for gamma-ray attenuation applications in the society.

Keywords: MAC, Gamma Ray Shielding, Glass, Bismuth- Borate

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OP82

The Rietveld refinement of $Ba_{0.6}Sr_{0.2}Ca_{0.2}TiO_3$; A detailed structural study

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Ceramics are non-metallic and inorganic solids made from metal or non-metal compounds. During the last decade, lead-based ceramics played a crucial role in the world of the

microprocessor industry. Due to the toxicity behavior of lead, researchers began examining new alternative earth-friendly materials. In this case, lead-free Barium titanate (BT) has materialized. Due to its high dielectric constant, good ferroelectric properties, and environmentally friendly nature barium titanate is the most permissible material. In the present work, we have synthesized $Ba_{0.6}Sr_{0.2}Ca_{0.2}TiO_3$ perovskite samples using the traditional high-temperature solid-state reaction route (HT-SSRR) in assisted with ball milling. The main objective of our investigation is to study the structure in detail. The powder XRD analysis confirmed the formation of single-phase crystalline material. We have used the Full_Prof software suite to analyze the PXRD data using the Rietveld refinement method. The χ^2, R_p, and R_{wp} are found to be in the acceptable range. The splitting of the (200) peak confirmed the formation of a tetragonal structure. The crystalline size is determined by the Debye-Scherrer method (DSM) and the Williamsons-Hall(W-H) plot.

Keywords: Ceramics, Lead-free ceramics, XRD, Rietveld refinement, Crystallite size

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OP83

Significance of structure - magnetic property of Cobalt Ferrite

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Ferrites are widely studied for their extensive use in various industries, from manufacturing to the biomedical field. Among ferrites, the spinel ferrites (Cobalt Ferrite) show high magnetization and good dielectric properties also. In this report, Cobalt ferrite was synthesized by using a solid-state reaction route. The calcination temperature for the sample and the sintering temperature of the pellets was 1050^{o}C & 1150^{o}C respectively. The XRD result shows the formation of a single-phase spinel structure, which was further confirmed by the Rietveld refinement analysis. The crystal structure was found to be cubic with lattice parameter 8.3896Å. The χ^2 value and all the reliability parameters lie in the acceptable range, which confirmed the accuracy of the model taken for the refinement. The presence of all Raman modes as predicted by the group theory for the spinel structure, confirmed the formation of the sample. The magnetic hysteresis loop was measured by using VSM at room temperature. The samples show M_s and M_r as 71.54emu/g and 28.536emu/g which opens up a window for advanced device applications.

Keywords: Spinel Ferrites, Crystal Structure, Rietveld Refinement, Raman spectroscopy, M-H Loop.

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OP84

Theoretical Calculation of Mass Attenuation Coefficient of $40P_2O_5 - 20PbO - 20B_2O_5 - 10Bi_2O_3 - xMnO_2 - (10 - x)TeO_2$ Melt Quenching Glass System

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In this study, we theoretically investigate the gamma-ray shielding properties of a phosphate-based glass system with the composition $40P_2O_5 - 20PbO - 20B_2O_5 - 10Bi_2O_3 - xMnO_2 - (10 - x)TeO_2$ (for x = 0,1,2,3,4 mol%). The mass attenuation coefficient (μ/ρ) was computed using the NIST XCOM database for various photon energies (0.1 MeV–15 MeV). At 662 keV, the glass samples exhibit a higher mass attenuation coefficient (S1:0.083471cm^2/g, S2: 0.083475cm^2/g, S3:0.083478cm^2/g, S4:0.083482cm^2/g, S5:0.083486 cm^2/g) compared to barite concrete (0.0780 cm^2/g), which is commonly used as a radiation shielding material. The study provides insight into the suitability of the given glass system for gamma-ray shielding without requiring experimental fabrication. The findings indicate that the selected composition exhibits promising shielding characteristics, making it a potential candidate for radiation protection applications.

Keywords: MAC, melt quenching glass, gamma ray shielding.

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OP85

Corporate Growth vs. Environmental Responsibility: The Path to Sustainability

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The environment is facing severe degradation due to rapid industrialization, pollution and modern materialistic viewpoints. Climate change, biodiversity loss, and ecosystem collapse are among the most pressing issues, driven by deforestation and unsustainable resource consumption. While the growing industry in the novel initially represents progress and prosperity, its unchecked expansion results in environmental contamination, contribute to unforeseen health crises. This message resonates with contemporary environmental concerns, as modern industries continue to pollute air, water, and soil in pursuit of economic gain. Richard Powers' novel *Gain* presents a critical exploration of the effect of these issues on both human lives and the natural world which are becoming increasingly evident over time, illustrating how economic growth often comes at the expense of environmental and public health. This paper examines the moral lessons conveyed in *Gain* and argues for a transition toward more environmentally friendly processes to mitigate further ecological harm. It is an attempt to explore possible solutions, including reaching out to stakeholders, implementing stricter environmental regulations, and investing in green technologies. By integrating these ethical considerations into real-world environmental policies, it urges a shift in the human perspective, advocating for a more harmonious relationship with nature to promote society to move towards a more sustainable future to preserve the resources of nature for the coming generations.

