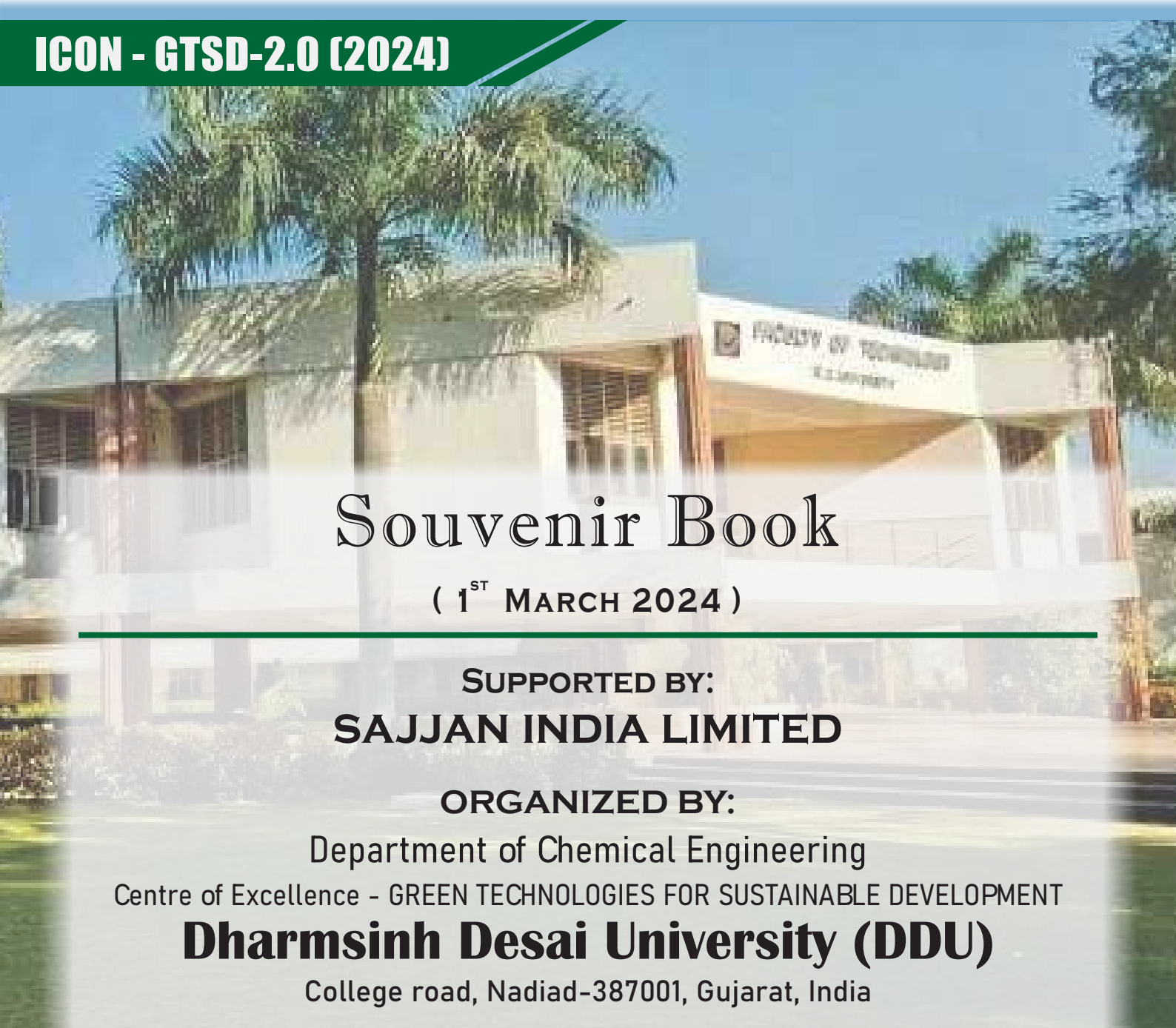
2nd Hybrid Mode International Conference

on

GREEN TECHNOLOGIES FOR SUSTAINABLE DEVELOPMENT 2.0

ICON - GTSD-2.0 (2024)



Souvenir Book

(1ST MARCH 2024)

SUPPORTED BY:

SAJJAN INDIA LIMITED

ORGANIZED BY:

Department of Chemical Engineering

Centre of Excellence - GREEN TECHNOLOGIES FOR SUSTAINABLE DEVELOPMENT

Dharmsinh Desai University (DDU)

College road, Nadiad-387001, Gujarat, India

GREEN TECHNOLOGIES FOR SUSTAINABLE DEVELOPMENT ICON-GTSD - 2.0 (2024)

1st March 2024

Supported By :-

Sajjan India Limited

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ORGANIZED BY :-

Department of Chemical Engineering

(Centre of Excellence - Green Technologies for Sustainable Development)

DHARMSINH DESAI UNIVERSITY

College Road, Nadiad-387001, Gujarat, India

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	Prof. Dhrumil Gandhi	
	Prof. Niraj Nair	
	Prof. Jaydeep Jivani	
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	Dr. Mittal Thakkar	Prof. Deep Shah
	Prof. Pranay Patel	Prof. Jaimin Patel
	Prof. Aditya Christian	-

ICON - Green Technologies for Sustainable Development – 2.0

Friday, 1st March, 2024

Department of Chemical Engineering, DDU, Nadiad

Conference Schedule

TIME (IST)	EVENT	VENUE
08:30 to 09:30 AM	Registration, Welcome Breakfast	Opposite MMH
09:30 to 10:15 AM	**INAUGURATION** Centre of excellence – GTSD ICON- GTSD – 2.0 (2024)	MMH
10:15 AM - 11:00 AM	**PLENARY** Prof. S. S. Bhagwat (Director, IISER, Pune)	MMH
11:00 AM - 11:15 AM	**TEA BREAK**	Opposite MMH
11:15 AM – 1:00 AM	**INDUSTRIAL CASE STUDIES** Reliance Industries Limited Linde India Deepak Group of Companies Sajjan India Limited	MMH
1:00 PM - 1:45 PM	**LUNCH BREAK**	Opposite MMH
1:45 PM - 2:45 PM	**INDUSTRIAL CASE STUDIES** Gujarat Cleaner Production Centre Nirma Industries Utility Services Specialist Pvt. Ltd.	MMH
2:45 PM - 5:15 PM	**PARALLEL SESSIONS** Offline Paper Presentations (11 Sessions) Online Paper Presentations (2 Sessions) Poster Presentation (3 Themes)	Places Allocated
5:15 PM	**HIGH TEA**	Opposite MMH

*** MMH – Multi Media Hall**

VICE CHANCELLOR'S MESSAGE

Green Technologies for Sustainable Development - 2.0 (GTSD-2.0) 2024

It is my distinct pleasure to extend my warm greetings and introduce the forthcoming International Conference on "Green Technologies for Sustainable Development - 2.0" (GTSD-2.0), organized by Department of Chemical Engineering at Dharmsinh Desai University (formerly known as DDIT).

Founded in 1968 by the revered educationist, social worker, and Member of Parliament, Late Shri Dharmsinh Desai, our university has evolved from a chemical engineering institute into a comprehensive institution offering a diverse range of Graduate, Post Graduate, and Doctorate programs in various faculties. Our commitment to excellence is evident in the expansion of our faculties, including Faculty of Technology (Chemical, Computer, Civil, Mechanical, Instrumentation, Electronics & Communications, Information Technology), Faculty of Pharmacy, Faculty of Management, Faculty of Commerce, Faculty of Dental Science and Faculty of Medical Science.

The Dr. H. M. Desai Department of Chemical Engineering, stands as a pioneer in the field of chemicals and petrochemicals in Gujarat. Following the tremendous success of GTSD-1.0 in March 2021, Department has Scheduled to organize GTSD-2.0. This international conference aims to provide a platform for discussions on the theme: "Sustainable development through green and clean technology for a better future business." I am sure, the conference is set to be a global event, drawing participants from diverse sectors and countries. DD University is proud to assemble industry and academia's renowned speakers, along with esteemed panelists, fostering interactive sessions and encouraging robust dialogue to maximize participant benefits.

I would like to extend my heartfelt congratulations to the Chemical Engineering Department and Sajjan India Limited for orchestrating the remarkable International

Conference on Green Technologies for Sustainable Development-2.0. Your collective efforts and commitment to organizing such a prestigious event are truly commendable.

I am confident that this conference will be a resounding great success. The exchange of ideas and insights during this event will undoubtedly contribute to advancing knowledge and promoting sustainable practices. I wish the conference participants, organisers, and all involved the very best in this endeavour and look forward to witnessing the positive impact.

Padma shri Dr. H.M. Desai

Vice Chancellor, D.D.U. Nadiad

Message from the IQAC DIRECTOR/Head of Chemical Engineering Department

Green Technologies for Sustainable Development - 2.0 (GTSD-2.0) 2024

It is with immense pride and excitement that I welcome you to our esteemed department. Since its inception in 1968, the Chemical Engineering Department has evolved into the largest of its kind in the state of Gujarat, India. Over the years, we have remained committed to our mission of academic excellence, research innovation, and industry collaboration.

Our comprehensive programs, ranging from Diploma to PhD, cater to the diverse needs of aspiring chemical engineers, providing them with a solid foundation and advanced expertise in their chosen field. Through rigorous academic curriculum and state-of-the-art facilities, we strive to nurture the next generation of leaders and innovators in the realm of chemical engineering.

In addition to our academic endeavors, we take great pride in our role as a catalyst for industry growth and development. Through our consultancy, audit, and testing services, we have forged invaluable partnerships with various industries, offering expertise in process intensification, catalysis, surface science and nanotechnology, and environmental audit. These collaborations not only enhance the practical knowledge of our students but also contribute significantly to the advancement of industrial practices.

I am delighted to announce the establishment of our newest Center of Excellence in Greener Technologies for Sustainable Development (GTSD), generously sponsored by Sajjan India. Building upon the success of GTSD1, organized in 2021, GTSD2 promises to be another landmark event in our journey towards sustainable innovation. We are determined to make this conference a resounding success, leveraging the power of technology to foster collaboration and knowledge exchange.

As we embark on this exciting endeavor, I extend my heartfelt gratitude to all our sponsors, partners, faculty members, and participants for their unwavering support and enthusiasm. Together, let us continue to push the boundaries of excellence, driving positive change and sustainable development in the field of chemical engineering.

Wishing you all a fruitful and enriching experience at GTSD2!

Warm regards
Dr M S Rao
Head of Chemical Engineering Department

Dean's Message

Green Technologies for Sustainable Development - 2.0 (GTSD-2.0) 2024

Greetings from Faculty of Technology, Dharmsinh Desai University, Nadiad!!!

*I am extremely happy that the Department of Chemical Engineering, Faculty of Technology is organising a Hybrid Mode International Conference on "**Green Technologies for Sustainable Development - 2.0 (GTSD-2.0) on 1st March 2024.***

Research is an endless process and Inputs to the research are contributed by thorough knowledge in a particular field through immense learning. Immense learning can be brought by attending various forums related to the subject. Hence it becomes essential to conduct an International conference of this sort to contribute to the field of research and technology.

The field of engineering is a vast area including various disciplines and its applications keep increasing to satisfy the automated era. To keep the knowledge shared and updated it is essential to bring the students, faculty members and researchers from various institutes and organizations worldwide into a common forum. I hope this International conference will bring it to reality by uniting participants from different places to present their research works and exchange their ideas. I wish all the participants to have a good learning experience throughout the International conference.

The topics of the International Conference truly reflects the current trends, recent advances and new approaches in Green Technologies. Let us join hands for the future of this world, for the Next generation of mankind, for the prospective and collective efforts to change what is within our reach and means. Our collaborative efforts have the power to change the destiny. So, let us live up to their expectations and participate in this Event.

I sincerely hope this International conference will deliberate and discuss all the different facets of this exciting topic and come up with recommendations that will lead to a better, healthier, merrier world. I wish this International conference a great success.

Prof (Dr.) V. A. Shah
Dean,Faculty of Technology
Dharmsinh Desai University,Nadiad

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Dear Esteemed Attendees, Organizers, and Participants,

We extend our heartfelt gratitude to the entire organizing team for your invaluable contributions and unwavering support during the International Conference on Green Technologies and Sustainable Development (GTSD-2.0, 2024), held at Dharmsinh Desai University, Nadiad, Gujarat, India. Your commitment has undoubtedly played a pivotal role in making this event a resounding success.

It's immense pride and enthusiasm that SAJJAN India Limited stands as the main sponsor of the Centre of Excellence and this prestigious event. At SAJJAN, we are deeply committed to fostering innovation and advancements in sustainable technologies that pave the way for a greener and more sustainable future. Through our sponsorship, we aim to support initiatives that promote environmental consciousness and sustainable development, aligning with our core values and corporate responsibility. We believe that collaboration and knowledge-sharing platforms like this conference are instrumental in driving meaningful change and progress towards a more sustainable world.

We would also like to express our gratitude to all the participants for their invaluable contributions and enthusiastic engagement throughout the conference. The exchange of ideas, insightful discussions, and collaborative efforts showcased a shared commitment to advancing green technologies and sustainable development. As we move forward, let us continue to foster the spirit of collaboration, inspiring action, and forging partnerships that have the potential to make a lasting impact on our planet. It is through such collective efforts that we can contribute to a brighter and more sustainable future for generations to come.

Once again, thank you for your participation and support. We look forward to continued collaboration and success in our shared mission.

Warm regards

SAJJAN INDIA LIMITED

It is matter of great pride for Dharmsinh Desai University to start Centre of Excellence in "Green Technologies for Sustainable Development" with the support from Sajjan India Limited. The basic objective of the centre is to create awareness about upcoming technologies related to green chemistry and green engineering among our next generation.

The centre is aiming to play pioneering role in the area of green technologies by connecting various process industries and academic institutions to achieve the goal of sustainable development. The major focus of the centre is to boost research activities, conduct seminar/workshop and offer online learning programs for the students and industrial participants.

The International Conference on Green Technologies for Sustainable Development (GTSD-2024) organized by the Centre as first step towards its goal has provided platform for presenting innovative ideas and deliberations on the future course of action. The overwhelming response from both industries and academia is reflected in the abstract book which highlights more than 150 research studies in this emerging field.

At present, more than 200 individuals and organizations have joined the centre from various industries and academic institutions. I am sure that more number of Chemical process Industries and academic institutions will join hands with us in near future for the noble cause of "Save the Environment". I am thankful to Almighty God, DDU management , Sajjan India Limited , faculty members and students for whole hearted support to the Canter and its activities.

संरक्षेद्दूषितो न स्याल्लोकः मानवजीवनम्।

To safeguard our own lives, let's preserve nature.

Dr. Vimal Gandhi
Associate Professor,
Dept. of Chem. Engg.,D. D. University, Nadiad

Message from the Conference Organising Secretaries

Green Technologies for Sustainable Development - 2.0 (GTSD-2.0) 2024

भूमिर् भवतु वर्धनं (Let the Earth Grow)

It is a matter of pride for the Department of Chemical Engineering, Dharmsinh Desai University, Nadiad, to host the International Conference on Green Technologies for Sustainable Development – 2.0 (ICON-GTSD-2.0). The GTSD-2.0 (2024) is the second International Conference in hybrid mode on the Green Technologies theme after the success of ICON-GTSD-1.0 (2021).

*To foster the knowledge of green technologies at the global level and to bridge the gap between Industry-Academia, the ICON-GTSD-2.0 (2024) is being organized with the support of **Sajjan India Limited**. The ICON-GTSD-2.0 (2024) covers the broader spectrum of themes starting from clean and green approaches for chemical and pharma industries to process modelling, optimization, intensification, green solvents, green buildings, green hydrogen and ammonia, systems engineering and applications of Artificial Intelligence and Machine Learning for greener approaches.*

We are indeed very happy to announce the overwhelming response received from all over the world to the ICON-GTSD-2.0 (2024). For the hybrid mode one-day conference of ICON-GTSD-2.0 (2024), we have received more than 170 abstract submissions. Through the peer-review process, 98 presentations are selected and divided into 11 parallel offline sessions, 18 presentations are selected for 2 parallel online sessions having participants from China, Taiwan, South Korea, South Africa and Vietnam. In the ICON-GTSD-2.0 (2024), 45 offline poster presentations are also selected and considered for 3 parallel sessions.

To support the journey of young researchers in the field of Green Technologies, we have tied up with four publishing partners namely the Indian Journal of Environmental Protection (Scopus), Indian Journal of Science and Technology (Web of Science), Water-Energy Nexus (Elsevier) and International Science Congress Association Journals (ISCA). We are pretty much sure that young researchers will be benefited by these plethora of journals by publishing their work into suitable journals.

We are quite confident that the present conference ICON-GTSD-2.0 (2024) will encourage a lot more multidisciplinary collaborative research among young researchers all over the world for economic prosperity with ecological and societal well-being and growth. In nutshell, the ICON-GTSD-2.0 (2024) will spread the message of भूमिर् भवतु वर्धनं (Let the Earth Grow).

Dr. Siddharth C. Modi
Organizing Secretary

Dr. Anand Kumar Tiwari
Organizing Secretary

PLENARY SPEAKER

Green Technologies for Sustainable Development - 2.0 (GTSD-2.0) 2024

Dr. Sunil S Bhagwat, B.Chem.Engg., M.Chem.Engg., Ph.D.(Tech) is the Director, Indian Insititute of Science Education and Research, Pune since 2023. Earlier, he was a Professor fo Chemical Engineering in the Institute of Chemical Technology (earlier known as UDCT/UICT), Mumbai since 1986. There, he held the positions of Dean, Academic Programmes, member, Board of Governors, Coordinator of Centre of Excellence in Process Intensification and PostGraduate Diploma course in Chemical Technology Management.

His area of Specialization is Interfacial Science and Engineering, Artificial Neural Networks, Energy and Exergy Engineering. He is a Fellow of the Indian National Academy of Engineering and Maharashtra Academy of Sciences. and was also bestowed the INSA Teacher award.

His group has successfully completed several research projects funded by government agencies such as CSIR, DST, public sector bodies such as DAE, NTPC, and by private sector companies such as Hindustan Lever Ltd, MARICO Industries Ltd, ICI, British Petroleum, etc. In 2013, his research group won the first prize in the Bry-Air asia awards for the HVAC for his work in the area of heat based refrigeration. He was awarded NOCIL Award of the Indian Institute of Chemical Engineers for excellence in design or Development of Process Plant or Equipment in 2012 and the CSMCRI-Chemcon Distinguished Speaker Award at Chemcon Dec 2014. He was Elected the best teacher by the students and awarded the Prof. R. A. Rajadhyaksha Best Teacher Award at ICT many times and in 2016, the Indian National Science Academy (INSA) bestowed upon him the best Teacher Award for the year 2016. In 2019, he was selected for the UDCT Alumni Association's Distinguished Alumnus Award - Academic category. In 2023, he was awarded the K V Mariwala Award for Industry- Academia interactions by the Indian Chemical Council.

He is a life member of Indian Institute of Chemical Engineers (past Chairman, Mumbai Regional Center) and the Honourary secretary of the Indian Society for Surface Science and Technology, Western India Chapter. He is also a life member of Oil Technologist's Association of India. He is on the Editorial Board of the Journal of Surface Science and Technology, India and was on the Editorial Advisory Board of the Industrial &Engineering Chemistry Research of the American Chemical Society between 2013-2015. He is also on the editorial board of Journal Surface Science and Technology. Besides at the ICT, he has spent one year at the University of Florida, USA and a semester at Texas Tech University, USA where he contributed to research and teaching.

He is a past chairman of the Indian Institute of chemical Engineers (IIChE) Mumbai regional Center and is the Hon Secretary of the Indian Society for Surface Science and Technology, Western India Chapter. He is an active consultant to the chemical industry and the client companies range from pharmaceutical ancillary company to an industrial research company like Tata Research Development and Design Centre to manufacturing companies such as Galaxy Surfactants, MARICO Industries, Balmer-Lawrie, GSK-CH, GAIL, HUL, TRDDC, Thermax, Reliance Industries, IPCA laboratories, UNICHEM laboratories, Jayant Agro-Organics Ltd, KV Fire, DCM-Shriram and PPG Industries, USA. He has presented talks at various university research centers, industries and conferences in India as well as abroad.

ABSTRACT OF PLENARY TALK

New Microbial Surfactants

Sunil S Bhagwat

Department of Chemical Engineering, Institute of Chemical Technology

Matunga, Mumbai 400019, INDIA

and

Indian Institute of Science Education and Research, Pune 411008, INDIA email:

ss.bhagwat@ictmumbai.edu.in/ ss.bhagwat@iiserpune.ac.in

ABSTRACT: Some of the new surface active molecules synthesized and characterized in our recent work are presented here. Sophorose is a sugar which can work as a polar headgroup. Sophoro lipids were prepared microbially by using fatty alcohols instead of usual fatty acids and as a result, the molecule remains nonionic. As a material to combine with existent large scale commercial surfactants, the sophoro lipids have a great potential to reduce surfactant requirements. These molecules are also active as antimicrobial agents and have the potential to replace some of the harsher materials.

KEYNOTE SPEAKERS

Dr. Kabir Jasuja

Kabeer Jasuja *is currently an Associate Professor in the Discipline of Chemical Engineering. He began his academic career at IIT Gandhinagar in 2012. He received his B.Tech. degree from the IIT Kharagpur in 2007 and Ph.D. degree from Kansas State University in 2011. After his Ph.D., he also worked as a Post-doctoral research fellow at the Northwestern University till 2012.*

Studies from 2018 to 2020,and as an Dean, Academic Affairs from 2020 to 2022. In 2020, he received the Award for Excellence in Institution Building by IIT Gandhinagar.
For his research contributions, he was selected for a Chair position (Dr. Dinesh O. Shah Chair in Surface Science and Nanotechnology) in 2021.

His research group at IIT Gandhinagar has discovered a new family of boron-rich nanosheets isomorphous to graphene by revisiting the chemistry of layered metal diborides. Their work has presented fundamentally new perspectives on utilizing nanoscaled metal borides for changing some of our everyday technologies. For discovering this new family of nanomaterials, Kabeer received the INAE Young Engineer Award in 2018, and in 2019 he was selected as an Associate of the Indian Academy of Sciences. He is also a recipient of the INSPIRE faculty award. He serves as an Editorial Board Member for Scientific Reports (Nature Publishing Group.

One of the foremost service activities in which Kabeer was involved was conceptualizing Peer Assisted Learning (PAL), an academic support scheme that we initiated to help students who face difficulties with their coursework. The program facilitates academic guidance to the freshmen by senior year students in an informal peer learning setting. This program has also been emulated by other IITs and higher education institutes. Kabeer also served the Institute as the Head, Counseling Services from 2014 to 2017, as an Associate Dean, Undergraduate.

Nanoscaling Layered Metal Borides into Boron based Nanosheets Analogous to Chemically Modified Graphene for Energy Conversion, Generation, and Storage

Saroj Kumar Das, Asha Liza James, Harini Gunda, Satadru Chakrabarty, Anshul Rasyotra, Bhagyashri Gaykwad, Akash Varma, Vruddhi Jani, Rishabh Patidar and Kabeer Jasuja*

Discipline of Chemical Engineering, Indian Institute of Technology Gandhinagar, Palaj, 382355, Gujarat, India

ABSTRACT

The feasibility to exfoliate van der Waals layered materials and form their 2D counterparts has enabled an entire library of graphene analogs that exhibit a wide spectrum of properties. The research on 2D nanomaterials is gradually evolving beyond exfoliating weakly bonded van der Waals solids, with increasing incidences of exfoliating layered ionic compounds. In this context, the family of layered metal borides, having boron honeycomb planes interleaved with metal atoms, holds immense promise. Their construct presents a unique opportunity to obtain access to 2D boron honeycomb planes. So far, metal borides have been primarily investigated for their superior physicochemical properties in their bulk form; however, their prospects of yielding 2D forms were unexplored until our study on layered metal borides exfoliation, that was published in 2015. At IITGN, our research group has carried out a pioneer work on delaminating AlB_2-type metal diborides – mainly MgB_2 and TiB_2, into their quasi-2D forms. In this talk, firstly we will present various methodologies that we have developed over the last seven years to exfoliate these metal diborides – we will also provide insights on scalability of these approaches. Briefly, we have demonstrated that MgB_2 and TiB_2 can be exfoliated into functionalized and minimally functionalized 2D forms. In the later part of the talk, we will present the following results on the applicability of these metal diboride derived nanostructures in energy conversion, generation, and storage – energetic additives for solid propellants and a hydrogen storage medium using MgB_2 nanosheets ; anode materials for Li-ion and Na-ion batteries; photocatalytic hydrogen production, additives for enhancing CO_2 capture capacity using TiB_2 nanosheets. The work that we have carried out at IITGN on exfoliating layered metal diborides has laid the seeds for a new family of 2D nanomaterials that is gradually growing; this has widened the non-traditional use of metal borides in transforming some of our everyday technologies.

