SOUVENIR

NATIONAL CONFERENCE
ON
ADVANCED TECHNOLOGIES & INNOVATIONS IN BIOENERGY

22ND FEBRUARY 2025

ORGANIZED BY

BECS

BIO ENVIRO CHEMICAL SOLUTIONS PVT. LTD.

(An ISO 9001 , 14001 : 2015 Certified R & D Lab)

Chinna Waltair , Visakhapatnam - 530017

INDIA

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DR.B.SATHISH MOHAN

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Chinna Waltair , Visakhapatnam - 530017

INDIA

National Conference On Advanced Technologies and Innovations in

22 Feb, 2025

Venue

IEI Visweswarayya Bhawan
Near RTC Complex
Visakhapatnam-530016, A.P., India

Organized by

Bio Enviro Chemical Solutions

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Visakhapatnam – 530017

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About Conference

BioEnergy is a critical field in the current energy landscape, offering sustainable solutions to our growing energy needs. This conference aims to provide an in-depth understanding of BioEnergy, its technologies, applications, and future prospects. The target audience includes students, researchers, industry professionals, and policymakers interested in renewable energy solutions. Through keynote speeches, panel discussions, and interactive sessions, the seminar will provide a platform for sharing knowledge, fostering collaboration, and developing strategies to overcome obstacles and accelerate the adoption of BioEnergy as a viable alternative to fossil fuels. This conference is poised to contribute significantly to the ongoing discourse on renewable energy, promoting sustainable practices, and inspiring new initiatives in the field of BioEnergy. For more information https://reddytesting-com.stackstaging.com/

About ORGANIZATION

Bio Enviro Chemical Solutions (BECS) is a promising R&D Laboratory in Andhra Pradesh, established in 2021 with the aim of pursuing sustainable solutions in the field of environmental sciences. BECS has accredited by *ISO 9001:2015* & *14001* certifications, recognized by MSME, NSIC and APPCB, also have NSDC, APSSDC and Skill India accreditations. BECS has a great professional team of 14 doctorates covering multidisciplinary science (life science, chemical science, environmental science, physics and engineering). BECS has published 23 research papers, 3 Books and completed 80+ UG/PG projects successfully. BECS developed new materials or composites, enzymes, drugs and significant methods to solve the environmental issues.

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INVITED SPEAKERS

Sri. Thota Subrahmanyam

Managing Director
Elite Natural Oils and Fuels Pvt. Ltd

Dr. B. Kishore Babu

Associate Professor
Dept. of Engineering Chemistry, Andhra University, Visakhapatnam

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THEMES

- ❑ Solar Energy/Wind Energy/ Hydro Energy
- ❑ Biodiesel/Biofuel/Biogas/BioEthanol
- ❑ Agricultural waste/Forest residues/Algae/ Municipal solid waste
- ❑ Combustion/Gasification/Pyrolysis/ Fermentation/ Anaerobic digestion
- ❑ Biodiversity and ecosystems/Chemical processes
- ❑ Analysis/Purification/Marketing strategy
- ❑ waste from Food/pharmaceuticals/sludge

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GUIDELINES

- ❖ The abstract should not exceed 250 words in MS Word Document.
- ❖ Poster presentation should not exceed 1X1 mm in size.
- ❖ Title, Authors name, Designation, Institution Address, Mail ID & Phone number and Abstract, should be stated clearly.
- ❖ Times New Roman, font size 12 & 1.5 line spacing, not exceeding 4000 words for full manuscript.
- ❖ The Editorial Committee will review the abstract and full papers.
- ❖ Full manuscript will be published in **Scopus** journals 2025.
- ❖ Abstracts will be published in **Book** with ISBN **978-81-970874-6-21**

Awards

- ❑ Best Oral - 02
- ❑ Best Poster - 02
- ❑ Best Entrepreneur - 01

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Industrialist	: Rs. 2000/-	100

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IMPORTANT DATES

Abstract Submission Deadline : Feb 15, 2025
Acceptance Abstract mail : Feb 17, 2025
Full paper Submission : Mar 15, 2025

For Queries:

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Associate Professor

Department of Engineering Chemistry, Andhra University

- Convener

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Contd.

Advanced Technologies and Innovations in BioEnergy

THEMES

Biofuels • Bioethanol • Biodiesel • Biobutanol • Production processes and technologies • Applications in transportation and industry	**Biogas** • Production and purification • Applications (electricity generation, heating, transportation) • Biogas upgrading and utilization
Bioelectricity • Generation technologies • Integration with the grid • Distributed generation	**Biomass Resources** • Agricultural waste • Forest residues • Algae • Municipal solid waste
Conversion Technologies • Combustion • Gasification • Pyrolysis • Anaerobic digestion • Fermentation	**Innovations in BioEnergy** • Advances in biotechnology • Emerging technologies • Future trends and research directions
Environmental Impacts • Greenhouse gas emissions reduction • Impact on biodiversity and ecosystems • Waste management and recycling benefits	**Sustainability and Life Cycle Assessment** • Environmental sustainability • Economic sustainability • Social sustainability
➢ Solar Energy	➢ Energy storage solutions
➢ Wind Energy ➢ Hydro Energy	➢ Smart grids and decentralized energy systems

Dr.Sathish Mohan Botsa

Managing Director
Bio Enviro Chemical Solutions Pvt.Ltd.
Visakhapatnam

FOREWARD

It is my great privilege to welcome you all to the **National Conference on Advanced Technologies and Innovations in BioEnergy on 22 February 2025**, a premier platform dedicated to advancing research, innovation, and sustainable solutions in the field of bioenergy. As we navigate the urgent need for cleaner energy alternatives, this conference brings together esteemed scientists, industry experts, academicians, and policymakers to collaborate and drive transformative change in the bioenergy sector.

With a focus on cutting-edge advancements, from biofuels and biomass valorization to waste-to-energy strategies and novel biotechnological approaches, this event will serve as a catalyst for knowledge exchange and groundbreaking discussions. Our aim is to foster meaningful collaborations that will not only address global energy challenges but also contribute to India's sustainable energy goals.

I extend my heartfelt gratitude to all the distinguished speakers, researchers, and participants who are contributing to this important dialogue. Your insights and innovations will shape the future of bioenergy and inspire the next generation of sustainable energy solutions.

I look forward to an enriching and impactful conference.

(Dr. Sathish Mohan Botsa)
Convener, National Conference on BioEnergy

Sri.Thota Subrahmanyam

Managing Director
Elite Natural Oil and Fuels Pvt.Ltd.
Kakinada

MESSAGE

I am honored to be the keynote speaker at the **National Conference on Advanced Technologies and Innovations in BioEnergy on 22 February 2025**, a gathering of brilliant minds dedicated to shaping a sustainable energy future. As the world faces pressing challenges in energy security and climate change, bioenergy stands as a vital pillar in the transition toward cleaner, renewable alternatives. This conference is a crucial platform for researchers, policymakers, and industry leaders to exchange groundbreaking ideas, discuss innovations, and explore practical solutions in bioenergy technologies. From biomass valorization to biofuels and waste-to-energy strategies, our discussions will shape the roadmap for a greener tomorrow. Let us seize this opportunity to collaborate, innovate, and drive impactful change.

I look forward to engaging with all of you in meaningful discussions that will inspire action and advance the bioenergy sector. **The future of sustainable energy depends on our collective commitment to research, development, and implementation of cutting-edge bioenergy solutions.** By fostering interdisciplinary collaboration and leveraging technological advancements, we can unlock the full potential of bioenergy and contribute to a resilient and carbon-neutral future. Let this conference be a catalyst for transformative ideas and long-term impact in the global energy landscape.

Best Regards

(Thota Subrahmanyam)

Managing Director

Dr.B.Kishore Babu

Associate Professor
Department of Engineering Chemistry
Andhra University, Visakhapatnam

MESSAGE

Dear Esteemed Delegates, Researchers, and Industry Experts, It is my great honor and privilege to address you all at the National Conference on **Advanced Technologies and Innovations in BioEnergy,** a significant platform that brings together brilliant minds working towards a sustainable energy future. Bioenergy has emerged as a crucial component in our global efforts to transition toward renewable and environmentally responsible energy solutions. With the increasing demand for cleaner energy sources, the role of biofuels, biomass conversion, and innovative biotechnological approaches has never been more critical. This conference serves as an excellent opportunity to deliberate on recent advancements in Green nanotechnology, including next-generation biofuels, biorefineries, waste-to-energy technologies, and their socio-economic impacts. It is imperative that we adopt cutting-edge strategies such as genetic engineering, metabolic optimization, and artificial intelligence-driven process enhancements to maximize energy yields while ensuring environmental sustainability.

As an academic deeply engaged in research and development, I believe that interdisciplinary collaboration and industry-academia partnerships will be the driving forces in accelerating bioenergy innovation. India, with its vast agricultural resources and scientific expertise, has the potential to lead the global bioenergy revolution. Together, through discussions, knowledge exchange, and policy recommendations, we can pave the way for sustainable and scalable bioenergy solutions that benefit both the economy and the environment. I extend my heartfelt gratitude to the organizers for this invitation, and I look forward to engaging in meaningful discussions with all participants. Let us work together to shape a future where bioenergy becomes a pillar of sustainable development.

Wishing you all a productive and inspiring conference

(Dr. B. Kishore Babu)

INVITED TALKS

INVITED TALK-1

Biodiesel – An alternative to Sustainable Energy

Thota Subrahmanyam

Elite Natural Oils and Fuels Pvt.Ltd

The growing demand for sustainable and renewable energy sources has led to significant advancements in biofuel technology, with biodiesel emerging as a key alternative to conventional fossil fuels. Biodiesel is a biodegradable, non-toxic, and eco-friendly fuel derived from renewable resources such as vegetable oils, animal fats, and waste cooking oils. It offers significant environmental benefits, including reduced greenhouse gas emissions, lower carbon footprint, and improved energy security.

This presentation explores the production, benefits, and challenges of biodiesel, with a focus on feedstock selection, transesterification processes, and fuel properties. Additionally, the economic and policy aspects influencing biodiesel adoption will be discussed, particularly in the context of India's renewable energy goals. Case studies of biodiesel plants, their operational efficiency, and potential for scalability will be highlighted to demonstrate real-world applications.

The presentation aims to provide a comprehensive understanding of biodiesel technology, its role in mitigating climate change, and the opportunities for integrating biodiesel into mainstream fuel markets. Emphasis will be placed on innovation, research advancements, and policy frameworks that can drive the transition towards a greener and more sustainable future.

Keywords: Biodiesel; Transesterification, Renewable energy, Sustainable energy.

INVITED TALK-2

GREEN NANOTECHNOLOGICAL APPROACHES FOR BIO ENERGY STORAGE AND CONVERSION

Dr. B. Kishore Babu
Associate professor,
Dept of Engineering Chemistry

Innovative, sustainable solutions are required due to the growing global energy demand, environmental degradation, and the depletion of fossil fuels. By combining environmentally friendly nanomaterials and procedures, green nanotechnology becomes a revolutionary way to enhance the production of bioenergy. With an emphasis on the creation of nanomaterials such as nanoparticles, nanocomposites, and nano catalysts made via sustainable processes (e.g., plant-mediated or microbial pathways), this paper investigates the potential for synergy between nanotechnology and bioenergy systems. By maximizing biomass conversion, enzymatic hydrolysis, fermentation, and microbial fuel cell efficiency, these nanomaterials improve the production of bioenergy.

Applications include algal biofuel systems improved by nanoparticles, nanostructured electrodes for bioelectricity, and nano catalysts for biodiesel synthesis. Green nanotechnological approaches lower greenhouse gas emissions, waste production, and process energy inputs in addition to increasing energy yields. Additionally, they make it possible to value biomass from lignocellulosic and organic waste, which is consistent with the ideas of the circular economy. Notwithstanding their potential, issues including scalability, cost-effectiveness, and long-term environmental effects need more research. Through interdisciplinary research and policy assistance, green nanotechnology can help overcome these obstacles and accelerate the shift to a low-carbon, resilient energy future. This study emphasizes how important sustainable nanoscale developments are to attaining environmental sustainability and energy security.

Keywords: Green Nanotechnology, Bioenergy, Sustainability, Fossil fuels.

ORAL
&
POSTER
PRESENTATIONS

P 1

FUTURE SCOPE AND CHALLENGES IN BIOENERGY

Sathish Mohan Botsa

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Bioenergy has emerged as a crucial alternative to fossil fuels, offering sustainable energy solutions with reduced environmental impact. As global energy demands continue to rise, bioenergy plays a pivotal role in the transition towards a low-carbon economy. The future scope of bioenergy encompasses advancements in feedstock utilization, bioconversion technologies, and integration with existing energy infrastructure. Innovations in biofuels, biogas, and biomass-based power generation have the potential to enhance energy security and mitigate climate change.

Despite its promising potential, bioenergy faces several challenges. The availability and sustainability of biomass feedstocks remain a significant concern, as large-scale production can lead to competition with food crops and land-use changes. Technological limitations in biomass conversion processes, including efficiency, cost-effectiveness, and scalability, hinder widespread adoption.

To overcome these challenges, future research should focus on improving the efficiency of bioenergy technologies, developing cost-effective and scalable solutions, and implementing sustainable biomass sourcing strategies. The integration of artificial intelligence, biotechnology, and nanotechnology in bioenergy systems can further enhance process efficiency and output. Additionally, strong policy support, financial incentives, and international collaborations are essential to accelerate the adoption of bioenergy solutions worldwide.

Keywords: Bioenergy; Sustainable energy; Nanotechnology; Biotechnology; AI.

P 2

ADVANCEMENTS IN NANOMATERIALS FOR SOLAR ENERGY APPLICATIONS: CHALLENGES AND FUTURE PERSPECTIVES

B. Jagan Mohan Reddy[1]* K. V. B. Ranjitha[1], Shiva Kishna Loke[2] and K. V. S. R Seshu Kumar[1]

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Nanomaterials increased stability, efficiency and affordability have completely changed the use of solar energy. Due to their distinct physicochemical characteristics such as their large surface area, adjustable bandgap, and superior charge transport capabilities photovoltaic cells, solar-driven water splitting, and solar thermal energy conversion have advanced significantly. Quantum dots, perovskite nanocrystals, plasmonic nanoparticles, and nanocomposites are among the materials that have shown great promise in enhancing energy conversion, reducing recombination losses, and improving light absorption. The problems of stability, large-scale synthesis, and environmental effect still pose serious obstacles in spite of recent developments. The development of scalable, affordable, sustainable nanomaterials with improved performance and durability is the main goal of future research. The integration of artificial intelligence and machine learning in material design, along with the exploration of novel nanostructures, holds great promise for the next generation of solar energy technologies. This review highlights recent progress in nanomaterials for solar energy applications and discusses emerging trends and future perspectives for achieving a sustainable energy landscape.

Keywords: Nanomaterials; solar energy; artificial intelligence; machine learning.

P 3

OPTIMIZATION OF DRYING TEMPERATURES FOR ENHANCED BIODIESEL PRODUCTION FROM WATER HYACINTH (EICHHORNIA CRASSIPES)

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This research explores the extraction of biodiesel from water hyacinth (Eichhornia crassipes), focusing on optimizing drying temperatures to improve both yield and fuel quality. Water hyacinth samples were collected from local ponds in Vadlamudi village, near Vignan's University. A total of 1500 grams of biomass was processed through three replications, with drying temperatures of 120°C, 130°C, and 140°C for 6 hours. The dried biomass underwent NaOH treatment for delignification, followed by immersion in 900 ml of hexane for lipid extraction. The resulting biodiesel yield and quality were evaluated based on density, viscosity, flash point, acid value, water content, and cetane number. Results showed that increasing the drying temperature improved the biodiesel yield, reaching 160 ml at 140°C compared to 140 ml at 120°C. Additionally, higher temperatures resulted in improved fuel quality, as indicated by lower acid values and water content, alongside increases in cetane number and flash point. These findings highlight the potential of water hyacinth, a locally available and invasive aquatic plant, as a viable feedstock for biodiesel production, with optimized conditions yielding better-quality fuel. Further research is needed to assess the feasibility of large-scale production.