Keywords: Environment, pollution, sustainability, ecological, degradation, modern, challenge, economic growth

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OP86

Salts of Lithium metal in organic solvents: An innovative electrolyte material that enhances energy density and overall performance for supercapacitors

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Supercapacitors, the high-power energy storage devices, have gained impactful attention recently virtue of their rapid charge and discharge capabilities along with a longer life cycle. The lithium ion capacitor (LIC) is a hybrid energy storage device combining the energy storage mechanisms of the lithium ion battery (LIB) and the electrical double-layer capacitor (EDLC), which offers some of the advantages of both technologies and eliminates their

drawbacks. This article presents a review of LIC materials, cyclic voltammetry (CV), galvanostatic charge discharge (GCD) and electrochemical impedance spectroscopy (EIS) techniques were used to test the LICs. Possible applications in order to summarise the recent findings and research progress for LIC technology have been mentioned. Some potential applications reported in the literature are outlined, especially the combination with a high-energy device for hybrid energy storage constitution to obtain the synergistic benefit of the combined energy storage units. Nevertheless, in order to progress their utilization in diverse fields such as electric vehicles, renewable energy systems, and portable electronic devices, it is imperative to create sophisticated electrolytes that may augment their energy density, power density, and overall performance.

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OP87

Nano Fabrication for Functional Nanomaterials for Versatile Applications

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Nanofabrication has emerged as a pivotal technology in engineering functional nanomaterials with enhanced properties, enabling a wide range of versatile applications. This paper explores advanced nanofabrication techniques such as bottom-up assembly, top-down lithography, and hybrid approaches for creating nanomaterials with tailored functionalities. By manipulating structural dimensions at the atomic and molecular levels, these techniques enhance the physical, chemical, and electronic properties of materials, leading to breakthroughs in various fields, including healthcare, energy storage, environmental sensing, and nanoelectronics. In healthcare, functional nanomaterials are being utilized for targeted drug delivery, biosensing, and diagnostic imaging, significantly improving therapeutic efficacy and patient outcomes. Because they have large surface areas, nanostructured materials improve the efficiency of batteries and supercapacitors in energy storage and improved ion transport. Environmental applications benefit from nanomaterials' catalytic properties for pollution control and water purification. Additionally, in nanoelectronics, the miniaturization and enhanced conductivity of nanomaterials are paving the way for the next generation of high-performance electronic devices. This paper also highlights the challenges of scalability, reproducibility, and environmental impact associated

with nanofabrication techniques. Future prospects include the development of eco-friendly fabrication methods and the integration of artificial intelligence to optimize design processes. The convergence of nanotechnology with other disciplines promises to unlock new potentials, driving innovation across multiple industries. This review provides a comprehensive overview of the current state and future directions in nanofabrication for functional nanomaterials, emphasizing their transformative potential in versatile applications.

Keywords: Nanofabrication, Functional Nanomaterials, Versatile Applications, Advanced Techniques, Multidisciplinary Innovations

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OP88

Evaluation of Radiation Shielding Potential of Bismuth Boro-Tellurite Glasses

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The increasing demand for effective and environment friendly radiation shielding materials has led to the exploration of bismuth boro-tellurite glasses as potential alternatives to conventional lead materials. This study investigated the radiation shielding potential of bismuth tellurite glasses having composition $15B_2O_3$-xBi_2O_3-(85-x)TeO_2 where *x* =35, 40, 45, 50, 55 mol % & analyzed the mass attenuation coefficient (μ/ρ), effective atomic number (Z_{eff}) & electron density (N_e) over a wide photon energy range of 0.015 MeV to 15 MeV using WinXcom software. The dependence of Z_{eff} and N_e on photon energy and Bi_2O_3 concentration was evaluated to assess the material's radiation shielding efficiency. The results indicated that the increasing Bi_2O_3 content enhances the photon attenuation due to the high atomic number and density of bismuth. It has been observed that the G_5 glass sample exhibiting the maximum value of mass attenuation coefficient (μ/ρ), effective atomic number (Z_{eff}) & electron density (N_e) and can be used as a promising material for radiation protection applications in nuclear medicine, space technology and high-energy physics.

Keywords: Bismuth tellurite glasses, mass attenuation coefficient, effective atomic number, electron density, radiation shielding.

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OP89

Interfacial charge transfer in g-C_3N_4/$FeVO_4$/AgBr Nanocomposite for Efficient Photodegradation of Tetracycline antibiotic and Victoria Blue dye

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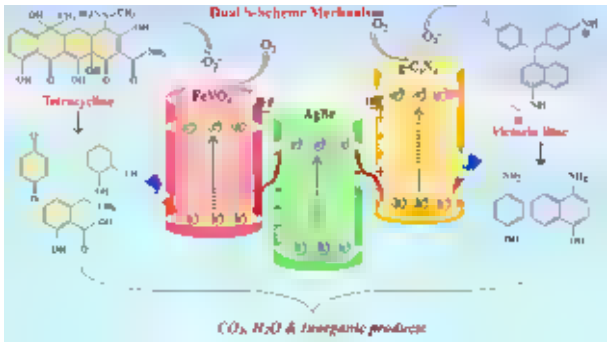