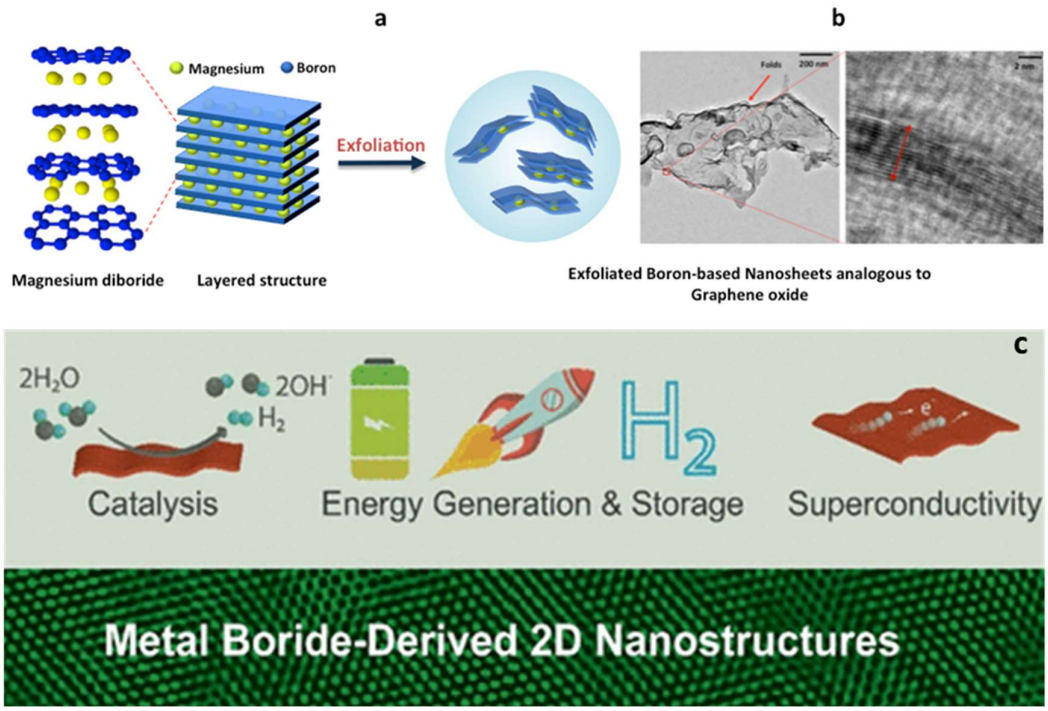

Fig. 1. a) Layered MgB_2, with Mg atoms sandwiched in between graphenic planes of boron, present promising layered materials to obtain access to boron honeycomb upon exfoliation; b) TEM image showing the crumpled morphology of boron-based nanosheets and HRTEM image of the transverse view of an edge depicting it to be few-layer-thick; c) Energy conversion and storage application based on metal diboride derived nanostructures.

Dr. Bharat Jain

- *Ex-Member of Expert Appraisal Committee for Environmental Clearance (Violation), MoEF & CC, GoI*
- *Ex-Member of State Expert Appraisal Committee, Gujarat*
- *Member of State Level Approval Committee for Assistance to Environment Protection Measures*
- *Representative Member, RECPNet, UNIDO for Asia and Asia Pacific Centers*
- *Member, Technical Committee, Gujarat Pollution Control Board*
- *Member, Env. Audit Committee, Gujarat Pollution Control Board*
- *Member, Screening Committee for Allotment, Dahej PCPIR*
- *He is a Vice Chairman of Narmada Clean Technology Ltd (CETP of 60 MLD) and Director of many CETPs.*
- *Lifetime Achievement Award for Environment Protection from Occupational Safety and Health (OSHAI)*

Green Technology for Sustainable Development

Dr. Bharat Jain, Member Secretary
Gujarat Cleaner Production Centre,
Address: Block No.11 & 12, 3rd floor, Udhyog
Bhavan, Sector 11, Gandhinagar-382017, Gujarat.
Contact No: 9978909131
E-mail: gcpc11@yahoo.com, ms@gcpcgujarat.org.in , gcpc-env@nic.in

ABSTRACT:

Sustainable Development is the development that meets the needs of present without compromising the ability of future generations to meet their own needs. These are a set of 17 global goals established by the United Nations (UN) in 2015 as part of the 2030 Agenda for Sustainable Development. Our Government has committed to achieve these goals by 2030.

As we know natural resources like minerals, water, and source of energy are limited while there is continuous increase in demand as the population of world is increasing. It is said that if same pattern of demand of resources continues we may need three earth by 2050.

For Economic growth in developing country like India Industries are required. Gujarat is highly industrialized State and leading in Chemical, Petrochemical, Pharmaceuticals, etc. Moreover, Gujarat has set the target and vision to become USD 500 billion economy by 2026-27.

However due to rapid industrialization there were major environmental issues of pollution. Initially, management started with EoP (End-of-Pipe Treatment) solution, comprising collection, treatment and disposal. As a result, the state has CETP model successfully working with more than 40 CETPs and total treatment capacity of about 850 MLD. Also the State is leading in providing deep marine disposal schemes, Common TSDF for Hazardous Solid Waste, Common MEE, Common Spray Dryer etc. The State being proactive, concept of Cleaner Production and Clean Technology is being implemented by Industries under guidance of GCPC, established by GIDC. The Centre is promoting Reduce, Reuse, Recycle, Recover and advocating philosophy of Circular Economy i.e. refurbishing and remanufacturing of product to extend its life. Looking to the availability of resources, to achieve the target of the SDG Goal No.9 (Industry, Innovation and Infrastructure) and Goal No.12 (Responsible Consumption and Production) it is necessary to adopt concept of Cleaner Production, Circular Economy and optimization usage of resources through Green Technologies. Our Hon'ble Prime Minister introduced 'Mission LiFE' i.e., Lifestyle for Environment, focuses on mindful and deliberate utilization instead of mindless and destructive consumption.

Dr. Rohidas Bhoi

- *B.E. (Chemical Engg.) in 2003 from Pune University*
- *Ph.D. (Chemical Engg.) in 2016 from IIT Bombay*
- *Research Staff at IIT Bombay during 2004-2019*
- *Faculty at MNIT Jaipur Since 2019*
- *Administrative positions*
  - *Faculty coordinator, 2019-2021 (Training and Placement)*
  - *Hostel Warden, 2022- till date*
- *Publications (National / International):*
  - *Journal: 15*
  - *Conference publications: 09*
  - *Book chapters: 05*
- *Research supervised*
  - *PhD: 02 (ongoing)*
  - *MTech: 02 (Completed)*
- *Research interest:*
  - *Reaction Engg &Catalysis*
  - *Process Intensification*
  - *Biofuels*
  - *Plastic and biomass pyrolysis*

Research Projects:
Research Project: 02
Consultancy Project: 05

Energy recovery of waste plastic to high quality fuels

Rohidas Bhoi

MNIT, Jaipur, Rajasthan, India

ABSTRACT:

The fossil fuel-based thermoplastics i.e. low-density polyethylene (LDPE), polypropylene (PP) and polystyrene (PS) were pyrolyzed at 450 °C, 500 °C and 550 °C thermally and catalytically to enhance the oil yield and further enrichment via fractionation. In the catalytic process, spent FCC (*sFCC*) and low cost $BaCO_3$ with 10 wt% loading was used in a semi-batch quartz reactor. Thermogravimetric analysis (TGA) and derivative thermogravimetric analysis (DTG) was carried out at 10 °C/min for LDPE, PP and PS to analyze the degradation behavior. Among the used catalysts, the *sFCC* gives higher oil yield than $BaCO_3$ under identical conditions. The LDPE oil yield obtained were 55.5% and 35.7% for *sFCC* and $BaCO_3$, respectively. Similar trends were observed for PP (80.0% & 70.0%) and PS (98.0% & 95.0%). Gas chromatography–mass spectrometry (GC-MS) analysis revealed that product oil composition for sFCC catalyzed pyrolysis was majorly in the gasoline range (C_6-C_{12}) whereas for $BaCO_3$ enabled pyrolysis in the diesel range (C_{13}-C_{18}). Plausible acid and base catalyzed reaction mechanism and product formation are discussed for catalytic pyrolysis of PP. Fractionation of pyrolysis oil was performed at 150°C, 250°C and 350°C and physiochemical properties as well as the visual inspection of resulting fractions was carried out as per ASTM methods. Further experiments were carried out for a mixed plastic representing the MSW compositions. The maximum oil yield of 80.42 wt.% was obtained at a temperature of 470 °C, heating rate 10.25 °C /min and plastic ratio of 1.43 (PS: PE+PP). Overall, this work represents the utilization of *sFCC* and low cost *$BaCO_3$* catalyst to convert plastic waste into promising fuel. The outcome of mixed plastic pyrolysis could offer insights into the management of municipal plastic waste in Indian cities, thereby fostering a circular economy and promoting environmental sustainability through the cleaner production of fuels.

Dr. Nitin V. Bhate

- *Ph.D. IIT Bombay (2008) Research Topic: Studies in the Mechanism of Aromatic Nitration: Investigating the Role of Microphase*
- *Master of Engineering (M.E.) in Polymer Technology (July 1998), Faculty of Technology and Engineering, The M. S. University of Baroda*
- *Bachelor of Engineering (B.E.) in Chemical Engineering (July 1994), PVPIT, Budhgaon*
- *Associate Professor in the Dept. of Chemical Engg., Faculty of Technology and Engineering, M.S.U. Baroda (2006 till date)*
- *Mentor for VLabs Development under Vlabs IIT Bombay*
- *Received **Dr. R. P. Parnerkar Poornawad** Award for Excellence in Engineering & Technology*

Research Areas:

Phase Equilibrium Thermodynamics: Experimentation & Modeling Reactive Separations: Experimentation, Modeling & Optimization Process Development of Industry relevant products Plastics Waste Management: Secondary recycling in the form of Blends or Composites, Pyrolysis, Applications in bitumen

Green Solvents

Nitin Bhate
M.S.U, Vadodara, Gujarat, India

ABSTRACT:

Solvents form an integral part of any chemical process. The applications may range from the solvent being one of the reactants or solubilizing one of the species to promote the reaction in the case of processes to acting as a solvent or entrainer in separation operations. Majority of the solvents used especially in the refinery operations namely, DMSO, sulfolane etc. are extremely hazardous but they must be used to get the desired separation in the absence of sober solvents. One of the principles of Green Chemistry is 'Benign Solvents' which means relatively less hazardous solvents. Pertaining to the given synthesis, it is necessary to choose the appropriate solvent based on the criteria of Basicity, Acidity and Polarity (BAP). This can be very well established by using the famous Kamlet-Taft methodology for employing protic and aprotic solvents. Earlier, the solvent with lower footprints on the environment was welcomed as a 'green solvent'. However, of late, the rating of green solvents is being done based on life cycle analysis (LCA) which takes into account the chemicals, processes and the energy used in the synthesis as well as that used for the recovery of the so called 'green solvent'. There are seven categories of green solvents which are generally recommended namely, bio-solvents, ionic liquids, Deep Eutectic solvents, liquid polymers, Supercritical CO_2, switchable solvents and CO_2 expanded liquids. A sequential procedure has been outlined for selecting a green solvent to replace the conventional one. Presently, the major emphasis is on the solvents derived from natural sources eg. Biomass. However, it is imperative to ensure that the process used for the same should not be detrimental to the environment. There are several leading industries which have come up with selection guidelines for replacing conventional solvents with the above recommended solvents. Although solvents like ethyl lactate, 2-MeTHF, CPME etc. appear to be promising having better shades of green, it is not necessary that they can replace all the conventional solvents. Thus, in addition to finding a relatively green alternative to the existing hazardous solvents, time and effort should also be spent on lowering the emissions, making recovery of solvents more efficient etc. by using innovative Chemical Engineering fundamentals and toolsets.

INDUSTRIAL SPEAKERS

Dr. Chintansinh. D. Chudasama

Assistant Vice President, SIC-ES group,

R & D, RIL-VMD, Vadodara.

Value Addition to Industrial Spent Catalyst: Utilization & Metal Recovery

Summary of Talk:

ABSTRACT:

As per Global exponential industrial growth and high demand of chemicals in future leads to the new development in catalysis, adsorption & separation science. From various industries, huge amount of waste is generating in different forms whose disposal is challenging for environmental aspects. Waste recycling and circular economy has significant role for several environmental, economy and society benefits. This presentation is focused on metal recovery which is essential for the fulfilment of the demand as well as environment requirement for safe disposal. Detail presentation on generation of metal waste from different sources and its various recovery processes will be discussed along with challenges of metal recovery with green routes.

Mr. Nilesh Mangukia,

Director (Business Development & Sales – South Asia)

Linde Engineering India Private Limited

Green Hydrogen: Opportunities & Challenges

Summary of talk:

Hydrogen is most abundant element in the universe and today it is most abundantly talked about element. India has one of the fastest growing Renewable Energy (RE) resources in the world which can help to replace fossil fuels, help decarbonization and make Indian economy self reliant. India is doing great in decarbonizing electricity which is the first and important steps towards achieving decarbonization. India have set a target to achieve 500 GW of RE capacity by 2030. RE is abundant but intermittent. Round The Clock (RTC) RE is expensive.

In hard-to-abate sectors, direct electrification is not enough. They will need low carbon dense energy source i.e. Hydrogen. Hydrogen can be used for fuel in transport and power sector. It can be used as a source of heat for industries & buildings and also as a feedstock for process industries like refinery and fertilizers. Global Hydrogen demand as on today is approx. 100 MMT and the demand is expected to grow to about 120 MMT by year 2030. Almost all hydrogen product as on today is manufactured by using fossil fuels (like Natural Gas, Coal etc.). A very minor portion of hydrogen is produced by electrolysis of water.

Government of India have announced setting up of National Green Hydrogen Mission which have set up very ambitious targets for deployment of green hydrogen in Indian industries to the tune of 5 MMT by year 2030.

Currently Steam Methane Reforming (SMR) is the industry workhorse for production of hydrogen at large scale. Capturing CO2 in the hydrogen manufacturing process is a good option before large scale green hydrogen is produced by electrolysis of water. Captured CO2 needs to find an application like sequestration.

Green hydrogen is hydrogen produced by using RE for electrolysis of water. There are currently two mature technologies i.e. Alkaline and Proton Exchange Membrane (PEM) technologies. Other technologies like Solid Oxide (SOEC) and Anion Exchange Membrane (AEM) are under development. Global electrolyser manufacturing capacity needs to be increased significantly from current capacity to achieve the decarbonization goals set by

various companies and countries. RE cost is major cost contribution in production of green hydrogen followed by the capital expenditure for electrolysers. Alkaline electrolysers are cheaper compared to PEM electrolysers as they use very precious and noble metals as a catalyst. Availability of those metals is going to remain a challenge in scale up of electrolyser capacity.

Energy Transition is inevitable. Hydrogen have gained significant momentum. India have great potential to utilize this opportunity to become self reliant in energy. Challenges are Affordability, Availability and Sustainability. Fossil fuels are going to stay. Various forms of energy will co-exist. The rate of change and development needs to be much more fast than ever before.

Mr. Amin Ismaili

Head – PERI

Deepak Nitrite Limited

Mr. Amin Ismaili is currently working as Head – Process Engineering Research & innovation (PERI) at Deepak Nitrite Limited Vadodara, He is having bachelor's degree in chemical engineering from DDIT, Gujarat University with 33+ years of industrial experience in all aspects of process engineering.

Prior joining Deepak Nitrite, he worked with Alembic group company, Cadila Pharmaceutical ltd and Torrent Pharmaceutical. During his journey he has worked on 360 deg aspect of process engineering like innovative technology development from lab to commercial, process equipment design, basic & detail engineering, plant trouble shooting, capacity debottlenecking related issue in pharma and specialty chemical industry.

Since 2007 he exclusively works on developing different innovative technology for process intensification and continuous flow chemistry. His dream is 'HOME FACTORY' concept i.e to develop Platform Technology which can produce tons of intermediate products in 10 x 12 ft room without use of any solvent and without generation of any effluent.

He has filed 17 patents + published articles and papers in various journals & magazines + actively participated as a speaker in various research conferences, workshops and engineering colleges.

Mr. Dipakkumar Bhikadiya

Nirma LTD

Bhavnagar, Chemical Complex

Re-Heat Regeneration and Water Harvesting.

Problem Statement: High cost of power and process water generation
Company's Approach to solve the Problem: Improvements on energy efficiency can reduce the consumption of water and power. It can leads to too many other economic, social and environmental benefits which can reduces energy consumption worldwide,

Outcome of the Approach:

1. In Co-Generation Cycle

- *M/s. Nirma Limited has installed coal based high pressure cogeneration with Reheat-Regenerative Cycle in process plant to meet their steam and power demand of their process plant expansions.*
- It has set a benchmarking in Reheat regeneration cycle < 100 MW plant in co-generation system and it is first commissioning in India.
- The plant has an installed capacity of 410 TPH CFBC boiler & 70MW (Re-heat +Regenerative Cycle) +12 MW Back pressure Turbines at Kalatalav site Bhavnagar.

- This plant efficient utilization of input resources like coal and water which are proven operational practices and also positive effect of reduction to the global warming, (reduction in Co2 emission) & energy saving.
- **Coal saving 9.5MT/Day**

2. Rain Water Harvesting: (Water resources)

- Nirma Developed Rain Water Harvesting facility for collecting precious water running into sea with 22 Lac-M^3 storage capacity
- Harvesting rain waters directly used in process (Brine Purification instead of RO water) without any treatment it is giving huge energy saving. **Energy saving is 4.0 KWh / M3 of water**
- ***Awarded by ICMA for "Excellence in Water Resource Management in Chemical Industry"***

3. Caustic Plant Energy Saving

- Caustic Plant- Adopted New Technology (6th Generation) for caustic production and Nirma got best energy saving **Award from Bureau of Energy Efficiency in** caustic production.
- Awarded by BEE for top performance in PAT cycle –ii in Chlor- Alkali sector in India 2023.

Saving of energy is 200 KWh/Ton of caustic.

RAJESH BHAVSAR

Managing Director

(Utility Services Specialist Pvt. Ltd.)

This abstract highlight key areas of process intensification through innovative approaches:

1. **Elimination of Brine Circuit for Cooling:**
    - Case study detailing the elimination of the brine circuit for air cooling, achieving a temperature reduction from 25 to 0 ^{o}C.
2. **Conversion of Indirect Heat Recovery to Direct Heat Recovery:**
    - Case study demonstrating the transformation of indirect heat recovery from hot process gases to direct heat recovery, incorporating direct steam generation as opposed to the conventional method of generating steam from hot air.
3. **Closed Loop Flash Steam and Condensate Recovery:**
    - Introduction of an innovative closed-loop system for flash steam and condensate recovery, ensuring 100% recovery of both flash and live steam, resulting in zero operating costs. This serves as a superior alternative to steam operated PPPPUs (Pressure Powered Pumping Units).
4. **Variable Orifice Steam Trap - A Unique Heating Solution:**
    - Presentation of a variable orifice steam trap as a distinctive heating solution, offering a more efficient alternative to traditional steam traps such as ball float, inverted bucket, TD, and SOPT (Steam Operated Pumping Trap).

Keywords: Heat Exchanger, Flash steam and condensate recovery, waste heat recovery boiler Steam Trap.

CASE STUDY ON PROCESS INTENSIFICATION

Discover cutting-edge Waste Heat Recovery Systems for efficient thermal energy utilization in industrial settings, driving significant cost savings. tailored Process Heating Solutions, equipped with advanced heat transfer technologies and state-of-the-art Heat Exchangers, optimize process heat recovery for operational excellence. Experience the transformative power of process intensification with our innovative suite of solutions, maximizing efficiency and profitability for industrial and chemical enterprises.

PROCESS DESCRIPTION

The current process have a 2 pipe in pipe rtype of the heatexchanger that is uses atm air and heat it to desired tempreature and the so3+ air mixture is on the tube side making it an air to air heat exchanger than has low heat transfer coffiecient. We cahnged that pipe in pipe typoe of heat exchnager to STHE wioht tht eprocess fluid as a boilwer feed water and directly generating trh steam instead of indirect utility terminating hot air. And aslo generarting hot water for the processs stream and running 80 TR of vam cycle.

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SESSION:01

WASTE RECYCLING & CIRCULAR ECONOMY-I

Session Chair

Dr. Swapnil Dharaskar

Session Co-Chair

Dr. P.A. Joshi

Converting Metallurgy and Municipal Solid Waste into High-Performance Ground Enhancers for Sustainable Gains

Bhatoa Karanjeet Singh R.[a*]

[a] L.D Engineering College, Ahmedabad, Gujarat, INDIA

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ABSTRACT:

Effectively managing metallurgy waste and municipal solid waste (MSW) is a global imperative, prompting the need for innovative approaches to sustainable waste utilization. This review explores the integration of metallurgy waste, including slags and sludges, with municipal waste components to create compounds that enhance soil quality. The synthesis process involves a comprehensive approach, encompassing waste collection, sorting, and chemical processing to extract valuable constituents. Through optimization techniques, the resulting compound is tailored for ground enhancement applications, showcasing improved structural properties and enhanced nutrient content. The paper synthesizes current research efforts, addressing technical methodologies, challenges, and potential environmental benefits associated with this waste transformation. Furthermore, the review evaluates the economic feasibility and implications of repurposing these waste streams into ground-enhancing compounds, contributing to the discourse on sustainable waste management practices. The versatile application of these ground enhancers spans soil improvement in Geotechnical Engineering to construction materials, the creation of economically viable products from discarded materials.

KEYWORDS: Metallurgy waste, Municipal Waste, Sustainable Gains, Geotechnical Engineering

PHOTON DRIVEN SHEET BREAKING OF REDUCED GRAPHENE OXIDE FOR AMPLIFYING UV LIGHT TRANSMISSION

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ABSTRACT

Graphene has been rightly called the wonderous 2D material owing to its several unique properties. Despite continuous research efforts on the development of reduced graphene oxide (rGO), its optical properties remain largely unexplored. Herein we have explored the light irradiation effects on the optical and structural properties of rGO. Crystalline natured rGO was prepared by simple microwave exfoliation and ultra-sonication technique. Transmission Electron Microscopy (TEM) and Dynamic Light Scattering (DLS) measurements revealed a reduction in the sheet size of rGO upon light irradiation. Raman analysis revealed an I_D/I_G ratio of 0.11, signifying little defects with good crystallinity. Moreover, an increment in the light transmission was also observed in the light treated rGO, which was verified for solar cell application. It can be a potential candidate for applications which require UV light transmission such as, water treatment, surface disinfection etc.

KEYWORDS: UV-Light, Graphene oxide, water treatment, solar cell

Photoelectrocatalytic System For Organic Degradation Of Wastewater

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ABSTRACT

Conventional wastewater treatment relies on various oxidation methods, including physical, biological, chemical, and electrochemical approaches. However, due to the immense diversity of industrial waste compositions, a one-size-fits-all strategy simply is not effective. The success of wastewater remediation hinges on understanding the specific nature and concentration of pollutants within each unique mixture of organic and inorganic compounds. Photoelectrocatalysis (PEC) emerges as a promising advanced oxidation process that harnesses the synergistic combination of photocatalysis and electrocatalysis. This method utilizes a semiconductor photoanode irradiated by sunlight, triggering the creation of electron-hole pairs. However, instead of letting them recombine, a strategic electrical potential difference keeps them apart. This remarkable separation unlocks the full potential of these energized charges, leading to the powerful "mineralization" – complete breakdown – of organic pollutants present in wastewater. The following review highlights the different photocatalysts like TiO_2, WO_3, ZnO **carbon-based photoelectrodes** and modified TiO_2 used for the degradation of waste water.

KEYWORDS: wastewater, Photo-electrocatalysis, photoanode, TiO_2

Ciprofloxacin (Cip) Removal From Synthetic Wastewater By Electrocoagulation

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ABSTRACT

Ciprofloxacin (CIP) is frequently used as an antibiotic drug to treat bacterial infectious diseases in both people and animals. It is vital to highlight that hospitals and medication industries are the primary contributors of polluted wastewaters. Inadequate metabolization of CIP and improper disposal have contributed significantly to its rising pollution of surface water during the last decade. This study focuses on the use of electrocoagulation to eliminate the antibiotic Ciprofloxacin, which is frequently found in wastewater. The removal of Ciprofloxacin was examined using electrocoagulation (EC) under various operating parameters like initial concentration, current density, and electrode distance. The optimal operating parameters for the treatment of synthetic wastewater were determined by the EC process to be removal percentage of 82.56 % at the initial concentration of 46.81 mg/L, current density of 1.95 mA/cm^2, electrode distance of 2 cm, and operating duration of 45 minutes. The current study demonstrates that EC is a highly effective method for removing CIP from synthetic wastewater, with an estimated 0.245 US$/m^3 operating cost and 2.4 kWh/m^3 energy usage. The study reveals the efficiency of electrocoagulation in the removal of Ciprofloxacin, indicating its appropriateness for the treatment of pharmaceutical wastewater and its potential role in reducing environmental and public health problems related to antibiotic pollution.

KEYWORDS: Ciprofloxacin removal, Electrocoagulation, Iron electrode, artificial wastewater, economic evaluation.

A Critical Review On Conventional Versus Electrochemical Methods For Dye Wastewater Treatment

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ABSTRACT

The ecosystem and all forms of life are severely affected by the dye effluents that are produced and released by several industries. One of the world's major environmental contamination issues is caused by the textile industry. As a result, the environment and public health are significantly harmed by the continuous untreated discharge of effluent from textile sectors. An effective and sustainable dye effluent treatment system needs to be implemented to solve this problem. To reduce the negative impacts of dye-containing effluents on both the environment and living organisms, dye wastewater must be treated first before being released. Because of insufficient knowledge about effective dye removal techniques, choosing one method for solving the recent dye effluent problem offers major complexity. Therefore, this review paper briefly overviews recent developments in dye wastewater treatment by physical, chemical, and biological methods as well as Advanced Oxidation Processes (AOP) with specific emphasis on Electrochemical techniques (ET) that have shown excellent performance in the elimination of several dyes from polluted waters. Additionally, detailed information is also incorporated on electrode materials, recent developments in AOPs, and different variations in electrochemical treatment technology and their mechanisms. Furthermore, extensive research in this area is essential for such technologies to be accepted at a commercial scale for wastewater cleanup effectively.

KEYWORDS - Conventional, Dye Wastewater, Electrochemical, Treatment, Types of Dyes

Water Disinfection By Hydrodynamic Cavitation Technology-Review

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ABSTRACT

The availability of clean drinking water remains a pressing global challenge.Contaminated water sources, improper faecal disposal, and inadequate hygiene practices contribute to the proliferation of pathogenic microorganisms, such as viruses, bacteria, and parasites, leading to various waterborne diseases. Disinfection plays a crucial role in eliminating these microbes and safeguarding human health within drinking water treatment processes. Established methods like Chlorination, Ozonation, and Ultraviolet treatment are widely accepted for their efficacy. However, chemical disinfection methods pose drawbacks such as the formation of potentially carcinogenic by-products. The effectiveness of disinfection techniques is influenced by various factors, including solution conditions and microorganism resistance. Consequently, there is a demand for alternative disinfection approaches that mitigate reliance on chemical agents. This review paper examines the potential of hydrodynamic cavitation as an emerging technique for water disinfection. Hydrodynamic cavitation shows promise in reducing microorganism levels, including Total Coliforms and E. coli. The physical and chemical effects generated by cavitation bubbles offer a means to eradicate microorganisms. Additionally, the review discusses factors such as pressure, temperature, pH, and cavitator device geometry, which impact disinfection efficiency enhancements.