Keywords: Biodiesel, Water Hyacinth, Drying Temperature, Lipid Extraction, Fuel Quality, Biomass

P 4

A Review of Lithium Recycling Technology Research for Sustainable Future Requirements

Loke Shiva Krishna[1]* K. V. B. Ranjitha 2 B. Jagan Mohan Reddy [2]* **K. V. S. R. Seshu kumar**[2]

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Abstract:

To achieve sustainable power development and address climate change, it is expected that the entire lithium-ion (Li-ion) battery supply chain, encompassing mining to recycling, could expand by over 30 percent each year, eventually reaching a market size of 4.7 TWh and a value exceeding $400 billion. The main focus of research on recycling used lithium batteries is the recovery of valuable anode metals such as cobalt and lithium. The negative electrode of discarded lithium batteries can contain as much as 35% copper, a valuable raw material used in various applications. Lithium-ion batteries have become a crucial component of the energy supply chain in electric vehicles and systems for renewable energy storage. In this study, an overview of recycling technologies for lithium-ion batteries is provided, examining their technical and economic viability along with the environmental implications. The work highlights the existing knowledge gaps and outlines research needs necessary for advancing appropriate technologies. Additionally, an effort is made to establish criteria for an optimized value chain for lithium-ion batteries.

Keywords: Lithium-ion battery, renewable energy, environmental, recycling.

P 5

THE ROLE OF NANOMATERIALS IN BIOENERGY

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Currently the world is facing more problems in energy utilization due to growing human population. Our day-to-day life human beings are using so many things that are related energy. Harvesting of energy from renewable energy source like fossil fuels increasing the environment pollution and exhausting the fossil fuels, which leads the energy crises. With the rapid economic development, it is necessary to crucial expansion and consumption of sustainable energy sources like solar, water and wind power. This is significantly considered to be one of the greatest important substitutes to permit further fast social expansion and sustainable economic development. Researches are facing more problems on extracting the energy from these renewable energy sources and storage of this energy in storage devices to avoid energy crises. So, they are always inventing new materials for energy conversation and storage. Materials like Nanomaterials play a pivotal role in enhancing bioenergy technologies by improving the efficiency and sustainability of biofuel production, energy storage, and biomass conversion processes. Their unique properties at the nanoscale, such as increased surface area, reactivity, and conductivity, enable more efficient catalytic reactions in biofuel production, including the breakdown of cellulose and lignin into usable biofuels. Nanomaterials also enhance the performance of energy storage systems like batteries and supercapacitors, which are crucial for optimizing bioenergy applications. In addition, they are employed in improving bioreactor design by increasing microbial activity, promoting faster and more efficient conversion of organic matter into bioenergy. Nanomaterials also aid in the development of advanced technologies like microbial fuel cells and solar cells, further supporting the integration of bioenergy into sustainable energy solutions.This study explains the role of nanomaterials contribute to making bioenergy production more efficient, cost-effective, and environmentally friendly, helping to drive the future of renewable energy systems.

Keywords: Bioenergy, Nanomaterials, Renwableenergy sources, Biofuels

P 6

DYNAMIC MODELING OF AN ARTIFICIAL NEURAL NETWORK POWERED SOLAR PHOTOVOLTAIC SYSTEM FOR ELECTRIC VEHICLES

Vijaychandra Joddumahanthi[1*], Veda Prakash Kakinada[1], Sri Anjaneyulu Unnam, Vanajakshi Bammidi[1], Bhaskara Rao Ankam[1], Anil Kumar Alamanda[1], Nagamani Kalyampudi[1], T.Varun Kumar[2]

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Electric vehicle (EV) technology has become very popular across the globe and due to which massive research has been emerged into the picture. However, the absence of charging stations limits the global adoption of EVs. The global demand for power continues to rise significantly these days, and as fossil fuels eventually begin to run out, everyone is moving towards alternate energy sources, of which renewable energy sources are essential for supplying the needed power. The production of electricity through solar power generation is one of the main uses for renewable energy resources. Significant research has been done on control techniques for maximum power point tracking (MPPT) technologies in order to maximize the power output of PV systems. Conventional techniques have various drawbacks and hence intelligent controllers will be used. In this paper, maximum power point tracking system based on artificial neural networks was discussed.

Keywords: Electric vehicles, PV systems, Fossil fuels, Artificial Neural Network.

P 7

VERMICONVERSION OF TEXTILE INDUSTRIAL SLUDGE; MANAGEMENT AND NUTRIENTS RECYCLING

M. Mallikarjuna Rao

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Present study aimed on conversion of Textile Industrial Sludge (TIS) amended with the Cow dung into vermicompost operated by the epigenic earthworm *Eudriluseugeniae.* To accomplish the intent of the experiment we were allowed the substrate to decompose for 30 days, it was allowed under monitored environmental conditions.Total three different combinations were prepared($V_{25\%}$, $V_{50\%}$, and $V_{75\%}$,)from TIS, and compared with V_{agro}(vermicompost prepared from agricultural waste) and V_{soil}. Among all of the three treatments, $V_{75\%}$was shown as batter pohysico-chemical parameters for *Trigonella foenum* (Fenugreek/Methi) plant growth, seed germination, and leaves production in the tested pot. Maximum amount of Available NPK was recorded in $V_{75\%}$.On the other side toxic heavy metal (Cd, Cr, Cu, Mn, Pb and Zn) concentrations were diluted into minimum levels. The result advised that vermicomposting consider as one of the alternative methods for waste management and energy recovery from industrial waste.

Keywords: Textile industrial sludge, agricultural waste,toxic heavy metal, vermicomposting, energy recovery and waste management.

P 9

BIO ENERGY PRODUCTION FROM NANO IMMOBILIZED BIO CATALYST

P. Likitha[1], Dr. P. Sridevi[2], Dr. B. Ravibabu[3], T. Manasa[4] Dr. B. Kishorebabu[5]

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ABSTRACT:

One important prerequisite for the manufacture of biofuels, especially biodiesel and bioethanol, is the development of highly effective biocatalysts. By using nanoparticles as biocatalyst carriers, nanotechnology opens a way around the low efficiency of traditionally employed biocatalysts. The resulting nano biocatalysts are used as a tool to convert a variety of biomass-related compounds into biofuels. Novel nano biocatalysts can surpass the drawbacks of traditional biocatalysts, including mass transfer, poisoning, catalyst deactivation, and lengthy reaction times. Catalytic activity is boosted by nano biocatalysts, and this increased activity results from a larger surface to volume ratio can also serve as a catalyst for deoxygenation.

In order to boost the production of biofuel, high-quality, optimized, and conditioned nano catalyst systems, including metal oxide nanoparticles, magnetic nanoparticles, and carbon nanotubes, have been produced recently by utilizing contemporary tools for nanoparticle synthesis and characterization. Lipases and cellulases immobilized by nanomaterials are inevitably novel catalysts with exceptional qualities. The development of several nanomaterial-immobilized enzymes and their impact on biofuel generation are critically examined in this article. For businesses that produce biofuel to stabilize, ongoing research and development as well as innovative nano biocatalyst engineering are crucial.

Keywords: Nanoparticles, Bioenergy, immobilized enzymes

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ADVANCING BIOFUEL SUSTAINABILITY: ROLE OF BIOTECHNOLOGY IN ENHANCING EFFICIENCY AND PRODUCTIVITY

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The growing energy demands and environmental concerns necessitate a shift toward sustainable biofuel production, where biotechnology plays a crucial role in optimizing efficiency, scalability, and eco-friendliness. This review explores the integration of advanced biotechnological approaches including genetic engineering, metabolic engineering, and synthetic biology in enhancing biofuel production. Special emphasis is placed on the role of machine learning and life cycle assessment in improving microalgae cultivation and harvesting, making biofuels more viable and sustainable. Furthermore, this study critically examines the technological, ethical, social, and economic implications of biofuel production, offering a comprehensive perspective on its future prospects. By assessing both the opportunities and limitations of biotechnology-driven biofuel systems, this work aims to contribute to informed decision making and policy development, ultimately supporting a transition toward a cleaner and more resilient energy paradigm.

Keywords: Biotechnology, Biofuel, microalgae, cultivation, harvesting.

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BIO-DERIVED NANOCOMPOSITES FOR GREEN BATTERIES

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ABSTRACT:

Bio-inspired materials offer revolutionary potential for improving battery technology by taking inspiration from the complex structures and effective workings of natural systems. These materials seek to improve energy density, mechanical resilience, and electrochemical performance in batteries by mimicking the hierarchical architectures, self-healing characteristics, and optimized ion-transport pathways found in biological structures (such as plant vasculature, bone matrices, or cellular networks). However, major structural design issues prevent them from being used in practice. Important challenges include integrating multifunctional components without sacrificing conductivity or energy storage capacity, guaranteeing mechanical stability under cyclic loads, and reproducing nanoscale biological complexity using scalable synthetic processes. Furthermore, it is still crucial to strike a balance between economical manufacture and environmentally beneficial fabrication.

In order to overcome these obstacles, future perspectives emphasize the convergence of computational modeling, advanced manufacturing (such as 3D printing and bioassembly), and interdisciplinary cooperation. Technologies like self-repairing interfaces, adaptive morphing electrodes, and biomimetic solid-state electrolytes have the potential to revolutionize energy storage systems and bring them into line with sustainability objectives. In order to overcome these obstacles, engineering realism and nature-inspired creativity must be balanced. This will eventually open the door for high-performance, long-lasting, and ecologically friendly batteries that are necessary for electric cars and renewable energy systems.

Keywords: Nanocomposites, green synthesis, 3D printing

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SUSTAINABLE BIOENERGY PRODUCTION FROM FOOD WASTE IN INDIA: PATHWAYS, TECHNOLOGIES, AND POLICY PERSPECTIVES

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India faces significant challenges in managing its substantial food waste, which, if not properly addressed, leads to environmental degradation and resource inefficiency. This study explores the potential of converting food waste into bioenergy within the Indian context, aiming to contribute to a sustainable circular economy. We evaluate various technologies for transforming food waste into biofuels, such as biogas and biodiesel, and assess their applicability in India. The integration of black soldier fly larvae (BSFL) composting systems is examined as a means to enhance the efficiency of these processes. Our analysis considers the economic and environmental benefits of improved food waste management practices, including the reduction of greenhouse gas emissions and the promotion of renewable energy sources. We also discuss the challenges and opportunities associated with implementing these technologies on a large scale in India, taking into account supply chain logistics, technological feasibility, and societal attitudes towards waste and energy. Policy implications are addressed to support the development of sustainable waste-to-energy initiatives. This study underscores the importance of adopting integrated approaches to food waste valorization, positioning it as a critical component in India's transition towards a sustainable and circular economy.

Keywords: Food waste; BSFL; Bioenergy; Biogas; Biodiesel.

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ENVIRONMENTALLY FRIENDLY NANOFUNCTIONALIZED MATERIALS FOR BIODIESEL PRODUCTION

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ABSTRACT

The need for sustainable alternatives like biodiesel has increased due to the world's growing reliance on diesel engines and their harmful particulate matter emissions. This thorough analysis examines how nanotechnology can improve the manufacturing of biodiesel, with a particular emphasis on the processes of lipid extraction and transesterification. The move toward nanocatalysts is a result of issues with conventional catalysts, such as saponification, sluggish reaction rates, and environmental concerns. Because of their high surface-to-volume ratios, nanomaterials reduce the production of soap while increasing catalytic activity, stability, and reusability. Classified as acid (such as carbon nanotubes and sulfated metal oxides), base (such as calcium oxide and zinc oxide), bifunctional acid-base (such as calcium-boron oxides), and enzymatic (lipase-immobilized nanoparticles), heterogeneous nanocatalysts exhibit exceptional efficiency in transesterifying a variety of feedstocks, including waste oils and microalgae. While base variants provide fast reactions but require low levels of free fatty acid (FFA), acid nanocatalysts perform best in feedstocks with high FFA. Bifunctional catalysts overcome feedstock heterogeneity by enabling simultaneous esterification and transesterification. Despite their high cost, enzymatic nanocatalysts produce highly pure results in mild circumstances. By breaking down microalgal cell walls through mechanical interactions or the production of reactive oxygen species, nanotechnology also transforms lipid extraction, increasing yields while using less solvent. Notwithstanding these developments, issues including catalyst deactivation, economic feasibility, and nanoparticle toxicity still exist. Strict safety assessments are required due to the potential health and environmental hazards posed by nanoparticle leakage. In order to reduce publication bias and technical gaps, the study emphasizes the need for environmentally benign, recyclable nanomaterials and transdisciplinary research, while also aligning applications with the UN Sustainable Development Goals (SDGs 7, 9, 12, 13, 15). In order to guarantee sustainable biodiesel production, future directions will prioritize biodegradable supports, scalable synthesis, and lifecycle assessments. By overcoming these obstacles, nanotechnology can help close the gap between success in the lab and industrial adoption, promoting a more environmentally friendly energy transition.

Keywords: Biodiesel, Zinc oxide, nanoparticles

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METAMORPHIC SYNTHESIS AND PHYSICAL CHARACTERIZATION OF Ni^{2+} DOPED ZnO NANOSTRUCTURES FOR GAS SENSING APPLICATION

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Now-a-days the gas sensors were widely used in various applications in day-to-day research and development activities, industrial purposes Viz. The low temperature and low parts per million (ppm) level of gas sensing has very good importance in multiple applications in various fields. In this work, Hexagonal ZnO nanoparticles, Hexagonal ring structures and morphed nanostructures of Ni doped ZnO were synthesized from zinc and nickel metal chlorides by sol-gel method without use of any shape modified or arresting agents. The prepared nanoparticles are characterized for structural analysis by X-ray diffraction, composition by EDAX, band gap by UV-Visible spectroscopy, vibration modes by Raman Spectroscopy, thermal analysis by differential scanning calorimetry (DSC), morphology study by scanning electron microscopy (SEM) and size analysis by transmission electron microscopy (TEM). The observations made from above experimental techniques shows that, the influence of Ni doping on metamorphic behaviour, growth mechanism and replacement of the Zn have been studied. The Ni insertion had reduced the crystallite size from 30nm to 19nm and band gap variation is extended by doping from 3.30 eV to 3.64 eV (blue shift). The crystallite size is well correlated with TEM average particle size of 26nm. The SEM micrographs are noticed for the evidence of shape and matter-of-fact to metamorphic behaviour of ZnO having hexagonal, disk shape to broccoli like surface. Finally, an unsaturated volatile organic gas (VOC) namely acetylene gas sensing activity is tested for low ppm of 7 to 17 ppm at 1100C and compared with reported values of sensing performance of other gases by various transition metal doped and un-doped ZnO. The enhanced sensitivity achieved by 0.03 mol of Ni doped ZnO at1100C (13 ppm). It is an exemplary achievement for ZnO and Ni doped of ZnO.

Keywords: Sol-Gel, XRD, SEM, TEM, Gas Sensing.