The study presents the fabrication and superior photoactivity of a ternary g-C_3N_4/$FeVO_4$/AgBr heterojunction nanocomposite, synthesized via a chemical precipitation method for effective degradation of tetracycline (TC) and Victoria Blue (VB) dye under light illumination. The morphology and the crystal size of the synthesized nanocomposite were characterized by using FESEM and XRD and the calculated grain size (100.39 nm) is larger than the crystal size (48.14 nm) indicating strong interparticle bonding. The heterojunction design leverages dual S-scheme interfacial charge transfer, reducing electron-hole recombination as confirmed by optoelectronic and electrochemical techniques. The composite demonstrated superior performance, achieving 82.15% degradation of TC and 97.25% degradation of VB. The study highlights density functional theory (DFT) simulations and Mott-Schottky (MS) analysis, providing insight into the electronic structure, distribution of charge, and band alignments of the g-C_3N_4/$FeVO_4$/AgBr nanocomposite. Electron spin resonance and radical scavenging experiments revealed holes and superoxide radicals as the primary species driving the degradation process. Furthermore, LC-MS analysis provided insights into the degradation pathways, confirming the conversion of TC and VB into non-toxic byproducts. The photocatalytic stability was confirmed through five consecutive cycles with minimal disruption in both performance and morphology, demonstrating its potential for wastewater treatment applications. Consequently, this study

illustrates how the collaborative interplay of dual S-scheme charge migration and silver plasmonic effects enhances the efficiency of the g-C_3N_4/$FeVO_4$/AgBr nanocomposite, offering a novel and highly effective solution for the degradation of complex pollutants in environmental remediation.

Key Words: Surface plasmon resonance (SPR); Optoelectronic properties; Dual S-Scheme; Pollutant Degradation; Interfacial charge transfer

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OP90

Mass Attenuation Coefficient of Some Bismuth-Based Alloys for Gamma-Ray Shielding: Theoretical and Experimental Approach

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Bismuth-based alloys have gained significant attention for their potential use in gamma-ray shielding applications due to their high atomic number and non-toxic nature compared to conventional lead-based materials. In this study, the mass attenuation coefficient (MAC) of bismuth-based alloys was determined using both theoretical and experimental approaches. Theoretical values were obtained using the WinXCom software, which provides photon interaction cross-sections for various energies. Experimentally, the mass attenuation coefficient was measured using the narrow beam geometry method with gamma-ray sources of varying energies. The results from both methods were analyzed and compared to assess the accuracy of WinXCom in predicting attenuation properties. Further, the role of preliminary computations of optimum thickness range for alloy samples play a vital role in obtaining accurate results. The findings indicate that bismuth-based alloys exhibit promising attenuation characteristics, making them viable candidates for radiation shielding applications in medical, industrial, and nuclear environments.

Keywords: Gamma-rays; bismuth-based alloys; lead free alloys; radiation shielding; mass attenuation coefficient.

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OP91

Structural and Morphological Investigations of Sol-Gel Synthesized $LaMnO_3$ and $LaMnO_3$/rGO Composites for Energy Applications

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$LaMnO_3$ and $LaMnO_3$/reduced graphene oxide (rGO) composites were successfully synthesized using the sol-gel method and spun calcination. Both samples were systematically analyzed for their structural and morphological properties. X-ray diffraction (XRD) confirmed the formation of a pure crystalline phase for both samples, with crystallite size calculations using the Scherrer formula revealing an increase in size for the composite, likely due to the incorporation of rGO. Scanning electron microscopy (SEM) images indicated a homogeneous arrangement of particles, and the average particle size was determined. Fourier-transform infrared spectroscopy (FTIR) further validated the structural integrity of the synthesized materials. The sol-gel synthesis ensured uniform particle distribution and controlled crystallinity, enhancing the material properties. The synergistic interaction between $LaMnO_3$ and rGO suggests potential improvements in electrical and electrochemical performance, making these materials promising candidates for energy storage and conversion applications.

Keywords: $LaMnO_3$, rGO, Composite, XRD, SEM

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OP92

Manganese Doped Bismuth- Borate Glass System for Gamma Ray Shielding: A Theoretical and Experimental Correlation

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This study investigates the structural and gamma-ray shielding properties of MnO_2-doped bismuth borate glasses by analyzing their mass attenuation coefficient (MAC), half-value layer (HVL), density, optical properties, and elastic parameters. The experimental MAC values, obtained using a ^{137}Cs source (4.5 µCi, 662 keV), were compared with theoretical

values from XCOM software, showing close agreement. Results indicate that increasing MnO_2 content reduces MAC due to the replacement of high-atomic-mass Bi_2O_3, leading to lower electron density and photon absorption. The S1 sample, with the highest Bi_2O_3 content, exhibited the highest MAC and the lowest HVL (1.477 cm at 662 keV), making it the most effective radiation shield. Density decreased with increasing MnO_2, while molar volume and non-bridging oxygen content increased, influencing bandgap reduction from 3.49 eV to 3.27 eV. The refractive index and cationic polarizability increased with MnO_2 concentration, affecting structural rigidity. Poisson's ratio analysis indicated higher cross-link density in MnO_2-rich samples (S4-S6), leading to a more rigid network. Compared to barite concrete, the bismuth borate glasses demonstrated superior radiation shielding, making them promising candidates for gamma-ray attenuation applications