KEYWORDS

Disinfection; Hydrodynamic Cavitation; E coli; Total Coliforms; Wastewater treatment

Enhancing Microbial Fuel Cell Performance Through Modified Carbon Felt Electrodes: A Comprehensive Investigation Of Power Generation And Wastewater Treatment

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ABSTRACT

The idea of using microorganisms to produce electricity was initially put forth in the early 20th century. Microbial fuel cell(MFC), a type of bioelectrochemical fuel cell technology, generates voltage by rerouting electrons produced by microorganisms. The primary use of MFC is the simultaneous generation of electricity and wastewater treatment by removing multiple pollutants. The effectiveness of power production and substrate degradation significantly relies on electrode materials, offering crucial support to microorganisms for enhancing biofilm generation and facilitating the transfer of electrons from the anode to the cathode. In this research, carbon felt electrodes undergoes modification using a combination of HNO_3 and H_2O_2 solutions to improve the performance and compared with MFC having bare carbon felt electrode. Coated MFC showed open circuit voltage of 702 mV which was 54.65 % higher with power density of 715 mW/m^2 with 52 % reduction in substrate concentration. The electrochemical performance of MFC's were investigated by open circuit voltage, polarization curve, cyclic voltammetry, electrochemical impedance spectroscopy and scanning electron microscopy were conducted to characterize morphology of electrodes, membrane. In conclusion the coated carbon felt indicated that modified electrodes used in MFC are suitable for energy generation.

KEYWORDS

Microbial fuel cell, Carbon felt, Anode modification, Cyclic voltammetry, Electrochemical impedance spectroscopy, Distillery spent wash

Innovative Approaches For Improving Nutritional Quality And Sustainability In Spirulina Production

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ABSTRACT

Spirulina, a blue-green algae, has gained recognition as a valuable source of nutrition due to its high protein content, essential vitamins, minerals, and antioxidants. However, enhancing its nutritional quality and sustainability in production remains a crucial challenge. This paper presents innovative approaches aimed at improving both the nutritional profile and sustainability of spirulina cultivation. Firstly, the optimization of cultivation conditions is explored to maximize biomass production and nutrient content. Through meticulous adjustments of temperature, pH, light intensity, and nutrient concentrations, the cultivation process can be fine-tuned to yield spirulina with superior nutritional value. Secondly, strategies for enhancing the efficiency and sustainability of spirulina production are investigated. This includes the utilization of waste streams and renewable energy sources for cultivation, reducing water and nutrient requirements, and minimizing contamination risks. By adopting these approaches, spirulina production can become more environmentally friendly and economically viable. Moreover, scaling up production from laboratory settings to commercial operations is addressed, considering factors such as culture density, harvesting techniques, and infrastructure requirements. By overcoming the challenges associated with scaling up, spirulina production can meet the growing demand for this nutrient-rich superfood.

KEYWORDS

Spirulina, Nutritional qualities, Cultivation Condition, Biomass production, Renewable energy, Waste Utilization, Antioxidants, Protein Content.

Studies To Produce Steel From Waste: Sustainable Approach Towards Circular Economy

Urmil Dave, Dipak Bholanda, Jayesh Ruparelia*
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ABSTRACT:

Mill scale emerges as one of the byproducts rich in iron, originating from the steel production process within hot-rolling steel companies. Typically constituting 1% to 3% of the weight of the steel subjected to milling, this study focuses on the transformation of mill scale into Direct Reduced Iron (DRI) through an induction furnace, leveraging the reduction process. The research commenced with the design of a suitable induction furnace, exploring various process parameters related to processing, optimization, and characterization. The induction furnace underwent scrutiny involving different combinations of mill scale, reducing agents, time, and temperature. However, challenges arose during the introduction of mill scale with reducing chemicals into the furnace, leading to practical issues, notably damage to the furnace lining. To overcome this obstacle, a crucible with a neutral lining material was introduced, resolving the furnace lining damage. Subsequently, bridging issues were identified within the furnace, posing a safety concern by impeding the uniform distribution of heat in the reaction mass. This challenge was addressed by forming lumps of raw materials with reducing agents, subsequently charging them into the furnace for processing. In the final step, the successful production of DRI from mill scale, a waste material, was confirmed by XRD and EDAX characterization. This research not only sheds light on the creation of value-added products from waste but also contributes to preventing losses within the steel industry, reducing pollution loads, and opening avenues for environmentally sustainable practices in the stainless steel sector.

KEYWORDS: circular economy, material recycle, induction furnace, direct reduced iron

SESSION:02

WASTE RECYCLING & CIRCULAR ECONOMY-II

Session Chair

Dr. Sunder Lal Pal

Session Co-Chair

Dr. Yash Jaiswal

Comparison Study Of ZnO And TiO_2 Catalyst For Photocatalytic Treatment Of Wastewater

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*Corresponding Author: ishitaraval.sscssn@ddu.ac.in

ABSTRACT

There is currently a risk of tainted water and the emergence of several diseases from consuming water. Even though this water was released from the municipal water system, it still included certain persistent chemicals that are challenging to remove using standard wastewater treatment methods. Although a number of cutting-edge technologies have been created to address this problem, they are expensive and complex. One of the most advanced methods that can treat wastewater quickly and with low maintenance and operating costs is photocatalytic treatment, which uses catalyst with UV and visible light. A comparative analysis of ZnO and TiO_2 catalysts for the treatment of persistence compounds has been conducted in this work. Both catalysts compared on the basis of light source characterization and degradation study.

KEYWORDS: Waste water, Photocatalysis, ZnO, TiO_2, Visible light

Transesterification Of Waste Cottonseed Oil To Biodiesel Using Methanesulphonic Acid As A Homogeneous Catalyst

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[a] Vishwakarma Government Engineering College, Chandkheda, Ahmedabad

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ABSTRACT

This research delves into the transesterification process of waste cottonseed oil into biodiesel, employing methane sulphonic acid as a homogeneous catalyst. The central objective of this study is to comprehensively investigate the impact of key operational parameters on the transesterification process. Specifically, the study scrutinizes the influence of temperature, molar ratio of oil to methanol, and catalyst loading on the reaction kinetics, Temperature variations were observed to significantly affect the reaction rate, emphasizing the need for precise temperature control. Moreover, the adjustment of the molar ratio and catalyst loading was shown to play a vital role in influencing the reaction kinetics. The outcome of this research provides valuable insights into the intricate mechanics of the transesterification process and highlights the critical importance of parameter optimization for improved biodiesel production efficiency.

KEYWORDS: Biodiesel, Waste Cottonseed Oil (WCO), Methane sulphonic Acid(MSA), Free Fatty Acid(FFA), Trans-esterification Process

Recovery Of Precious Metals From The Cru Spent Catalyst

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ABSTRACT

Catalysts play a pivotal role in accelerating chemical reactions, with various chemical industries relying heavily on heterogeneous catalysts to efficiently convert raw materials into products. Most of industrial-level chemical processes are based on catalysts to get faster reactions. This enhancement in catalytic reactions not only reduces energy consumption but also minimizes time requirements, thereby fostering a more sustainable and circular economy at the national level. However, the scarcity of natural resources and the challenge of disposing of low-active spent catalysts present significant obstacles worldwide. The fresh catalysts are costly and the metals are insufficient on the earth. The spent catalyst contains specious costly metals and landfilling of spent catalysts is harmful to people and nature. Embracing the concept of recovery and recycling can alleviate the demand for original catalytic minerals. In contrast, traditional recovery methods like pyrometallurgy and hydrometallurgy suffer from drawbacks such as high energy consumption and environmental impact. Various eco-friendly techniques exist for the recovery of costly metals. Bio-metallurgy is environmentally friendly but remains underutilized due to its slow pace and limited commercialization. The organic acid-based hydrometallurgy technique showed more scope in the recovery of specious metals from the spent catalysts. Overall, the article focused on economic and eco-friendly metal recovery methods, emphasizing the importance of complete catalytic metal recovery for enhancing circular economy practices and sustainable development.

KEYWORDS: Spent Catalysts, Platinum Group Metals, Rare Earth Elements, Pyrometallurgy, Hydrometallurgy

A Systematic Review On Recent Trends And Emerging Technologies For Sustainable Solid Waste Recycling And Circular Economy

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ABSTRACT

Our planet is facing numerous environmental and ecological problems due to increased economic activities and development processes. A major portion of these environmental problems are related to waste in production sectors such as textile, construction, and packaging. A significant part of the solid waste is non-biodegradable which induces hazardous chemical extraction processes. Burning of such waste products results into toxic gas emissions into the atmosphere. This has led to extreme pollution of the soil, rivers, and the sea. Due to the non-biodegradable nature of the waste, it takes hundreds of years to decompose naturally. However, the concept of circular economy shall be considered a high-yielding remedy to the existing issues associated with solid waste management. It can also strengthen the approach to sustainable development. In this study we provide a literature review on recent developments in the upcycling of different types of solid wastes, potential emerging technologies and new opportunities for a sustainable environment. The study presents strong association of circular economy, sustainable production and waste management. Also it offers a thorough view of the potential significance and current commercial applications of the developed biobased materials in relevant areas such as packaging, construction and textile. The review also discusses evolution of circular economy by ways of designing of new products and enacting of new regulations for industries to embrace it. The movement towards circular economy stems from aspirations to tackle urgent environmental issues, cultivate financial success, alleviate the effects of climate change, advance social justice and safegaurd the welfare of current and future generations. It signifies a pattern change towards method of manufacturing and consumer behaviour that are more fair, regenerative and sustainable.

KEYWORDS

Sustainable development, Circular economy, waste recycling, solid waste management, bio based materials

Optimizing Municipal Solid Waste Management: A Strategy For Nadiad Town, Gujarat (India)

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ABSTRACT

Municipal solid waste management poses a significant challenge for cities and towns globally, with only about 70-80% of the total generated waste being collected in developing countries. Unfortunately, many cities still resort to open dumping as a primary disposal method. This not only impacts public health but also harms the environment. The study aims to address these challenges by proposing a solid waste management strategy for Nadiad town in Gujarat, India, which has a population of 224,000 spread over 304 square kilometers. The town is divided into six solid waste management zones for efficient waste collection. The first phase of the study focuses on optimizing waste handling in one of these zones. Data collection from various sources has been conducted to develop an optimization model aimed at minimizing the cost of solid waste handling. The model is formulated using the GAMS software, which is effective for solving and analyzing such optimization problems. The results indicate that employing such optimization models can significantly reduce the overall cost of solid waste management.

KEYWORDS: Municipal solid waste, Waste collection, Cost optimization, Waste handling, Environmental impact

Optimizing Wastewater Management: A Hybrid Approach Of Early Treatment Options And End Of The Pipe Treatment For Sustainable Batch Processes

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ABSTRACT

A dependable water supply is crucial for various multi product batch processes, with water playing a pivotal role in almost every aspect of plant operations. However, the washing of process equipment generates a significant amount of wastewater. This wastewater must undergo treatment, either onsite or offsite, before being discharged into the environment. End-of-the-Pipe Treatment is effective in removing contaminants from wastewater but can be expensive. In contrast, Early Treatment focuses on prevention and reducing pollutant loads at the source. This approach is proactive and sustainable but may require specific methodologies for handling and treating wastewater. Early treatment has the potential to be cost-effective in the long run as it reduces the need for extensive end-of-the-pipe treatment facilities. It addresses pollution prevention at its source, thereby reducing environmental risks. By reducing the overall pollutant load, Early Treatment Options (ETO) complement End-of-the-Pipe (EOP) treatment, which ensures that the remaining wastewater is adequately treated before discharge. The present work utilizes a combination of both approaches to achieve optimal results. The proposed model aims to achieve a 70% reduction in the effluent load on the treatment plant from equipment washing and a 60-70% reduction in the consumption of coagulants in the primary treatment of wastewater. This hybrid approach combines the strengths of both methods, leveraging the proactive nature of Early Treatment with the effectiveness of End-of-the-Pipe Treatment, to create a more efficient and sustainable wastewater management system.

KEYWORDS: Batch processes, Equipment washing, EOP Treatment, Early Treatment Options, Pollution prevention, Sustainable practices

Catalytic Ozonation Of Dye Wastewater Using La-Ce-Co Composite Metal Oxide Catalyst

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ABSTRACT

This research tackles the issue of dye wastewater treatment using catalytic ozonation treatment. In the present study, we synthesized the catalyst comprising oxides of La-Ce-Co nanostructure through the co-precipitation method. Our investigation focuses on the decolourisation and degradation of RB5 dye. The catalyst was characterized using various methods, including XRD, BET, SEM with EDX, and TEM. The catalyst was found to decolorize the dye solution in just 20 minutes and achieve 70% TOC removal in 80 minutes, which is significantly higher than the 30% TOC removal by ozonation without a catalyst. Several factors, such as the amount of catalyst, solution pH, ozone concentration, and initial dye concentration, were found to affect the ozonation system and corresponding optimum parametric values. The performance of the synthesized catalyst was investigated on a real industrial effluent and reported in terms of TOC removal efficiency.

KEYWORDS:

Catalytic ozonation, dye wastewater, advanced oxidation process, Reactive Black 5

Synthesis And Characterization Of Multi-Metal Oxides For Dye Degradation Applications

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ABSTRACT

Degradation of dyes from industrial effluents is a critical environmental challenge. In this study, we investigate the potential of multi-metal oxides as catalysts for the degradation of dyes, aiming to develop better solutions for wastewater treatment. The Na, Ni and Al metal salts were used for the synthesis of the multi metal oxides particles. The synthesis of the multi metal oxides particles were carried out using the Peschani method including the calcination at 550°C. Various characterization techniques such as X-ray Diffraction, Particle size analyser and UV spectroscopy were employed for the study. Average particles size of the multi-metal oxides was found to 103 nm and with the zeta potential 10.5 mV. Various dyes were chosen for the study but degradation was observed only in Methylene Blue and Congo red at the specific amount of catalyst dosage and at 10 ppm dye concertation. The Dye degdration was performed in the presence of visible light and the samples was collected at 10 minutes interval for the UV spectroscopy. Methylene blue and Congo red degdration rate was 94% and 78% respectively at the time period of 70 minutes with the same amount of dosage of multi metal oxides. The present results demonstrate the good photocatalytic behaviour of multi-metal oxides, suggesting their applications in water purification with further enhancements.

KEYWORDS: Dye Degradation, UV Spectroscopy, Multi Metal Oxides, Photocatalytic behaviour.

SESSION:03

ENERGY & SUSTAINABILITY - I

Session Chair	Session Co-Chair
Dr. Milind Joshipura	Dr. Avinash Deshmukh

Enhancing Sustainability Through Remote Sensing of Evapotranspiration for Climate Change Adaptation

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ABSTRACT

Climate change poses a significant threat to global sustainability, impacting various ecological systems, water resources, and human livelihoods. Effective mitigation and adaptation strategies require accurate monitoring and understanding of key environmental processes, such as evapotranspiration (ET), which plays a crucial role in the water and energy cycles. This abstract explores the utilization of remote sensing techniques to assess ET at contrasting agro-ecosystems of India using remote sensing-based model, highlighting its potential in enhancing sustainability efforts amidst climate change challenges. Evapotranspiration, the combined process of water evaporation from land surfaces and transpiration from plants, is a vital component of the hydrological cycle and ecosystem functioning. Advanced satellite sensors, such as MODIS (Moderate Resolution Imaging Spectroradiometer) and Landsat, enable the estimation of ET based on surface energy balance principles and vegetation indices. By integrating remote sensing data with hydrological models and climate projections, understanding of ET dynamics and their implications for water resources management and climate change adaptation can be obtained. Monitoring changes in ET patterns helps identify areas vulnerable to water stress and informs decision-making processes for sustainable land use planning, irrigation management, and drought mitigation strategies. Furthermore, remote sensing-derived ET data facilitate the evaluation of ecosystem resilience to climate variability and the effectiveness of conservation measures. In conclusion, remote sensing of evapotranspiration emerges as a crucial tool for promoting sustainability and mitigating climate change impacts. By providing comprehensive spatiotemporal information on water fluxes, remote sensing facilitates efficient water resource management, supports agricultural resilience, and enriches climate modelling efforts.

KEYWORDS: Evapotranspiration, Remote sensing, Sustainability, Climate change, Water resource management, Land surface processes, Satellite sensors, Climate modelling.

Parametric Investigation Of Single Basin Single Slope Solar Distiller By Design Modifications: An Experimental Approach

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ABSTRACT:

The scarcity of potable water has been observed worldwide for many years. Especially in a country like India, with its diverse communities, delivering fresh drinkable water is an imperative task. Consequently, consumption of fossil fuels for recycling wastewater and purification technologies may not be available in several remote regions. Solar distillers, thermal devices utilizing solar energy, can produce a significant amount of fresh water. The concept of critical heat transfer, mainly evaporation and condensation, is involved throughout the entire process. Solar distillers can provide fresh drinkable water from saline sources. However, conventional single-basin, single-slope solar stills consist of a simple design: a black basin with glass on a slope. In this research article, an attempt has been made to modify the design parameters of the conventional setup, and a comparison of the modified setup with the conventional one has been achieved. The conventional setup consists of a 1m² basin area with dimensions of 1m × 1m, while the modified setup was designed with dimensions of 0.8m × 1.25m. It was observed that modifications in width and length may further improve the fresh water production rate compared to the conventional setup. The conventional distiller with a 1m × 1m design is able to generate 2-3 L/m² day, whereas by altering the dimensions of the developed distiller, it can generate 40% more potable water with the same capacity under an average solar radiation of 700 W/m². Moreover, the initial and running costs of the setup are lower compared to fossil-fuel-assisted water purification systems. That being said, a minimum cost of $0.008 per liter must be sustained at the consumer end. These solar distillers can be implemented near salt farming regions, coastal areas, and household applications, and can be adopted by local communities.

KEYWORDS:

Solar energy; Solar desalination; Fresh water production; Solar radiation; Thermal analysis.

Enhancing Thermal Efficiency of a Solar Air Heater with Rotating Spiral Baffles

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ABSTRACT

This study contributes to the overarching objectives of sustainable energy advancement and environmental preservation by improving the functionality of a solar air heating system (SAH). Unique rotating spiral-shaped baffles were introduced onto the absorber plate to enhance thermal performance. Through experimentation using a solar simulator, key parameters such as relative roughness height (*e/H*) and Reynolds number (*Re*) were systematically adjusted within defined ranges, while maintaining a constant relative roughness pitch (*P/e*) of 8. The solar simulator complied with the EN-12975-2 standard and maintained an average solar irradiance of 955 W/m^2. The incorporation of these artificial roughness elements notably boosted the thermal efficiency of the SAH. The study also unveiled a correlation between *Re* and plate temperature, illustrating its impact on heat transfer. Particularly noteworthy was the observation that configurations with smooth plates exhibited higher plate temperatures, while those with *e/H*–0.8 displayed lower temperatures across varying *Re*. Furthermore, as *Re* increased, there was a discernible elevation in outlet temperature, with the *e/H*–0.8 setup showing the most substantial temperature difference, peaking at 4.9℃ at a *Re* of 12000. Moreover, the configuration featuring a roughened plate with *e/H*–0.8 achieved the highest thermal efficiency of 61.03% at *Re* of 12000, indicating a significant 64.86% enhancement compared to the smooth absorber plate. These findings provide valuable insights for optimizing both the design and performance of SAH systems.

KEYWORDS Solar Air Heater, Rotating Spiral Baffles, Relative roughness height and pitch

Comprehensive review on Solar drying technologies for agricultural products

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ABSTRACT:

Drying is a process in which moisture is removed from the agricultural products by heating them. In the present times the demand is high for the food-grains, vegetables, fruits and it will increase by manifolds in the future. In the context of agricultural products, drying is a step towards their safe and prolonged storage. During the drying process; the products are dried until they attain a safe-moisture content. By removing the moisture to a safe level, we can control the growth and reproduction of micro-organisms, restrict biochemical reactions in the agricultural products. This reduces post-harvest wastage and prolongs the life-span of agricultural products. Removal of moisture decreases weight, this results in the reduction of handling, storage and transportation costs. It is the need of the present time to develop sustainable, green, economical drying technologies. Research and development in the field of solar thermal and photovoltaic technologies have opened the path for such technologies. Emphasis is given on the review of different solar drying methods like direct, indirect and hybrid solar drying. Their merits and demerits have been discussed in details. Scope and the effects of integrating automation and AI/ML technologies in the solar drying system has been studied. Solar drying is compared with other drying technologies in order to give clear insight to select a particular method which would be green, economical, sustainable and at the same time minimize the qualitative and quantitative losses of the products. Effects of various parameters like temperature, humidity, velocity, pressure of air on the rate of drying, penetration of drying and nutritional quality of the dried products have been studied thoroughly. A number of papers have been studied on the application of modern Artificial Intelligence/ Machine Learning techniques in context of solar drying. It has been found that these tools can significantly improve the effectiveness and sustainability of solar drying systems for agricultural products. Data analytics and automation technologies can help in having better control on the solar drying processes. This will ultimately protect nutritional values of the products, reduce wastage and make the system more reliable and efficient.

KEYWORDS: AI/ML, Solar drying, Agricultural products, Sustainable technologies

Sustainable approaches towards Carbon-Neutral Steel Sector

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ABSTRACT:

In this fast-growing economy, race is always there to be the best. Countries are growing in industrialization, population, transportation, and whatnot. The focus is on the basic requirements of infrastructure, and for almost all infrastructure, steel is an essential raw material. Thus, the progress of any country can be easily linked with the utilization of steel by the country and the availability and processing of steel are of utmost importance for any country. Like many other industries, the steel processing industries are currently experiencing ongoing enhancement to achieve greater environmental sustainability, sometimes referred to as "green" practices. The annual carbon dioxide (CO_2) emissions from steel corporations are substantial. The steel sector ranks 3rd after electricity (25%) and agriculture (24%) sector. Steel and cement industries emit around 21% of global CO_2 emissions. This is due to the steel industries primarily depend on coal in the iron-smelting process. The furnaces majorly used for the production are still based on old method (coal-dependent) although new method of incorporating green hydrogen in the process to reduce the emission of CO_2 is still under experimentation. Companies like SSAB, Vattenfall, and LKAB are collaborating on some new initiatives, and in India, Tata Steel and ArcelorMittal Nippon Steel are exploring similar initiatives. Currently, no steel producer company uses exclusively green hydrogen for commercial production as the technological infrastructure and availability of affordable green hydrogen remain significant challenges. This review deliberates optimizing pre-existing methods and the upcoming new technologies like the HYBRIT method, molten oxide method, etc., which provide sustainable solutions to GHG emissions from steel industries.

KEYWORDS: sustainable production of steel, green hydrogen, decarbonisation

Large-Scale Green Hydrogen Storage and Transportation: Advancements and Challenges for Sustainable Energy Integration

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ABSTRACT

The transition from non-renewable energy sources to renewable energy sources is a significant step in the direction of a sustainable future. Hydrogen is acknowledged as a great renewable energy source, which may help overcome the energy intermittency challenges. Hydrogen must have convenient storage and transportation to become a green hydrogen, i.e., greenhouse gas emission-free energy carrier. Large-scale green hydrogen storage and transportation are pivotal for the effective integration of renewable energy sources within the current power grid infrastructure and may play the role of reservoir. The scalability of green hydrogen storage presents opportunities for terawatt-scale long-term energy storage, which is critical for decarbonization objectives and sustainable energy goals. This research thoroughly reviews the most recent large-scale green hydrogen storage and transportation technologies. It examines the various storage and transportation techniques, such as liquefaction, compression, chemical storage, solid-state storage, cryo-adsorption, and hydrogen carriers, considering their benefits, drawbacks, most recent advancements, and economic factors. Findings reveal significant information on expenses, difficulties, and future developments in the field. Over time, technological developments and economies of scale should reduce the cost of storage and transportation, but in order to successfully commercialize new technologies, it is essential to solve issues with storage techniques, modes of transportation, efficiency optimization, and technology adoption. In-depth technical and financial analyses offer important insights for developing an economically and sustainably feasible green hydrogen sector.

KEYWORDS

Sustainable future, green hydrogen, decarbonization, storage and transportation technologies, economics.

Harnessing Clean Hydrogen from Wastewater: Technologies, Challenges, and Environmental Implications

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ABSTRACT

In the pursuit of sustainable energy solutions, the extraction of clean hydrogen from wastewater has emerged as a focal point, offering a dual advantage of renewable energy generation and wastewater treatment. This review comprehensively explores the spectrum of technologies utilized to harness hydrogen from wastewater sources, elucidating the underlying principles governing microbial electrolysis cells (MECs), photoelectrochemical cells (PECs), and thermochemical processes. It assesses the efficiency, scalability, and economic viability of each technology, considering variables such as hydrogen production rates, energy consumption, and resource requisites. Additionally, the review scrutinizes the environmental ramifications of clean hydrogen production from wastewater, analyzing its potential to mitigate greenhouse gas emissions, diminish reliance on fossil fuels, and mitigate wastewater contamination. Despite its promise, the widespread adoption of clean hydrogen technologies encounters a myriad of challenges, spanning technological constraints, regulatory frameworks, and economic hurdles. This paper meticulously outlines these challenges while also delving into ongoing research initiatives, innovative methodologies, and emerging trends aimed at overcoming implementation barriers. By presenting a holistic synthesis of the current landscape of clean hydrogen production from wastewater, this review provides valuable insights into its potential as both a sustainable energy solution and a wastewater management strategy, thereby informing future research trajectories and policy decisions in this burgeoning domain.

KEYWORDS: Clean hydrogen, wastewater treatment, microbial electrolysis cells, photoelectrochemical cells, thermochemical processes, sustainability, environmental implications, challenges, future prospects.