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MULTIFARIOUS UTILIZATION OF LIGNO-CELLULOSIC BIOMASS

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Ligno cellulose is a complex plant material consists of lignin, cellulose and hemi cellulose. It is the most abundant biomass present in almost all agricultural residues. Processing of agricultural commodities separates the cellulosic biomass. If it is not properly treated, it may cause soil and environmental pollution. Research scientific findings suggest that proper treatment of this biomass turns into valuable resource in many ways. By blending with wood or alone, it can use in the manufacturing of paper. Syngas can produce through gasification process which can use further for heating or generation of electricity. It can convert into bio gas through anaerobic digestion of cellulose as a substrate. By the process of composting, organic biomass along with the other waste materials decomposes into organic fertilizers/ soil conditioners. It can process into bio ethanol/ bio diesel by fermentation or by transesterification method.

Keywords : Ligno cellulosic bio mass – gasification – compost – syngas

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A COMPREHENSIVE REVIEW ON WASTE MANAGEMENT AND RECYCLING PROCESSES: STRATEGIES, CHALLENGES AND INNOVATIONS

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Effective waste management and recycling are crucial for addressing the escalating environmental challenges posed by increasing waste generation and resource depletion. This comprehensive review examines strategies, challenges, and innovations in waste management and recycling. Traditional methods like landfilling and incineration are compared with modern approaches such as Waste-to-Energy, anaerobic digestion, and Material Recovery Facilities (MRFs). Key challenges, including economic constraints, environmental impacts, global infrastructure disparities, and technological limitations, are highlighted. The review also explores various recycling processes for materials like paper, plastics, glass, and metals, with a focus on advancements in chemical recycling and pyrolysis. Innovations such as smart waste management systems, sustainable materials, and public-private partnerships are proposed to enhance waste management and promote a circular economy. By synthesizing current knowledge and identifying emerging trends, this review aims to provide valuable insights for policymakers, practitioners, and researchers in advancing sustainable waste management practices.

Keywords: Anaerobic digestion; Smart waste; Environmental impact; Pyrolysis; Recycling

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METAL OXIDE MODIFICATION OF G. C_3N_4 FOR IMPROVED PHOTOCATALYTIC PERFORMANCE IN SOLAR ENERGY CONVERSION AND ENVIRONMENTAL CLEANUP

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The goal of this work is to modify graphitic carbon nitride (g. C3N4) with metal oxides to improve its photocatalytic activity for solar energy conversion and environmental remediation. The issue that needs to be addressed is that g. C3N4 has some limitations that prevent it from being widely used in solar-powered environmental cleanup procedures. These limits include low photocatalytic efficiency and a limited range of light absorption. Through the use of metal oxide modification, this study seeks to improve g. C3N4's overall photocatalytic activity by increasing light absorption and promoting charge separation. In order to clarify the structural and morphological changes brought about by the incorporation of metal oxide, the methods comprised the synthesis of metal oxide-modified g. C3N4 composites using an easy and scalable approach, followed by thorough characterization using a variety of spectroscopic and microscopic techniques. The findings show that, when compared to pure g. C3N4, the modified g. C3N4 composites significantly outperform it in terms of photocatalytic activity, with better organic pollutant degradation efficiency under solar radiation. The combined impacts of g. C3N4 and metal oxide components are responsible for the modified composites' increased charge separation efficiency and expanded light absorption range. To summarize, the modification of metal oxides appears to be a viable approach to enhance the photocatalytic activity of g. C3N4. This will enable its possible use in solar-powered environmental cleanup and solar energy conversion procedures, ultimately supporting sustainable development and environmental restoration initiatives.

Keywords: Metal oxide, modification, g. C3N4, photocatalytic performance, solar energy conversion, environmental cleanup.

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EFFECT OF Al^{3+} SUBSTITUTION ON THE FUNCTIONAL PROPERTIES OF CO-ZN FERRITE NANOPARTICLES BY HYDROTHERMAL METHOD

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The hydrothermal approach is used in this work to prepare the Al^{3+} substitution $Co_{0.3}Zn_{0.7}Al_xFe_{2-x}O_4$ (x = 0.2 – 0.8)/CZAF nanoparticals. The synthesized samples were examined for structural and functional characteristics using X-ray diffraction (XRD), photoluminescence (PL), UV-Vis spectrophotometer, and Fourier transform infrared spectroscopy (FTIR). The cubic spinel structure is confirmed by the XRD pattern. The crystallite size values range from 5.61 to 6.18 nm, increasing with substitution Al^{3+} concentration x, according to the Debye-Scherer formula. FT-IR confirms the existence of Metal-Oxides. Using a UV-visible spectrophotometer and the impact of Al^{3+} substitutions on Co-Zn ferrite (CZF) nanoparticles, the energy band gap of the sample was investigated. The samples' energy band gap decreases as the Al3+ content rises, from x = 0.2 to 0.8. Photoluminescence emission between 360 nm and 615 nm expose the radiative deficiencies and oxygen vacancies in the effect of Al^{3+} substituting CZF nanoparticles at room temperature.

Keywords: Aluminum, Cobalt-Zinc ferrite (CZF), Nanoparticles, Hydrothermal Method, Optical Property.

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INVESTIGATIONS ON THE FUNCTIONAL PROPERTIES OF Ba DOPED $CoTiO_3$ NANOPARTICLES BY HYDROTHERMAL METHOD

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In this work, we report the synthesis and characterization of Cobalt doped Barium titanate Co(x) Ba(1-x)TiO_3 by (x = 0.2, 0.4, 0.6, 0.8) samples were synthesized using hydrothermal technique and were characterized for structural studies using X-ray diffraction studies, FTIR, SEM with EDAX and TEM with SAED. The XRD spectrum analysis infers the samples to be crystalline in nature as well as mixed phased. The XRD spectral study of as synthesized samples further reveals their crystallization into the cubic and hexagonal structure with confirmed JCPDS 89-2475 and 82-1029. The intense reflection peaks witness the crystallinity and narrow full-width at half maximum indicates the higher average crystallite size. The average crystallite size calculated using Scherrer's formula was decreasing from 19.73 – 17.10 nm for increasing x = 0.2 -0.8. The additional structural studies of Co(x) Ba(1-x)TiO_3 by (x = 0.2, 0.4, 0.6, 0.8) samples were performed using FTIR spectrum. The peaks assigned to the Ba doped $CoTiO_3$ confirm its formation by hydrothermal technique. The corresponding bonding of materials was shown by the wavelength. Also, TEM result show high crystallinity of the synthesized materials. It has strong agreements with XRD result when powder is shows agglomeration in the crystals.

Keywords: Hydrothermal, Barium, Cobalt titanate, Structural Properties XRD, FTIR, TEM.

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STRUCTURAL AND FUNCTIONAL PROPERTIES OF Mg-Co NANOFERRITE BY HYDROTHERMAL METHOD

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In this study, the hydrothermal method has been used to the Mg-Co spinel ferrites with the chemical formula$Co_{1-x}Mg_xFe_2O_4$ (x = 0.2, 0.4, 0.6, 0.8) nanoparticles, which have been characterized using X-ray diffraction (XRD), Fourier transform Infrared spectroscopy (FTIR), UV-Vis spectrometer, photoluminescence and magnetic properties. XRD investigation confirms the cubic spinel structure, and the Debye-Scherer formula was used to determine the crystallite size, showing values of 33.477 to 34.635 nm. FTIR confirms the presence of all functional groups and A, B-site wave numbers are studied and these are responsible for the characteristic of spinel ferrites. The UV-visible analysis was used to explain the variation of optical energy bandgap as Mg doping was increased and Photoluminescence intensity were found varying from 377-573 nm for Mg-Co Nanoferrite.

Keywords: Crystallite size, Mg-Co Nanoferrite, Hydrothermal Method, FTIR, PL, Optical Property.

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ULTRASONIC STUDIES OF EQUIMOLAR SOLUTION OF N, N-DIMETHYL FORMAMIDE AND METHANOL WITH BENZOIC ACID AT VARIOUS CONCENTRATIONS

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Benzoic acid is a colorless crystalline solid and simple aromatic carboxylic acid. It is very useful in food industry, personal care industry and medicinal world. Molecular Interactions of Benzoic acid with equimolar solution of N, N-Dimethyl Formamide and Methanol have been investigated using experimental and computational techniques. The Benzoic acid has been added in specific quantities to 99% pure equimolar solution of Methanol and DMF mixture to obtain certain morality mixture solutions ranging from 0.01 M to 0.08 M. The density, viscosity and ultrasonic velocity of the mixture solutions have been experimentally measured using standard techniques. From these values various parameters, such as Adiabatic Compressibility, free volume, Rao's constant, Relative Association have been derived which shows qualitatively the strength of intermolecular interactions between solute and solvent. Such studies have been done at various concentrations. It has been found that the interactions become strong with increase in concentration.

Keywords: Benzoic acid, Methanol, Ultrasonic Studies, Inter Molecular interactions

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NITROGEN ENCAPSULATED IN SULFUR DOPED GRAPHENE AS HIGH PERFORMANCE ANODE FOR Li-Ion BATTERIES

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Sulfur and nitrogen doping in carbonaceous materials is an effective approach to improve the performance of Li-ion batteries (LIBs). Herein, nitrogen encapsulated sulfur doped graphene (N/S-rGO) as an anode material for LIBs is reported. A facile method is used to prepare N/S-rGO by annealing the mixture of benzyl disulfide (BDS), Polypyrrole, and graphene oxide (GO). Herein, BDS and Polypyrrole assist as the sources for sulfur and nitrogen. N/S-RGO as an anode material for LIB delivers high reversible capacity of 650 mAh g^{-1} at a current density of 100 mA g^{-1} also it exhibits specific capacity of 316 mAh g^{-1} and superior cycling performance with good capacity retentions of 85 % (2000 cycles) at higher current densities of 3000 mA g^{-1}. Moreover, the full cell performance of the prepared N/S-rGO as an anode and LiFePO4 as a cathode in the voltage range of 1.5–3.9 V delivers a high reversible capacity of 250.5 mAh g^{-1} after extensive 1000 cycles at 500 mA g^{-1} with 65 % retention (a low fading rate of 0.035% per cycle), rendering it as a promising anode material for application in high-performance LIBs.

Keywords: Li-ion batteries, Doping, Nitrogen, Sulphur, Graphene.

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AVAILABLE AND UTILIZE SOURCES PERSPECTIVE OF UPGRADING OF EMERGING TECHNOLOGIES IN INDIA A REVIEW

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This paper offers a thorough review of biofuel production in India, covering state-by-state production information, preparation and characterization methods, comparative benefits over traditional fossil fuels, and a look at recent production trends. India has achieved great progress in using biofuels as a sustainable energy source, according to data gathered from credible web sources and a variety of periodicals. different states have different production environments, which are impacted by things like agricultural productivity, feedstock availability, and government regulations that are helpful. The two main procedures for preparing biofuels that are covered are fermentation for bioethanol and trans esterification for biodiesel, with a focus on using locally available resources such as agricultural waste and non-edible oils. Standard analytical methods are used to characterize these biofuels in order to evaluate their viscosity, emission profiles, and calorific value. The results highlight the advantages of biofuels for the economy and environment, including lower greenhouse gas emissions, improved energy security, and assistance for rural economies. Nevertheless, the research also discusses feedstock supply, technological difficulties, and industrial scale constraints. An examination of output by year shows a growth trend that is favourable and is supported by increased investment in renewable energy infrastructure and regulatory actions. The study's conclusion offers strategic recommendations for resolving current issues and fostering India's biofuel industry's sustainable growth, supporting the nation's commitment to cleaner energy and environmental sustainability.

Keywords: Biofuels, Bioethanol, Biodiesel, Biogas, Aviation biodiesel

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INVESTIGATION ON Fe-DOPED SnO_2 FOR GAS SENSING APPLICATION

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A simple sol-gel method was introduced for the synthesis of Fe-doped SnO_2 (FeS) nanostructures for gas sensing application. Predetermined amounts of $SnCl_2 \cdot 2H_2O$ and iron nitrate, with weight percentages denoted by x values of 0.00, 0.02, 0.04, 0.06, and 0.08, were dissolved in a standard synthesis procedure.X-ray diffraction (XRD) analysis confirmed that the Fe-doped SnO_2 materials maintained a tetragonal crystal structure.UV-Vis spectroscopy analysis was used to calculate the optical properties. The band gap values were calculated as 2.5V to 3.5eV. The surface morphology of Fe-doped SnO_2 nanostructures were investigated by the Field emission scanning electron microscopy (FE-SEM). By doping with Fe, the surface adsorption activity, specific surface area, grains of the material is increased leading to more active sites and oxygen vacancies, which enhance its sensing capability expected and this will be confirmed by further investigations.

Keywords: Sol-Gel, Nanostructures, structural and optical properties, Surface morphology, and band gap.

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LIFE CYCLE ASSESSMENT (LCA): STRATEGIES TO EDUCATE THE FUTURE GENERATION

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Life Cycle Assessment (LCA) is a systematic method used to evaluate the environmental impacts of a product, process, or service throughout its entire life cycle. It helps in identifying resource consumption, emissions, and waste generation at different stages, promoting sustainable decision-making. LCA follows a "cradle-to-grave" approach, covering all phases that include raw material extraction (cradle), Manufacturing & production, Distribution & Transportation, Usage phase and End-of-life (Grave). LCA finds it application in wide varieties of fields which include- Eco-friendly product design, corporate sustainability for reducing their carbon footprints, planning and implementation of environmental standards and policies, helps industries optimize energy use etc. Integrating Life Cycle Assessment (LCA) into education can create environmentally conscious citizens who make sustainable choices. It helps students understand environmental impacts and promotes responsible consumption, waste management, and eco-friendly innovations. Teaching LCA through practical projects, curriculum integration, and digital tools helps students understand the impact of everyday choices. By embedding sustainability education in schools and colleges, we can prepare future generations to build a healthier planet.

Keywords: Life Cycle Assessment (LCA), Cradle-to-grave approach, Eco-friendly product design, Carbon Footprints.

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SYNERGISTIC EXTRACTION OF Mn (II)

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Abstract: Synergistic extraction (SX) of Mn(II) from sulphuric, nitric, hydrochloric and perchloric acid solutions containing a mixture of Organic extractants like Triphenylphosphine oxide (TPPO) and Tributyl amine (TBuA) , Triphenyl arsine oxide (TPAsO) and Trimethylamine (TMA) , Tri-Capryl amine oxide (TCAO) and Tribenzyl amine (TBA) in xylene has been studied. The investigations were first performed to select optimal conditions for the effective separation including pH of the aqueous phase as well as concentration of synergistic mixture. Stoichiometries of extracted species in both individual and mixed extraction were ascertained by slope ratio analysis. Thermodynamic parameters controlling the nature of the extraction were also evaluated from the distribution ratio values obtained at different temperatures in order to explain the extraction mechanism.

Keywords: Synergitic extraction, Mn(II) , pH, TBA, TMA,TPPO,TBuA, TCAO, TPAsO

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THERMODYNAMIC, TRANSPORT PROPERTIES AND FT-IR STUDIES OF BINARY LIQUID MIXTURES: A STUDY ON ANISOLE WITH GLYCOL ETHERS (2-BUTOXYETHANOL, 2-ETHOXYETHANOL AND 2-METHOXYETHANOL) AT DIFFERENT TEMPERATURES.

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Densities (ρ), speeds of sound (u), and viscosities (η) of binary mixtures of Anisole with Glycol Ethers (2-Butoxyethanol, 2-Ethoxyethanol and 2-Methoxyethanol) including those of pure liquids, over the entire composition range were measured at temperatures (303.15, 308.15, 313.15 and 318.15 K) and 0.1 MPa. Using the experimental data, the excess volume (V^E), intermolecular free length (L_f^E), deviation in viscosity (Δ_η), excess partial molar volumes ($V^E{}_m$) and, and excess adiabatic compressibility's(β^E_{ad}) and of the components at infinite dilution were calculated. The V^E results have been analysed in the terms of Prigogine–Flory–Patterson theory. An analysis of each of the three contributions viz. interactional, free volume to V^E shows that free volume effects are negative for all the binary mixtures. FT-IR (Fourier transform infrared spectroscopy) properties have been carried out to study the specific interaction such as formation of hydrogen bond between unlike molecules in the binary liquid mixtures; a good agreement is observed among the excess parameters and FT-IR spectroscopic properties.