Keywords: Mass attenuation coefficient, γ- ray shielding, glass material, HVL, band gap

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OP93

Highly efficient photocatalysis of Reactive Yellow 15 with ethyleneglycol capped Ag-TiO_2 nanoparticles

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Reactive Yellow 15 (RY15) is a synthetic azo dye used mainly in textile which belongs to the class of reactive dyes and it chemically bonds with fibers, making it resistant to natural degradation, causing long-term environmental damage. This paper presents the synthesis of photocatalyst i.e., ethylene glycol-capped Ag-doped TiO_2 nanoparticles for enhanced photocatalytic activity to degrade RY15 completely. The nanoparticles were synthesized via a sol-gel method, and their structural, optical, and photocatalytic properties were investigated. For optical properties UV Spectroscopy, fluorescence spectroscopy was recorded. To determine capping IR Spectroscopy was performed. To determine crystalline nature XRD and SAED was performed. The results showed that the Ag doping and ethylene glycol capping significantly improved the photocatalytic efficiency of TiO_2 nanoparticles. The nanoparticles with Ethyleneglycol capping and 2% Ag doped-TiO_2 exhibited 100% degradation efficiency to degrade RY15. Thus, this research contributes to the development of highly efficient photocatalytic materials for sustainable environmental solutions

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Poster Presentation Abstracts

PP01

Natural Plant Product Extraction and Purification Using Ionic Liquid-Based Green Solvents

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This research paper explores the environmental sustainability of ionic liquid-based green solvents in the extraction and purification of natural plant products, with a focus on their entire life cycle. The objectives of the study were to assess the environmental impact of ionic liquid synthesis, energy consumption, water usage, emissions, recycling rates, policy effects, and stakeholder perceptions. Methodologically, we conducted a comprehensive Life Cycle Assessment (LCA) that involved primary data collection through field surveys and interviews with key stakeholders in the ionic liquid production and usage industry across various regions in India. The data were analyzed using specialized LCA software tools to quantify environmental impacts.

Key findings include the identification of synthesis as a major contributor to environmental impact, emphasizing the need for greener synthesis methods. The study revealed the significant carbon footprint, energy consumption, and water usage during production, highlighting opportunities for improvement. Emissions data underscored the importance of emission control measures, particularly for greenhouse gases and volatile organic compounds. Recycling and reuse were identified as environmentally friendly disposal methods. Policy compliance varied among stakeholders, indicating room for stricter regulations. Stakeholder perceptions varied, with researchers having the most positive outlook. Implications of the findings extend to sustainable chemistry practices, emphasizing interdisciplinary collaboration and the importance of considering the entire life cycle of chemical processes. This research contributes to a deeper understanding of green solvents and provides a foundation for promoting sustainable practices in industrial processes, not only in India but also globally.

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PP02

Manganese Doped Bismuth- Borate Glass System for Gamma Ray Shielding: A Theoretical and Experimental Correlation

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This study investigates the structural and gamma-ray shielding properties of MnO_2-doped bismuth borate glasses by analyzing their mass attenuation coefficient (MAC), half-value layer (HVL), density, optical properties, and elastic parameters. The experimental MAC values, obtained using a ^{137}Cs source (4.5 µCi, 662 keV), were compared with theoretical values from XCOM software, showing close agreement. Results indicate that increasing MnO_2 content reduces MAC due to the replacement of high-atomic-mass Bi_2O_3, leading to lower electron density and photon absorption. The S1 sample, with the highest Bi_2O_3 content, exhibited the highest MAC and the lowest HVL (1.477 cm at 662 keV), making it the most effective radiation shield. Density decreased with increasing MnO_2, while molar volume and non-bridging oxygen content increased, influencing bandgap reduction from 3.49 eV to 3.27 eV. The refractive index and cationic polarizability increased with MnO_2 concentration, affecting structural rigidity. Poisson's ratio analysis indicated higher cross-link density in MnO_2-rich samples (S4-S6), leading to a more rigid network. Compared to barite concrete, the bismuth borate glasses demonstrated superior radiation shielding, making them promising candidates for gamma-ray attenuation applications

Keywords: Mass attenuation coefficient, gamma ray shielding, glass material, HVL, band gap

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PP03

Heterogeneous catalyst in organic synthesis: a mini-Review

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Over the last two decades, Heteropolyacid has gained considerable attention due to its distinct properties, including Brønsted acidity, oxidizing qualities, and proton mobility. Unlike traditional liquid mineral acid catalysts, Heteropolyacid offers a greater number of acidic sites and enhanced catalytic activity, making it a more environmentally friendly and

efficient option for reaction catalysis. Heteropolyacid presents notable advantages over conventional acid catalysts. It is not only straightforward to prepare and handle but also easy to separate and, crucially, to reuse. These HPA salts are effectively used in various types of oxidation-reduction, esterification &trans-esterification, dehydration and alkylation reactions by minimizing harsh reaction conditions and make them feasible at ambient conditions with remarkable yield. The In the present review article, data collected from past decades reveals that heteropolyacid salts can catalyse a wide range of reactions. In optimal conditions, these reactions effectively reduce acid waste while maximizing efficiency. The versatility and reusability of heteropolyacid salts enable them to catalyse various reactions.