Design of a Piezoelectric Ocean Wave Energy Converter: Towards Sustainable Energy Harvesting

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ABSTRACT

The vast expanse of the ocean represents a significant reservoir of kinetic energy, offering substantial potential for energy extraction. Utilizing renewable ocean wave energy holds promise for advancing sustainable development and fostering the growth of green energy initiatives. This paper introduces a novel approach to wave energy harvesting through a Piezoelectric Wave Energy Harvester (PWEH) that leverages both piezoelectric principles and a rolling ball mechanism. The proposed system comprises four key components: a piezoelectric module, a floating body housing the rolling ball mechanism, and an energy storage module. The piezoelectric module incorporates two piezoelectric plates positioned at the ends of pipes through which rolling balls move. These piezoelectric plates harness the mechanical energy generated by the motion of the rolling balls, converting it into electrical energy. As described, the rolling balls within the pipes are set in motion by the undulating waves, exerting pressure on the piezoelectric plates as they traverse the pipes. This pressure induces electrical charge accumulation within the piezoelectric material, thus generating electricity. The electrical energy produced by the piezoelectric module undergoes rectification and stabilization before being stored in the energy storage module for future use.

KEYWORDS

Piezoelectric wave energy harvester (PWEH), Rolling ball mechanism, Electricity, Energy storage module

Study On Strength Characteristics Of Copper Oxide Nanoparticle-Based Concrete.

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ABSTRACT

The effect of replacement of cement with Copper Oxide nanoparticle on the Strength of concrete has been investigated. Three different mixes designed for a characteristic strength of 20, 25 and 30 N/mm^2 were replaced at 3%,4.5%,6%,7.5% and 9% dosage of Copper Oxide (CuO) nanoparticle with cement, and the strength parameters were measured. Results indicate an increase in the compressive strength, flexural strength, and tensile strength of concrete with increase in the dosage of CuO nanoparticle. The promising results support the potential of replacement of cement with CuO nanoparticle for sustainability.

KEYWORDS

Copper Oxide nanoparticle, Concrete; compressive strength, flexural strength, and tensile strength.

SESSION:04

ENERGY & SUSTAINABILITY - II

Session Chair	Session Co-Chair
Dr. Sanjay Patel	Dr. G. D. Basan

Optimizing Output: A Critical Analysis of Strategies to Improve Flat Plate Solar Thermal Collector Performance

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ABSTRACT

The pursuit of enhancing solar collector performance is both captivating and imperative in the current era of escalating demand for renewable energy sources. Amidst the myriad options available, solar energy stands out as a focal point for researchers globally. This paper elucidates a spectrum of methodologies aimed at augmenting the efficacy of solar thermal flat plate collectors (SFPCs), encompassing both active and passive techniques. From innovative modifications to collector design and absorber plates to the incorporation of advanced elements such as twisted tape inserts, phase change materials (PCM), Nano fluids, and superior surface coatings, a plethora of avenues are explored. Additionally, the application of vibration techniques further amplifies the potential for enhancing thermal performance. Through a comprehensive analysis of pertinent literature, it becomes apparent that extensive research endeavours have been dedicated to optimizing SFPC functionality, focusing on aspects such as heightened solar radiation absorption, enhanced heat storage capabilities, minimized heat and pressure losses, and overall improved output. This paper serves as a conduit for disseminating valuable insights into the diverse methodologies available to elevate the performance of solar flat plate collectors, thereby fostering advancements in renewable energy utilization.

KEYWORDS SFPC, Collector Plate, Absorber plate, Thermal performance aids, Nano fluids, Vibration techniques, PCM, Twisted tape inserts, Heat storage, Thermal output

Green Building Rating System: Strategies for Energy Efficiency and Sustainable Building in India.

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ABSTRACT

The rapid surge in infrastructure development and construction in India has led to increased attention on green buildings, driven by the imperative to adopt sustainable practices. Green buildings, also known as sustainable or high-performance buildings, aim to minimize energy, water, and material consumption while reducing environmental impact and promoting human health. This movement traces its roots back to the environmental awareness of the 1960s and energy crises of the 1970s, formalizing in the 1990s with terms like "sustainable building" and "high-performance building" emerging. Key to energy-efficient green buildings is the utilization of sustainable materials that minimize environmental impact and maximize energy conservation. These materials, ranging from low-emissivity windows to recycled glass and straw bales, contribute to energy efficiency, resource conservation, and healthier indoor environments. To assess and promote sustainability in construction, various green building rating systems are utilized in India, including GRIHA, IGBC, ECBC, BEE, and LEED-India. These systems evaluate factors like energy efficiency, water conservation, and indoor environmental quality, offering certifications based on performance. This paper primarily focuses on energy-efficient green buildings, detailing how to convert existing buildings into such structures. It also discusses the construction of new energy-efficient green buildings, emphasizing adherence to rules and regulations for maximizing energy conservation. Additionally, this paper covers case studies of various energy-efficient green buildings in India, showcasing innovative designs and key features aimed at reducing energy consumption and harnessing renewable energy sources.

KEYWORDS:

Green buildings, Sustainable building, Energy-efficient, GRIHA, IGBC.

Exploring Digital twins applications for solar-thermal systems: A review

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ABSTRACT

A digital twin (DT) is a digital replica of an actual product or asset, serving as the connection between the real and modeled setups across vast areas, ranging from space applications to offshore facilities. It aids in collecting real-time data from systems, which can then be applied to the virtual models of similar systems. Our intention is to gain insight into the replacement, enhancement of efficiency, or improvement in the present real model or system, as well as the optimization of various system parameters. With the world transitioning from conventional to renewable sources, the reliability and uncertainty associated with systems will be addressed by the proposed DT framework. Solar and wind are major areas for energy harvesting in renewable energy, followed by bio-energy. Since seafood is a staple for many communities worldwide, the ocean is a primary source for meeting their needs. However, preserving food items for extended periods presents a major challenge compared to direct consumption. Therefore, one of the objectives of the proposed research is to explore food preservation in dry form after obtaining it from the ocean, using solar-assisted thermal systems. The review article comprehensively examines recent progress in the domain of digital twin applications for solar thermal systems, including case studies of real projects. Additionally, a potential future direction is proposed for bridging DT technology with solar thermal systems in future research.

KEYWORDS: Solar thermal system, Renewable energy, Digital twins, Sustainabilty.

Driving towards Sustainability: A case study on Flex-Fuel and tracing the path to its adoption

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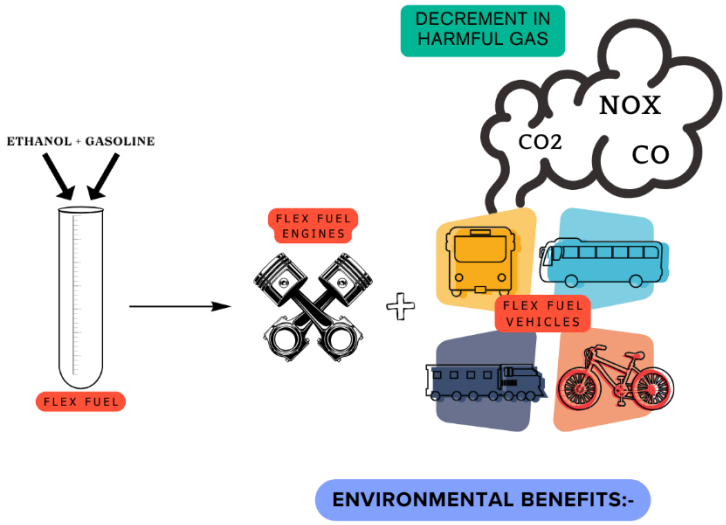
ABSTRACT

Exploring the sustainability of a blend of ethanol and gasoline offering variable compositions, is getting popular day by day, called as the Flex-Fuel. This review paper delves into the potential of flex fuel as a sustainable energy source, enabling people around the world to select their preferred fuel blend. Integral to this transition are the development of Flex Fuel Engines and subsequently creating Flex Fuel Vehicles. By varying fuel compositions, significant reductions in harmful emissions such as CO_2, CO, HC, and NO_x can be achieved. Notably, flex fuel gained the attention of G20 Summit 2023, signalling its potential as the fuel of the future. The paper also discusses strategies for its global implementation, noting the benefits and challenges in making informed



decisions regarding fuel selection for a cleaner and sustainable future.

KEYWORDS: Flex fuel**,** Gasoline**,** Ethanol**,** Flex fuel vehicle (FFV)**,** Flex fuel engine (FFE)

Sustainable Biofuels: Exploring different feedstock and production processes for a greener future

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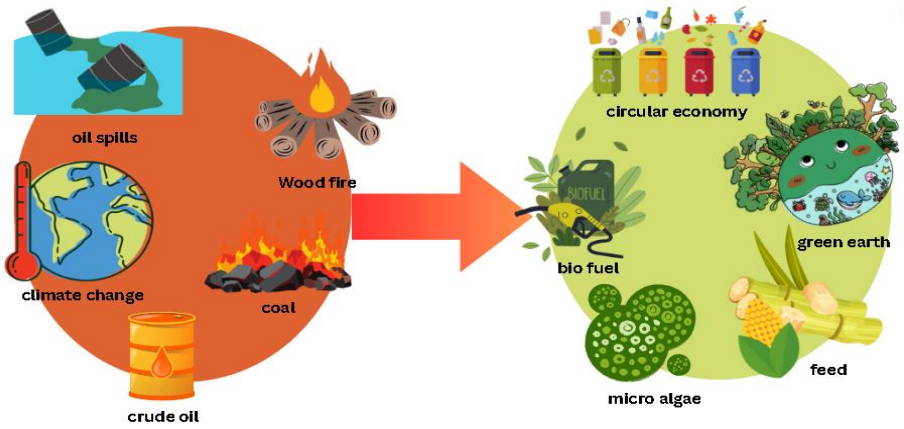
ABSTRACT

The usage of fossil fuels increased drastically after the industrial revolution causing global warming, climate change, and depletion of oil reserves. This has caused scientists and researchers to develop an alternative fuel. Currently, biofuels, plug-in electric, solar, and hydrogen fuel have been identified as alternatives. Biofuels that are derived from biomass have gained more attention as it is renewable, carbon-neutral, and have greater energy density. In-depth information on the classification of biofuels from first to fourth generation, their industrial development, different non-edible feedstock for biofuel generation, genetic modification of algae for higher yield of biofuel production, various processes to develop biofuels and challenges faced to implement biofuels on a larger scale have been discussed in this paper.

GRAPHICAL ABSTRACT



KEYWORDS

biomass; biofuel; biodiesel; biochemical process; chemical process; thermochemical process;

Review on various techniques to optimize use of non-renewable resources

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ABSTRACT

Optimized use of non-renewable resources refers to the optimization and responsible management of finite natural resources which cannot be easily replaced or regenerated over short period of time. Non-renewable resources include fossil fuels (such as coal, oil, and natural gas), minerals, and nuclear fuels. The abstract concept involves maximizing the utility derived from these resources while minimizing waste, environmental impact and the rate of depletion. In our proposed review paper advanced technologies like resource recovery, smart waste management, reducing the energy demand and the optimize consumption of non-renewable resources would be explained. As per survey material efficiency is crucial for both decreasing damage, pollution, and improving global waste statistics**.** Resource recovery is the most critical solution to many problems with sustainability, from the supply chain to the climate crisis. Secondly, Actions like driving electric and hybrid vehicles, installing solar panel and using energy-efficient appliances are all smaller-scale changes. Increasing public awareness and education about the nature of non-renewable resources to mitigate environmental impacts. Encouraging sustainable consumption patterns can help to reduce overall resource demand. Direct investment towards the development and deployment of renewable energy technologies. Explore energy sources that can substitute for non-renewable resources. Innovation in renewable energy technologies such as solar, wind, hydroelectric power can help reduce reliance on fossil fuels. Improved energy efficiency in industrial processes can lead to sustainable and climate-neutral energy systems. Energy-efficient construction can result in increased energy and cost savings, reduced greenhouse gas emissions, and improved standards of living. In our proposed paper we can conclude that the optimized use of non-renewable resources is paramount for sustainable development and implementing advanced technologies like recycling, reducing and remote sensing are crucial steps to mitigate the environmental effect.

Keywords: Non-Renewable Resources, Energy-efficient appliances, Waste Management, Resource Recovery, Technologies.

Sustainable and Eco-Friendly Lab Grown Diamonds-The Shape of Tomorrow's Jewellery

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ABSTRACT

Research into sustainable alternatives has surged in response to the growing environmental problems around traditional diamond mining processes and the expanding demand for diamonds. This study compares the environmental effects of lab-grown diamonds to those that are mined naturally. Innovative methods are used to produce lab-grown diamonds, which offer a viable solution for reducing the environmental damage caused by conventional mining. This study clarifies the greater environmental friendliness of lab-grown diamonds by thoroughly examining carbon emissions, energy use, and water use. To determine water and energy consumptions we will be examining case studies which are publicly available from industry leaders. Additionally, traditional diamond mining has been linked to environmental incidents and disasters, whereas lab-grown diamonds have resulted in none. The research emphasizes environmental advantages of choosing lab-grown diamonds over mined ones. In the end, this study emphasizes how important lab-grown diamonds are to the advancement of sustainability in the diamond industry.

KEYWORDS

Lab grown , Diamond, Sustainability, Man made, Environmental impact

Energy-Efficient Green Buildings: Technologies, Strategies, and Impacts

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ABSTRACT

The proposed research paper renders an in-depth analysis of energy-efficient green buildings, focusing on the latest technologies, strategies, and environmental and economic impacts. The different elements of a green building showcased are 1. sustainable site selection 2. Energy efficiency 3. Water efficiency 4. Material efficiency 5. Design. The paper reflects on designing and operating green buildings to reduce energy consumption and minimize environmental impact. It examines the integration of renewable energy resources, passive design principles, efficient HVAC (heating, ventilation, and air conditioning) systems, smart building technologies, green roofs, bio-walls, Geothermal Systems, and maximizing natural light. Our idea shows how different designs and angles of an architectural structure maximize power generation and light generation. Additionally, the environmental benefits of green buildings are reduced greenhouse gas emissions and conservation of natural resources. Overall, it emphasizes the role of green buildings in mitigating climate change and achieving sustainable development goals. The proposed paper shows four aspects of reducing the energy consumption of buildings, which results in mitigating CO_2 emissions. a. Comfortable passive building design and its planning for harnessing solar energy. b. low-embodied energy materials for building design. c. energy-efficient domestic appliances to conserve the building's operational energy. d. Creating integrated renewable energy technologies. In conclusion, it highlights the critical role of energy-efficient green buildings in addressing the challenges of climate change and promoting sustainable development. Through an in-depth exploration of various strategies and technologies, the paper underscores the significance of adopting energy-efficient practices in the design and operation of buildings.

KEYWORDS Energy efficiency, HVAC systems, solar energy, climate change, green buildings

SESSION:05

MODELLING, OPTIMIZATION AND INTENSIFICATION-I

Session Chair	Session Co-Chair
Dr. Rohidas Bhoi	Dr. Hemant Kumar

Optimizing Transesterification of Azadirachta indica Fatty Acids: ASPEN-Based Simulation for Methylated Ester Production in Reactive Distillation

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ABSTRACT

This research investigates the transesterification process of five key fatty acids (Palmitic, Stearic, Oleic, Linoleic, Arachidic) derived from *Azadirachta indica* for the production of methylated esters. The study focuses on evaluating the thermodynamic properties of these individual fatty acids to understand their behavior during the transesterification process. Using the RADFRAC module in ASPEN, a comprehensive simulation of the reactive distillation process is conducted to optimize conditions and enhance the efficiency of methylated ester production. The choice of these specific fatty acids aims to explore the diverse composition of *Azadirachta indica* and its potential application in biodiesel production. The simulation results provide insights into the complex interactions within the reactive distillation column, offering a valuable contribution to the understanding and optimization of transesterification processes. This research bridges the gap between theoretical understanding and practical application, paving the way for sustainable and efficient biofuel production from *Azadirachta indica* fatty acids.

KEYWORDS

Neem Oil, Biodiesel, Reactive Distillation, Process Simulation, Process Intensification

Towards Sustainable Supply Chains: Exploring the Synergy of Innovative Practices in Hardware-Based Digitization and Subscription Models.

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ABSTRACT

This paper gives insights into sustainable supply chains by examining the synergistic impact of hardware-based digitization and subscription models. The study theorizes their potential to reduce carbon footprint and enhance operational efficiency in small-scale trading. Through a comparative analysis of traditional purchasing and subscription-based approaches, the research aims to contribute theoretical insights on achieving environmental sustainability in local trading environments. By addressing the carbon footprint, the study explores how innovative supply chain practices can align with eco-friendly objectives, providing a foundation for future research and practical applications in the pursuit of environmentally conscious and efficient trading practices.

KEYWORDS: Sustainability, subscription-based approaches, Synergy Innovatives

Optimization of parameters for extraction and isolation of Steviol glycosides from *Stevia Rebaudiana* leaves using water

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ABSTRACT

Steviol glycoside is a well-known intense natural sweetener and is a non-caloric sweetener. Its widespread application requires an innovative extraction, isolation and purification method to obtain steviol glycoside in crystal form. This study sought to improve the extraction step by applying Response surface methodology (RSM). A Box Behnken design (BBD) was applied under these independent parameters: different S/L (10, 15 and 20) water as a solvent for different times (1h, 3 h, 5 h) at different temperatures (40 ^{o}C , 60 ^{o}C, 80 ^{o}C). In our work, the determination coefficient R^2 was 96.73 % which shows that the experimental data were satisfactory. It was discovered that the % extraction recovery of steviol glycoside from stevia leaves can be maximum at 51.09 % at the optimum condition at an immersion temperature of 80 °C, S/L 10 and extraction time of 5 hours. 47.87 % was the experimental extraction recovery obtained from Stevia extraction at the feasible optimum condition. This work can be used to maximize the recovery for the extraction step in the extraction and followed by the isolation steps which can be further scaled up.

KEYWORDS

Steviol Glycosides, Stevioside, Rebaudiana-A, Stevia Rebaudiana Bertoni, Response Surface Methodology, Box-Behnken Design

Improving Reactor Performance Through Hydrodynamic Studies

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ABSTRACT

Mixing using moving geometries in mechanically agitated vessels is one of the most common operations encountered in the process industries. Over a long period, researchers worked on improving hydrodynamics of continuous operation by varying mixing phenomena in reaction vessel. Present work focuses on improving hydrodynamics without incorporating any moving geometry or by creating any internal obstacle to flow. The conventional tube with one normal inlet and outlet will have no mixing component in tangential direction, thus behaviour of the vessel will not be ideal Plug Flow condition. Computational Fluid Dynamics (CFD) simulation tool was used to identify possible causes of problems occurring in existing systems and provide useful insights to be used in design of experiments. Number of variations were simulated using CFD for hydrodynamic study inside a proposed geometry and finally a modified geometry is selected with tangential entry and exit nozzles. The proposed geometry imparts presence of Tangential Velocity component due to arrangement of entry and exit nozzles. This will improve the hydrodynamics inside vessel without using any external force. Residence time Distribution (RTD) study confirmed presence of Tangential Component velocity, thereby improving hydrodynamics in proposed geometry. Further the Saponification and Radox reaction were conducted in both conventional and proposed geometries. Almost 40% of improvement in conversion under steady state condition was observed in proposed geometry in comparison to conventional geometry. From present work it can be concluded that the proposed geometry gives better hydrodynamic in comparison to conventional geometry. This work is best example of sustainable development by innovation by changing present technology.

KEYWORDS

Hydrodynamics, Reaction Vessel, CFD, Tangential Velocity, RTD, conversion

Process simulation of coal and biomass co-firing in fluidized bed reactor

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ABSTRACT

The demand for coal has grown globally due to economic expansion and increased industrial activity, despite the active development of alternative energy sources in compliance with climate change regulations. Although coal combustion is a well-established technology, still some drawbacks are debatable. The widespread release of trace pollutants is the primary factor contributing to the overall deterioration in air quality. Furthermore, the combustion process is infamous for having a low efficiency. As part of the solution combustion of biomass in the existing systems as a carbon neutral fuel has increased significantly as a result Of the global drive for sustainable energy alternatives. Co-firing of coal and biomass in a fluidized bed reactor has been an efficient way to optimize the pollutant emission. Numerous models of coal combustion processes have been developed; However, they have several constraints, including the kind of coal used, the operating environment, the simplifying assumptions, and the overall stiffness of the model. Furthermore, these models do not take into account the optimization benefits of using a blend of coal and biomass. The present study focuses on using biomass and coal mixture in the fluidized bed reactors as a carbon neutral, sustainable substitute for fossil fuels. This model is created in Aspen Plus® to incorporate reaction kinetics and bed hydrodynamics in the combustion process. Simulating the combustion process of a coal/biomass blend is made possible by designating coal/ biomass as non-conventional solid components. It also allows for changes to different grades of coal and biomass with their different composition to note the effect of CO2 and CO emission in particular with generation of clean energy. We expect to foster a model for coal/biomass blend fuel, especially for the various Indian coal with available biomass, in order to determine the optimum coal/biomass proportion to contribute cleaner and greener energy solutions.

KEYWORDS: Coal/Biomass, Fluidized bed reactors, Aspen Plus, Combustion, Carbon neutral

Optimisation of Biodiesel Production process from different types of edible oils using KOH and NaOH as homogeneous catalysts

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ABSTRACT

In the present study, optimization of biodiesel production from different types of edible oils such as Palm oil, Cotton seed oil and Sunflower oil using KOH and NaOH as homogenous catalyst has been investigated. In the first step, different types of edible oils has been optimised using KOH and NaOH catalyst. The maximum biodiesel yield of 98% was found from sunflower oil using reaction temperature of 60°C, methanol to oil molar ratio of 6:1, KOH catalyst concentration of 1 gm./100 cc feed, reaction time of 55 min. In the second step, transesterification reaction parameters were again optimised using sunflower oil and KOH as homogeneous catalyst and found the maximum desired biodiesel yield of 99% using a 0.8 gm KOH catalyst, 6:1 methanol to oil ratio was 6:1 and 55 minute process time at 55°C. Produced biodiesel properties were also estimated and checked by the biodiesel standard ASTM D6751 and found within the prescribed limit. These results indicate that KOH as homogeneous catalyst and sunflower oil as edible oil is found to be the best combination of homogeneous catalyst and edible oil in terms of biodiesel yield and properties.

KEYWORDS

Biodiesel, Sunflower oil, Homogenous catalyst, Transesterification reaction, Edible oil.

Simulation studies of extractive distillation for separating the Toluene/2-Methoxyethanol binary azeotrope mixture using Glycerol & Lactic Acid Green Solvents.

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ABSTRACT

Toluene and 2-Methoxyethanol formed a minimum azeotrope and extractive distillation should be a suitable method to separate their mixture. This research systematically explores the separation of a Toluene-2Methoxyethanol mixture using an solvent in extractive distillation. Glycerol and Lactic acid was chosen to be the solvent because it could break the original binary azeotrope. The primary objective is to develop a process design achieving high purity, specifically targeting 99.9 mole% for toluene and purity exceeding 99.3 mole% for 2-Methoxyethanol. The process characteristics were simulated through chemical process simulation software-ChemCAD. Subsequently, a sensitivity analysis was conducted to optimize the flow sheets. To achieve the optimized design of the extractive distillation column, the influence of key parameters such as solvent flow rate, impact on reflux ratio, Azeotrope feed stage, and solvent feed stage were thoroughly investigated. Total cost estimation has contributed valuable insights into the feasibility and efficacy of green solvents for separating the Toluene-2Methoxyethanol azeotrope, having the way for more sustainable and efficient separation processes in the chemical engineering domain.

KEYWORDS:
Sensistive analysis, Extractive distillation, Azeotrope, Green solvents

Optimizing Carbon Dioxide Absorption Efficiency in Industrial Flue GStreams: A Comparative Study of Amine-Based Absorption and Deep Eutectic Solvents

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ABSTRACT

Carbon dioxide (CO_2) is recognized as a significant contributor to global temperature fluctuations due to its prevalence in the atmosphere, primarily originating from substantial emissions in industrial flue gas. Amine-based absorption emerges as a viable method for capturing CO_2 and hydrogen sulfide (H_2S) from vent gas streams, with potential applications in Enhanced Oil Recovery (EOR). Additionally, there is ongoing exploration into Deep Eutectic Solvents (DES), a novel class of solvents distinguished by their environmental friendliness and promising commercial prospects. This work aims to identify optimal DES candidates based on their CO_2 absorption kinetics, with Choline chloride (ChCl) + Urea (Reline) identified as a promising candidate for subsequent simulation studies. Using ChemCAD, an initial simulation employing a solvent blend comprising 15% w/w monoethanolamine (MEA), 15% w/w piperazine, and water demonstrated remarkable CO_2 absorption efficiency nearing 99%. Subsequently, Aspen Plus was utilized to simulate CO_2 capture using Reline as a solvent, which consists of a Choline chloride and Urea mixture at a 1:2 molar ratio. Reline was incorporated into Aspen Plus as a pseudo compound, drawing upon literature-derived data. Results indicate a CO_2 recovery rate of approximately 97% with reduced heat duty for solvent recovery compared to the former simulation.

KEYWORDS

Carbon capture, Absorption, Deep Eutectic solvents, Mono ethanol amine, Simulations

Studies In Double Pipe Heat Exchanger With Small Diameter Tubes: Experimental And Modelling

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ABSTRACT

Shell and tube heat exchangers are widely used in industries for heating and cooling purposes. The design aspects of these can be easily understood by the study of double pipe heat exchanger. Two double pipe heat exchangers having diameters of 2.8 mm and 4 mm respectively were used for the experimental work. Heat transfer coefficients were determined for distilled water at three different temperatures (50□ C, 60□ C, 70□ C). It was found that Dittus-Boelter equation does not give a good prediction for the experimental data. Models proposed for the heat transfer coefficient show an excellent match with the experimental data. The model parameters were obtained using regression analysis performed in MS Excel. The power of Reynolds number decreases with decrease in the tube diameter. As the temperature increases heat transfer coefficient increases.