Keywords: Spectroscopy, Prigogine–Flory–Patterson theory, deviation in viscosity, excess partial molar volume, excess adiabatic compressibility.

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INVESTIGATIONS ON STRUCTURAL, MORPHOLOGICAL, OPTICAL AND DIELECTRIC PROPERTIES OF ZINC DOPED LaTiO3 NANOPARTICLES VIA HYDROTHERMAL METHOD

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This study focuses on the synthesis and characterization of Zinc-substituted LaTiO3 with the compositions ZnxLa1-xTiO3 (where x = 0.1-0.7) was successfully synthesized using a hydrothermal method. The X-ray diffraction (XRD) patterns were consistent with the standard reference pattern from JCPDS card (89-7507). The observed lattice parameters ranged from a = 3.843 to 3.921 Å and c = 27.176 to 27.718 Å. Both the lattice parameters and the crystallite size increased with higher zinc content, with the crystallite size varying from 24.11 to 28.58 nm. Infrared spectroscopy revealed characteristic bands at 540–550 cm^{-1} (υa) and 447–457 cm^{-1} (υb), confirming the formation of a tetragonal perovskite structure. Morphological analysis revealed the formation of spherical grains, rods, and nanoscale particles. UV-Visible spectroscopy indicated a band gap (Eg) ranging from 3.01 eV to 3.64 eV, depending on the value of 'x'. Dielectric measurements showed that the dielectric constant and dielectric loss ranged from approximately 328 to 494 and 645 to 920, respectively, for x = 0.1-0.7 at 100 Hz. The Cole-Cole plots provided insight into the grain and grain boundary resistivity. Analysis of the dielectric modulus and impedance indicated the presence of non-Debye relaxation for all the ZLTO nanoparticles. Cole-Cole plots confirmed the semiconducting nature of ZLTO materials, evidenced by the complete semicircular arcs, and revealed the presence of non-Debye type relaxations. These optimized dielectric properties suggest that the synthesized materials are well-suited for energy storage applications.

Keywords:Nanoparticles, Hydrothermal method, XRD, Dielectric Property, UV-Vis.

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MICROBIAL VALORIZATION OF AGRICULTURAL WASTE IN SUSTAINABLE BIOFUEL PRODUCTION

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The growing need for alternative fuels is prompted by continuous environmental degradation, volatility in the oil market, and poor performance of fossil fuels in compression ignition engines. Due to population growth, agricultural and industrial advances, and increased food production, waste generation, fuel consumption, and toxic gas emissions have escalated. The demand for economical, abundant, and eco-friendly agricultural waste for biofuels production is at an all-time high. Microorganisms convert lignocellulosic wood waste into renewable, biodegradable, low-cost, and eco-friendly biofuels. Converting agricultural wastes into biofuel addresses issues of food security, waste management, environmental degradation, and energy security. This review focuses on microbial valorisation of agricultural wastes into bioethanol, hydrogen, butanol, methane, methanol, and diesel for multiple uses. Agricultural wastes can effectively contribute to the global renewable energy goal, making them a valuable resource. This study will significantly expand our understanding and offer new methods and applications for agricultural waste utilization. To advance conversion technologies for agricultural wastes into state-of-the-art, eco-friendly, and cost-effective processes for generating renewable fuels, interdisciplinary collaborations are essential. Increased human, financial, and infrastructural investment is necessary for converting agricultural waste into biofuels to foster environmental cleanliness, advance the use of renewable fuels, and prevent planetary destruction.

Keywords: Agricultural waste, Valorisation, Microrganisms, Biofuel, Ecofriendly, Sustainable.

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A COMPREHENSIVE REVIEW ON GENE THERAPY

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The therapeutic transfer of genetic material, such as DNA or RNA, with the goal of curing diseases caused by inherited mutations or acquired abnormalities is referred to as gene therapy. Gene therapies can be categorized as either somatic (focusing on cells that are not involved in reproduction) or germ line (targeting cells that are engaged in reproduction) . It is generally knowledge that gene treatments involve some level of risk; nevertheless, the vast majority of the risks associated with these therapies come from the method of delivery or technology that was accessible at the time that they were developed, and not from the concept of utilising genes to cure illness itself. Gene therapy is not just one procedure, but rather a collection of methods that aim to change the way in which our genes are expressed in our bodies. This can be done in a number of different ways. These treatments are intended to treat or prevent disease by fixing a genetic mutation or by exchanging a gene that is mutated for a healthy copy of the gene. Gene therapy is currently being investigated for many non-life-threatening diseases. Including those that have an effect on the patient's quality of life. The fact that there is not enough therapy available provides a justification for expanding the range of services that are offered. This manuscript provides an over view of common methods used to transfer genes and various examples of their clinical applications.

Keywords: Gene therapy, Vectors, Adeno-associated virus, GIC, CAR-Tcell.

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ENHANCING WELDMENT MECHANICAL PROPERTIES WITH MECHANICAL VIBRATION

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This research investigates the enhancement of mechanical properties, such as strength, hardness, and toughness, in weldments through mechanical vibration during welding. A vibration-assisted welding system is employed to impart controlled mechanical vibrations during the process. The study systematically examines the effects of vibration frequency, amplitude, and welding parameters to identify optimal conditions for improved weldment quality. Experimental results demonstrate that applying mechanical vibration refines microstructures, reduces porosity, and improves bonding at the weld interface, significantly improving tensile strength, hardness, and impact toughness compared to conventional weldments. Additionally, the study provides insights into the relationship between process parameters and mechanical properties, offering a comprehensive understanding of the vibration-assisted welding process. These findings highlight the potential of this technique for enhancing weldment performance across various industrial applications, with future research focusing on optimizing vibration parameters, exploring different welding processes, and assessing the long-term performance of vibration-assisted weldments.

Keywords: Weldments; Welding process; Mechanical properties; Mechanical vibration; Flexural strength

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EXPLORING THERAPEUTIC POTENTIAL OF MEDICINAL PLANTS: BRIDGING TRADITIONAL KNOWLEDGE AND MODERN PHARMACOLOGY

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Medicinal plants have been vital to human health for centuries, providing bioactive compounds with therapeutic potential. Scientific research has identified a diverse range of phytochemicals, such as flavonoids and phenolics, which contribute to their medicinal properties. For example, *Vernonia coloratum* and *Hedyotis diffusa* have demonstrated significant antioxidant and anti-inflammatory activities, underscoring the importance of integrating traditional knowledge with modern scientific validation. The ethnobotanical knowledge surrounding these plants is extensive, with numerous species documented for therapeutic uses across cultures. An inventory in Nigeria highlighted various medicinal and poisonous plants, emphasizing the need for further research to validate their efficacy. The rich biodiversity of regions like the Western Ghats of India supports traditional medicine practices, yet the sustainability of these resources is threatened by climate change and overexploitation, necessitating urgent conservation efforts. Moreover, the pharmacological properties of medicinal plants are increasingly recognized in modern medicine, particularly for immunomodulation and cancer therapy. Clinical trials have substantiated the immunomodulatory effects of extracts from plants like *Ocimum sanctum* (Tulsi), showcasing their potential as complementary therapies. In conclusion, the exploration of medicinal plants bridges traditional practices and scientific inquiry, revealing their potential contributions to modern medicine. Future research should prioritize the sustainable use and conservation of these resources to ensure their benefits for future generations.

Keywords: Medicinal plants; phytochemicals; ethnobotanical; immunomodulation; cancer therapy.

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APPLICATION OF MAGNETIC ACTIVATED CARBON MATERIAL FOR THE REMOVAL OF FLUORIDE FROM WASTEWATER

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In the present investigation, Fe_3O_4-Rice husk activated carbon (Fe_3O_4-RHAC) as an antecedent material for the removal of fluoride from wastewater. The factors which impact the adsorption strength, for example, pH, contact time, Fe_3O_4-RHAC dosage, as well as initial fluoride concentration were studied. The characterization studies were performed such as SEM to know the morphology of the bio-adsorbent. The experimental results proved that Fe_3O_4-RHAC has excellent potential for the removal of fluoride ions (95.2% removal efficiency) at pH 4.00 under room temperature. The most extreme adsorption limit (Q_m) was acquired as 26.2 mg g^{-1}. The adsorption isotherm showed that the Langmuir model (R^2= 0.9924) was the best fit and adsorption refers to a uni-layer mechanism. The kinetic adsorption study reveals that the pseudo-second-order model (R^2= 0.991) is the better fit and chemisorption is the rate determining step. The magnetic properties of Fe_3O_4-RHAC facilitated the separation of the adsorbent from the treated solution using an external magnetic field, eliminating the need for additional filtration or centrifugation steps. The regeneration of Fe_3O_4-RHAC was also investigated, and it was found that the composite could be efficiently regenerated using ethanol as a desorption agent, allowing for repeated use.

Keywords: Rice Husk activated carbon, Fe_3O_4-RHAC, adsorption

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RENEWABLE BIO ENERGY SYSTEMS: CONVERSION TECHNOLOGIES AND APPLICATIONS

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When plants and other organic materials are used to generate energy, it is called bio energy. Bio energy is a form of renewable energy to generate the burned biomass fuels that comes from organic materials such as harvest residues, purpose-grown crops and organic waste from our homes, business and farms. This paper intends to highlight on the myriad advantages of bioenergy such as Environmental profits, waste reduction, cost effective etc. Bio energy could also help in reducing air, water, and land pollution. It could also help improving soil, health and provide habitats for a better wild life. This research paper also has attempted to throw light into the application of Bio energy as zero emission strategy. It illustrates how Bio energy can be converted into liquid or gaseous fuels that can be used in conventional boilers or furnaces. While highlighting the advanced innovations on bio energy the paper focuses on advanced bio energy applications, and how it has the potential to create thousands of new jobs prospects, stimulating countryside improvement and cause wealth within the emergent Indian bio economy. The paper scrutinizes vividly how bio energy is a very imperative part of sustainable, equitable, a climate adaptable future. It would explore on concepts like AI technologies, Bio fuels, and Agriculture waste cum Energy storage.

Keywords: AI technologies, Bio fuels, Agriculture waste cum Energy storage.

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PHOTOCATALYTIC DEGRADATION OF BRILLIANT GREEN AND CARMINE INDIGO USING $ZnBi_2O_4$ AND $CuBi_2O_4$ SYNTHESIZED VIA COMBUSTION METHOD

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This paper deals with the synthesis, characterization and photocatalytic degradation of Carmine Indigo (CI) and Brilliant green (BG) dyes. The photo catalysts $ZnBi_2O_4$ and $CuBi_2O_4$ were synthesized by solution combustion method using $Zn(NO_3)_2$, $Cu(NO_3)_2$, $Bi(NO_3)_3$ used as a starting materials (Fuels) and urea used as oxidant to initiate the combustion process with different fuel to oxidant ratio (1:1, 1:1.5, 1:75). After preparation of photo catalysts, they are examined to X-ray diffraction (XRD), Fourier transformer infra-red (FTIR), UV-Diffused reflectance (UVDRS), Scanning electron microscopy (SEM) and Transmission emission microscopy (TEM) studies. From the characterization study we can say that both synthesized catalysts are phase pure and visible light active. The obtained phase pure catalysts are used to photo catalytic degradation of Brilliant green and Carmine indigo using metal halide lamp as a visible light source.

Keywords: Photocatalysis, Indigo Caramine, Brilliant green

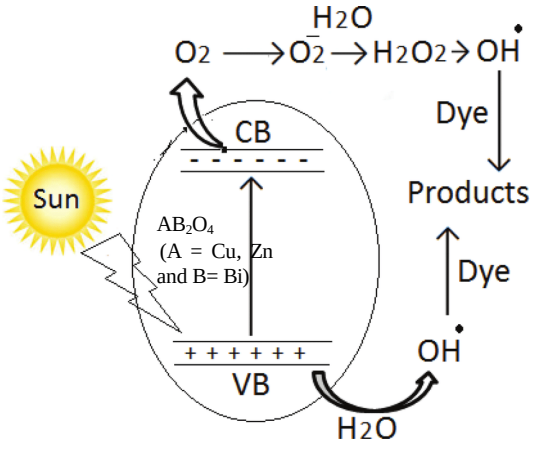

Figure. Photocatalytic degradation mechanism

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DEVELOPMENT OF A REDUCED GRAPHENE OXIDE BASED COPPER OXIDE NANO COMPOSITE VIA HYDROTHERMAL APPROACH FOR SENSITIVE DETECTION OF MERCURY IONS

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In this study, we report the development of a reduced graphene oxide (RGO)-based copper oxide (CuO) nanocomposite via a hydrothermal synthesis approach for the sensitive detection of mercury ions (Hg^{2+}). The composite material combines the high surface area and excellent conductivity of RGO with the unique semiconducting properties of CuO, making it highly suitable for electrochemical sensing applications. The RGO-CuO nanocomposite was synthesized by reducing graphene oxide in the presence of CuO nanoparticles under hydrothermal conditions, resulting in a well- dispersed and stable material. The structural and morphological properties of the synthesized nanocomposite were characterized using techniques such as X-ray diffraction (XRD), scanning electron microscopy (SEM), and transmission electron microscopy (TEM). The electrochemical performance of the sensor was evaluated, revealing a high sensitivity and selectivity towards Hg^{2+} ions with a low detection limit. The results suggest that the RGO-CuO nanocomposite has significant potential for application in environmental monitoring and remediation, offering a cost-effective and reliable method for mercury ion detection.

Keywords: RGO-CuO nanocomposite; hydrothermal route; Mercury ions; sensing applications.

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EVALUATING GROUNDWATER QUALITY THROUGH THE WATER QUALITY INDEX: A COMPREHENSIVE ASSESSMENT

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The assessment of groundwater quality using the Water Quality Index (WQI) is a crucial tool for promoting the sustainability of water resources while safeguarding human health and the environment. By incorporating multiple parameters into a single index, the WQI offers a comprehensive approach to evaluating groundwater quality, facilitating informed management decisions and policy interventions. In this study, 25 groundwater samples were randomly collected from various locations in Srikakulam District, Andhra Pradesh, to examine the geochemistry of the groundwater. Nine chemical parameters were analyzed to assess water quality. The findings revealed that 68% of the groundwater samples were of poor quality, 12% were of very poor quality, and 20% were of good quality. The analysis of physicochemical parameters showed elevated levels of calcium, magnesium, sodium, and chloride, with concentrations exceeding WHO standards. Strong positive correlations were observed among these ions. Major pollution sources were linked to uncontrolled fertilizer use, domestic sewage, and animal waste, compounded by inadequate drainage systems. Therefore, effective treatment measures, careful management, and regular monitoring are recommended to improve groundwater quality before its use for drinking purposes.