Graphical abstract

Keywords: Heteropolyacids salt, Heterogeneous catalyst, Brønsted acid, organic reactions

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PP04

Recent Progress on Spiropyran-based Photochromic dyes for Sensor Applications

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Spiropyrans are a type of photochromic chemical that have two major isoforms: an open merocyanine (MC) and a closed spiropyran (SP). These compounds are inter-switchable with both visible and ultraviolet light. The phenomenon of photochromism is a reversible color shift in photochromic molecules caused by the interaction of light and heat. These molecules can be classified into two types based on their absorption spectra. In this study We have highlighted and compiled the latest findings and developments in photo-switchable spiropyran-based materials and their uses sensors for heavy metal cations, anions, pH, acid

and base vapors, wettability, and humidity. The primary potential uses of spiropyrans are also explored, including the fabrication of smart materials, molecular electronics and nanomachinery, biological and environmental molecule sensing, and phytopharmacology. This review may accelerate the improvements in designing more advanced probes with innovative applications in the near future.

Keywords: Spiropyrans; photochromic; Fluorescence; Chemosensors; phytopharmacology

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PP05

Importance of stimuli responsive confined space

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Molecular behaviour changes drastically in a confined space in comparison to their corresponding bulk phase. A confined space also available to trap/encapsulate a guest molecule. In an artificial system, such confined space also termed as cavity formed through judicial choice of either only organic ligand (termed as capsule) or with suitable metal-ion (termed as metallacapsule). Molecular capsule formed by non-covalent interactions gets benefit of reversible assembly in response to an external stimulus through dynamic self-assembly.

In this presentation we will discuss about encapsulation of notorious and toxic nitrate anion and their role in the formation and isolation of single isomer, formed by photochemical [2+2] cycloaddition reaction (Figure 1) with mechanistic point of view.

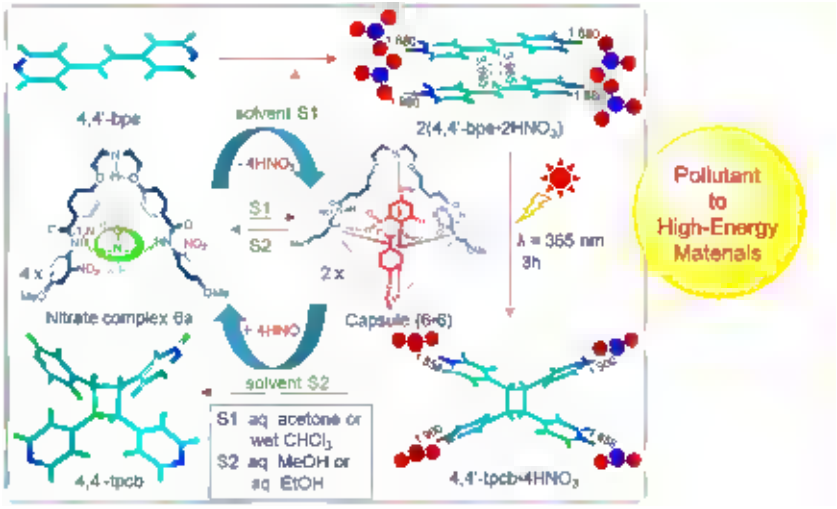

Figure 1. Schematic representation of nitrate anion promoted photochemical [2+2] cycloaddition reaction assisted by N-bridged ligand.

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PP06

Role of anion•••π interactions in photochemical [2+2] cycloaddition reaction

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Anion•••π interactions play crucial role in biological metabolism. In an artificial system also, such interactions have been explored in sensing and catalysis. In this presentation, we will discuss their role as template in photochemical [2+2] cycloaddition reaction to form four-membered cyclic ring. Hydrogen atom of such four membered ring is very sensitive to pH and temperature. At present, the main problem is removal of template after photochemical [2+2] cycloaddition reaction. Anion (as template) can be removed easily. The complete process and role of anion•••π interactions will be discussed in present conference.

Key words: Anion•••π interactions, photochemical [2+2] cycloaddition reaction, hydrogen bond.

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PP07

Graphene Oxide-Enhanced Metal-Polymer Composites for High-Performance Direct Ethanol Fuel Cells

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Direct ethanol fuel cells (DEFCs) have gained significant attention as promising energy conversion devices due to their high energy density and environmental benefits. However, their performance is often limited by sluggish electrode kinetics, catalyst degradation, and poor ionic conductivity. To address these challenges, this study explores the integration of graphene oxide (GO) into a metal-polymer composite to enhance the electrochemical performance of DEFCs. The incorporation of GO into the composite structure improves electron transfer, increases catalytic activity, and enhances proton conductivity, leading to superior fuel cell efficiency. Additionally, the metal-polymer matrix ensures mechanical stability and optimizes ionic transport. The synergistic effect of GO with metal catalysts, such as platinum or palladium, enhances ethanol oxidation reaction (EOR) kinetics, mitigating issues related to carbon monoxide poisoning. The composite also exhibits improved corrosion resistance and long-term operational stability. Electrochemical characterizations, including cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS), and single-cell performance tests, confirm the enhanced catalytic efficiency and fuel cell performance. This study highlights the potential of GO-integrated metal-polymer composites as a promising strategy for next-generation DEFCs, providing insights into material design for efficient and durable energy conversion systems.