KEYWORDS

Double pipe heat exchanger, heat transfer coefficient, modelling and regression

SESSION:06

MODELLING, OPTIMIZATION AND INTENSIFICATION-II

Session Chair	Session Co-Chair
Dr. Nitin Bhate	Dr. B. Suryawanshi

Simulation Of Close Boiling Mixture Using Green Solvents

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ABSTRACT

The application of green solvents has become a crucial option for a range of industrial applications as the need for environmentally friendly and sustainable operations grows globally. In order to find novel green solvents that provide efficient separation and a lower environmental impact, we started simulating near boiling combinations in this work, concentrating on acetone and n-heptane system. We evaluated several potential solvents made from renewable resources using simulation software. Our research showed that biodegradable solvents provided improved sustainability indicators, such lower toxicity and carbon footprints, in addition to showing separation efficiency that were on par with traditional solvents. Here, we also attempted to compare two simulators: Aspen Plus and CHEMCAD. This work opens the door for further studies on the environmentally friendly separation of close boiling mixtures and highlights the potential of green solvents in contemporary distillation procedures. Based on this research work, we can conclude that to achieve a separation above 90%, 1-chlorobutane solvent requires a higher reflux ratio than triethylamine, and the solvent requirement is higher when using 1-chlorobutane compared to triethylamine so triethylamine would be a suitable solvent for this system. Moreover, detailed operating conditions for both solvents were also studied and mentioned in this research work.

KEYWORDS

Green Solvent, Extractive Distillation, Simulations, CHEMCAD

Ethyl levulinate Production from Biomass Derived Furfural Alcohol: A Study of Modeling, Simulation, and Economics for Sustainability

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ABSTRACT

The goal of this study was to assess the economic viability of producing ethyl levulinate from furfural alcohol. Aspen Plus v14 was used to develop methodology, the production process of ethyl levulinate from furfural alcohol, and life cycle evaluation methodologies. A base scenario was investigated using a total yield of 1.4693 kg ethyl levulinate/kg FAL (1:15 mass% FAL:Eth ratio). Based on experimental results, this work presents a large-scale process modeling study that involves energy analysis and economic analysis to illustrate the economic feasibility of the proposed method. Ethyl levulinate had a minimal carbon footprint at 97% conversion, according to a Life Cycle Assessment study. For the economic scenario, a class V economic evaluation is performed, providing a high market value net present value. As a result, using a biomass-derived chemical for ethyl levulinate is a viable alternative that will grow the e-fuel business and convert agro-industrial waste into valuable products.

KEYWORDS

Furfural Alcohol, Ethyl Levulinate, Economic Analysis, Simulation, ASPEN

Study on Critical Properties based Models for the Density Estimation of Deep Eutectic Solvents

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ABSTRACT

The accurate estimation of density is essential owing to the growing interest in Deep Eutectic Solvents (DESs). This study conducted a comprehensive evaluation of critical properties-based empirical models for the density of DESs. Accurate density estimation is essential for efficient process design, product quality control, safety management, cost optimization, equipment design, and environmental compliance in the chemical industry. In this regard, an analysis was conducted covering over 600 experimental data points on the density of over 200 DESs sourced from the open literature. These data were used to train the critical properties-based models. Furthermore, a novel eutectic solvent, comprising Tetrabutylammonium Bromide and Mandelic Acid was synthesized experimentally at a laboratory scale. The density of synthesized DES was determined within the temperature range of 298 K to 333 K. These experimental data of synthesized novel DES were used to validate the recommended model based on comprehensive comparison and statistical evaluation. The strengths and limitations of these studied models were summarized.

KEYWORD

Deep Eutectic Solvents, Density, Modeling

Adsorption of chromium from industrial waste water by in situ formation of iron oxide particles: an approach for process intensification

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ABSTRACT

Nowadays, waste water containing chromium is discharged from various industries cause an increasing risk to human health and the environment. Hexavalent chromium is toxic, carcinogenic and likely mutagenic in nature and can cause severe problems for humans and marine ecosystems. Lots of techniques were discussed for the removal of heavy metal ion like adsorption and ion-exchange, chemical precipitation, coagulation-flocculation & flotation, membrane filtration and electrocoagulation. Adsorption processes have been mostly used for removal of chromium from the contaminated water stream. In this study, the lab scale experimental method is developed for removal of chromium from industrial waste water. Batch adsorption experiments were conducted to evaluate the effect of contact time and pH on chromium removal along with modification in the experimental setup. The samples are analysed by ICP (Inductively Coupled Plasma) Spectroscopy. Experimental results showed that steel wool adsorbent could perform effectively in a wide range of experimental conditions. However, in optimum experimental conditions such as 660 minutes contact time, pH 3.5 and 20 gm for 30 litre of adsorbent dose of steel wool effectively removes 95.91 % of chromium from an industrial waste water having 100 ppm of chromium concentration.

KEYWORDS*:* Chromium, Industrial wastewater, Adsorption, Steel wool, pH effect.

Investigate effect of machining parameters on geometric form and orientation controls (2^3 Design)

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ABSTRACT

This study examines the influence of machining variables such as spindle speed, feed rate, and depth of cut on Face Milling of Aluminium 6061. Aluminium 6061 is commonly used in manufacturing due to its affordability. The experiment employs 2^3 full factorial designs with four central factors to ensure reliable results. The response variables considered are Flatness, Straightness, and Parallelism, which govern the form and orientation controls. The spindle speed, feed rate, and depth of cut directly impact the flatness, straightness, and parallelism of the machined surface. Controlling these machining parameters is crucial to achieving the desired values for flatness, straightness, and parallelism. Utilizing predictive models helps in selecting optimal process parameters. ANOVA analysis is employed to determine the significance of input parameters. Measurements of flatness, straightness, and parallelism are conducted using a coordinate measuring machine. The values predicted by the model closely match experimental results, indicating the effectiveness of the predictive approach..

KEYWORDS

Machining Parameters Speed, Feed and Depth of cut, Flatness, Straightness, Parallelism, ANOVA

Column Composite Curve, Invariant Rectifying and Stripping Curves- as Energy Targets of Distillation Column

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ABSTRACT

The methodology for generating temperature-enthalpy diagram for distillation column is described. The curve, known as column grand composite curve, depends on the operating reflux and feed tray location for the given specification of operating pressure and product purity. From the literature review on the subject, there are temperature-enthalpy diagrams, called invariant curves, obtained from a converged simulation of a distillation column. For specified operating pressure and product purity, it is shown that the energy targeting for Minimum thermodynamic condition (MTC) is deterministic, indepedent of design operation of distillation column. The T – H curves, invariant-rectifying curve (T − H curve for rectifying section) and invariant-stripping curve (T − H curve for stripping section) are indepedent of feed tray location, operating reflux. The paper also demostrates the methodology for proper feed location target that will minimize utility consumption for a fixed no. of stages and maximize the scope for energy consurvation through reflux modification. Case studies on Binary mixture of Benzene-Toluene are also done to illustrate the concepts.

KEYWORDS

Pinch Technology, Column Grand Composite Curve, Invariant Curves, Energy Targets

Treatment of model wastewater containing Rhodamine B (RhB) by Electrochemical Fenton (ECF) process: Modeling and optimization using Box-Behnken Design (BBD)

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ABSTRACT

The treatment of synthetic Rhodamine B (RhB) wastewater with an Electrochemical Fenton (ECF) technique in batch mode utilising commercially available iron plates as electrodes were investigated. The response surface methodology (RSM) technique, which employs Box-Behnken Design (BBD), was used to create a mathematical model and optimize process parameters for colour removal efficiency (%) for RhB model dye. The maximum colour removal efficiency (%) was obtained to be 99.57 % with 0.99 desirability under such optimum conditions, 3.0 pH, 97.76 A/m^2 current density, RhB Concentration 52.33 ppm, and 9.83 min electrolysis time. After finding the optimum conditions were identified, three duplicates of the actual tests were carried out. The regression model's predictions were in line with the findings, which showed a colour removal effectiveness of 98.77 %.

KEYWORDS

Wastewater, Electrochemical Fenton, Response surface methodology, Optimization, Rhodamine B

Quantum Chemistry Insights Behind The Formation Of Iodide-Based Deep Eutectic Solvents

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ABSTRACT

Deep eutectic solvents (DES) are the eutectic mixtures of hydrogen bond acceptor (HBA) and hydrogen bond donor (HBD) [1]. Studies on DES, to create a field of green and sustainable chemistry, is gradually increasing. DESs have found application in several areas such as the fields of nanotechnology, nano-biotechnology, materials science and electrochemistry, various separation techniques, and also in organic reactions like synthesis of polymer materials, lipase- and metal-catalyzed reactions, and bio-transformation reactions [2-4]. A detailed computational study on the formation mechanisms of DES provides an insight of their structural and electronic properties [5]. It further creates a molecular-level link between quantum chemistry and chemical engineering thermodynamics. Studies on iodide-based DES, especially on the basis of computational chemistry, are limited. This research article focuses on the self-association during formation of various iodide based DES. Lithium iodide and sodium iodide have been selected as HBA, with ethylene glycol or glycerol as HBD. The quantum chemistry calculations were performed on the basis of density functional theory methods at B3LYP/ LanL2DZ level in Gaussian software (6.0.16 version). Different thermodynamic properties such as interaction energies, electronic energy, zero-point energy, dipole moment, heat capacity and entropy of the eutectic mixture are anticipated. To describe the quantum chemical characteristics of the eutectic systems, the HOMO and LUMO energies data were assimilated to calculate the electronegativity, electrophilicity index, chemical hardness and chemical softness.

KEYWORDS

Density functional theory, iodide-based deep eutectic solvents, ethylene glycol, glycerol, electronic energy, interactions, hydrogen bonding, orbital energies

SESSION:07

SYSTEMS ENGINEERING

Session Chair	Session Co-Chair
Dr. M. S. Rao	Dr. J. L. Purohit

The Hazop And Fault Tree Analysis Of Sulphonation Reaction In Batch Process

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ABSTRACT

The present study investigates the safety aspects of the sulfonation reaction in the batch reactor. The sulfonation reaction considered here uses acetanilide, thionyl chloride, and chlorosulphonic acid to produce acetyl sulphonyl chloride, alongside by-products like acid fumes and SO_x. The reaction is exothermic in nature and steam initiates the reaction, followed by chilling water to maintain a temperature of 50°C and vacuum pressure. Considering the safety issues associated with the mentioned reaction, the Hazard and Operability (HAZOP) Study and Fault Tree Analysis (FTA) is performed in this work to identify the risks inherently present with this complex process. The HAZOP analysis systematically scrutinizes the process parameters, detects process deviations that could lead to hazards such as uncontrolled reactions or operational failures. The findings of HAZOP study are incorporated into fault tree analysis by considering reactor failure chances as top event. The proposed fault tree has 18 intermediate events, and 35 basic events. The critical parameters like temperature and pressure severely affects the process, i.e., exceeding the temperature beyond 160°C may trigger possible thermal runaway and simultaneous overpressure occurrences. By integrating FTA and HAZOP, this study aims to ensure the safety, reliability, and efficiency of sulfonation reactions in batch processes.

KEYWORDS:

Sulphonation Reaction, Safety Analysis, Hazard Operability, Fault Tree Analysis

Examining And Addressing Green Lean Six Sigma Drivers: Insights From Higher Education Institutions

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Abstract

The objective of the study is to identify and explore the Green Lean Six Sigma (GLSS) drivers in the context of Higher Education Institutions (HEIs). A systematic literature review was conducted to examine the factors propelling GLSS initiatives, particularly within the context of HEIs. By scrutinizing the unique perspectives and experiences of experts, this study aims to identify the key drivers influencing the adoption and implementation of GLSS methodologies in HEIs. Through a comprehensive analysis, this paper offers valuable insights into the strategies and practices employed by HEIs to effectively integrate sustainability principles into their operational frameworks. The findings of this study contribute to a deeper understanding of the vital enablers influencing the adoption and implementation of GLSS methodologies in HEIs.

KEYWORDS:

Green Lean Six Sigma, Higher Education Institutions (HEIs), drivers, enablers

Nucleonic Level Measurement In Fluid Catalytic Cracking Unit, Oil & Gas Refinery

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ABSTRACT

Measurement of Level is very crucial in an Industrial Process, as low levels can cause problems and damage equipment, while high levels can cause overflow and potentially create safety and environmental problems. When working with Fluid Catalytic Cracking System Unit (FCCU) in Refineries, there're requirements for various types of level measurement instruments. One of them is Nucleonic Level Measurement device which is used in the process involved in separation of catalyst from the Flue gasses which is passes through equipments Third Stage Separator, Fourth Stage Separator, Fines Collection Hopper, Fines Disposal Hopper and End Level Drums or Bins. Nucleonic level measurement works upon radiometric level measurement technique in which sources and detectors are there to transmit and receive gamma rays for detection of the catalyst level of hoppers / vessels. Following are the advantages of Nucleonic Level Measurement:

- It's used in Level, interface, density, concentration and point level measurement
- It can be utilize measurement in liquids, solids, suspensions or sludges
- It's also used in extreme process conditions: high pressure, high temperature, corrosion, abrasion, viscosity, toxicity and all kinds of process vessels, e.g. reactors, autoclaves, separators, acid tanks, cyclones.

KEYWORDS: Nucleonic Level Measurement, Fluid Catalytic Cracking System Unit, Refinery

Adapting Conventional Energy Meter To Be “Smart” For Smart Grids

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ABSTRACT

As technological advancements continue to improve the quality of life, there has been a marked increase in the use of electrical appliances, leading to heightened energy dependency. With finite energy resources rapidly depleting, it is imperative to monitor electricity consumption in household, agricultural, and industrial applications efficiently to promote savings. Moreover, there is a rising concern over energy theft due to metering irregularities and billing cycle discrepancies, compounded by the significant on-field manpower required for conventional billing methods. The transition to entirely new hardware can also prove to be an expensive process. In light of these concerns, this study proposes a novel system that offers an alternative approach for energy metering, billing, and consumption analysis. The system augments the conventional energy meters with a circuit to enhance their functionality, enabling remote monitoring, prepaid service, GSM alerts, smart device control, and cloud-based consumption analysis. This system can operate in tandem with existing hardware, providing modularity, scalability, and an economical solution. Additionally, it is expected to contribute to raising social awareness towards energy conservation by providing valuable insights into energy consumption patterns.

KEYWORDS: Smart Energy Meter, IoT, Automation, Smart Grid, Energy me

Actuator Fault Detection of Active Suspension System in Rail Vehicles

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ABSTRACT

Sustainable development encompasses various facets of human existence, including the domain of public transportation. This study presents a methodology for detecting faults in active rail vehicle suspension systems. The primary objective is to enhance the reliability of the active suspension systems employed in railway vehicles. This paper presents an approach for fault detection of active rail vehicle suspension system. A quarter car suspension system model grounded in the fundamental principles of Newton's Law of motion is employed on account of its widespread adoption and straightforward nature. The proposed methodology integrates Linear Quadratic Regulator (LQR) as a state feedback control mechanism to implement the active rail suspension system. The investigation employs a sequential analysis technique of CUSUM which is useful in diagnostics for various model misspecifications or structural changes. In order to analyze the efficacy of the proposed approach, a loss of effectiveness in actuator operation is considered and the results of fault detection are put forth which provides the information of fault status and time of fault occurrence.

KEYWORDS: Fault Detection, Active Suspension, Rail Vehicle

Abrupt And Incipient Fault Detection And Compensation For A Quadruple Tank System Benchmark

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ABSTRACT

This work presents an innovative approach to address the critical importance of fault detection and compensation in technological systems, aimed at enhancing both performance and safety. Specifically, the proposed active fault-tolerant control scheme focuses on identifying and mitigating actuator faults within a Quadruple tank system benchmark. These faults are characterized by a significant loss of gain in the actuators, particularly pumps, which could severely impact the system's nominal performance. The methodology employed in this study is based on a model-driven strategy, utilizing a recursive least squares parameter estimation algorithm to establish a fault detection and diagnosis subsystem. Furthermore, a parametric eigen structure assignment method is leveraged to reconfigure the state feedback controller in response to identified faults. The designed controller is then subjected to simulation tests on the nonlinear Quadruple tank system. The simulation results showcase promising performance improvements in faulty scenarios when compared to a non-fault-tolerant controller. This underscores the effectiveness of the proposed approach in detecting and compensating for actuator faults, contributing to heightened system reliability and safety.

KEYWORDS: Active fault-tolerant control systems, fault detection and diagnosis, online parameter estimation

Weather Adaptive Helmet

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ABSTRACT

In the realm of motorcycle safety, helmets have undergone significant advancements, incorporating features such as accident detection, SOS alerts, and alcohol detection to enhance rider safety. However, in the diverse and extreme seasonal variations of the Indian subcontinent, additional challenges arise. To address these challenges, we introduce the Weather-Adaptive Smart Helmet, a smart concept. This innovative helmet offers three fundamental solutions for rider safety and comfort. It is equipped with an automatic light-resistant visor, ensuring optimal vision and eye protection during intense sunlight and scorching heat waves. The helmet also includes an efficient ventilation system, maintaining riders' comfort by optimizing airflow, regardless of weather conditions. In monsoon conditions, a detachable rain cover deploys automatically upon detecting rainfall, safeguarding the rider's possessions. The primary goal of this system is to enhance the two-wheeler riding experience, giving riders the confidence to navigate diverse weather conditions while prioritizing their safety and comfort.

KEYWORDS: Weather adaptive helmet, optimisation, safety.

SESSION:08

GREEN TECHNOLOGIES FOR PHARMACEUTICAL INDUSTRIES

Session Chair	Session Co-Chair
Dr. B. N. Suhagia	Dr. Tejal Soni

Greenness Evaluations Of Chromatographic Method: Qbd Assisted Simultaneous Estimation Of Amlodipine Besylate, Telmisartan And Indapamie In Their Syntheti Mixture By Hptlc

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ABSTRACT:

A precise, simplified, sensitive and rapid superior thin-layer chromatography technique has been optimized and validated for Amlodipine besylate, Telmisartan and Indapamide in their ternary synthetic combination by Box Behnken design. Chromatography method was employing aluminium plates; as a stationary phase, pre-coat with silica gel $60F_{254}$ by using Toluene: Isopropanol: Methanol: Triethylamine (6:1:1.3:0.2v/v/v/v) as a mobile phase and densitometric determination was performed at 255 nm. Optimization was performed using AQbD followed by experimental of design enabled optimization of chromatographic conditions by selection of critical parameters: chamber saturation time, volume of methanol and solvent front and studying their effects on critical method attributes: R_f values of 3 drugs and resolution response Rs 1,2 and Rs 2,3. For the calibration plots, the results of the linear regression analysis revealed r2 of 0.99 value greater than in a concentration range of 500-1500 ng/band for Amlodipine besylate, 100-500ng/band for Telmisartan and 400-2000 ng/band for Indapamide. The percent recovery for Amlodipine besylate, Telmisartan and Indapamide were in range of 98.36-100.83, 98.71-100.2 and 98.89-100.56 respectively. Among 3 parameters volume of methanol was found more critical parameter. The development of methods based on QbD led to a design space that was more knowledgeable about all method performance characteristics, which improved comprehension of critical parameters. Furthermore, the Analytical GREEnness profile was evaluated with an overall score of 0.77 using the AGREE and GAPI tools.

KEYWORDS: Chromatography, Green Evaluation, Amlodipine besylate.

Development & Validation Of Green RP-HPLC Method For Simultaneous Determination Of Bupivacaine And Meloxicam In Their Bulk And Synthetic Mixture

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ABSTRACT:

Bupivacaine is a potent local anesthetic drug used to numb the area of the body for minor surgery and meloxicam is a nonsteroidal anti-inflammatory drug (NSAID) used to relieve the symptoms of arthritis and joint pain. No green technique incorporating the use of green analytical chemistry (GAC) in RP-HPLC for BUP(bupivacaine) and MEL(meloxicaime) has been reported. The current study focuses on how GAC was used in the development and validation of a green RP-HPLC technique. The mobile phase used for RP-PLC was green solvents, namely, acetonitrile and methanol (30:70, v/v) was used. The detection was carried out at 220 nm. Method was validated for linearity,range, precision, accuracy, limit of detection, limit of quantification, sensitivity, and specificity. In the range of 50−250 µg/mL for BUP and 4 to 20 µg/mL for MEL was proved to be linear. Analytical greenness (AGREE) score was estimated as 0.8 it was which indicated a high level of greenness. We compared our developed methods with previously reported HPLC (for similar class drugs) methods showing AGREE scores of 0.58, 0.61, 0.62, and 0.65, which are considered poor AGREE scores when compared to our established green RP-HPLC method. Our method demonstrated extreme greenness as compared to other reported methods, and these emerging environmentally friendly green methods should be explored in pharmaceutical industries to reduce the potential hazards of organic solvents on nature.

KEYWORDS: GAC, RP-HPLC, AGREE, anesthetic, nonsteroidal anti-inflammatory drug, method development, method validation

Stability Indicating Greenness Assessment Of Rp-Hplc Method For Simultaneous Determination Of Drospirenone And Ethinylestradiol In Tablet Dosage Form

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ABSTRACT:

Drospirenone and Ethylestradiol is decreasing follicle stimulating hormone (FSH) and luteinizing (LH) for preventing pregnancy by inhibiting ovulation. No green technique incorporating the use of green analytical chemistry (GAC) in RP-HPLC for DRSP(Drospirenone) and ETH(Ethinylestradiol) has been reported. The current study focuses on how GAC was used in the development and validation of a green RP-HPLC technique. The mobile phase used for RP-PLC was green solvents, namely, acetonitrile and acetate buffer (60:40, v/v, pH6.0) was used. The detection was carried out at 277 nm. Method was validated for linearity, range, precision, accuracy, limit of detection, limit of quantification, sensitivity, and specificity. In the range of 300-1500 µg/mL for DRSP and 10- 50 µg/mL for ETH was proved to be linear. Analytical greenness (AGREE) score was estimated at 0.78, it was which indicated a high level of greenness. We compared our developed methods with previously reported HPLC (for similar class drugs) methods showing AGREE scores of 0.48, 0.65, 0.57, and 0.61, which are considered poor AGREE scores when compared to our established green RP-HPLC method. Our method demonstrated extreme greenness as compared to other reported methods, and these emerging environmentally friendly green methods should be explored in pharmaceutical industries to reduce the potential hazards of organic solvents on nature.

KEYWORDS: FSH, LH, RP-HPLC, GAC, AGREE, extreme greenness, method validation

Development And Characterization Of Glycyrrhizin Loaded Herbal Lozenges For Mouth Ulcer Treatment

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ABSTRACT:

Abrus precatorius Linn. A highly beneficial plant, is a member of the Fabaceae family. The seeds, roots, and leaves are all utilized medicinally. The astringent, pleasant, emetic, diuretic, and anthelmintic roots and leaves. In the treatment of mouth ulcers widely used is oral gel dosage form but because of so many disadvantages of this Gel Dosage Form is blistering, burning, itching, and irritation of the skin and main disadvantage is sometimes people swallow and dissolve in the mouth. To overcome the above problem herbal lozenges were prepared from Abrus precatorius L. leaves. For that microscopy (powder study), morphology, extraction (maceration method), acidic isolation, and thin-layer chromatography were used to make glycyrrhizin acid extract. Then hard lozenges were prepared and their evaluation was done by different methods average weight and weight variation, friability, hardness tests, disintegration, and moisture content analysis. Fibers, Trichomes, and Xylems were present in its leaves. Powder characteristics of leaves of Abrus precatorius showed the presence of glycyrrhizin. Glycyrrhizin was isolated from the water extract of leaves and identified by chemical tests and Thin Layer Chromatography. Then lozenges were prepared in five batches. The first three batches were solidified so that evaluation was done for only batches fourth and fifth. According to observation and results, this is concluded that the fourth batch of lozenges passed all tests than batch-5. So, the batch-4 lozenges are better. So, it is concluded that the lozenge formulation can show better results than other formulations.

KEYWORDS:

Abrus precatorius L., Abruslactone, Abrusoside, glycyrrhizin, mouth ulcer, Thin Layer Chromatography

Development & Validation Of Green RP-HPLC Method For Simultaneous Determination Of Bupivacaine And Meloxicam In Their Bulk And Synthetic Mixture

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ABSTRACT:

Bupivacaine is a potent local anesthetic drug used to numb the area of the body for minor surgery and meloxicam is a nonsteroidal anti-inflammatory drug (NSAID) used to relieve the symptoms of arthritis and joint pain. No green technique incorporating the use of green analytical chemistry (GAC) in RP-HPLC for BUP(bupivacaine) and MEL(meloxicaime) has been reported. The current study focuses on how GAC was used in the development and validation of a green RP-HPLC technique. The mobile phase used for RP-PLC was green solvents, namely, acetonitrile and methanol (30:70, v/v) was used. The detection was carried out at 220 nm. Method was validated for linearity,range, precision, accuracy, limit of detection, limit of quantification, sensitivity, and specificity. In the range of 50−250 µg/mL for BUP and 4 to 20 µg/mL for MEL was proved to be linear. Analytical greenness (AGREE) score was estimated as 0.8 it was which indicated a high level of greenness. We compared our developed methods with previously reported HPLC (for similar class drugs) methods showing AGREE scores of 0.58, 0.61, 0.62, and 0.65, which are considered poor AGREE scores when compared to our established green RP-HPLC method. Our method demonstrated extreme greenness as compared to other reported methods, and these emerging environmentally friendly green methods should be explored in pharmaceutical industries to reduce the potential hazards of organic solvents on nature.

KEYWORDS: GAC, RP-HPLC, AGREE, anesthetic, nonsteroidal anti-inflammatory drug, method development, method validation

Biotinylated Polymeric Complexed Capecitabine Nanoparticles

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ABSTRACT:

Active targeted chemotherapy is anticipated to deliver cytotoxic chemicals to tumor cells in a more targeted manner, lessening the adverse effects on healthy organs. Biotinylation has been a promising technology in delivering the targeted therapy for treatment of various types of cancers. Biotin is used as a targeting agent due to the overexpression of biotin receptors on malignant cells as a result of a further necessity for rapid proliferations. In this Research process, the polymeric complex of bovine serum albumin and κ-carrageenan was biotinylated and loaded with Capecitabine (model drug) with one-step self-assembly process. In this study Bovine serum albumin and Kappa carrageenan were complexed to form an encore for drug loading. Biotin or Vitamin H used in these nanoparticles is the receptor binding agent on present on the tumour cells with gives targeted therapy. The drug loaded is Capecitabine- A Anticancer drug widely used for colon cancer. The –OH Stretching at 3660 cm-1, -NH2+ Stretching at 2780 cm-1, -C=N Stretching at 1690 cm-1, -COO Stretching at 1570 cm-1, -Sulphur Stretching at 1178 cm-1 confirmed the complexation and presence of Capecitabine, Biotin, Bovine serum albumin and Kappa Carrageenan in the nanoparticles.. Also the Characteristic peaks of Biotin; 2900cm-1 to 3010cm-1 is depicted on the Raman Spectra of Biotinylated Drug Nanoparticles. Various Analytical methods SEM, TEM and Zeta potential studies confirmed the nanoparticle design, shape, size and primer factor the complexation technology of polymers, Vitamin-H (Biotin) Binding and drug loading. The Biotinylated Polymeric complex Capecitabine Nanoparticle prepared is a carrier of drug that encores the drug reducing excessive drug exposure unless reached to biotin receptor on tumor cell leading to less toxicity of drug and reduction of side effects.