Keywords: Groundwater, WQI, Total dissolved solids, Total hardness

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SUSTAINABILITY AND LIFE CYCLE ASSESSMENT: A STUDY

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The production of Bio-energy has received important consideration in the present time scenario because of lower green-house gas emissions and less reliance resting on fossil fuels. To provide the reasonable dependable energy establishments, making job opportunities, growing entree to current energy services demands prime importance. The bio-energy performs principally in raising nations, gaze at food production, asset in-search & ability power. The limited technology blocks the production of world's bio-energy as well as lack of funds, transportation, technical proficiency, skilled manual labor, Technology, financial support & policy sustain are the all essential property for sustainable bio-energy creation. Further extension of bio-energy technologies is preferred mostly towards progress of efficiency, reliability, uniformity and current bio-energy chains of sustainability. Bio-energy chains explain the ease of use and cost of feedstock as fine as ecological and community issues and bio-energy chains analysis present and upcoming technology pathways and confer the position of bio-energy in meeting changes in climate, energy refuge and socio-economic activities. The present production is more efficient and sustainable. The innovations are changing waste into renewable, reasonable energy sources. The biomass briquette steps towards powering a cleaner and a greener future. The act of bio-energy policies recognize rising challenges and opportunities. These innovations procedures ensure responsiveness, strategies and justice over bio-energy development. At present the level of global bio-energy trade is miniature compare to trade in cultivation forestry commodities. Through integrating values of societal fairness and biological protection into policy design, bio energy contributes to comprehensive and environmentally sustainable development.

Keywords: Green House Gas Reduction, Energy Security, Ecosystem Conservation, Public Acceptance.

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RE-LOOKING INTO THE INNOVATIVE BIO-ENERGY RESOURCES IN INTERPRETING COMPETENT SUSTAINABLE POWER ENERGY

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Bio energy with carbon capture would focus on the bio-energy production with storage technologies to achieve sustainable energy generation while actively reducing green house gas emissions .This ground-breaking move towards combining the benefits of renewable bio energy sources with the ability to intern and accumulate carbon dioxide, thereby leading to climate change alleviation effort. Bio-energy with carbon capture sources (BECCS) comprises any power trail where co2 is captured through a biogenic foundation and enduringly stored. It is observed that only approximately 2Mt of biogenic co2 is at present captured every year, particularly in bio-ethanol applications. Looking on schemes presently in the initial and highly developed phases of progress, captures on biogenic resources could attain around 60Mt Co2/yr by 2030, which nevertheless is found to be far diminutive of the roughly 185Mt Co2/yr capture from biogenic sources by 2030 in the Net Zero Emissions by 2050(NZE) circumstances. In fact, the embattled sustain for carbon dioxide removal (CDR), and BECCS in specifically would be needed to interpret fresh impetus into equipped capacity. This paper has attempted to illustrate the bio energy production processes and how it is securely stored underground. Besides it throws light on bio-energy with carbon capture and how it offers a hopeful alleyway towards achieving competent sustainable power energy and promoting more sustainable energy future.

Keywords: Climate change, Biogenic resources, sustainable energy

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DEVELOPMENT OF TERNARY NANO COMPOSITES FOR ADVANCED ENVIRONMENTAL APPLICATIONS

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The escalating environmental challenges, including water pollution and atmospheric contamination, demand innovative materials for efficient remediation. Ternary nanocomposites, comprising three distinct components at the nanoscale, have emerged as a promising solution due to their enhanced multifunctionality and synergistic properties. This study focuses on the development and characterization of novel ternary nanocomposites, which integrate metal oxides, carbon-based materials, and conductive polymers. The incorporation of these components yields high surface area, superior electrical conductivity, and remarkable adsorption capacity, making them highly effective for environmental applications. The nanocomposites were synthesized using facile hydrothermal and sol-gel methods and demonstrated exceptional performance in sensing heavy metals, degrading organic pollutants, and capturing greenhouse gases. Moreover, their reusability and stability highlight their potential for sustainable environmental technologies. This research underscores the importance of nanocomposite design in addressing critical environmental issues, providing a foundation for further exploration in green chemistry and environmental engineering.

Keywords

Ternary nanocomposite; Synergistic properties; Environmental applications; Sustainability.

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METAL-DOPED FERRITE NANOPARTICLES: A PROMISING AVENUE FOR ADVANCED ENERGY APPLICATIONS

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Metal-doped ferrite nanoparticles have emerged as a key material for next-generation energy applications due to their unique magnetic, electronic, and catalytic properties. Doping ferrites with transition metals such as cobalt, nickel, and manganese significantly enhances their electrical conductivity, magnetic permeability, and thermal stability, making them ideal for use in energy storage, conversion, and harvesting technologies. These modified nanoparticles exhibit tunable bandgaps and high surface areas, facilitating improved charge transport and efficient energy transfer in applications such as lithium-ion batteries, supercapacitors, and solar cells. Additionally, their superior catalytic activity and stability make them promising candidates for fuel cells and hydrogen production. This review focuses on the synthesis, characterization, and functionalization of metal-doped ferrite nanoparticles, highlighting their role in addressing the challenges of energy efficiency and sustainability. Future research directions are also explored to fully realize their potential in green energy technologies.

Keywords: Ferrite nanoparticles; Doping; supercapacitors; lithium-ion batteries; green energy.

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BIO REMOVAL OF POLLUTANTS: ECO-FRIENDLY STRATEGIES FOR ENVIRONMENTAL REMEDIATION

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Bio removal of pollutants is an eco-friendly and cost-effective strategy for addressing environmental contamination. This process harnesses the metabolic capacities of microorganisms such as bacteria, fungi, and algae to degrade or adsorb toxic pollutants, including heavy metals, organic compounds, and dyes, from soil, water, and air. Microbial bioremediation, bio adsorption, and bioaccumulation are central to this approach, offering sustainable solutions to pollution through natural degradation mechanisms. Recent advances in biotechnology, such as genetic engineering and immobilization techniques, have enhanced the efficiency and specificity of microorganisms in removing pollutants, making bioremediation highly adaptable to diverse environmental contexts. In particular, bio sorbents derived from waste biomass, nanomaterial's, and microbial consortia have demonstrated significant potential for removing heavy metals and dyes from wastewater. This environmentally benign approach reduces reliance on harsh chemicals, minimizes secondary waste production, and contributes to a circular economy. While bioremediation techniques have limitations, such as longer treatment times and sensitivity to environmental conditions, ongoing research aims to optimize these processes for large-scale applications, making them increasingly relevant in addressing global pollution challenges.

Keywords: Bio removal; bio sorbents; nanomaterials; waste biomass; circular economy.

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ANTIBACTERIAL ATTITUDE OF SPUTTERED COPPER-MOLYBDENUM OXIDE FILMS UNDER DIFFERENT OXYGEN PARTIAL PRESSURES

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This paper contributes significantly towards the field of advanced wound care by offering a novel approach in developing effective antibacterial membranes. Absolutely, the development of hybrid composite antibacterial agents for wound dressings is a promising area of research. These materials often combine the advantages of different components, such as polymers, nanoparticles, and natural extracts, to enhance antibacterial properties while ensuring biocompatibility. Utilizing copper-Molybdenum oxide (Cu-MoO3) composites for wound dressing membranes via DC magnetron sputtering offers several advantages. Copper is well-known for its antibacterial effects, which can help reduce the risk of infections in wound care. MoO3 can enhance these properties, possibly through synergistic effects. Both copper and molybdenum oxide can be engineered to be biocompatible, which is essential for materials in direct contact with tissues. The sputtering process allows for precise control over the thickness and composition of the membranes, potentially leading to better control of the release rates of antibacterial agents. DC magnetron sputtering allows for uniform deposition and the ability to coat complex shapes, which could be beneficial for custom wound dressing applications. Understanding the morphology will help correlate structure with antibacterial efficacy, as surface area and porosity can significantly influence interaction with bacteria. Analyzing the phase transition from different MoO3 polymorphs deposited at different oxygen partial presssurs $1x10^{-3}$ mbar to $2.85x10^{-3}$ mbar could provide insights into how structure affects antibacterial properties. A detailed exploration of how MoO3 and copper work together or whether through synergistic reactive oxygen production or enhanced ion release could be a key focus.

Keywords: Copper doped Molybdenum oxide, dc magnetron sputtering, XRD, XPS and Electrical properties

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INNOVATIONS IN BIO-ENERGY: A DETAILED ANALYSIS

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The paper highlights on the role of Bio-energy in the Bio-economy. Nowadays bio-energy is being challenged about its future role in a secured manner. Moreover, bio energy needs to reconstruct its position under the environment of continuous transformation in the energy amalgamation mix based on renewable sources both for transportation purposes and for stationary purposes like heat, cooling, and power. The next generation of bio-fuels, also called advanced bio fuels, must meet the concerto required as drop-in bio fuels to avoid the costs of new power train infrastructures. Bio-mass is produced from organic material, known as bio mass, which contains carbon absorbed by plants through photosynthesis. Moreover bio energy is well defined and making modern bio energy a near zero-emission fuel. It is the largest source of renewable energy globally, accounting for 55% of renewable energy and over 6% of global energy supply. The imperative need for extenuating climate change necessitates a transformative move in energy production and utilization paradigms. Amongst this confront, bio-energy has been emerging as an essential contributor to the universal, comprehensive energy evolution, contributing a miscellaneous display of solid, liquid and gaseous fuels derived from biomass. This paper attempts to elaborate the competitive advantages, potential environmental impacts, and challenges of these biomass conversion technologies and its immense significance due to their gigantic operational and investment expenses and high energy usage.

Keywords: Bio energy, Renewable power, Train mitigation consumption

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CATIONIC SURFACTANT INFLUENCE ON TERNARY COMPLEXES OF Ca(II), Mg(II) AND Zn(II) IONS WITH L-CYSTEINE and L- METHIONINE

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Chemical speciation of ternary complexes of Ca(II), Mg(Ii) and Zn(II) ions with L-Cysteine, L-Methionine have been studied pH metrically in the concentration range of (0.0-2.5% w/v) in CTAB-water mixtures maintaining an ionic strength of 0.16 mol L^{-1} at 303 K. Alkalimetric titrations were carried out in different relative concentrations (M: L: X = 1:2:2, 1:2:4, 1:4:2) of metal (M) to L-Cysteine (L) to L-methionine (X). Stability constants of ternary complexes were calculated and various models were refined with MINIQUAD75. The best-fit chemical models were selected based on statistical parameters and residual analysis. The species detected are MLX , MLXH and ML_2X for Ca(II), Mg(II) and Zn(II). The electrostatic relationship of the ligand's side chains, charge neutralization, chelate effect, stacking interactions, and hydrogen bonding are used to explain the trend in the variation of logarithm of stability constants (log β) values with changing mole fraction of the surfactant. The variation in species distribution as a function of pH and surfactant composition is also presented and discussed, as are plausible equilibria for the formation of the species and structures of the ternary complexes are also presented.

Keywords: Chemical speciation; ternary complexes; L-Cysteine; L-methionine; CTAB.

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ADVANCE TECHNOLOGY IN BIOMASS: A STUDY

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Biomass is a renewable energy source that comes from organic materials like wood, crop waste, or even algae. Innovations in biomass will play an important role in advancing sustainable energy solutions. Biomass refers to organic material that comes from plants and animals. It is a renewable source of energy that can be used for different purposes, including electricity generation, heating, and as a fuel for vehicles. Biomass can include materials such as timber, agricultural harvest, waste from plants and animals, and even algae. The process of converting biomass into energy involves combustion, gasification, and anaerobic digestion. In combustion, biomass is burned to produce heat, which can be used to generate electricity. Gasification involves converting biomass into a gas that can be used for energy production. Anaerobic digestion is a natural process that breaks down the organic matter in the absence of oxygen, producing biogas can be used for heating and electricity. Biomass energy has more advantages. It is considered carbon neutral because the carbon dioxide released during its combustion is balance by the carbon dioxide absorbed by the plants during its growth. Additionally, biomass can help to reduce the waste by utilizing materials that would otherwise be useless. However, there are also challenges, such as competition for land with food production and possible emissions from biomass combustion. The paper has attempted to discuss on the overall how biomass is a flexible and renewable energy source that plays a major role in the transition to more sustainable energy systems.

Keywords: Bio-mass energy, Bio-fuels, Organic materials, sustainability, gasification

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SOLID WASTE MANAGEMENT: A CASE STUDY ON CHIRALA

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Solid waste management is a pressing environmental issue in urban India. This research focuses on the current state of SWM in Chirala, a rapidly expanding town in Andhra Pradesh. Data was collected through field surveys, interviews with local officials, and a review of existing literature. Chirala generates around 30 tonnes of mixed waste daily from 23,651 households, which is currently sent to a landfill without being recycled. The study highlights the lack of proper waste collection, transportation, and disposal systems, combined with low public awareness and participation, as key factors contributing to the town's poor waste management. It stresses the need for a comprehensive waste management plan, including segregation at the source, better collection methods, transportation, and scientific disposal techniques. Decentralized systems like composting and recycling can also help ease the pressure on landfills. Additionally, public awareness campaigns and capacity-building initiatives are essential to fostering sustainable waste management practices. By adopting integrated, community-based approaches, Chirala can overcome its waste challenges and create a cleaner, healthier environment for its residents.

Keywords: Solid waste management, Chirala, India, urban, environmental, sustainability, waste segregation, recycling, composting, public awareness.

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TUNING THE STRUCTURAL, THERMAL, AND OPTICAL PROPERTIES OF 7BA+7OBA LIQUID CRYSTAL WITH DYSPROSIUM-DOPED LITHIUM ZINC PHOSPHATE NANOPARTICLES FOR ADVANCED OPTOELECTRONIC APPLICATIONS

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This study explores the structural, thermal, and optical characteristics of a liquid crystal mixture composed of p-n-heptyl benzoic acid (7BA) and p-n-heptyloxy benzoic acid (7OBA), dispersed with dysprosium-doped lithium zinc phosphate ($Li_4Zn(PO_4)_2:Dy^{3+}$) phosphor nanoparticles at concentrations of 1.5 wt%, 2.5 wt%, and 3.5 wt%. The ($Li_4Zn(PO_4)_2:Dy^{3+}$) nanoparticles were synthesized via a combustion method and characterized using X-ray diffraction (XRD), confirming their presence in the 7BA+7OBA mixture. Scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy (EDS) demonstrated the uniform dispersion of the nanoparticles within the liquid crystal matrix. UV-visible spectroscopy revealed a reduction in the energy bandgap of 7BA+7OBA from 4.04 eV to 3.99 eV with increasing nanoparticle concentration. Phase transition temperatures and liquid crystal textures were examined using differential scanning calorimetry (DSC) and polarized optical microscopy (POM). Fourier-transform infrared spectroscopy (FTIR) identified functional groups in the nanocomposites, showing subtle shifts in the C=O, C=C, and C-H bond stretching regions, which varied with increasing nanoparticle concentration. The incorporation of ($Li_4Zn(PO_4)_2:Dy^{3+}$) nanoparticles into the 7BA+7OBA liquid crystal matrix demonstrates their potential for tuning liquid crystal properties, opening new possibilities for advanced display technologies and optoelectronic applications.

Keywords: 7BA+7OBA Liquid Crystal, Dysprosium-Doped Lithium Zinc Phosphate,

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EXCESS THERMODYNAMIC PROPERTIES AND FTIR ANALYSIS OF BINARY LIQUID SYSTEM CONTAINING (TETRACHLOROETHYLENE+ CYCLOALKANES) AT DIFFERENT TEMPERATURE.

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The ultrasonic velocity (u), density (ρ), and viscosity (η) for the binary mixture Tetrachloroethylene+ cycloalkanes were measured over the whole composition range at temperature T = (303.15 to 345.15) K. The experimental data have been used to calculate excess molar volume (V_m^E), excess adiabatic compressibility (β_{ad}^E), excess viscosity (η^E), excess intermolecular free length(L_f^E) and excess internal pressure (π_i) over the entire composition range. These results have been fitted to the Redlich-Kister polynomial equation. Excess molar volume (V_m^E), excess adiabatic compressibility (β_{ad}^E), excess viscosity (η^E), excess intermolecular free length (L_f^E) and excess internal pressure (π_i) were found to be negative for all temperance's. The results obtained have been discussed and interpreted in terms of the type and nature of the specific intermolecular interactions between the components, and molecular bonding studies by using FTIR analysis.