Keywords: Graphene oxide, Metal-polymer composite, Direct ethanol fuel cell, Electrocatalysis, Proton conductivity, Ethanol oxidation reaction, Energy conversion, Corrosion resistance.

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PP08

Review on Triazoles, Thiadiazoles, and Schiff Bases as Organic Corrosion Inhibitors for Mild Steel in Acidic Media

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Corrosion of mild steel in acidic environments poses a significant challenge, particularly in industrial applications that involve acid usage. The application of organic inhibitors has gained substantial attention due to their effectiveness in mitigating corrosion. Compounds such as triazoles, thiadiazoles, and Schiff bases have been extensively researched for their inhibition mechanisms and adsorption behaviors. This review consolidates existing literature on the efficiency of these inhibitors, examining both experimental findings and computational studies. The discussion is supplemented with data, figures, and tables to illustrate inhibitor types, efficiencies, and mechanisms of action.

Keywords: Corrosion inhibition, mild steel, acidic media, organic inhibitors, triazoles, thiadiazoles, Schiff bases

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PP09

Anticancer Properties of Metal Complexes: A Review

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Metal complexes have emerged as promising candidates in cancer therapy due to their unique mechanisms of action, high selectivity, and potential to overcome drug resistance. This review explores the anticancer properties of metal-based compounds, focusing on platinum, ruthenium, gold, and copper complexes. Platinum-based drugs, such as cisplatin, have revolutionized chemotherapy by inducing DNA damage and apoptosis in cancer cells. Ruthenium complexes offer lower toxicity and greater tumor selectivity, while gold compounds exhibit potent anti proliferative effects by targeting thiol-containing biomolecules. Copper complexes show promising redox based cytotoxicity, disrupting cancer cell metabolism. Spectroscopic and biochemical studies reveal that these metal

complexes interact with biomolecules, modulate signaling pathways, and induce oxidative stress, leading to selective cancer cell death. The review also discusses recent advancements in metal complex design, including ligand modifications to enhance efficacy and reduce side effects. By understanding the molecular mechanisms of metal-based anticancer agents, researchers can develop more effective and targeted therapies for cancer treatment.

Keywords: Proliferative Effects Metal Complexes, Cytotoxicity, Anti

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PP10

Efficient Removal of Methylparaben via Photocatalytic Degradation Using Mn.GO@NiS Nanocomposite

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There has been a steady increase in the production and use of personal care products for self -care activities in the past decades. Both terrestrial and aquatic habitats have become extremely polluted as a result of the trend. Therefore, the development of effective and sustainable degradation techniques is essential due to the growing environmental concerns. The present work involves the fabrication of Mn.GO@NiS nanocomposite by chemical co-precipitation. UV-Visible and Fourier transform infrared spectroscopy (FTIR) have been used to characterise the Mn.GO@NiS (0.5 - 2%) nanocomposites. The photocatalytic degradation efficiency of Mn@NiS, GO@NiS and Mn.GO@NiS (0.5 - 2%) nanocomposites has been examined for the methylparaben (MeP) under induced visible light irradiation. The effect of induced visible light irradiation has a remarkable impact on the degradation efficiency. The Mn.GO@NiS nanocomposite with 2% doping has exhibited significant degradation of MeP in comparison to Mn.GO@NiS, GO@NiS, and Mn.GO@NiS (0.5 - 1.5%), pure NiS. The nanocomposite Mn.GO@NiS with 2% dopant concentration exhibits more than 90% degradation of MeP within 120 minutes. The increased surface area, improved charge separation and efficient electron transfer characteristics of Mn.GO@NiS nanocomposite improved the overall performance of the catalyst.

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PP11

Green Synthesis of Nanoscale Zinc Stannate Perovskite for Bionanocomposite-Based Triboelectric Nanogenerators in Sustainable Energy Harvesting

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The depletion of fossil fuels and increasing energy demands highlight the urgent need for sustainable energy solutions. Triboelectric nanogenerators (TENGs) have emerged as a promising technology for converting mechanical energy into electrical energy through electrostatic induction and friction. However, challenges persist in optimizing the physicochemical properties of dielectric layers and reducing the reliance on non-biodegradable materials. To address these concerns, bio-TENGs incorporating biocompatible and renewable materials, such as biodegradable metals and natural polymers, are gaining attention for their environmental sustainability and cost-effectiveness. This study focuses on the green synthesis and comprehensive characterization of nanoscale zinc stannate perovskite for its application in bionanocomposite-based TENG devices. Various synthesis parameters are optimized, and detailed morphological, physicochemical, and optical properties are explored. By utilizing waste-derived biomaterials, bio-TENGs not only enhance green energy harvesting but also contribute to mitigating electronic waste, supporting the development of a smart and sustainable society.