KEYWORDS: Biotinylation, Targeted Therapy, Polymeric Nanoparticles, Tumour cells, Complexation Technique.

Formulation And Evaluation Of Topical Herbal Ointment For Joint Pain Using Calotropis Gigantea Leaves

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ABSTRACT:

Joint pain is a prevalent issue affecting individuals worldwide, necessitating effective therapeutic interventions. Herbal medicine prepare various part of plant are used like flower, leaves, seeds, root etc. Instead off an herbal drug is design as the alternative formulation for the external use in the form of ointment. This study explores the development of a topical formulation utilizing extract from Calotropis gigantea leaves for managing joint pain. Calotropis gigantea is commonly known as aak leaves and giant milk weed. It belongs to family (Asclepiadaceae) and sub family (Apocynaceae). It is a multipurpose purpose plant known for centuries for its pharmacological importance. It is one such plant that has been endowed with the best natural resources and ancient knowledge. Calotropis gigantea leaves have anti-inflammatory properties which help to ease the discomfort caused by joint pain. It mainly contains cardenolides, flavonoid, alkaloids, mudarine etc. The research encompasses the extraction process, formulation optimization, and evaluation of the prepared topical agent's efficacy. various parameters such as extract concentration, excipients, and stability were considered during the formulation development. Furthermore, the anti-inflammatory properties of Calotropis gigantea leaves were investigated through in-vitro studies. The findings reveal promising outcomes, indicating the potential of the developed topical formulation as a safe and efficacious option for managing joint pain. This research contributes to the exploration of natural remedies for joint ailments and underscores the significance of herbal-based therapies in modern healthcare practices.

KEYWORDS:

Calotropis gigantea L, Alkaloids, Joint pain, anti-inflammatory

A Novel Approach To Sertraline HCl Delivery: Development And Evaluation Of Solid Lipid Nanoparticles

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ABSTRACT:

This study focuses on the development and characterization of solid lipid nanoparticles (SLN) encapsulating Sertraline Hydrochloride (SH) for enhanced drug delivery. Sertraline Hydrochloride, a widely prescribed antidepressant, faces challenges related to its solubility and stability is a significant study in the field of pharmaceutical sciences. The SLNs were produced using a modified solvent injection method with the polymer tristearin and phospholipon 90H. Various combinations of tween 80 concentration and sonication time were employed in the SLN preparation The 3^2 factorial designs were used and two operating variables sonication time and tween 80 concentration were found to have significant effect on particle size, entrapment efficiency and % drug release. Characterization techniques such as scanning electron microscopy (SEM), Fourier-transform infrared spectroscopy (FTIR), entrapment efficiency, Differential scanning colorimetry, and in vitro diffusion studies were employed. The prepared sln were spherical in shape and possess particle of size range 238.9 to 384.4 nm. The formulation F7 demonstrated the highest % entrapment efficiency at 94%. The study concludes that two independent variables surfactant concentration, sonication time were found to have a give significant effect on particle size, % entrapment efficiency and % drug release.

KEYWORDS: Nanoparticles, Sertraline Hydrochloride, Infrared spectroscopy, Scanning electron microscopy.

Development & Validation Of Green RP-HPLC Method For Simultaneous Determination Of Sitagliptin Phosphate And Metformin HCl In Their Bulk And Pharmaceutical Dosage Form

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ABSTRACT:

Sitagliptin Phosphate and Metformin HCl are an anti-diabetic medications used to treat type 2 diabetes. No green technique incorporating the use of green analytical chemistry (GAC) in RP-HPLC for metformin (MET) and sitagliptin (SIT) has been reported. The current study focuses on how GAC was used in the development and validation of a green RP-HPLC technique. The mobile phase used for RP-PLC was green solvents, namely, Hexane-1-Sulfonic Acid (Buffer) pH 2 ± 0.05 with OPA : Water : Acetonitrile (30:60:10), v/v) was used. The detection was carried out at 210 nm (Sitagliptin) and 230 nm (Metformin). Method was validated for linearity,range, precision, accuracy, limit of detection, limit of quantification, sensitivity, and specificity. In the range of 4−24 µg/mL for SIT and 40 to 240 µg/mL for MET was proved to be linear. Analytical greenness (AGREE) score was estimated as 0.77 it was which indicated a high level of greenness. We compared our developed methods with previously reported HPLC (for similar class drugs) methods showing AGREE scores of 0.56, 0.60, 0.63, and 0.61, which are considered poor AGREE scores when compared to our established green RP-HPLC method. Our method demonstrated extreme greenness as compared to other reported methods, and these emerging environmentally friendly green methods should be explored in pharmaceutical industries to reduce the potential hazards of organic solvents on nature.

KEYWORDS: GAC, RP-HPLC, AGREE, Sitagliptin Phosphate, anti-diabetic, method development, method validation

Formulation And Characterization Of Local In-Situ Gel For Treatment Of Periodontal Diseases

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ABSTRACT:

The objective of the study was to develop local insitu biodegradable gel for the treatment of Periodontitis and peri implantitis. Poly-lactic co-glycolic acid (50:50) (PLGA) grade was chosen as biodegradable polymer. Selection of solvent was done based on solubility of polymer determined by gravimetric basis. Minimum Inhibitory Concentration (MIC) was determined using Broth dilution method. To study the influence of PLGA concentration and pH on the release rate of the drug, degradation time and zone of inhibition, 3^2 factorial design was applied. N-methyl 2 pyrrolidone (NMP) was selected as solvent of choice. MIC of Metronidazole was found to be 100 and 500 µg/ml for gram positive and negative microorganism. Application of factorial design demonstrated that conc. of PLGA played a crucial role in the antimicrobial activity of drug with reduction of activity as the PLGA concentration decreased. Acidic pH was found to be increasing the rate of degradation, also thereby causing the faster release of the drug from the insitu gel. From the statistical analysis, batch B3 consisting of 42% of PLGA and 6.2 pH was considered as optimized batch with the zone of Inhibition 17.28 mm, degradation time of 10.23 days and in-vitro drug release of 65.08 % (Metronidazole) at day 7. The achievement of a long-lasting drug release with degradation in 13± 2 days is expected to benefit patient compliance and reduce drug overdosing due to oral delivery.

KEYWORDS: Biodegradable polymer, Insitu gel, Polymer, Periodontal Diseases

Novel Sustainable Approach For Development Of Nir Dyes And Its Applications

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Abstract:

NIR dyes exhibit light absorption between 700 and 2000 nm in the near-infrared spectrum. A metal complex or organic dye's charge transfer is the source of their strong absorption. NIR dyes are a type of dye with a distinct technology. Near-infrared dyes (NIR dyes) have garnered considerable interest and practical applications across many domains such as defence on soldier cloths, security applications, fluorescence microscopy, photodynamic treatment and biomedical imaging.Their distinct optical characteristics provide them invaluable instruments for scientific investigations, healthcare diagnostics, and imaging uses. They can be incorporated into ink formulations, coatings, and materials to create invisible markings or codes that are only visible under near-infrared illumination. This property is highly valuable in anti-counterfeiting measures and product authentication.We developed 7-amino-3-formyl-4-hydroxynaphthalene-2-sulfonic acid by reaction of vilsmeier haack reagent with N-methyl J-acid. All the molecules synthesized were characterised by using lab analysis and sophisticated instrumental analysis.

Keywords: NRI Dyes, vilsmeier haack reagent, N-methyl J-acid, defence,photodynamic etc.

SESSION:09

PHOTO-, BIO- & MICELLAR CATALYSIS

Session Chair

Dr. Chintan Chudasama

Session Co-Chair

Dr. Atindra Shukla

Sunlight-Powered Dye Degradation with Plant-Based Magnetic Spinel Photocatalysts

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ABSTRACT

With growing concerns about environmental pollution caused by dyes, the development of sustainable and effective treatment methods is imperative. Among various treatment methods, photocatalysis stands out as a simple and effective approach for degrading dyes in effluents. Spinel, known for its magnetic properties, narrow band gap, superior catalytic activity, and compatibility with solar light, is a favored photocatalyst. Plant-derived magnetic spinel photocatalysts are synthesized using green and eco-friendly techniques, capitalizing on the inherent properties of plants to produce nanoparticles. These photocatalysts exhibit exceptional efficiency in harnessing sunlight for the degradation of dyes. In this research, spinel photocatalysts AFe_2O_4 (A = Mg, Ni, Co, Cu, Zn) synthesis, properties, applications, photocatalytic dye degradation mechanisms, and forthcoming challenges were synthesized using a sustainable method involving aloe vera plant extracts and sol gel techniques. The synthesized samples underwent characterization using X-ray diffraction (XRD), UV–Vis diffuse reflectance spectroscopy (UV-DRS), scanning electron microscopy (SEM), and energy-dispersive X-ray spectroscopy (EDX). The effectiveness of these synthesized photo catalysts was assessed by monitoring the degradation of Reactive Black-5, Reactive Orange dyes and reactive dye mixture under sunlight exposure. The $CuFe_2O_4$ demonstrated effective photocatalytic activity when exposed to sunlight, with a degradation rate of 94% for Reactive Black-5, 85% for Reactive Orange dyes and 90% for reactive dye mixture among all. The research assessed the effects of Catalyst dose, initial dye concentration, irradiation time, and light/dark conditions on dye degradation efficiency. $CuFe_2O_4$ did not exhibit any significant reduction in its activity even after three cycles.

KEYWORDS Photocatalysts, Dye Degradation, Magnetic Spinel, Sol-gel Method

Recent trends of Green Lean Six Sigma system: A review

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ABSTRACT:

Lean manufacturing is focuses on improving efficiency of the organization while six-sigma focuses on to reduce defects. Integration of both tools provide high quality product with less possible cost. To align with Paris agreement, every industry needs to focus on environment concern and global warming. This give arise of Green manufacturing in the world that create lot of opportunities to scientists and engineers to work on different face. Hence to cater the issue, integration of lean manufacturing, Six-sigma and Green manufacturing commonly called GLSS system can be give efficient product with highest quality and also align with environment concern. This study aims for systematic literature review to understand current trends in area of the GLSS. The paper is focusing on SLR of green lean six sigma system over the different facet like, Industry–wise, year-wise and country-wise. The benefits of learning of the focus area will help researchers and engineers for a new perspective of the GLSS system to explore & implement in the industries.

KEYWORDS: Green lean sigma six, GLSS,Green technology

Liquid-phase selective oxidation of o-chlorotoluene (OCT) to o-chlorobenzaldehyde (OCBD).

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ABSTRACT

Liquid-phase Selective oxidation of o-chlorotoluene (OCT) to o-chlorobenzaldehyde (OCBD) utilizing green oxidizing agent hydrogen peroxide (H_2O_2) and the bi-metallic catalytic systems e.g. Cobalt acetate and cerium oxide ($Co(OAc)_2/CeO_2$) in a solvent. This study demonstrates the impact of key reaction parameters such as temperature, solvent, reactant, reaction time and catalyst loading on the conversion and selectivity of OCT to OCBD. Parametric study shows that temperature, solvent and its type, oxidant, catalyst and time are important process parameters. Preliminary study reveals that molar ratio of Substract: Solvent: oxidant is 1: 2.035: 17.09, 120 °C Temperature and 4 h reaction time give higher conversion and selectivity of OCT to OCBD. Optimization protocol aiming for higher conversion and selectivity of OCBD will be carried out. This work provide insight developing a cost-effective, greener, and safe method for producing o-cholorobenzaldehyde via o-chlorotoluene liquid phase oxidation.

KEYWORDS

o-Chlorotoluene, Catalyst, Selective Oxidation, *o*-Chlorobenzaldehyde(OCBD).

Green Synthesis and Application of Nanoscale Zero-Valent Iron (nZVI) Supported on Activated Carbon for Reactive Dye Removal

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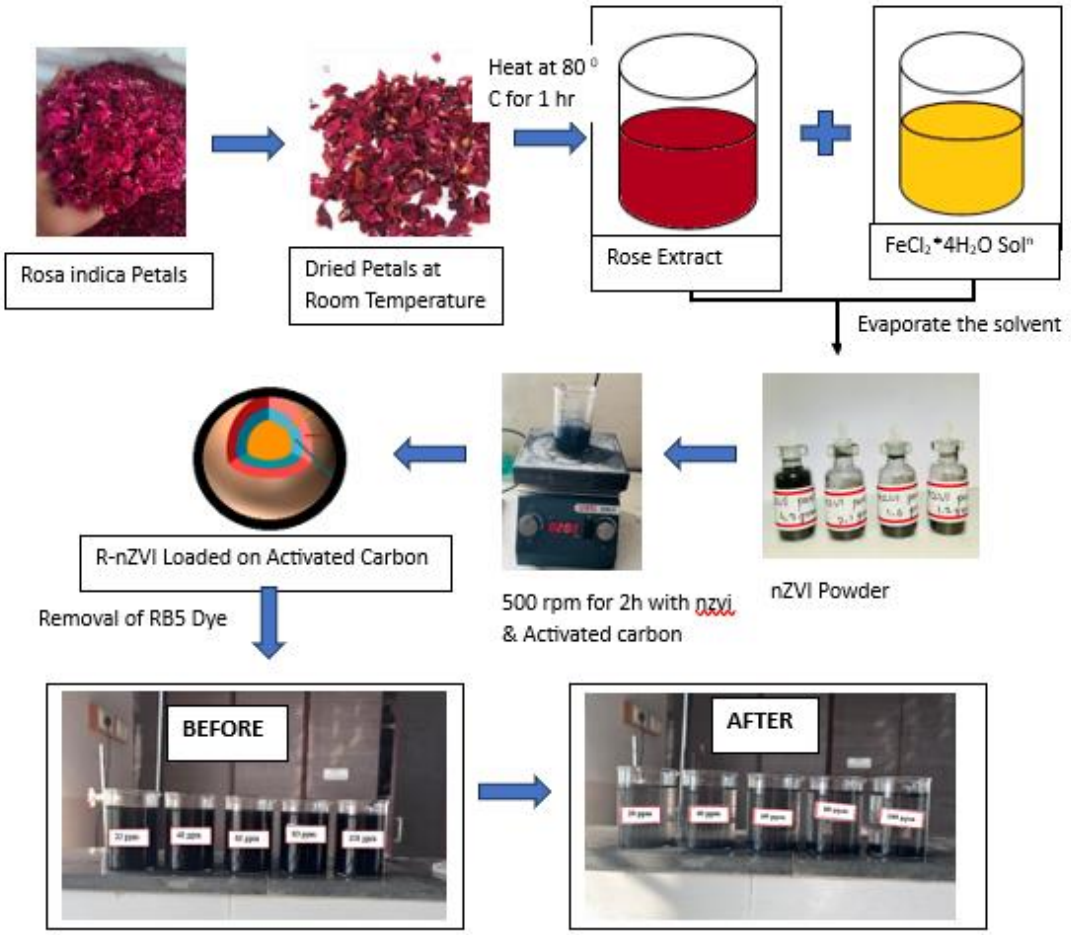
ABSTRACT:

Nanomaterials are good candidates for the removal of dyes and heavy-metal ions from industrial wastewater due to their unique properties, which include stability, low toxicity, high specific surface area, high pore size, and high heavy metal adsorption capacity. A metallic iron core surrounded by a thin, nanoscale iron oxide shell makes up the traditional core-shell structure of nZVI. In the present study, a novel, green and sustainable approach has been adopted for the synthesis of nanoscale zero-valent iron (NZVI) supported on activated carbon using plant species, *Rosa Indica*. The synthesized nano material has potential to demonstrate an appreciable efficacy in the removal of reactive dye from aqueous solutions. The detailed characterization of the synthesized NZVI supported on activated carbon was conducted including scanning electron microscopy (SEM), X-ray diffraction (XRD), and Fourier-transform infrared spectroscopy (FTIR) techniques. The results indicate successful synthesis and loading of nZVI onto the activated carbon substrate. Batch adsorption experiments were conducted to evaluate the dye removal efficiency of the synthesized material. The effects of various parameters such as initial dye concentration, contact time, and adsorbent dosage were investigated to optimize the dye removal process. The adsorption kinetics and isotherms were analysed to understand the adsorption mechanism and determine the equilibrium behaviour. The results reveal that the synthesized nZVI supported on activated carbon exhibits high adsorption capacity and rapid removal kinetics for reactive dye pollutants from aqueous solutions. This research contributes to the development of sustainable and effective method for wastewater treatment using green synthesis approach.

Graphical Abstract.



Keywords: nZVI, Dye wastewater, Rosa Indica, Green synthesis, Activated carbon

Enhancing Levofloxacin Degradation Using Nitrogen-Doped TiO_2 under Visible Light: A Comparative Study

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ABSTRACT

This study investigates the degradation of levofloxacin, a widely used antibiotic, using advanced oxidation processes (AOPs) under visible light irradiation. Titanium dioxide (TiO_2) and nitrogen-doped TiO_2 were employed as photocatalysts to enhance the degradation efficiency. The experiments were conducted at neutral pH with an initial concentration of 50 ppm levofloxacin. Results indicate a degradation efficiency of approximately 44% for TiO_2 and 48% for nitrogen-doped TiO_2, highlighting the enhanced performance of the latter. The presence of nitrogen doping in TiO_2 significantly promotes the photocatalytic activity, leading to improved degradation rates of levofloxacin under visible light. Furthermore, this study aligns with recent trends in environmental remediation, where the development of novel photocatalytic materials, such as nitrogen-doped TiO_2, has gained considerable attention. These materials offer enhanced photocatalytic properties, making them promising candidates for the degradation of various organic pollutants in water treatment applications. Understanding the mechanisms involved in the degradation of levofloxacin using nitrogen-doped TiO_2 can contribute to the development of efficient and sustainable water treatment technologies.

KEYWORDS*:* Levofloxacin degradation, Advanced oxidation processes, Nitrogen-doped TiO_2, Visible light irradiation, Environmental remediation.

A Critical Review On Biosurfactants In The Application Of Oil And Wastewater Treatment

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ABSTRACT

Biosurfactants are amphiphilic molecules produced by living organisms that have properties and characteristics that make them possible for use in various applications. This paper reviews the current research and developments in biosurfactants and their applications in wastewater and oil treatment. Biosurfactants produced by microorganisms represent an eco-friendly alternative to chemically-produced surfactants, which are considered persistent organic pollutants that need to be replaced with environmentally friendly alternatives. The paper discusses the challenges in large-scale production and associated high costs of biosurfactants. The paper also highlights the potential of biosurfactants in the oil and gas industry, where they offer considerable promise in producing novel types of biosurfactants for replacing those that are produced from organo- and the marine environment. The advantages of biosurfactants include their high biodegradability profile, low risk of toxicity, production from renewable sources, functionality under extreme pH and temperature conditions, and long-term physicochemical stability. The paper concludes that biosurfactants are a promising biotechnological area that offers a wide range of applications and potential for future research.

KEYWORDS

Biosurfactants, Microbial surface-active compounds, Amphiphilic molecules, Alternative substrates

Gas Foil Bearings: Enabling Sustainable Solutions in Green Tribology for High-Speed Rotating Machinery

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ABSTRACT

This paper explores the significant role of gas foil bearings as a compelling solution in the domain of green tribology, focusing on their innovative design and frictionless operation, which offer promising avenues for reducing energy consumption and environmental impact in high-speed rotating machinery applications. Providing a comprehensive investigation, this paper delves into the fundamental principles, design considerations, and performance characteristics of gas foil bearings, emphasizing their potential as a sustainable alternative to traditional lubricated bearings. Gas foil bearings operate by utilizing a thin film of pressurized gas, such as air or nitrogen, to support the rotating shaft. This eliminates the need for conventional lubricants, thereby reducing friction and wear. Consequently, gas foil bearings demonstrate enhanced energy efficiency, decreased maintenance requirements, and extended operational lifespans, aligning well with the principles of green tribology. The various configurations and operational principles of gas foil bearings, including compliant foil structures, aerodynamic film generation, and self-acting mechanisms, are thoroughly examined, showcasing their suitability for high-speed and high-temperature applications. Moreover, the paper discusses the environmental advantages associated with gas foil bearings, such as reduced carbon emissions, minimized resource consumption, and enhanced system reliability. By eliminating the use of lubricants and associated contaminants, gas foil bearings mitigate the risk of pollution and environmental degradation, thereby contributing to sustainable development in engineering and manufacturing. Additionally, ongoing research endeavours and technological advancements aimed at improving the performance, reliability, and applicability of gas foil bearings are discussed, highlighting their potential to revolutionize high-speed rotating machinery applications. Through interdisciplinary collaboration and innovative approaches, gas foil bearings emerge as a transformative solution in green tribology, offering a sustainable and environmentally friendly option for high-speed rotating machinery. Embracing gas foil bearings as a viable option for green tribology enables industries to achieve significant energy savings, minimize environmental impact, and foster sustainable development in engineering and manufacturing sectors.

KEYWORDS:

Gas foil bearings, green tribology, high-speed rotating machinery, sustainability, friction reduction, energy efficiency, environmental impact, lubrication-free operation.

A Comprehensive Overview of Efficiency Improvement & Electrolyser Design For Green Hydrogen Production Via Photo-Electrochemical Process

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ABSTRACT

To counter challenges of climate change and to achieve the goal of zero carbon emission, there is an urgent call for the study of green hydrogen production and strategy development through renewable technologies. Focused to this demand this research work is all about the green hydrogen production using electrochemical processes using solar photovoltaic systems. The current research work is focused to increase the efficiency of the electrolysis process through increment in the electrolyser efficiency and to optimize different parameters for green hydrogen production. Indigenously designed 1 L lab scale electrolyser is used for the electrolysis process along with different metal and electrolyte concentration. The electrolyser is designed in such a way that multiple parameters can be varied and tested. The electrode material, electrode thickness, electrolyte concentration, distance between electrodes and many other parameters are optimized for the best efficiency of the electrolyser. The SS321 is identified as the best electrode amongst the Nickel, Titanium and SS321. It has achieved the highest efficiency up to 32.95 % on DC supply which is going to be tested for the green hydrogen through solar technologies. This study is also focused on the design of experiments and electrolyser manufacturing for the scalable technologies. Different coating of electrodes is also being done to increase the efficiency from the conventional use. The efficiency rise is achieved with the increment of 67 % with the cobalt coating on SS321 and 41 % with the titanium dioxide coating on nickel. Apart from this, two efficiency calculation technologies are also developed for the comparative and scalable technologies for the lab scale, pilot scale and commercial scale green hydrogen production. The goal is to meet the organization demand for the green hydrogen production through minimum cost and maximum possible efficiency of the electrolysis process.

KEY WORDS: Green Hydrogen, Electrolyser Manufacturing, Electrolysis, Photovoltaic System, Solar Energy

Greener Encapsulates of Essential Oil

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ABSTRACT

Essential oils exhibit significant utility owing to their rich aromatic compounds, which facilitate relaxation, stress alleviation, mood enhancement, and potential health benefits within appropriate usage parameters. Because essential oils are volatile and sensitive to the environment, their use is limited. In order to prevent essential oil from coming into touch with the environment, a barrier must be placed over it. This may improve its suitability for a range of uses.) Therefore, encapsulation of essential oils serves to safeguard their potency, forestall oxidation, and regulate their release, thereby augmenting their stability and effectiveness across diverse domains such as cosmetics, aromatherapy, and pharmaceuticals. Various encapsulation techniques encompass spray drying, solvent evaporation, emulsion polymerization, and coacervation. When compared to other encapsulation techniques, in coacervation technique there is an opportunity of utilizing greener material thus it results in less environmental impact. The utilization of sodium alginate, xanthan gum, and Gelatine for coacervation-based encapsulation embodies a greener approach, stemming from their origins in natural sources and biodegradability, which collectively mitigate environmental impact in contrast to synthetic polymers. Additionally, their renewable nature and potential for efficient encapsulation processes make them greener choices for various applications. Drawing from multiple preliminary investigations Sodium alginate, xanthan gum, and gelatine were used to synthesize essential oil encapsulates. A parametric analysis was conducted after identifying various properties that affect the quality of encapsulates. It was found that increasing sodium alginate composition better encapsulates were formed.

KEYWORDS

Essential oil, Encapsulation, Coacervation, Greener approach

A comprehensive review on Sustainable Pathways to Synthesize 2, 5-Furandicarboxylic Acid (FDCA) from 5-Hydroxymethylfurfural (HMF) via Oxidative Processes

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ABSTRACT

The increasing global concern over the environmental impact of traditional plastics derived from petroleum and natural gas has spurred a search for more sustainable alternatives. Bioplastics, which are derived from renewable sources and may be biodegradable, have garnered significant interest as eco-friendly materials. Among the promising building blocks for bioplastics, 2,5-Furandicarboxylic Acid (FDCA) has emerged due to its potential to enhance polymer properties. One key precursor for bioplastics, 5-Hydroxymethylfurfural (5-HMF), has been identified, and its oxidation to FDCA represents a significant pathway for bioplastic synthesis. Various oxidation processes, employing homogeneous, heterogeneous catalysis, or even without catalysts, have been explored for the synthesis of FDCA from 5-HMF by various researchers.This review paper focuses on elucidating the recent advancements in the homogeneous and heterogeneous catalytic synthesis of FDCA from 5-HMF. It provides a comprehensive overview of the methodologies, catalysts, reaction conditions, and outcomes associated with these oxidation processes. By summarizing the state-of-the-art in FDCA synthesis, the review aims to contribute to the understanding and development of sustainable pathways for bioplastic production.