Keywords: Ultrasonic velocity, adiabatic compressibility, internal pressure, molar volume, intermolecular free length and Redlich Kister polynomial equation, FTIR analysis.

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ECOLOGY OF CILIATES IN SEWAGE WASTEWATER TREATMENT PLANT APPUGHAR, URBAN, VISAKHAPATNAM

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The study investigates the ecology of ciliates in the sewage treatment plant in Appughar, Visakhapatnam Urban, focusing on the reuse of sewage. Ciliates are known water pollution indicators, and their presence or absence can be related to environmental conditions. The study aims to understand reuse options for treated effluent and prepare appropriate water resources management plants. Protozoa, including ciliates and flagellates, play a crucial role in wastewater purification processes.

Keywords : STP(Sewage treatment plant), protozoa, ciliates, flagellates, pollution, indicators .

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SYNTHESIS, MICROSTRUCTURAL, VIBRATIONAL AND OPTICAL CHARACTERIZATIONS OF VANADIUM SUBSTITUTED $Li_4Ti_5O_{12}$ ANODE MATERIALS FOR Li-ion BATTERIES

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In this paper, we present the results on the effect of the partial substitution of Nb^{5+} in the place of Li and Ti in lithium titanate ($Li_4Ti_5O_{12}$, LTO) negative material. For the basic as well as Nb substituted with the formula $Li_4Ti_{5-x}V_xO_{12}$, the partial influence of niobium on structural properties have been presented in this paper. Well-crystallized spinel $Li_4Ti_{5-x}V_xO_{12}$, ($0 \leq x \leq 0.1$) anode materials are synthesized by simple ceramic route, which is calcined for 16 h at 900 °C. A systematic presentation of the results of the structural, morphological and vibrational bonding nature of the anode materials are investigated through TG/DTG/DSC, X-ray diffraction (XRD), FESEM with EDX, FTIR, Raman and UV-Vis-DRS spectroscopy. The observed diffraction peaks are in full agreement with the ordered LTO spinel cubic fcc structure indexed to the Fd-3m space group. The synthesized compounds are quite large upto around 1 μm in diameter and the grain size had a wide distribution range. EDS is used to identify the elements. All the vibrational bands are shifted upon doping concentration. The FTIR spectra show that the oxide lattice structure comprises of MO_6 tetrahedra and octahedra.

Keywords: Lithium Titanate, Anode materials, XRD, FESEM, FTIR, Raman

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FOOD WASTE: AN INTERNATIONAL ISSUE AND LONG-TERM SOLUTIONS

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Food waste is a significant worldwide issue that has an impact on environmental sustainability, economic stability, and food security. Millions of tons of food are wasted annually as it moves through the food supply chain from production to distribution. In addition to causing the loss of important resources like labor, energy, a nd water, this waste also contributes to environmental deterioration by emitting greenhouse gases. The primary causes of food waste include poor farming methods, excessive output, inappropriate storage, ignorance, and consumer behavior. A variety of approaches is needed to address this issue; including innovative waste management practices like composting and food reuse and recycle, better food distribution systems, sustainable consumption patterns, and policy initiatives. Promoting food recovery initiatives and strengthening communities that can drastically cut down on food waste would help ensure a sustainable future.

Keywords: Bioenergy; Sustainable energy; Nanotechnology; Biotechnology; AI.

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SOLID WASTE AND ITS MANAGEMENT: PERSPECTIVES AND CHALLENGES

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Solid waste is one of the important challenges to the environment. The inadequate waste management cause alteration the ecosystems including air, water, and soil pollution, thus it represents a real threatening to human health. Population increase, rapid urbanization, booming economy, and the rise in the standard of living have greatly accelerated the rate, amount and quality of the municipal solid waste generation. The only way to reduce the solid waste is to recycle and reuse strategies. In this review, we highlighted the following: potential causes of solid waste, health hazards exerted by accumulation of solid wastes, management of solid wastes and agro-based solid wastes.

Keywords: Agro-wastes, municipal solid waste, types, vermicomposting, solid state fermentation technology

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SEASONAL ASSESSMENT OF MOISTURE AND ASH IN MALE AND FEMALE *Scylla serrata* IN BHEEMUNIPATNAM, VISAKHAPATNAM

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The highly valued *Scylla serrata* (Forskål, 1775) is broadly spread throughout the Indo-West-Pacific region (Keenan et al., 1998), closely linked with mangroves. This species has both ecological and economic importance in the marine environment due to its high sensitivity to pollution and wide popularity as a seafood delicacy (Kathirvel et al., 2004). Mud crab is one of the seafood products that are high in protein and this organisms are mainly collected traditionally form the natural ecosystem. Currently, the request for the mud crab is increasing nowadays due to the increased demand for human consumption. In South-east Asian nations, mud crab is one of the most important fishery commodities (Kamaruzzaman et a*l.,* 2012). Moisture content is one of the most commonly measured properties of food materials for a number of different reasons such as to define of the limits to the maximum or minimum amount of water that must be present in certain types of food, to calculate the cost of many foods which depends on the amount of water they contain, and to examine the quality of the food such as the texture, taste, appearance and stability of it. Ash refers to the inorganic residue remaining after either ignition or complete oxidation of organic matter in a food stuff. The ash content is a measure of the total amount of minerals present within a food, whereas the mineral content is a measure of the amount of specific inorganic components present within a food, such as Ca, Na, and K. many statistically significant differences were observed in the mean metal values obtained for *S. serrata*in the study location. The differences in the pattern of metal occurrence in various seasons of the crab, *S. serrata*. The present study results showed that mud crab's Moisture and Ash composition varies significantly between sexes and sources. Particularly, females' possess a higher ash content than the males during all seasons. Whereas moisture was high in males during the pre-monsoon and monsoon, females recoded high moisture content during the post-monsoon. Moisture was found to be the major component as it varied from 77.90 % to 81.05 % in body meat.

Keywords: Ecological and Economic importance, Mud crab, mangroves, Moisture and Ash composition

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ROLE OF BIOPHTOVALTAICS IN BIOENERGY

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Biophotovoltaics (BPVs) are an emerging technology at the intersection of bioenergy and renewable energy production. They harness the natural photosynthetic processes of biological organisms, such as algae or cyanobacteria, to convert light into electrical energy. In BPVs, microorganisms are immobilized on an electrode, and through light absorption, they generate electrons that can be harvested to produce electricity. The integration of BPVs into bioenergy systems presents a sustainable solution to global energy challenges by offering an alternative to traditional photovoltaic technologies.The role of BPVs in bioenergy lies in their potential to exploit both natural light and the photosynthetic ability of microorganisms, enabling energy generation in an environmentally friendly and cost-effective manner. BPVs are also advantageous due to their ability to use organic materials and waste products as substrates, further enhancing their sustainability profile. Additionally, the low-energy production process and the ability to scale for decentralized energy production make them attractive for various applications, from powering low-energy devices to providing electricity in remote or underdeveloped areas.Current research is focused on improving the efficiency of BPVs, optimizing microbial strains, and increasing the longevity of bio-electrochemical systems. Although still in the experimental phase, the advances in biophotovoltaics hold the potential to complement other renewable energy technologies and contribute to a diverse, sustainable energy future.

Keywords: Biophotovoltaics, Bioenergy, Microorganisams,sustainability

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WASTE PLASTIC CONVERTED INTO FUEL ECONOMY

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With the increasing environmental threat posed by plastic waste, innovative solutions for its disposal and energy recovery are crucial. This project explores the conversion of waste plastic into electrical energy through a two-step proces such as pyrolysis and thermal power generation. Pyrolysis involves heating plastic waste in the absence of oxygen to produce synthetic gas, liquid fuel, and char. The liquid fuel is then used to generate electricity in a small-scale thermal power plant. This method provides a sustainable approach to plastic waste management while addressing the growing global energy crisis. The results demonstrate that this process can effectively generate electricity while reducing environmental pollution.

Keywords: Waste plastic, pyrolysis, thermal power, energy recovery, sustainable waste management, plastic-to-energy, renewable energy.

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ASSESSING THE DEVASTATING IMPACT OF CHEMICAL POLLUTION ON BIODIVERSITY AND ECOSYSTEM SERVICES.

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Chemical contamination is becoming a widespread and sneaky danger to ecosystem services and biodiversity worldwide. Decreases in species populations, disturbances to nutrient cycles, and changes to ecosystem processes have all been connected to the extensive discharge of synthetic chemicals into the environment. This review summarizes the state of the art regarding the effects of chemical pollution on ecosystem services and biodiversity, emphasizing important mechanisms, vulnerabilities, and outcomes. We investigate how different chemical pollutants, such as plastics, industrial pollutants, and pesticides, affect freshwater, marine, and terrestrial ecosystems. According to our findings, the effects of chemical pollution on ecosystem function can be extensive and cascading, resulting in losses of ecosystem services such soil formation, climate regulation, and air and water purification. Finally, we stress the critical requirement for coordinated actions to safeguard ecosystem integrity and the benefits they offer, encourage sustainable activities, and lessen chemical pollution. The majority of Eco toxicological investigations and a thorough assessment of potential Eco toxicological effects on ecosystem services are still far apart, despite the fact that this topic is being more and more discussed in the scientific literature. In the end, closing this gap would assist to better address the trade-off between the environmental losses and socioeconomic advantages brought about by the use of different chemicals, as well as harmonize and expand the science that guides policy and decision-making.

Keywords: chemical pollution, biodiversity, ecosystem services, environmental toxicology, sustainability.

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EFFECT OF MICROALGAL BIOMASS AS TOXICANT INDICATOR: ENHANCING BIOENERGY PRODUCTION

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Microalgal biomass can serve as a valuable 'toxicant indicator' by monitoring changes that majorly serving as living sensor to detect presence of toxicant level in environment.Biofuels from microalgal biomass is among some of the promising sustainable energy technologies that can significantly replace the dependence on fossil fuels worldwide due to potentiality to lower CO_2 emissions. Nevertheless, the extraction of biomolecules for biofuel generation is inhibited by the rigidity of the cellular structure of microalgal biomass. Various pretreatment strategies have been evaluated for their efficacy in microalgal cell wall disruption to enhance microalgal bioenergy production. With it's decreased growth rate, altered enzyme activity, cellular morphology changes indicates toxicity ;which is well known from it's sensitivity, diverse response mechanisms and bioassay applications which helps to evaluate the toxicity of various substances including pesticides, weedicides, heavy metals ,and other industrial chemicals. This microalgal biomass aims high for removal of toxicants, for better water management, removal of antibiotics and also as biofertilizer. Biomagnification; as it is essential to reduce toxicants level that pollute environment, through reduction of chemical and industrial pollutants to enrich the biomass energy in aquatic medium. Thereafter, its highly impossible to reduce the usage of pollutants but those can be minimized by enlightening farmer vision through IPM standards.

Keywords: Bioenergy; Biomagnification ; Toxicants; Cell wall disruption; Microalgae.

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NANO-CATALYTIC PYROLYSIS

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Nano-catalytic pyrolysis is a process that combines pyrolysis with nanotechnology to enhance the efficiency and selectivity of the pyrolysis process. Nano-catalytic pyrolysis is a process that uses nanoparticles as catalysts to enhance the pyrolysis of biomass or other organic materials. The nanoparticles are designed to have high surface areas, reactivity, and stability, which enables them to catalyze the pyrolysis reaction more efficiently. Benefits of nano-catalytic pyrolysis are Improved efficiency, Increased selectivity, Reduced temperature and Improved product quality. Few examples include Metal Nano-catalysts, Metal oxide Nano-catalysts, Bimetallic and Trimetallic Nano-catalysts etc. Benefits of Nano-catalytic pyrolysis will be discussed through the poster presentation.

Keywords: Nano-catalytic pyrolysis, pyrolysis, Nano -catalysts.

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INTRODUCTION TO GREEN HOUSE GASES

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Greenhouse gases are gases in the atmosphere that trap heat from the sun, warming the Earth. They include water vapor, carbon dioxide, methane, nitrous oxide, and others. These gases come from many sources, including burning fossil fuels, agriculture, deforestation, and waste. To control greenhouse gas emissions, we need to reduce reliance on fossil fuels, transition to renewable energy sources, improve energy efficiency, and reduce waste, while also implementing strategies to reduce methane emissions and increase fuel efficiency in transportation. Remediating greenhouse gases, or reducing their impact, involves a combination of mitigation (reducing emissions) and adaptation (adjusting to the effects of climate change) strategies, including transitioning to renewable energy, improving energy efficiency, and implementing carbon capture technologies. A carbon footprint is the total amount of greenhouse gases (GHGs) that are released into the atmosphere due to human activities. Emphasis in this presentation would be on carbon foot print.

Keywords: Green house gases, sources, control measures of green house gases, Remediation, carbon Foot print.

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PRODUCTION OF BIOGAS – A RENEWABLE FUEL FOR MODEL VILLAGES

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Biogas is a renewable energy source that is made from organic waste like food, animal dung, and sewage. It is a mixture of methane, hydrogen, and carbon dioxide. Biogas is produced by breaking down organic waste like food or animal waste in an oxygen-free environment. This process is called anaerobic digestion. Purification of Biogas is done which is incudes processes for removing impurities from biogas to make it suitable for use. This process is also known as biogas upgrading. Biogas, after purification and compression, can be packaged and transported using pipelines, trucks with pressurized tanks, or by compressing it into cylinders for storage and transportation. Biogas can be used as for fuel as well as for electricity production. In this paper we will be presenting how biogas can be of use to villages so that they become model villages. Here we will be discussion taking case study of our own village having 150 families and each family with minimum two cows. The dung obtained can contribute to minimum of 80% of power bill savings.

Keywords: Biogas production, purification, conversion of biogas to electricity, model village suggestion.

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BIODIESEL: A RENEWABLE ENERGY INDEPENDENCE

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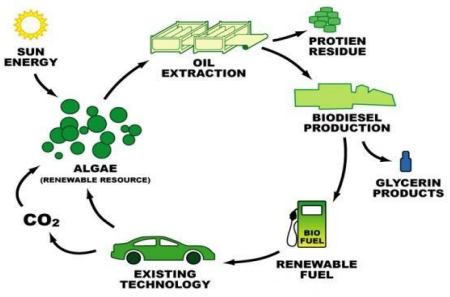
Biodiesel is an emerging and promising liquid biofuel that holds great potential for meeting transportation energy needs. As a renewable, non-toxic, eco-friendly, and sustainable alternative fuel, it offers numerous environmental benefits. While biodiesel can be used in its pure form to power vehicles, it is more commonly blended with diesel to help reduce particulate matter (PM), carbon monoxide (CO), and hydrocarbon (HC) emissions from diesel engines. Biodiesel is a biodegradable fuel derived from various biomass sources, including vegetable oils, animal fats, used cooking oils, and algae. It is composed of a mixture of long-chain fatty acid alkyl esters. Biodiesel can be used on its own or blended with petroleum diesel. Through transesterification, algal lipids are converted into biodegradable form of biodiesel. The in-situ transesterification technique utilizes acid, base, or enzymatic catalysts, with base catalysts being a common choice. These base-catalyzed reactions efficiently convert free fatty acids and triglycerides into fatty acid methyl esters (FAME). Reports indicate that base catalysts can achieve a high FAME yield, with conversion rates reaching 99%. Additionally, producing biodiesel from microalgae has proven to be a highly feasible and sustainable approach.