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PP12

Hydrothermal Process-Driven Luminescence Characteristics of Sulfur Quantum Dots and Their Nanocomposites for Optical Display Applications

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Semiconductor quantum dots (QDs) possess exceptional size-dependent optical properties, making them highly suitable for applications in LEDs, solar cells, lasers, bioimaging, and

sensing. However, their commercialization is hindered by the toxicity of heavy metals. Sulfur quantum dots (SQDs), a novel class of metal-free luminescent nanomaterials first discovered in 2014, have emerged as a promising alternative due to their biocompatibility, ease of synthesis, and outstanding optical properties. SQDs have demonstrated significant potential in antibacterial, bioimaging, and optoelectronic applications. Despite their advantages, synthesizing high-quality SQDs remains challenging due to time-intensive methods and difficulties in controlling size and surface properties. This study presents a facile, cost-effective, and scalable approach for synthesizing luminescent SQDs. The hydrothermal process is optimized within a temperature range of 110–220°C using sublimated sulfur powder with polyvinylpyrrolidone (PVP) as a surface passivating agent. The influence of hydrothermal process on the optical and fluorescence characteristics of SQDs is systematically investigated. Additionally, a biodegradable nanocomposite has been developed to explore its potential in optical display applications, demonstrating the versatility and sustainability of SQD-based materials in next-generation optoelectronics.

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PP13

Pharmacological and DFT Analysis of Acetylenic Pendant-Substituted Xanthenones: Elucidating Electronic Properties and Drug-Likeness

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The current paper evaluates three substituted xanthenones with acetylenic pendants synthesized beforehand, from the electronic and pharmacological standpoints. Parameters include basic electronic parameters: the dipole moment, energy, electronegativity, the global softness, electrophilicity, and the capacity for electron transfer computed by means of DFT simulations using the 6-311G basis set. Other than that, further pharmacological testing of the molecules was found by SWISS ADME software, drug-likeness, GI absorption, BBB permeability, and synthetic accessibility. All the compounds have excellent properties, such as very high GI absorption, valid BBB permeability, a bioavailability score of 0.55, and their adherence to all five criteria of drug-likeness. and a TPSA of about 48 Å^2. Compound 3, with combines -Cl and -CH3 substituents, exhibited exceptional pharmacokinetic and electronic properties, implying that it might represent an appealing choice for additional medicinal chemistry research.

Keywords: Xanthenones, DFT, SWISS ADME, drug-likeness, electronic properties

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PP14

Allosteric control in Supramolecular Catalysis

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Weak non-covalent interactions play crucial role in molecular assembly/disassembly process. With judicial choice of component(s) for assembly/disassembly process, the resulting complex may yield worthful material of tremendous importance. Non-covalent interactions provide ample opportunity to have a control over assembly/disassembly process. By tunning such control, the catalytic site may be controlled which in turn may yield worthful products. In this presentation, we will highlight the role and significance of such assembly/disassembly in controlled supramolecular catalysis for synthesis of polymers of finite length, depending upon the duration of open catalytic site. The complete process will be explained from mechanistic point of view.

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PP15

Thermodynamic investigation of binary mixtures containing isomeric picolines with alcohol

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Density and Speeds of sound, u data of isomeric picolines (i) + alcohol (j) binary mixtures have been measured as a function of composition using an Anton Parr vibrating-tube digital density and sound analyzer (model DSA 5000) at 298.15K, 303.15K 308.15K. The resulting Speeds of sound and density data of (i+j) binary mixtures have been utilized to determine isentropic compressibility changes of mixing K_S^E , and excess molar volumes V^E. The observed data have been analyzed in term of Graph theory. It has been observed that K_S^E and V^E values predicted by Graph theory compare well with their corresponding experimental values.

Keywords: Excess Molar volumes, V^E and isentropic compressibilities changes of mixing, K_S^E, interaction parameter, χ. connectivity parameter of third degree $^3\xi$

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PP16

Surface Functionalized Magnetic Nanoparticles: Synthesis and Applications

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During the past few decades, nanotechnology has become one of the most promising technologies in all areas of science. A variety of nanomaterials with unique functionalities such as nanoadsorbents, nanocatalysts, nanostructured membranes, have been considered as efficient, economical, and environmental-friendly substitutes to the current wastewater treatment agents. During the past few years a lot of work on magnetic nanoparticles and their utility in various fields has been published. The synthesis of magnetic nanoparticles has been reported using various methods including co-precipitation, sol gel and hydrothermal methods. In the present work, magnetic nanoparticles have been synthesized using a simple and cost-effective technique i.e. co-precipitation method using salts of Fe^{2+} and Fe^{3+} in molar ratio of 1:2 under non-oxidizing environment. Various techniques were used to characterize these nanoparticles. Surface modified magnetite nanoparticles have displayed their potential applications in removal of contaminants including dyes and pesticides residues from aqueous solution.

Keywords: Co-precipitation, Nanotechnology, Magnetic nanoparticles, Nanomaterials.