KEY WORDS: HMF, FDCA, Bioplastic, Homogeneous and Heterogeneous catalyst, Oxidation.

SESSION:10

NANOMATERIALS AND NANOTECHNOLOGY

Session Chair

Prof. Kabir Jasuja

Session Co-Chair

Dr. Krishna Chauhan

Exploring The Photocatalytic Performance Of Graphene Oxide Nanocomposites For Wastewater Treatment

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ABSTRACT

The industrialization has increased globally owing to the faster development of industries such as textile, chemicals, dyes, paints, leather, paper, pesticides, fertilizers. This rapid growth in the number of industries has led to generation of large amount of wastewater. This vast development of industries results in the discharge of untreated wastewater into the surrounding water resource. This wastewater contains harmful organic and inorganic pollutants affecting the living beings by causing many diseases. The hazardous substances that are present in the wastewater hinder the natural process of photosynthesis is hindered due to reduction in oxygen retention capacity. Various methods are employed for degradation and elimination of the pollutants to nullify the negative effects on the biological activities of living beings. Studies have depicted those techniques such as advanced oxidation and photocatalysis are effective in removal of the pollutants and thus treating wastewater. Photocatalysis is one of the techniques above all other that found to be efficient and environmentally friendly that produces no harmful secondary pollutants. Photocatalysis is governed through semiconductors that are capable to excite in presence of light source producing a electron hole pair which accelerates degradation of contaminants present. Carbon in its nano form has gained much attention in treatment of wastewater through Photocatalysis. One of the carbon-based nanomaterials is Graphene oxide that is used extensively in process of Photocatalysis. Graphene oxide possesses several properties large specific surface area, strong oxidizing power, high thermal stability adsorption capacity, non-toxic nature that makes it suitable for the treatment of wastewater. The photocatalytic efficiency of the conventional semiconductors like ZnO, TiO2 is reduced due to recombination of the electron hole pairs. The carbon-based nanomaterials have proved to enhance the efficiency of the conventional semiconductors that are used. This review depicts the applications of various graphene-based nanomaterials for the treatment of industrial wastewater.

KEYWORDS: Photocatalysis, Graphene oxide, Wastewater, Nanomaterials

Application Of Nano Graphene Oxide For Synthesising Nanohybrids As Pour Point Depressants For Waxy Crude Oil

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ABSTRACT

Flow improver play a crucial role in enhancing the low-temperature flow properties of fuels and lubricants used in the petroleum industry. Recently, nanographene oxide (NGO) has shown great potential as a flow improver owing to its excellent thermal stability, high specific surface area, and strong dispersibility. This has opened a new avenue of research in the petroleum industry, where polymer nanocomposites are being explored as flow improver for crude oil. In this study, a polymer nanocomposite, (Vinylimadizol-co-malic anhydride-co-behenyl acrylate) Graphene Oxide (VMAB-GO) was successfully synthesized via in situ free-radical polymerization. Various analytical techniques, such as FTIR, 1H NMR, and XRD were employed to confirm the successful formation of nanohybrid product. The rheological properties of the treated crude oil were analysed at different temperatures with a focus on the reduction in apparent viscosity and yield stress. The results showed that the synthesized product demonstrated superior performance compared to the commercial PPD which exhibited 9°C reduction in pour point and a 50% reduction in apparent viscosity of crude oil. These findings highlight the potential of the synthesized nanohybrid product as an efficient flow improver for improving the flow properties of crude oil.

KEYWORD: Crude oil, Pour point depressant, Graphene oxide, Terpolymer and Viscosity.

Utilization of Nano-Silica and Nano-Alumina for Enhancing Mechanical Properties of Sustainable Concrete

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ABSTRACT

Concrete suffers issues of high emissions and poor durability representing significant unsustainability. Present study utilized nano-silica (nS) and nano-alumina (nA) nanoparticles blended up to 4% by cement weight as sustainable solutions for enhancing mechanical performance and longevity of concrete. The nano-scale particles refined pore structure and transition zones via filler and pozzolanic actions. Improvements of 36%, 25%, 22% and 21% respectively in compressive strength, tensile strength, flexural capacity and elastic modulus highlight potential for high-performance concretes. The test results obtained were analysed using relevant Indian guidelines and practices. Improved lifespan with lowered carbon footprints offers sustainability benefits relative to conventional concrete. However, excessive nano-incorporation reduced properties indicating optimum additions. More life cycle studies are recommended however experimental results substantiate that targeted incorporation of nS and nA nanoparticles serves as an effective nanotechnology tool for producing green, sustainable and durable concrete structures towards next generation construction needs.

KEYWORDS: Nanoparticles, Sustainable Construction Materials, Nano Concrete, Mechanical Strength Enhancement.

Performance Comparison Between Corn Starch And Lime Peel Nanoparticle With Cornstarch In Water Based Drilling Fluid

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ABSTRACT

This outlines a pioneering research initiative focused on the development of an advanced water-based drilling fluid enriched with environmentally friendly additives like cornstarch and lime peel nanoparticles. The objective is to significantly enhance the performance of drilling operations while addressing sustainability concerns associated with traditional drilling fluid formulations. The investigation involves the synthesis of lime peel nanoparticles using an ecofriendly and cost effective method. These nanoparticles are synergistically combined with cornstarch to create a novel drilling fluid formation. The study meticulously explores the impact of varying concentrations of corn starch and lime peel nanoparticles with cornstarch on crucial drilling fluid properties including rheology, fluid loss control and overall drilling efficiency. The work delivers valuable insights into the feasibility of utilizing cornstarch and lime peel nanoparticles with cornstarch as additives for water based drilling fluid. The outcomes of this research contribute to the advancement of environmentally conscious solutions within the oil and gas industry, fostering a paradigm shift towards sustainable drilling practices. Synthesized cornstarch and lime peel nanoparticles are incorporated into water based drilling fluid. Rheological properties and filtration control are assessed using a rheometer and API filter press. Experimental results demonstrate improves fluid stability and reduced fluid loss. Sustained performance of nanoparticle enhanced drilling fluid. The potential application of cornstarch and lime peel nanoparticles in environmentally friendly water based drilling fluid.

KEYWORDS: Water-based drilling fluids; Line peel; Corn starch; Bionanomaterials; Rheology; Fluid loss control

An Impact Of Nano-Sio$_2$ Addition On Soil Geotechnical Properties And Applications

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ABSTRACT

This research paper investigates the influence of Nano-SiO_2 addition on the geotechnical properties of soil and explores potential applications in the field of geotechnical engineering. Nano-SiO2, with its unique properties and small particle size, has gained attention for its potential to enhance soil characteristics. The study involves laboratory experiments and analyses to evaluate the changes in soil properties, including shear strength, compressibility, and permeability, upon the addition of Nano-SiO_2. The research focuses on various soil types and their responses to different concentrations of Nano-SiO_2. Experimental data is gathered through a series of geotechnical tests, such as direct shear tests, consolidation tests, and permeability tests. The results provide insights into the mechanisms through which Nano-SiO_2 influences soil behaviour and its effectiveness in improving geotechnical properties. Furthermore, the paper discusses potential applications of Nano-SiO_2-enhanced soil in geotechnical engineering projects. These applications may include stabilization of weak soils, mitigation of liquefaction potential, and improvement of foundation support. The findings contribute to the understanding of Nano-SiO_2 as a soil modifier and its implications for sustainable and resilient geotechnical infrastructure.

KEYWORDS: Nano-SiO_2, geotechnical properties, soil modification, shear strength, compressibility, permeability, geotechnical engineering.

Development Of Nano Particle-Based Fungicides Formulation And Its Utilization In Paint To Control The Outbreak Of Mold And Fungi On Coated Substrates.

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ABSTRACT:

Many studies have shown that fungi can easily grow on a variety of building materials, infrastructures Including public sector, commercial building and apartments, marine ships etc. Fungus on walls is a serious health hazard and should be treated as soon as possible. Fortunately, there are several ways to prevent and treat fungus on walls, including using antifungal paints and coatings. Ideally, these chemical fungicides or mildewcides slowly leach out of the paint to the Surface and maintain their inhibitory properties for the life of the paint film, causing little or no harm to the environment. Use of Nano base antifungal paint is the opportunity to get the privileged properties, such as high surface to volume ratio, possibility of facile surface medication, homogeneous particles size distribution, good stability, and the ease of preparation, offer nano-particles great application in many fields. Use of Nano particle fungicides will reduce the doses by providing large surface area and it will improve the control that traditional way of biocides use. It will also help to decide best combination of paints and Nano particles to improve fungal resistance in real indoor and outdoor conditions. Carbendazim is one of the fungicide molecules which is used to control and prevent wide range of fungi and Mold in agriculture and other areas were antifungal activity requires. For Nano based antifungal paint Carbendazim is the ideal molecules to be used. The way to obtain Nano based fungicide dispersion is top to bottom approach. To get the particle size in Nano range different ways can be used which are wet milling on Dyno mill, Ultra probe sonicator etc. The Nano dispersion of fungicides must be examined on zeta sizer to confirm the particle size obtains in Nano range. After getting Nano based fungicide dispersion it must be used in paint formulation to get the advantage of its wide surface area and the properties. Nano particle will cover the wide surface of coated substrate at lower doses and will provide superior coverage against fungi and Molds on coated substrates.

KEYWORDS: Nanoparticle, Fungicide, Nano base antifungal paint, Substrates.

Synthesis Of Clay Supported Nickel Nanoparticles For Catalytic Hydrogenation Reaction

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ABSTRACT:

Highly productive hydrogenation reaction in the presence of supported transition metal nanoparticles is still a major research issue in the field of materials science and catalysis. The environmental benefits as well as the outstanding properties of clay as a support material, have led to an interest in investigating the feasibility of applying montmorillonite K10 as a support for nickel-based aldehyde hydrogenation nanocatalysts. The present study focuses on the development and use of environmentally benign montmorillonite K10 as a catalyst support material for the aldehyde hydrogenation reaction on nickel nanoparticles, as comparatively cheaper than platinum group metals. More work has also been done on the selectivity of desired product by changing the acidic nature of the clay with addition of the basic metal oxides. All the synthesized catalysts were characterized by BET, ICP, SEM, TEM, XRD, TPR, TPD and chemisorption to identify their physical and chemical properties for hydrogenation applications. Surface area and pore size distribution showed the effect of nanoparticles loading on the supports and other related properties were also influenced due to the coverage of surface. Support nature is an important matter to study and to do further investigation for catalytic reaction. All reaction conditions like temperature, pressure, flow rate were optimized for getting better conversion and selectivity for hydrogenation reaction. The selectivity to alcohol and other by-products was very sensitive to reaction conditions and meal loading on the supports. The reaction resulted in the formation of an aldol condensation product as by-product. The addition of 1 wt.% basic metal oxide to the nickel catalyst resulted in marginally improved catalytic activity, while the alcohol selectivity increased at 150 °C. Detailed results will be presented and discussed.

KEYWORDS : Hydrogenation Reaction**,** Montmorillonite K10, Catalyst, Nickel Nanoparticle

Electrooxidation Of Reactive Dye Using Nanoparticle Coated DSA Synthesized By Sol-Gel Method

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ABSTRACT:

In the present study, a novel, Dimensionally Stable Anode (DSA) coated with nanoparticles was synthesized using the sol-gel method with the objective to enhance the electrocatalytic activity and overall performance of the anode in treating industrial wastewaters. Nanoparticles of CuO and TiO_2 were coated on pretreated titanium substrate by thermal decomposition method. Nanoparticle coating on anode surface provides increased surface area and improved catalytic properties. This innovative approach aims to optimize the electrochemical processes involved in effluent treatment, leading to more efficient and environmentally friendly wastewater remediation in industrial settings. The nanoparticle coated DSA shows a notable improvement in the extraction of reactive dye from aqueous solutions. Characterisation of the DSA was carried out using X-ray diffraction (XRD) and scanning electron microscopy (SEM) techniques. The use of nanoparticles in the coating not only improves the overall performance of the DSA but also contributes to the removal of pollutants through advanced oxidation processes. This project has the potential to revolutionize industrial effluent treatment processes, providing a sustainable and cost-effective solution for the remediation of wastewater, thereby promoting environmental stewardship, and ensuring compliance with regulatory standards.

KEYWORDS: X-ray diffraction, Thermal decomposition, Nanoparticle, Scanning electron microscopy.

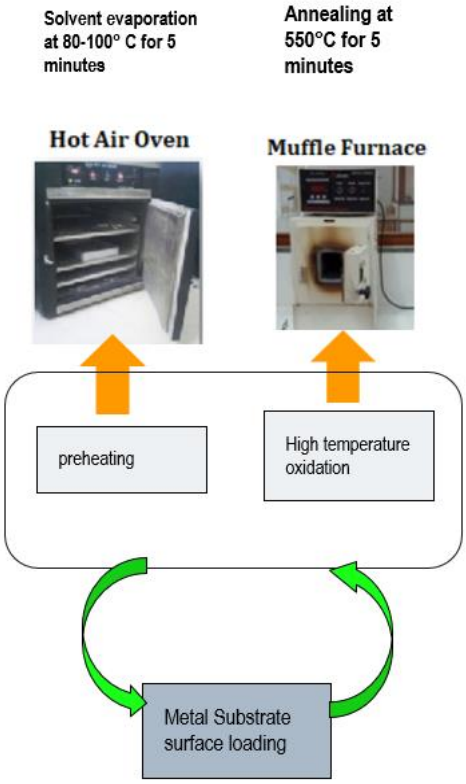

Figure 1: Coating of nanoparticles

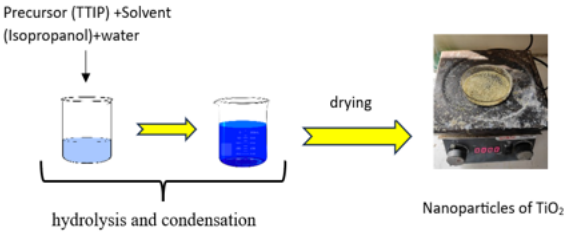

Figure 2: Sol-Gel method for preparation of nanoparticle

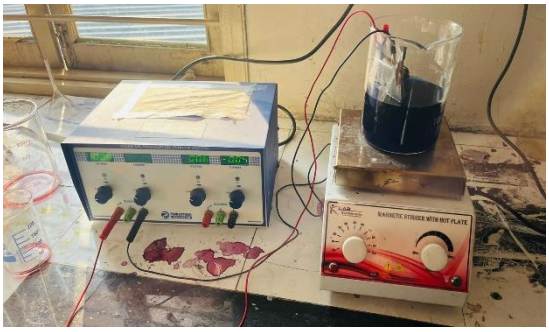

Figure 3: Electrooxidation set-up

Figure 4: Gradual decrease in colour to completely colourless

Green Synthesis Of Silver

Nanoparticles Of Ixora Coccinea L. Leaf Extract And Its Antibacterial Activity

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ABSTRACT

Silver nanoparticles are gained popularity due to its diverse pharmacological actions like anti-inflammatory, antibacterial, anticancer action, etc. Green synthesis of silver nanoparticle incorporates the use of medicinal plant extract and silver nitrate. Ixora coccinea is commonly grown medicinal plant in Gujarat and many parts of India. I. coccinea exhibited many medicinal properties like anti-inflammatory, hepatoprotective, anticancer actions. In the present research, a silver nanoparticle of I. coccinea leaf water extract was prepared using green synthesis method. In-vitro antibacterial activity of the synthesized nanoparticles was evaluated against Pseudomonas aeruginosa and Staphylococcus aureus using disc diffusion method. Synthesized nanoparticles were subjected to evaluate for Ultraviolet Spectroscopy, Infrared spectroscopy and particle size measurement using zeta sizer. The results showed that synthesized nanoparticles showed characteristic absorbance maxima around 412-413 nanometer. IR spectroscopy showed stretching at 1749 cm^{-1}, alkene stretching at 1427.1 cm^{-1} and alkyl stretching around 2919 cm^{-1}. The synthesized nanoparticles showed the diameter ranging from 91 to 94 nm which confirms that the particles are at nanosize. In case of in-vitro antibacterial activity, nanoparticles showed the zone of inhibition 20.25±1.75 mm and 16.5±1.5 mm against P. aeruginosa and S. aureus, respectively.

KEYWORDS

Ixora coccinea, silver nanoparticles, antibacterial, medicinal plant

A Sustainable Nano-Emulsion: Formulation, Parametric Study And Modelling

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ABSTRACT

Neem oil consists of a biological compound Azadirachtin having medicinal and pesticidal activities. In emulsified phase the compound Azadirachtin therefore, have the numerous applications in pharma and sustainable agrochemicals. Study in this field has been reported by forming a micro-emulsified neem oil, however, little work has been reported in the nano-emulsified (NE) form and this lacuna gives a motivation for research work. In the present work, a nano-emulsified formulation of the neem oil in water is obtained by the application of low energy method. A series of variations in parameters like surfactant to oil ratio (S/O) ratio (1.75-2), oil percent (5-7%) was studied at constant rate of dispersed phase addition (0.5 ml/min) and their effect on droplet size, nm (Zavg) was studied at constant temperature of 40 ^{O}C. Study resulted in a highly stable nano-emulsion (45 days) with the droplet size of 413.8 nm at oil percent (Wt.%), and S/O of 6 and 2.25 respectively. Two instability model viz. Coalescence and Ostwald ripening was fitted and a ω, (Ostwald ripening rate) value of 0.27 x 10-28 (m3.s-1) was best fit. The proposed o/w NE could be a potential pesticide for safeguarding the crops, without affecting the useful microorganisms, in the agriculture fields.

KEYWORDS

Nano-emulsions, Ostwald ripening, Modelling, Green pesticide

SESSION:11

APPLICATIONS OF AI AND ML

Session Chair

Dr. V. A. Shah

Session Co-Chair

Dr. Purvang Dalal

A Study of 3D Printing Technology and M.L Algorithms for Enhanced Production

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ABSTRACT

The realm of 3D printing technology, also referred to as additive manufacturing, has garnered increasing interest in recent times due to its capacity to construct intricate geometric structures. Fused deposition modeling (FDM) stands out among the various techniques and has gained widespread adoption. However, achieving optimal outcomes with FDM poses a challenge, necessitating meticulous selection of process parameters. Presently, many methodologies rely on Machine Learning (ML) algorithms akin to open-loop systems, offering predictions on printed part properties but lacking quality assurance mechanisms. Conversely, certain closed-loop approaches focus on monitoring a single adjustable processing parameter to assess printed part properties. This study aims to investigate the influence of process parameters and control techniques on mechanical strength, tribology, and other output parameters of production. By providing a comprehensive overview of these developed methods, it aims to facilitate comparison regarding their characteristics, merits, and drawbacks, aiding in the selection of the most suitable approach for specific applications.

KEYWORDS

3-D Printer, FDM, Machine Learning, Control System.

Evaluation of Deep learning optimizers for Gujarati Handwritten Numeral Recognition

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ABSTRACT

Handwritten digit recognition is a fundamental task in the field of pattern recognition and computer vision with numerous applications. With the surge of deep learning techniques, the accuracy and efficiency of handwritten digit recognition systems have significantly improved. However, the choice of optimizer plays a crucial role in determining the convergence rate and final performance of deep learning models. In this research paper, we present a comprehensive evaluation of various deep learning optimizers for the specific task of Gujarati handwritten digit recognition. The study focuses on optimizing the recognition accuracy and convergence speed of convolutional neural network (CNN) models trained on a dataset comprising handwritten digits in the Gujarati script. The performance of popular optimizers such as Stochastic Gradient Descent (SGD), Adam, RMSprop, Adagrad and Adadelta are compared and analysed. The evaluation metrics include classification accuracy, training time, and convergence behaviour. The insights gained from this study can guide the selection of optimizers for similar tasks in other languages and domains, facilitating the development of efficient and accurate deep learning models.

KEYWORDS

Deep Learning, Gujarati Numerals, Handwritten script recognition, CNN, Gradient descent, RMSprop, Adam, Adagrad, Adadelta.

IOT Based Virtual Doctor Robot

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ABSTRACT

This paper presents the design and development of a Virtual Doctor Robot (VDR) aimed at enabling remote medical assistance utilizing IoT technologies. Given the limitations of physical presence, particularly in underserved regions such as remote areas of India during the COVID-19 pandemic, the VDR offers a solution to bridge the gap between patients and doctors. Leveraging real-time data processing and machine learning algorithms, the VDR facilitates accurate diagnosis and treatment recommendations. Key functionalities include remote patient observation, communication via video calls, and vital sign monitoring through integrated sensors. Control and monitoring are facilitated through an IoT-based panel accessible to doctors, enabling seamless interaction with both patients and the robot. Additionally, the VDR features battery status alerts and cloud-based data storage for patient records. Utilizing a four-wheel drive automated vehicle framework, the VDR ensures efficient mobility, while real-time internet connectivity facilitates continuous communication between the doctor and the robot. Furthermore, the paper discusses future trends, including the potential integration of humanoid robots for surgical assistance and other advancements in the healthcare sector. The robot also includes a controller box for circuitry along with surveillance camera. The camera is used to monitor patients. The required hardware components are: NODEMCU (esp-8266), L298N MOTOR DRIVER, DC Motors, Temperature sensor, pulse oximeter. The directions sent online are received by the robot controller. The robot controller operates over WI-FI internet. The received directions are received in real time and the robot motors are operated to achieve the desired movement commands. Overall system is controlled and monitored using Microcontroller and IOT.

KEYWORDS

VDR, IoT , Nodemcu, L298n motor driver, Dc motors, Temperature sensor, Pulse oximeter

Development Of Adaptive Water Vending Machine Using Raspberry Pi

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ABSTRACT

Thanks to advancements in technology, numerous sophisticated devices and machines have become invaluable tools for humanity. Among these, automated vending machines have emerged as a cornerstone, streamlining various activities and significantly enhancing efficiency while minimizing the need for manual intervention. Equipped with multiple inputs and outputs, these machines cater to a wide range of customer needs, dispensing snacks, cold drinks, coffee, tea, water, and more. Particularly in India, railway stations boast a prevalent presence of specialized vending machines known as 'Water Vending Machines,' a key component of the Government of India's "Rail Neer" initiative. These machines offer clean and hygienic water, contributing to public health and convenience for travellers. The water vending machine efficiently provides clean drinking water at a low cost within railway premises. However, it possesses a design limitation: it dispenses a fixed volume of water with each transaction. This presents challenges when users insert water bottles of varying dimensions or partially filled bottles. Consequently, excess water dispensed by the vending machine in such situations may go to waste. This paper introduces an adaptive algorithm integrated with the machine's design to address this issue effectively. Our objective is to implement a system capable of scanning the bottle and gathering essential data regarding its height and weight. This data will enable us to calculate the optimal duration for water dispensation by the machine, ensuring efficient usage and minimizing wastage. The prototype of the adaptive water vending machine, as proposed in this paper, has been effectively developed utilizing a Raspberry Pi 3 as its processing unit.

KEYWORDS

Raspberry Pi 3, Ultrasonic Sensor, Water Sensor, Load Cell, HX711, Solenoid Valve, Relay Circuit

Implementation of Indigenous Voice Interactive System

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ABSTRACT

In the era of advancing Artificial Intelligence, humans are increasingly encountering its capabilities, with even more to come in the future. Constantly writing and searching can become tedious over time, but imagine the convenience of simply voicing your inquiries and instantly receiving the answers you seek. Our system, a fusion of Raspberry Pi 4, dual microphones, bluetooth speaker, and touchscreen display, aims to revolutionize this experience. Gone are the days of switching between tasks like writing an article and looking up information online, which consumes valuable time and effort. With our integrated system, users can effortlessly perform tasks in parallel, whether it's browsing the web, accessing YouTube or Wikipedia, or utilizing other essential websites. Additionally, functionalities like QR code scanning, password generation, and timekeeping further enhance the user experience. By minimizing the need to constantly gaze at screens, our system promotes human comfort and reduces the strain on the eyes, aligning with our goal of enhancing well-being. Moreover, it encourages the development of good habits, such as practicing pronunciation when searching for unfamiliar words, and fosters the skill of asking precise, point-to-point questions. The speech recognition library available in python language is modified to reduce time latency between user input and systems response.

KEYWORDS

Artificial Intelligence, Integrated System, Speech recognition, and python.

Development Of Internet Of Things (Iot) Based Solar Panel Cleaning System

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ABSTRACT

Solar photovoltaic (PV) systems have become indispensable in the global renewable energy landscape, offering sustainable solutions for both grid-connected and off-grid applications. Despite their environmental benefits, solar panels face performance degradation due to dirt, dust, and other contaminants accumulating on their surfaces. In response, innovative Internet of Things (IoT) based solar panel monitoring systems have emerged to provide real-time monitoring and proactive maintenance. Traditional solar panel cleaning methods rely on periodic schedules or manual inspections, which may not be timely or efficient enough to prevent performance losses from dust build-up. In contrast, IoT-based monitoring systems continuously monitor panel cleanliness in real-time, using integrated sensors to accurately detect dust levels. By analyzing this data, the system triggers automated notifications when dust accumulation exceeds predefined threshold levels, prompting stakeholders to take timely cleaning actions. In this work, we present a protype model of Internet of Things (IoT)-based solar panel cleaning system aimed at improving the overall energy output and reliability of solar panels. Our proposed system is based on ESP32 microcontroller along with Camera Module to monitor the functioning of the solar panel particularly real-time assessment of dust levels, and performs automated cleaning operations. The proposed system utilizes LDR sensors to measure the intensity of light received by the panel and compare it to a predefined reference intensity. If the measured intensity falls below the reference value, indicating a detrimental level of dust, the system sends a notification, prompting the need for cleaning. By employing IoT connectivity, the proposed system enables remote monitoring and control, allowing operators to receive notifications on Telegram bot application along with an image of the panel, track cleaning operations, and intervene if necessary.In summary, as the demand for renewable energy continues to grow, our proposed IoT-based Solar panel monitoring and cleaning systems will play an increasingly vital role in optimizing the performance and sustainability of solar photovoltaic systems worldwide.