Keywords: Biodiesel. Green energy, Alkyl ester, Transesterification.

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SOLAR ENERGY

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The concept of harnessing solar energy dates back to ancient civilizations, but its scientific discovery is attributed to Edmond Becquerel in 1839 when he discovered the photovoltaic effect. Later, in 1954, Bell Laboratories developed the first practical solar cell, marking a significant advancement in solar technology. India initiated its solar energy journey in the early 1980s, but the real momentum came with the launch of the Jawaharlal Nehru National Solar Mission in 2010. The first 50MW solar plant in India was established in Neemuch, Madhya Pradesh. This plant played a crucial role in demonstrating the feasibility of large-scale solar energy projects in India. Research is being done on improving the efficiency of solar panels. High-efficiency solar panels ensure better energy conversion rates. Monocrystalline panels, known for their high efficiency and longevity, are often preferred over polycrystalline panels. Efficient energy storage systems, such as lithium-ion and lead-acid batteries, are crucial for maintaining a steady power supply. Advances in battery technology, including solid-state batteries, are further enhancing solar energy storage capabilities. India's rapid advancement in solar energy is a testament to its commitment to sustainable and renewable energy sources. By improving efficiency, storage, and implementation, solar energy can significantly contribute to global energy solutions and environmental conservation.

Keywords: Solar energy, Photovoltaic cell, Solar cell, Solar Panel, Solar tracking, Solar energy storage.

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Structural, Electrical and Magnetic Studies of Ni 0.7 Mn 0.2 Cu 0.1 Fe 2-x Al x O 4 (x=0, 0.05, 0.1, 0.15, 0.2 and 0.25) Nano-Ferrite Synthesized by Sol-gel Method

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Abstract:

In this research analysis, the outcome of aluminum substitution on the structural, magnetic, electric and dielectric features of spinel ferrite is studied. The nano-ferrites Ni 0.7 Mn 0.2 Cu 0.1 Fe 2-x Al x O 4 with x=0, 0.05, 0.1, 0.15, 0.2 and 0.25 are contrived by sol-gel auto- combustion technique. The spinel phase of the synthesized materials is identified by using the XRD diffraction pattern and gives a good confirmation for the development of ferrite. The SEM studies reveal about the uniformity of the materials and the spherical shape of the grains. The IR spectra reveal replacement of Al 3+ ions which broaden and shift the ν 2 band suggesting the occupation of Al 3+ ions on octahedral B-location. Relative permittivity and dielectric loss tangent decline with aluminum concentration rise for every synthesized ferrite. VSM is employed to study the magnetic behavior of the samples at room temperature.

Keywords: Cation distribution, force constant, magnetic moment, electron spin resonance

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Unlocking the potential of agro-based biomass through pyrolysis for high-value products

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The increasing global population, rapid industrialization, and urbanization have led to an exponential rise in solid waste generation. In solid waste generation, agro-based biomass residues present a significant opportunity for sustainable resource utilization. Various thermochemical and biochemical processes are employed to convert the agro-based biomass into value added products. Pyrolysis, a thermochemical conversion process offers a promising approach to unlock the full potential of these biomass feedstock for producing high-value added products. The present study demonstrates the development of an efficient activated carbon and bio-oil from the corncob biomass (as a precursor). The processes parameters such as process temperature, biomass loading rate, and particles sizes were varied to enhance the yield and quality of the valuable products. Bio-oil derived from pyrolysis can be employed as an alternative to conventional fuels, while biochar can be used for wastewater treatment and carbon capturing from air for climate change mitigation.

Keywords: Biomass, Thermochemical, Pyrolysis, Corncob.

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Biotechnology in production of Biofuel and Methanol: Advances and Future prospects

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The increasing global demand for sustainable energy has driven significant advancements in biotechnology for biofuel and methanol production. Biotechnology plays a pivotal role in enhancing the efficiency of biofuel generation through microbial fermentation, genetic engineering, and enzyme optimization. Microbial bioconversion of lignocellulosic biomass, algae-based biodiesel production, and synthetic biology approaches have revolutionized bioethanol, biodiesel, and biogas synthesis. Similarly, methanol production through biotechnological routes, such as microbial methanogenesis and engineered metabolic pathways, offers a promising alternative to conventional fossil fuel-based methods. The integration of bio-based catalysts, metabolic engineering of microorganisms, and advancements in process optimization have improved yield, cost-effectiveness, and environmental sustainability. This review highlights recent developments in biotechnology for biofuel and methanol production, challenges in large-scale implementation, and future research directions for enhancing renewable energy technologies.

Keywords: biotechnology; biofuel; methanol production; lignocellulosic.

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BIODIESEL

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Biodiesel is an excellent alternative for diesel, which is used as fuel for vehicles. Biodiesel can be produced from vegetable oils, used cooking oils and also from animal fats. We can produce biodiesel from the products of plants and animals so we can reduce environmental pollution. We are using the waste materials from biological systems that's why it will be definitely eco-friendly. We will produce bio diesel by transesterification process, in which we converts fats and oils into biodiesel and glycerin. Here glycerin is produced as a co-product, which can be used in the manufacture of pharmaceuticals and cosmetics. Hence it is a renewable and sustainable product and it reduces greenhouse gases it can be used as fuel in diesel engines, vehicles and also as aviation fuel. Biodiesel can also be used as lubricant and as solvent also.

Keywords : Biodiesel, Glycerin, Sustainable product.

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Speed of Sound Studies of Ethyl-4-hydroxy benzoate with N-methyl formamide & D-methyl formamide liquid mixtures

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Abstract:

Record the Measured values of densities (ρ) and speed of sounds (U) for the mixture of Ethyl-4-hydroxy benzoate(E-4HB) with N-methyl formamide (NMF) and Di methyl formamide(DMF) from temperature 303.15, 308.15 and 313.15K. Several speed of sound theories like nomoto (NOM) relation, impedance (IMP) relation, ideal mixing relation (IMR), vandael and vangeel (VDV) relation, junjie (JUN) relation and rao's specific velocity (RAO) relation have been determined and collate to measured values. By applying the chi-square test (χ) and average percentage error (APE) used to check the validity of these theories. The upshots are discussed interms of intera molecular interactions betwixt the molecules in the two-fold mix.

Keywords: Ethyl-4-hydroxy benzoate, chi-square test, average percentage error, two-fold mix

P 69

SUSTAINABLE BIODIESEL PRODUCTION FROM DIVERSE FEEDSTOCKS: A COMPARATIVE ANALYSIS OF SOURCES AND ADVANTAGES

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Biodiesel, an eco-friendly and renewable alternative to fossil fuels, is synthesized through transesterification of triglycerides from various biological sources. Feedstocks such as vegetable oils (soybean, palm, jatropha), waste cooking oils, animal fats, and microalgae have been extensively studied for their potential in biodiesel production. The selection of feedstock significantly influences biodiesel yield, quality, and economic feasibility. Vegetable oils offer high yields but compete with food supply, while waste oils and animal fats provide costeffective solutions with waste management benefits. Microalgae emerge as a promising alternative due to their rapid growth, high lipid content, and non-reliance on arable land. Biodiesel derived from these sources exhibits advantages such as biodegradability, lower greenhouse gas emissions, and enhanced lubricity. However, challenges remain in optimizing production efficiency, feedstock availability, and cost-effectiveness. This review highlights the comparative advantages of different biodiesel feedstocks, addressing their sustainability, production viability, and future prospects in mitigating energy crises and environmental pollution.

Keywords: Biodiesel; Biodegradable; feedstock; vegetable oils.

P 70

STUDY THE PROPERTIES OF DY3+:SM3+ IONS IN LI2O-CAF2-AL2O3-SIO2-B2O3 GLASSES

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Abstract:

The current investigation looks at the glass framework Li2O-CaF2-Al2O3-SiO2-B2O3 having Dy3+:Sm3+ ions arranged by melt and quenching method and its characterization consist of XRD, FTIR, optical and emission studies. By utilizing J-O theory; oscillator strength, JO parameter, radiative transition probability, and branching ratios measured to find the potentiality of the materials. Based on the emission the maximum intensity occurs at 4G5/2→6H7/2 transition specifying that the glasses are helpful for laser applications.

Key words: Glasses, JO parameter, branching ratios, laser applications

P 71

Fabrication of cellulose nano crystals from marine green algae and its antibacterial activity

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Abstract:

Green algae are photosynthetic unicellular or multicellular organisms form in both fresh water and marine environments. These are known for their multi fascinated applications and are prominent source of bio composite materials that comprises anti-cancer, therapeutic, anti-microbial properties. Nano cellulose crystals derived from marine green algae is a good renewable material. It has high surface area with high strength, chemical inertness and high porosity. Algal derived nano crystals are potent antibacterial activists. They much pronounce as drug candidates for use in nano medicine against bacterial diseases.

In this paper we discussed the synthesis of nano cellulose crystals from marine sea algae obtained from Visakhapatnam cost. Tempo mediated synthesis is carried out to obtain the nano cellulose crystals from these green algae. Typical peaks associated with cellulose were observed through FTIR at 1314 cm^{-1}, 1510 cm^{-1}, 1627 cm^{-1}, 1672 cm^{-1} and 3375 cm^{-1} corresponding to C-O stretching, N-O stretching, C=C stretching, C=O stretching, O-H stretching. The surface morphology and chemical compound percentage of these cellulose powdered material is tested using SEM and EDX. Further we discussed the antibacterial activity of this nano crystalline powder against gram positive and gram negative bacteria.

Key words:

TEMPO mediated synthesis, nano cellulose crystals, SEM, EDX, antibacterial activity

P 72

Facile Green Synthesis of Magnetite Nanoparticles using aqueous leaf extract of *Grewia tiliaefolia* vahl for anticancer and hepatoprotective activities

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ABSTRACT

During the past decade, green nanotechnology has received attention due to minimized use of toxic chemicals for preparation of nanomaterials. Among all green protocols, the plant mediated synthesis of nanoparticles offer numerous advantages such as eco-friendly and biocompatibility for pharmaceutical, biotechnological and biological applications. In this paper , for the first time ,we report an eco-friendly,cost-effective and simple method for the synthesis of Fe3O4 NPs using aqueous leaf extract of Grewia tiliaefolia vahl.The phytoconstituents present in the plants are responsible for the synthesis of Fe3O4 NPs and the phytoconstituents act as both reducing as well as stabilizing agents.Synthesized Fe3O4 NPs were charecterized using various analytical techniques such as UV-Visible spectroscopy, Fourier transform-infrared (FTIR) spectroscopy, Powder X-ray diffraction (XRD),Field emission scanning electron microscopy (FE-SEM),and Transmission electron microscopy(TEM).The FTIR and UV-Visible spectroscopic technique confirms the formation of Fe3O4 NPs .The powder XRD pattern confirmed the formation of phase pure Fe3O4 NPs. Fe3O4 NPs showed dose dependent hepatoprotective activity against paracetamol induced hepatoprotective activity percentage protection of Fe3O4 NPs for serum blood parameters like AST , ALT, ALP, Total Bilurubin, Total Protein were calculated as Fe3O4 Nps at 40 mg/kg b.w, 58.02 (U/L), 55 (U/L) , 52.23 (U/L), 61.88 (mg/dl), 43.36 (g/dl) respectively. Anticancer activity on HepG2 and MCF7 cell lines by using MTT assay was carried out Fe3O4 NPs were active against both the cell lines IC50 found to be 78.45 and 66.63 µg/ml respectively.

***Key words*:** *Grewia tiliaefolia* vahl, anticancer and hepatoprotective activity.

P 73

Nanocomposites and their applications on Supercapacitor

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Abstract

Nanomaterials have several advantages over bulk materials such as the large surface-to-volume ratio, very high porosity and completely different physiochemical properties. Nanomaterials are being developed for applications to wide range of fields including medicine, drug delivery, fuel cells, space exploration and electronics etc.,

Supercapacitors is a special type of energy storage device which has an extremely large capacitance by combining the capacitors and batteries properties into one device. Few important characteristics of supercapacitors are Charge time, Specific power, Cycle life of supercapacitors and Safety of supercapacitors. Supercapacitors are used in a wide range of applications which are Electronic cars, Static memories (SRAM), Wind turbines, Photographic flash, Flywheel in industry, Industrial electrical motors etc.,

The major objective is to synthesize the Non-Polymer based metal nanocomposite by the Sol-Gel method, how would the synthesized nanocomposite be efficient in supercapacitors as a working electrode and be utilized in antibacterial activity analysis and other environmental applications etc. For the Characterization and Synthesizing of the nanocomposites, the following instruments will be employed such as X-ray diffractometer (XRD) machine, Scanning electron microscope (SEM) machine, Transmission electron microscope (TEM), Energy Dispersive X-ray (EDX) and Fourier Transform Infrared (FTIR) machine.

***Keywords*:** SEM(Scanning Electron Microscope), Supercapacitors, Nanoparticles.

P 74

Structural and Electrical Studies of Magnesium Doped $Li_4Ti_5O_{12}$ Synthesized by Ceramic Technique

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Abstract:

In this paper the effect of magnesium (Mg) substitution in lithium (Li) site of spinel lithium titanate anode materials for lithium-ion batteries is extensively studied. The anode materials based on the formula $Li_{4-x}Mg_xTi_5O_{12}$(x=0 and 0.2)are prepared by conventional ceramic method at 850° C for 16h. Their phase formation processes, crystal structures, morphology, elemental analysis, and electrical properties were studied using XRD, SEM, EDX, FT-IR and CIS characterization techniques. The X-ray diffraction studies revealed the exact structure of the material which belonged to cubic spinel group with Fd-3m space group. The phase morphological features and grain size distribution were found using scanning electron microscopy (SEM) and the grain size was found to be in the range 0.9-1.1µm. The FT-IR results revealed the structure of the oxide lattice built of MO_6 (M= Li, Mg and Ti) as tetrahedra and octahedra. The electrical impedance studies showed the material to exhibit excellent conductivity which was found to be 3.9×10^{-5} S/cm at ambient temperature for frequency ranging from 100 Hz to 2 MHz.

Keywords: Anode material, XRD, FT-IR, LCR.

P 75

Zinc-Substituted Cobalt Ferrite Synthesized by Hydrothermal Method for Magneto strictive and Hyperthermia Applications

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Abstract: Zinc-substituted cobalt ferrite ($Co_{1-x}Zn_xFe_2O_4$) nanoparticles were synthesized using the hydrothermal method to investigate their potential for magnetostrictive and hyperthermia applications. The influence of Zn substitution on the structural, magnetic, and thermal properties of cobalt ferrite was systematically analyzed. X-ray diffraction (XRD) confirmed the formation of a single-phase spinel structure, with lattice parameters increasing as Zn content increased, indicating successful substitution. Field-emission scanning electron microscopy (FE-SEM) revealed a uniform distribution of spherical nanoparticles with an average size in the range of 20–50 nm.

Vibrating Sample Magnetometer (VSM) analysis revealed decreased coercivity and saturation magnetization with Zn substitution due to weakened A-B super exchange interactions. Magnetostriction studies showed enhanced strain sensitivity for sensor applications. Specific Absorption Rate measurements under alternate magnetic field indicated optimized Zn content achieving therapeutic temperatures (42–46°C), making Zn-substituted cobalt ferrite promising for magnetic fluid hyperthermia and biomedical applications.

The combined analysis of structural, magnetic, and thermal properties suggests that Zn-substituted cobalt ferrite synthesized via the hydrothermal method offers a tunable platform for dual applications in magnetostrictive sensors and hyperthermia therapy. The optimized composition balances the trade-off between magnetization, coercivity, and heating efficiency, paving the way for future advancements in functional magnetic nanomaterials.