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PP17

A Comprehensive Review: Synthetic Pathways to Imidazole

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Imidazoles are a class of heterocyclic compounds with a five-membered ring structure containing two nitrogen atoms, which have garnered significant attention due to their diverse biological activities and extensive applications in drug development. This review explores the synthetic pathways for imidazole derivatives, including cyclo-condensation, multicomponent reactions, and metal-catalyzed approaches, highlighting their efficiency, selectivity, and sustainability. The biological activities of imidazoles, such as antimicrobial, antifungal, anticancer, anti-inflammatory, and antiviral properties, are discussed, emphasizing their mechanisms of action and therapeutic potential. Imidazole-based drugs, includingketoconazole, metronidazole, and cimetidine, exemplify their clinical relevance in treating various diseases. Furthermore, the role of imidazoles in drug development is examined,focusing on their use as pharmacophores and their ability to interact with biological targets,such as enzymes and receptors. The futuristic approach to imidazole synthesis involves leveraging green chemistry, nanotechnology, and computational tools to design novel derivatives with enhanced efficacy and reduced toxicity.Advances in artificial intelligence and machine learning are also explored for predicting biological activities and optimizing synthetic routes. This article underscores the importance of imidazoles in medicinal chemistry and provides insights into innovative strategies for their synthesis and application, paving the way for the development of next-generation therapeutics. The integration of synthetic chemistry, biology, and technology holds promise for addressing unmet medical needs and advancing personalized medicine.

Keywords: Heterocycles, Synthetic methods, Imidazole, Biological activity, Coupling, Cyclization

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PP18

Chemistry of flavonoids with special reference to pharmacology

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Several current and most traditional medications have been derived from natural sources. Flavonoids, also known as bioflavonoids, are the most common polyphenolic chemicals

found in plants and fungi. Apart from their biological functions in plants (protection against herbivores, UV radiation, and diseases), they also have a wide range of therapeutic actions in humans. Though flavonoids are not recognized as nutrients, their frequent consumption is considered beneficial to human health. Flavonoids are biosynthesized using the phenylpropanoid pathway and have a C6-C3-C6 carbon structure. The current review examined the chemistry, structure, and classification of flavonoids. Additionally, their incidence and chemical properties have been investigated. Furthermore, we address the several ways by which flavonoids work, such as direct radical scavenging, leukocyte immobilization, and interaction with different enzymes. Flavonoids have a variety of pharmacological effects, including anti-parkinson, anti-ulcer, spasmolytic, anti-depressant, antibacterial, antihypertensive, anti-diabetic, anti-inflammatory, and anti-cancer properties. This review aims to provide healthy information for the development of new flavonoid-based pharmacological formulations to combat various ailments.

Keywords: Flavonoids, Polyphenolic compound, Pharmacological activity, Mechanism, Biosynthesis.

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PP19

Green Catalyst-Assisted Functionalization of Microwave-Exfoliated Graphene oxide with Amine and Ester groups for sensor application

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Microwave-exfoliated graphene oxide (MEGO) has emerged as a promising material for sensor applications due to its high surface area, excellent electrical conductivity, and tunable surface chemistry. In this study, MEGO was functionalized with amine and ester groups using a green and efficient synthetic route employing 1,1,3,3-tetramethylguanidine (TMG) and 1,5-diazabicyclo non-5-ene (DBN) as dual catalytic ionic (DCI) green catalysts. The functionalization process was optimized to enhance the dispersibility, stability, and reactivity of MEGO while maintaining its desirable electronic properties. Fourier-transform infrared spectroscopy (FTIR), Raman spectroscopy, SEM, X-ray photoelectron spectroscopy (XPS), and zeta potential confirmed the successful grafting of amine and ester groups onto MEGO. Amine and Ester functionalization of Graphene oxide is done using para-chlorobenzoic acid and 1,1'-carbonyldiimidazole (CDI) respectively. CDI used for

ester functionalization, at room temperature, generates much less by products and the main by product it produces is imidazole which is easier to handle. Electrochemical characterization revealed improved charge transfer characteristics, making the functionalized MEGO highly suitable for sensor applications.

Key words: Microwave exfoliated GO, DCI catalysts, Amine and Ester functionalization, Sensor application.

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PP20

Exploring the antimicrobial and antituberculosis potential of diorganotin (IV) complexes derived from hydrazone ligands: Synthesis and their structural elucidation

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In our present work, we have synthesized four diorganotin(IV) complexes (R_2SnL where, R = methyl, ethyl, butyl and phenyl groups) from hydrazone ligand, which was derived from 4-nitro-3-methoxybenzhydrazide and benzaldehyde derivatives. Hydrazones are classified as "privileged ligands" due to their ability to readily bind with metal ions. They exhibit exceptional affinity for complexation owing to their favourable solubility, robust stability, facile synthesis, and the presence of the (–NH–C=O) group in close proximity to the azomethine group, rendering them effective chelating agents. Organotin (IV) complexes incorporating hydrazone components hold significant relevance in the pharmaceutical industry. All the prepared compounds were characterized with the help of numerous spectroscopic techniques like FT-IR, (^1H, ^{13}C & ^{119}Sn) NMR, and Mass spectrometry. Spectroscopic analysis indicated a penta-coordinated configuration around the tin metal atom, with the ligand binding to the tin atom in a tridentate manner through enolic O, imine N, and phenolic O donor atoms. Furthermore, the synthesised compounds have been analysed for their *in vitro* antituberculosis and antimicrobial efficacy and the results were compared with values of standard drugs. The findings illustrated that diorganotin(IV) complexes exhibited superior activity as compared to their parent ligand. The results depicted that compound [Ph_2SnL] with MIC = 0.0195 ± 0.0048 µmol/mL value showed greater potential against *E. coli* and *C. albicans* strains.

Keywords: Hydrazone ligand; Diorganotin (IV) complexes; Antimicrobial efficacy; antituberculosis study

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