Keywords: Zinc-substituted cobalt ferrite, hydrothermal synthesis, magnetostriction, hyperthermia, magnetic nanoparticles, spinel ferrite.

P 76

Molecular Docking Investigations and Experimental FT-IR, UV-Vis Spectroscopic Studies of anti-cancer drug Afinitor

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Abstract

According to the World Health Organization reports, cancer is the leading cause of death around the globe. Infectious diseases, parasitic infections, and cardiovascular diseases are closely followed. It is accounted that in 2021, 19.8 million individuals had been treated for cancer, indicating how widespread cancer has grown. Even after all the efforts in these years, research into cancer's medical implications is still an exciting area of profound investigation. In pursuit of such fundamental scientific efforts, this investigation summarizes, the assignment of specific vibrational modes of Afinitor using standard FT-IR spectral analysis and employing molecular docking techniques have identified an exact atomic level itinerary mechanism of the Afinitor and target immunosuppressant FK506 binding protein. To ascertain the molecule's bioactivity and charge transit between its frontier orbitals, the UV-Vis spectra of the molecule were examined, and the appropriate energy intervals were estimated by employing quantum computations of wavelength–energy relations.

Keywords : Molecular docking, FT-IR, UV-Visible, etc.,

P 77

Improved magnetic, structural and dielectric behavior of Cu-Ce substituted Cobalt nano ferrites

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Abstract:

The nano ferrite compounds $Co_{1-x}Cu_xFe_{2-y}Ce_yO_4$ (with x values of 0.0, 0.25, 0.5, and 0.75, and y values of 0.0, 0.03, 0.06, and 0.09) were synthesized through the sol-gel auto-combustion method. The characteristics of spinel ferrites were tailored by creating nano ferrites with desirable properties, which were then sintered at 1150 °C for 2 h in the presence of rare earth (Ce^{3+}) and transition metals (Cu^{2+}). They were investigated using dielectric, FTIR, FESEM, XRD, VSM, and DC electrical resistivity experiments. XRD examination verified the samples' cubic spinel structure by measuring the average crystallite size, x-ray density, and lattice constant. FESEM images revealed grain sizes ranging from 41.07 to 156 nm. FTIR spectra in the range of 415 cm^{-1} to 430 cm^{-1} further supported the substitution of Cu^{2+}/Ce^{3+} ions in the tetrahedral sites, indicated by an increase in the lattice parameter. Measurements of the remanence ratio, saturation magnetization, anisotropy constant, coercivity, and magnetic moment, among other magnetic characteristics, were made. Higher concentrations of Cu^{2+}/Ce^{3+} ions were found to considerably reduce magnetic saturation (Ms), coercivity (Hc), and remanence (Mr). These materials were semiconducting because their activation energy varied between 0.52 and 0.62 eV, and their DC resistivity increased with increasing Cu^{2+}/Ce^{3+} concentration. Above 1 MHz, the dielectric properties became frequency-independent and decreased with increasing frequency. These ferrites seem highly potential for devices working at high frequency.

Keywords: Dielectric characteristics, Dc resiativity, Magnetic properties, Spinel nanoferrites

P 78

Effect of Cr^{3+} substitution on the structural and improved magnetic properties of $Mg_{0.5}R_{0.5}Fe_{1.5}Cr_{0.5}O_4$ (R = Cu and Zn) ferrites

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Abstract: - Magnetic nanoparticles have recently gained popularity due to their wide range of applications in fields such as catalysis, sensor materials, and medicine. Among these, ferrite-based magnetic spinel nanoparticles have become particularly important in the fields of nano-science and biophysics due to their exceptional physical and chemical properties. These nanoparticles, typically composed of ferric oxide combined with various metals, exhibit unique magnetic properties. The structural, microstructural, and magnetic properties of $Mg_{0.5}Cu_{0.5}Fe_{1.5}Cr_{0.5}O_4$ and $Mg_{0.5}Zn_{0.5}Fe_{1.5}Cr_{0.5}O_4$ ferrites synthesized via the solid-state reaction method have been studied. Characterization techniques such as X-ray powder diffraction (XRD), scanning electron microscopy (SEM), and Fourier Transform Infrared spectra (FTIR) were employed to analyze the phase purity, microstructure, and particle size of the particles. From XRD patterns confirmed the formation of a single-phase cobalt ferrite with a cubic spinel structure for two samples. Structural parameters, including lattice parameters and average crystallite size, were calculated from the XRD data. SEM analysis showed grains with diameters between 4 μm and 6 μm. The high-frequency tetrahedral vibration band $\vartheta 1$ and the low-frequency octahedral vibration band $\vartheta 2$ in the FTIR spectra are in the reported range.

Keywords: Spinel ferrites, structure, vibrational band, XRD, SEM and FTIR.

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SYNTHESIS AND CHARACTERIZATION OF FERRITE NANOCOMPOSITES USED FOR THE TREATMENT OF HEAVY METAL IONS

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Abstract

Water is a vital component for the survival of living organisms. Due to the swift expansion of industrialization, water sources have become contaminated with heavy metals including zinc (Zn), nickel (Ni), lead (Pb), copper (Cu), chromium (Cr), and cadmium (Cd) and harmful pollutants. The presence of heavy metal ions in water sources even at low concentrations can lead to various health complications. Recently, better remediation techniques were offered using the nanotechnology and ferrite nanocomposites.Ferrite nanocomposites (FNCs) have attracted a great interest due to their wide applications in several areas such as biomedical, waste water treatment, catalyst and electronic device. Ferrite nanocomposites (FNCs) are prepared by hydrothermal process and green synthesis process. The prepared material were characterized by X-ray powder diffraction (XRD) to study particle size and crystallinity, the morphology of the particles were analyzed by using Scanning Electron Microscopy (SEM), functional group were observed using Fourier Transform Infrared Spectrometer (FTIR) and band gap energy were examined by UV-Visible spectrometer.

Keywords *:* Ferrite Nanocomposites, heavy metals, FTIR.

P 80

Pharmacological behaviour of silver nanoparticles using *Saccharomyces cerevisiae* isolated from marine soil in Visakhapatnam sea shore

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Abstract

Silver nanoparticles are nanomaterials with a wide range of possible uses in medicine. In this work, we used *Saccharomyces cerevisiae* that was isolated from marine soil on the Visakhapatnam seashore to bioform silver nanoparticles (AgNPs). Numerous methods, including UV–visible spectroscopy, X-ray difraction, Fourier-transform infrared spectroscopy, scanning electron microscopy, energy dispersive X-ray analysis, X-ray photoelectron spectroscopy, and Raman spectroscopy, were used to characterize the synthesized AgNPs. *E.coli* and *S.pyogenes* bacterial strains were used to evaluate the antibacterial qualities of the AgNPs. The synthesized particles are crystalline nature was confirmed by XRD analysis, while the UV-visible spectra displayed distinctive peaks suggestive of AgNPs. According to FTIR data, capping proteins are present and aid in the synthesis and stability of AgNPs. Additionally, the size and morphology of the AgNPs were shown by SEM images, which showed spherical shapes with sizes that varied from 53 to 97 nm. Interestingly, it was discovered that the AgNPs' antibacterial activity was stronger against E. coli than *S.pyogenes*, suggesting that these nanoparticles have the potential to be effective antimicrobial agents. Furthermore, the Bio-AgNPs demonstrated antiproliferative effects on the HepG2 cancer cell line, with an IC_{50} of 169, which is a low toxicity inhibition control. Consequently, *Saccharomyces cerevisiae*-biosynthesised AgNPs may find use in the management of cancer and bacterial infections.

Keywords: AgNPs; *Saccharomyces cerevisiae*; Marine soil bioreduction; HepG2 cell line; antimicrobial assay.

P 81

Therapeutic Role of Trace Element in Medicinal Botanicals

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ABSTRACT

The trace element composition of medicinal plants plays a crucial role in their therapeutic efficacy. By analyzing various plants used in traditional medicine, researchers have unveiled a wealth of information regarding the concentration and types of trace elements present. These elements, such as iron, zinc, and copper, have been shown to possess significant health benefits. The systematic study of these plants ensures that both their historical uses and modern applications are grounded in scientific evidence, thereby facilitating a deeper understanding of their roles as complementary therapies in many diseases. By focusing on the interplay between trace elements and therapeutic outcomes, this outline lays the groundwork for a comprehensive examination of how these plants can be effectively utilized in treatment of diseases. To further elucidate the implications of trace elements in medicinal plants, it is essential to consider their individual contributions to the mechanisms of action targeting diseases. The diversity of roles that trace elements play within the biochemical pathways but also the need to investigate their cumulative effects when consumed through medicinal plants. Furthermore, integrating trace element knowledge into treatment regimens emphasizes the importance of evidence-based practice in herbal medicine. The assessment of bioactive compounds and their trace element profiles complements existing traditional knowledge and offers medical practitioners a scientifically validated basis for incorporating these plants into treatment protocols. By investigating and documenting the trace element composition of various medicinal plants, healthcare professionals can draw meaningful connections between traditional practices and contemporary therapeutic methods.

Keywords: Trace elements, Medicinal Plants, Diseases

P 82

Advances in Non-Evaporable Getter Materials for UHV Applications

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Abstract: Non-evaporable getter (NEG) materials have a variety of applications in the emerging fields relating to innovative technologies of vacuum systems. These materials possess potential applications for the storage of Isotopes (like hydrogen), particle accelerators, evacuated solar collectors, plasma fusion machines. Several metals belong to the IVth and Vth group of the periodic table (such as Ti, Zr, V, etc) elements can be used to synthesize and fabricate NEG materials. Recently, titanium and zirconium-based NEG materials are found to use for maintaining good vacuum levels in the evacuated packing(s). Vacuum sealed enclosures enhance the gas-absorption properties yielding high bonding stability with the lowest expenses of manufacturing. The NEGs are used for absorbing the residual gases such as H2, CO2, CO, N2, O2, H2O etc in the Ultra High Vacuum (UHV) systems and closed containers. For the development of new non-evaporable getter materials, the appropriate concentration of suitable reactive materials (like Ti, Zr, V) is mixed with one of the structural metals (like Fe, Al, Co). Earlier, it observed that the synthesis of titanium and zirconium-based getter alloys have good chemical structure; bonding interstitial sites, and good mechanical strength at room temperature as well as at elevated temperatures up to 1000°C. Further, analysis of the prepared NEG materials' absorption properties with respect to residual gases is essential to understand their suitability and sustainability for using them as pumps for vacuum sealing. In earlier studies Ti-Co, and Zr-Co based compounds indicated that these materials are more appropriate and suitable materials in several aspects relative to other materials. Even though, some experimental techniques were used to study the characterization of these materials; no measurements with TGA/DTA and DSC systems for characterization of these materials performed. Therefore, for complete understanding of the properties /behaviour pertaining to the non-evaporable getter (NEG) materials have been carried out by using TGA/DTA and DSC systems besides other experimental facilities for the first time. Aim of the present work is to characterize non-evaporable getter (NEG) materials by using thermal analysis techniques those mentioned above (TGA/DTA and DSC) to examine the residual gas absorption properties along with the structural and morphological investigations by using X-ray powder diffraction (XRD), scanning electron microscopy (SEM) and energy dispersive spectroscopy (EDS) experimental techniques.

Keywords: Elements, alloys, materials, non-evaporable getters, gas absorption.

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MAGNETIC and DC ELECTRICAL PROPERTIES OF Cu DOPPED Co-Zn NANOFERRITES

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Abstract:

Cu-doped Co-Zn nanoferrites Co0.5 Cu Zno.5 - Fe2O4 (x = 0.0, 0.2 and 0.4) were synthesized by sol-gel auto-combustion. X-ray diffraction (XRD), field emission scanning electron microscopy (FESEM) with EDS, Fourier transform infrared (FTIR) spectroscopy, vibrating sample magnetometry (VSM), and two-probe methods were employed to study the structural, morphological, magnetic and DC electrical resistivity properties, respectively, of the prepared samples. Monotonically decreasing values of the lattice constants with the dopant concentrations were calculated. The crystallite sizes were also re-corded in a decreasing pattern. The stretching bond vibrations measured by room temperature FT-IR showed characteristic absorptions in the range of 579.634-393.49 cm-1. The magnetic parameters were observed to have a tuned value, although decreasing in a non-monotonic pattern. A higher value of the DC resistivity value was recorded for x = 0.2 concentration of the do-pant, indicating the optimal concentration for synthesizing materials appli-cable in high-frequency microwave devices.

Keywords: Nano ferrites, XRD, FTIR, resistivity

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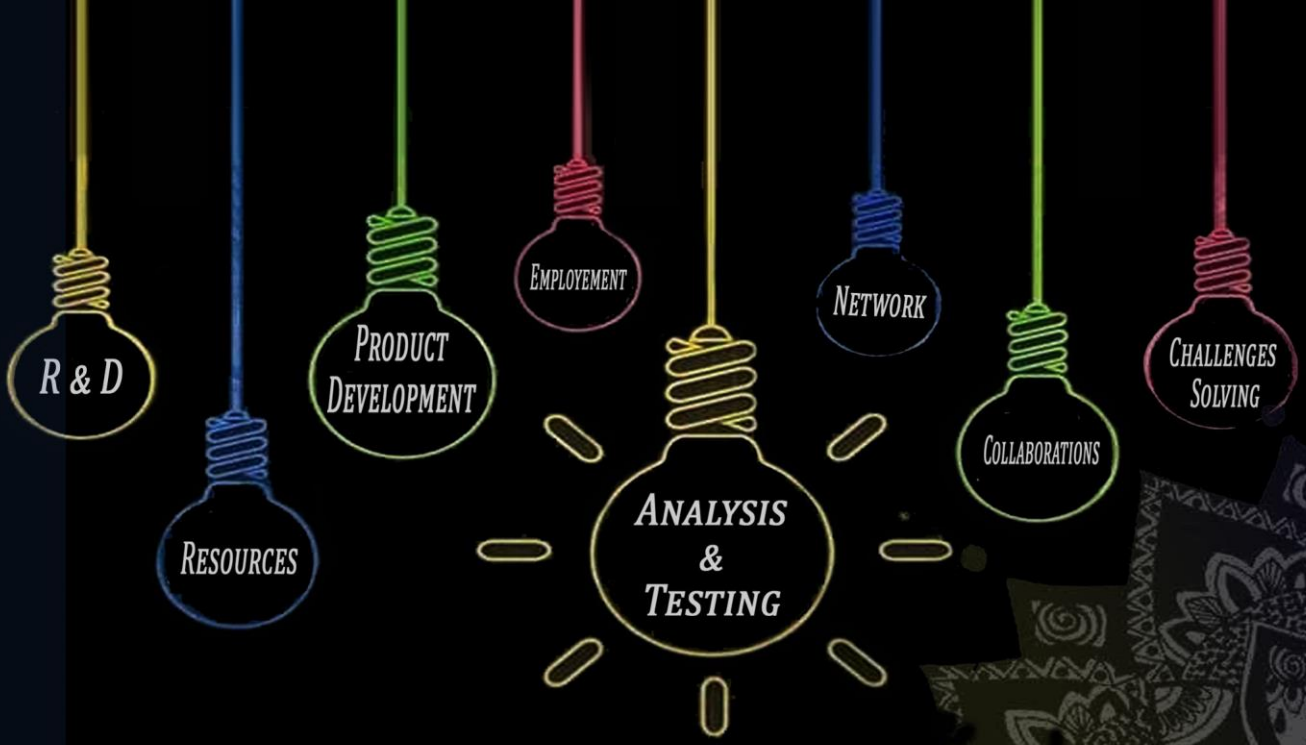

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