KEYWORDS

Solar Panel, Internet of Things (IoT), ESP32 microcontroller, LDR sensors, Telegram bot application

Optimizing RFID-Based Toll Gate Systems: A Novel Approach to Reducing Latency and Enhancing Traffic Flow

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ABSTRACT

This paper presents a novel approach aimed at boosting the efficiency of Radio Frequency Identification (RFID) based toll gate systems. Traditional RFID-enabled toll gates function by reading the RFID data from the vehicle, fetching the corresponding user information from a centralized server, and subsequently deducting the toll amount from the user's account. This process, while effective, inherently introduces a latency period. This latency, particularly during peak hours, can result in significant traffic congestion at the toll gates. The proposed method tackles this issue by markedly reducing the latency involved in the toll collection process. This is achieved by optimizing the data retrieval and balance deduction processes. The optimization involves pre-fetching user data and implementing faster transaction protocols, thereby diminishing the time taken for each vehicle at the toll gate. By minimizing the time each vehicle spends at the toll gate, the proposed method not only boosts the efficiency of the toll collection process but also facilitates smoother traffic flow. This decrease in traffic congestion at toll gates can lead to enhanced fuel efficiency and reduced travel time for commuters. Moreover, the proposed method improves the user experience by offering a more seamless and efficient toll payment process.

KEYWORDS

Radio Frequency Identification (RFID), Toll gate systems, Faster transaction protocols, Seamless toll payment process

Bridging Reality And Virtuality Through Gesture-Controlled 3D Holography

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ABSTRACT

In the evolving field of holography, there is a growing need for intuitive and versatile systems that allow users to interact with holographic content in real-time. Addressing this need, this project introduces a novel system for holographic video control. The system offers a user-friendly interface that integrates hand gestures and live camera feed, enabling seamless interaction with holographic content. Users can switch between local video files and live camera feed, enhancing the versatility of their holographic experience. The system employs image processing techniques to recognize specific hand gestures, providing intuitive control over video playback. The integration of live camera feed allows users to transition between pre-recorded holographic content and real-time surroundings, further enriching the immersive experience. This system's adaptability makes it suitable for various applications, including presentations, entertainment, and interactive educational experiences.

KEYWORDS

Holography, Holographic video control, Hand gestures, Image processing techniques

Design of Power Efficient Electronic Speed Controllers

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ABSTRACT

This paper presents a novel approach to electronic speed controllers utilizing field-oriented control techniques, enhanced with internet of things integration. Current methods used for controlling motors using field - oriented control provide zero accommodation for individual tuning of motors. Generic tuning for all motors causes losses due to each motor being different from the other and the wide range of environments it is used in. These losses occur in the form of heat, reducing the efficiency and performance of motors. Our technique monitors multiple parameters of each phase of the motor such as current and voltage and dynamically changes the magnetic flux component provided to the motor based on real time results. This decreases the losses that occur due to poor tuning and optimizes motor performance. Moreover, these real time results and changes are monitored externally using internet of things integration, making data collection easier and enabling proactive maintenance. Experimental validation demonstrates efficacy of the proposed approach. These advantages make our method extremely suitable to be used in electric vehicles.

KEYWORDS

Field-oriented control, Power efficient motors, Dynamic monitoring, Internet of things.

Scope Of Renewable Energy And Non-Renewable Energy: A Review

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ABSTRACT

Increase In population worldwide leads to Increase in energy consumption, as a result of it Increase in production of energy is also required. In case of the energy is being produced and consumed form fossil fuels. There is an adverse effect and direct threat to global climate and also to the healthy conditions of life and existence of all living things Including human being. Being a primary source of energy in majority of the power plants, operating process of vehicles etc. conventional fossil fuel technologies generates considerable amount of hazardous pollutants Including carbon monoxide, carbon dioxide, sulphur dioxide, lead, nitrogen oxide, other air pollutants during power generation and operating process, which further leads to air, water and/or land pollution. During the manufacturing process of an equipment renewable energy technologies also contributes to pollution. The combustion of traditional fuels gives rise to significant volumes of greenhouse gases and hazardous substances, leading to escalated costs for individuals and the worldwide populace. In case of a power plants renewable energy technologies are cheapest solution in comparison of gas based, coal based and nuclear based power plants. Overall operating cost of nuclear power plants per kilowatt-hour is highest, which is nearly four times higher than those of gas-fired power plants, and multiple times greater than the expenditures linked with renewable energy technologies. In-order to prevent overall pollution substitution of non-renewable fuels with renewable energy sources stands as an effective approach and the concomitant external expenses. on a global scale, considerable amount of savings is attainable by achieving a 50% share of renewable energy within the global energy mix by the year 2032. This paper reviews renewable and non-renewable energy resources along with long-term future demand, environment effects and cost.

KEYWORDS

Renewable energy technologies, Fossil fuels, Air pollution, Green house gases

Agribot: Arduino Controlled Automatic Seed Sowing Machine For Small Scale Cultivation.

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ABSTRACT

This Agribot reduces the efforts and total cost of sowing the seeds. Seed Sowing Machine should be suitable to all farms, robust construction, also it should be reliable, this is basic requirement of sowing machine. Thus, we made a seed sowing machine which is operated manually but reduces the efforts of farmers thus increasing the efficiency of planting also reduces the problem encountered in manual planting. For this robot we use an Arduino for controlling purpose and servo motor and DC motors to serve the purposes of the robot. So, in this project seed is falling a fixed interval of time and bot is moving at a constant speed so that linearity in plantation is maintained. Also, a mechanism is constructed so that after the seed falls on the ground through a seed rotor which is controlled with a DC motor and commands through a Bluetooth module a fine amount of soil is covered on the seed and after that a water is sprinkled on it through the same bot.

KEYWORDS

Agribot, Arduino, Robust construction, Seed sowing machine, Cultivation

Design And Implementation 8-Bit CPU Architecture For Undergraduate LearningSupport

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ABSTRACT

In Electronics and IT studies today, understanding computer architecture and logic design is crucial. To deepen students' grasp of Computer Organization and Architecture (COA), a comprehensive hands-on approach is vital. Our kit is designed based on the Von Neumann architecture, encompassing crucial elements like bus interfaces and Arithmetic and Logic Unit (ALU), memory structures, and functional registers. Typically, undergraduates are introduced to COA through theoretical methods like block diagrams and top-level diagrams, missing the digital design aspect. In this paper, we present a model that elucidates the intricate operations of an 8-bit CPU through the use of digital logic gates in a physical hardware simulation, providing an intuitive understanding and fostering the skills needed to design purpose-specific computers.

KEYWORDS

8-bit; student learning kit; computer architecture; Digital logic design

ONLINE SESSION-1

Session Chair	Session Co-Chair
Dr. Paul Musonge	Dr. A. P. Dhanwani

Cutting-edge Nano-Augmented Stabilization of BC Soil Utilizing Coir Fiber and Micro-Cut Recycled Plastic: An Exhaustive Contrasting Examination

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ABSTRACT

This research paper investigates the innovative utilization of coir fiber and micro-shredded waste plastic for the stabilization of BC soil within the subgrade layer of road construction, examining both their individual contributions and potential synergistic effects. A comprehensive array of tests was conducted, encompassing assessments such as liquid limit, plastic limit, unconfined compressive strength (UCS), California bearing ratio (CBR), Proctor test, free swell index, mechanical analysis, moisture content, specific gravity, direct shear test, consolidation test, tri-axial test, and swelling pressure test. These tests were performed on various soil samples: virgin soil, virgin soil mixed with 0.6% and 4% coir fiber, micro-shredded waste plastic powder, and soil modified with a combination of 0.6% and 8% coir fiber alongside micro-shredded waste plastic powder. The study not only assesses the mechanical and geotechnical properties of the modified soils but also delves into the potential influence of nanotechnology on enhancing their performance. Through meticulous experimentation and analysis, the research aims to provide insights into the effectiveness and viability of employing these novel stabilization techniques in road construction, with a particular focus on the implications for infrastructure resilience and sustainability.

KEYWORDS

Nano-fortification, Coir filament, Micro-cut recycled plastic, Black Cotton Soil, Soil engineering characteristics

Development of Stability Indicating HPLC Method For Simultaneous Estimation of Remogliflozin Etabonate and Teneligliptin Hydrobromide Hydrate By Using a DOE approach

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ABSTRACT

A simple, sensitive, precise, accurate and robust high performance liquid chromatographic method has been developed for simultaneous estimation of remogliflozin etabonate (RGE) and teneligliptin hydrobromide hydrate (TG) in pharmaceutical formulation. Design of experiments (DoE) was applied for multivariate optimization of the experimental conditions of RP-HPLC method. Risk assessment was performed to identify the critical method parameters. Three independent factors; mobile phase composition, flow rate and column temperature were used to design mathematical models. Central composite design (CCD) was used to study the response surface methodology and to study in depth the effects of these independent factors. Desirability function was used to simultaneously optimize the retention time and resolution of RGE and TG. The optimized and predicted data from contour diagram consisted of acetonitrile and KH_2PO_4 in the ratio of 55:45 respectively, at a flow rate of 1 ml/min and column temperature 30 °C. Using these optimum conditions baseline separation of both drugs with good resolution and run time of less than 6 min were achieved. The optimized assay conditions were validated according to ICH guidelines. Hence, the results clearly showed that Quality by design approach could be successfully applied to optimize RP-HPLC method for simultaneous estimation of RGE and TG.

KEYWORD: Remogliflozin etabonate, Teneligliptin Hydrobromide Hydrate, HPLC, QbD, Method

Room Temperature Synthesis Of Iron Oxide Nanoparticles By Co-Precipitation Method Using Ultrasound Assisted Solution Spray (Aerosol) Reactor

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ABSTRACT:

The co-precipitation method with ultrasonic atomization is used to synthesize mono dispersed iron oxide nanoparticles. Co-precipitation method has its own advantages over the other synthesis methods while the ultrasonic atomization offers number of benefits over the other atomization techniques. The co-precipitation method is used to synthesize iron oxide nanoparticles using ultrasound assisted solution spray (aerosol) reactor operated at room temperature. The main steps of the co-precipitation synthesis process are nucleation, crystal growth, precipitation and calcination. The effect of precursor, precipitator/ precipitant concentration, atomization technique, modes of operation etc. on the size of iron oxide nanoparticles is studied. The iron oxide nanoparticles synthesized with different set of conditions are characterized using FESEM, FTIR, and XRD. The spherical particle with mixed morphology and size in the range of 5-35 nm with ultrasonic atomization while with air atomization it is in the range of 30-60 nm are synthesized. Peaks representing Fe_3O_4, α-Fe_2O_3 and α-FeO(OH) are observed in FTIR analysis.

KEYWORDS:

Co-precipitation, Ultrasound, Atomization, Aerosol, Precursor, Precipitator

Application Of Transition Metal Doped Tio$_2$ Nanomaterials In Waste Water Treatment: A Short Review

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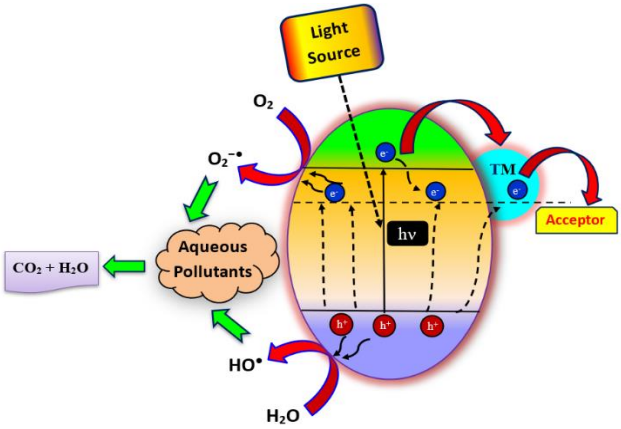
ABSTRACT:

The treatment of waste water is one of the immense challenges throughout the world from both quantitative and qualitative point of view. The photocatalytic degradation process attracts a great interest in the scientific fraternity as one of the advanced oxidation processes (AOPs) considering advantages, e.g. complete degradation of pollutants, modest reaction time, among few others. To enhance the performance efficiency of TiO_2 photocatalyst for pollutant degradation under visible light irradiation, doping with transition metals have emerged as effective strategy. TiO_2 doped with Cr, Mn and Fe demonstrate significant degradation efficiency due to reduction in energy band gap. In case of Co and Zn doped TiO_2 possess lower crystallite size compared to pure TiO_2, which results in reasonable improvement in degradation. Ni and Cu as dopants, exert moderate change in energy band gap leading to slightly improved efficiency of degradation. This short review highlights comparisons of improvement in degradation efficiency of nanophotocatalyst using various transition metal as dopant.

KEYWORDS: Photocatalysis; TiO_2; Dopant; Transition Metal; Pollutant Degradation

GRAPHICAL ABSTRACT



PEI-Inspired Silver Nanostar SERS Substrate For Rapid And Trace Level Detection Of Sulfites In Food Samples

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ABSTRACT

The production and application of advanced nanoengineered surfaces in a vast area of technological, environmental, and biological processes is a current issue of materials science research. The primary requirement for the fabrication of nanotextured surfaces for specific applications is the method's simplicity and reliability. In applied environmental nanoengineering, nano substrate surfaces could be specifically tailored to enhance the detection of environmental pollutants. This research work synthesized a versatile, tertiary polyamine functionalized silver nano-star surface sensitive to an SO_2 pollutant from silver nitrate, hydroxyl amine, and sodium citrate dihydrate solutions at pH of 12.5. This was achieved by careful tuning of the surface morphology of the silver nano-star that covalently interacts with branched polyethyleneimine (b-PEI) which in turn specifically binds with the environmentally toxic SO_2. The combined effect of the electromagnetic enhanced plasmonic silver nano-star hot spots and the specific affinity of the tertiary amine functional group to SO_2 absorption resulted in enhanced surface scattering Raman signals.

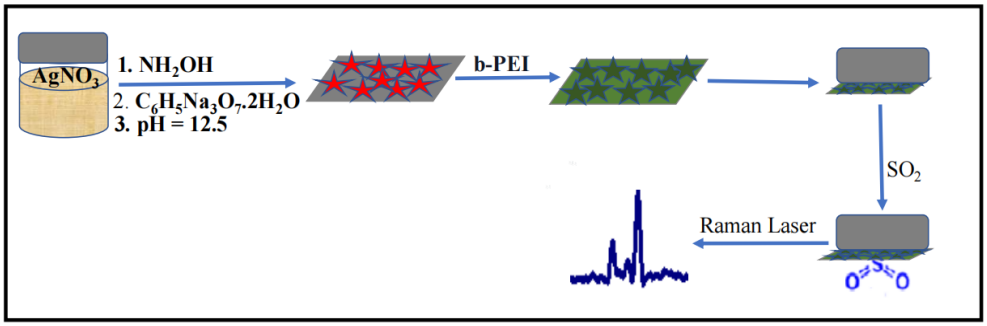

FIGURE 1: Synthesis of Ag nanostar and PEI-based SERS substrate and absorption mechanism of SO_2

KEYWORDS: Nanoengineered, Ag nanostar, SERS, PEI, SO

Advances In Carbon Neutral Technologies for Wastewater Plants: Water and Energy

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ABSTRACT

Wastewater treatment provides a pathway for man-made water purification that addresses the growth in domestic wastewater volumes brought about by urbanization while protecting the aquatic environment. However, this process also generates carbon emissions, so carbon-neutral operation has become a core component of future wastewater treatment. And in response to this problem, wastewater treatment plants have adopted a variety of methods to reduce carbon emissions and achieve carbon neutrality. This paper examines the carbon neutral mode and application methods in the wastewater treatment industry, from the carbon emission reduction effect of sewage treatment, carbon emission reduction effect of sludge treatment to the sewage treatment of carbon neutral technology strategy, to help understand the application of carbon neutral mode of thinking, summarizes the new carbon neutral treatment of sludge sewage technology, so that the carbon neutral mode can be effectively applied to the sewage treatment technology. Effective realization of carbon neutral technology operation and future sustainable development of wastewater plants provides a feasible path.

KEYWORDS

Sewage treatment, Carbon neutrality, Energy recovery, Resource utilization, Reduce carbon emissions

Microplastics In Wastewater Treatment Plants: Distribution And Removal Technologies

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ABSTRACT

Microplastics are prevalent in daily life, and as wastewater treatment plants (WWTPs) serve as an important pathway for microplastics to enter natural water bodies, an in-depth understanding of the distribution and removal of microplastics in WWTPs is of great significance. This paper provides a comprehensive overview of the measured distribution of microplastics and the current status of their removal in wastewater treatment plants. The main sources of microplastics in wastewater treatment plants are personal care products in domestic wastewater, textile clothing and industrial wastewater from plastics, textile factories and road tyre friction. The microplastics entering the sewage plant were mainly present as fibres, fragments, granular microplastics and other types of microplastics. The size of microplastics is classified into three categories: <0.5 mm, 0.5-1 mm and 1-5 mm. At all levels of treatment in wastewater plants, 56.8-88.4% of microplastics are removed in primary treatment, but the primary sedimentation and degreasing stages remove the most microplastics. The activated sludge process for secondary treatment is inconsistent in its microplastic removal efficiency, generally ranging from 42.1 per cent to 99.2 per cent. The coagulation, filtration, and disinfection stages of tertiary treatment all have some microplastic removal capacity. In addition, novel removal technologies are also described, such as modified filtration technology, membrane separation technology, electroflocculation, sol-gel and photocatalysis degradation. In conclusion, a comprehensive understanding of the mechanisms of MPs generation and removal in wastewater plants can help to improve the wastewater treatment process and effectively reduce the risk of MPs entering the water environment through wastewater plants.

KEYWORDS

Microplastics, Wastewater treatment plants, Sources, Distribution, Removal Technologies

Advances in Carbon Neutral Technologies for Water Supply Plants: Water and Energy

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ABSTRACT

As the global climate change and carbon emission problems become more and more serious, the search for low-carbon and sustainable development solutions has become the focus of global attention, and the water supply plant is a very important part of the urbanization construction and development process. Due to the certain carbon emission caused by the traditional water supply plant, it needs to be comprehensively reformed for carbon neutral technology, so the carbon neutral technology of water supply plant has also been widely studied. This paper mainly analyzes the main sources of carbon emissions from water supply plants, focusing mainly on carbon emissions from energy consumption and pharmaceutical consumption. It summarizes the research progress of carbon neutral technology in water supply plants in recent years, which mainly includes several aspects: optimization of water treatment processes to improve process efficiency and reduce carbon emissions; use of efficient and green water treatment chemicals to reduce carbon emissions from chemical consumption; energy saving and efficiency of equipment, promoting intelligent water services to reduce carbon emissions from energy consumption; and the use of renewable energy, resource recycling and reuse of sustainable carbon neutral technology. This paper analyzes the carbon neutral technology of water supply plant in detail for the source of carbon emissions from the water supply plant, aiming to provide useful reference value for the study of carbon emission reduction in the water supply plant, and point out the direction of development for the water supply enterprises to save energy and reduce consumption.

KEYWORDS

Water supply plants; Carbon neutral; Carbon emissions; Water and energy; Energy conservation and efficiency

ONLINE SESSION-2

Session Chair	Session Co-Chair
Prof. Kinjal Shah	Dr. M. S. Gaikwad

Acylation of Sugars: An Approachable Door to Green Surfactant

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ABSTRACT

The acylation of sugars represents a significant avenue in carbohydrate chemistry, involving the introduction of acyl groups derived from carboxylic acids to sugar molecules. This chemical modification targets the hydroxyl groups on the sugar structure in the presence of suitable acylating agents and is conducted in a controlled reaction conditions. The process aims to alter the physicochemical properties of sugars, impacting their solubility, stability, and reactivity. Such modifications hold promising applications in diverse industries, particularly in the synthesis of compounds for the food and pharmaceutical sectors. This article explores the acylation of dextrose to penta acetate using various catalysts as an accessible pathway to developing green surfactants, emphasizing the environmentally friendly nature of these modified compounds. The study primarily focuses on the acylation of dextrose using $ZnCl_2$, $TiCl_4$, $FeCl_3$ and catalyst mixtures. The tailored properties achieved through acylation present opportunities for the creation of surfactants with enhanced sustainability and performance, making them valuable in the context of green chemistry.

KEYWORDS: Acylation, Dextrose, Penta acetate, Green Surfactant

Repurposing Pandemic Masks Waste into Sound Absorber Material: A Sustainable Solution for Environmental and Acoustic Challenges

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ABSTRACT

The COVID-19 pandemic has brought about a surge in the production and disposal of single-use face masks, contributing significantly to environmental pollution. As the world grapples with this waste crisis, innovative solutions are imperative to mitigate its adverse effects. This abstract explores the concept of repurposing pandemic masks into noise sound absorber material, addressing both environmental concerns and acoustic challenges. By recycling used masks, which are typically composed of polypropylene and other sound-absorbing materials, into acoustic panels or insulation, we can create a dual-purpose solution. This approach not only reduces the burden on landfills but also provides a sustainable alternative to conventional noise-absorbing materials such as fiberglass or foam. The process involves collecting discarded masks, sanitizing and shredding them, and then incorporating the shredded material into sound-absorbing panels or other acoustic products. Preliminary studies have shown promising results, indicating that repurposed mask-based materials exhibit comparable or even superior acoustic performance compared to traditional options. Furthermore, this innovative recycling method aligns with the principles of circular economy and resource efficiency, promoting the reuse of materials that would otherwise end up as waste. It offers a tangible solution to the growing problem of pandemic-related waste while simultaneously addressing the pressing need for effective noise control in various settings, including workplaces, schools, and public spaces. Challenges such as scalability, cost-effectiveness, and ensuring the safety and hygiene of recycled materials must be carefully considered and addressed in implementing this solution on a larger scale. Collaborative efforts among stakeholders including governments, industries, researchers, and communities are essential to overcome these challenges and realize the full potential of waste pandemic masks recycling for sustainable sound management..

KEYWORDS: COVID-19 pandemic , Single-use, face masks, Environmental pollution, Waste crisis Repurposing, Sound absorber material, Polypropylene, Sustainable solution, Landfill reduction ,Acoustic panels, Circular economy, Resource efficiency

An Integrated Solid Waste Management Strategies For Sustainable Development In The State Of Himachal Pradesh

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ABSTRACT

Addressing the solid waste management challenges in Himachal Pradesh, a hilly state in India, the present study explores innovative solutions for its 56 urban local bodies facing reportedly high solid waste generation of 365 TPD. Hindered by difficulties in accessing rural areas and compounded by high moisture content, the research focuses on the seasonal variation of solid waste characteristics. With Himachal Pradesh boasting five major cement plants and potential for composting, the study proposes segregating wet waste in specific regions and trialing its co-processing with forest residues to enhance calorific value for cement kiln utilization. Considering the impracticality of large-scale composting due to weather conditions, the study investigates alternative methods, emphasizing the proximity of cement plants to key areas. This research aims to provide sustainable waste management solutions tailored to the region's challenges, exploring co-processing as a rapid and secure means of solid waste utilization in the hilly state of Himachal Pradesh.

KEYWORDS

Solid Waste, Waste Management, Sustainable Development, Himachal Pradesh, Cement Plants.

Development And Assessment Of Epigallocatechin Gallate Niosomal Dry Powder Inhaler For Enhanced Anti-Cancer Drug Delivery

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ABSTRACT

This study proposes an inhalable anti-cancer therapy, focusing on dry powder inhalers and employing the ether injection method. The formulation consists of Epigallocatechin Gallate (EGCG), Span 60, and cholesterol. Rigorous analyses, encompassing Fourier-transform infrared spectroscopy (FTIR) and differential scanning calorimetry (DSC), confirmed the absence of significant interactions among the components. Niosomes were formulated through the ether injection method, utilizing Span 60 and cholesterol as surfactant and co-surfactant. The Plackett-Burman design facilitated the screening of influencing factors, leading to the preparation and evaluation of 12 preliminary batches for entrapment efficiency, drug loading, and % cumulative drug release (%CDR). Subsequently, a 3^2 full-factorial design optimized concentrations of surfactant and co-surfactant, with drug loading and %CDR as dependent variables. Using design expert software, nine batches were generated, and through process optimization, batch B1 emerged as the optimized formulation, displaying %CDR up to 12 hours. The evaluation of the optimized batch included comprehensive analyses such as particle size, polydispersity index (PDI), zeta potential, % encapsulation efficiency (%EE), and % CDR study. The optimized batch (B1) exhibited a particle size of 897.1nm, a low PDI value of 0.078, zeta potential of -3.4mV, and 94.63% EE of EGCG. These findings underscore the potential of the proposed inhalable anti-cancer therapy, offering a promising avenue for improved cancer treatment by emphasizing enhanced drug release and reduced side effects.

KEYWORDS: ECGC, Anticancer, Niosomes, DPI, tea tree extract

Treatability Studies Of Textile Industrial Wastewater Through Photocatalysis By MOF-UIO66

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ABSTRACT

This study focuses on the synthesis and characterization of UiO-66 metal-organic framework (MOF) using a simple and efficient microwave-assisted method. Zirconium (IV) chloride (ZrCl4), terephthalic acid (H2BDC), and N, N-dimethylformamide (DMF) were used as starting materials without further purification. The synthesis process involved the combination of ZrCl4 and DMF, followed by the addition of acetic acid and H2BDC. The resulting solution underwent a reaction period in an oven and was then subjected to microwave irradiation. The UiO-66 product exhibited promising features for wastewater treatment, with a market price of ₹ 5600 for 500mg and our competitive price of ₹ 1700 per 500mg.

To evaluate the potential application of UiO-66 for photocatalytic wastewater treatment, industrial wastewaters from textile industries is collected and analyzed for physicochemical parameters. Lab-scale studies involved the introduction of UiO-66 into diluted wastewater samples, with absorbance measurements taken at various time intervals for both indoor and outdoor conditions. This research aims to explore the efficacy of UiO-66 in removing pollutants from industrial wastewater, providing valuable insights for future environmental remediation efforts.

KEYWORDS: UiO-66 metal-organic, industrial wastewaters, environmental remediation

Enhancing Nitrogen Removal Of Constructed Wetlands By Inoculating With Arbuscular Mycorrhizal Fungi

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ABSTRACT

Nitrogen emission from the soil results in eutrophication of surface water, nitrate pollution of groundwater, and intensification of the greenhouse effect. Arbuscular mycorrhizal fungi (AMF) can participate in the nitrogen cycle of the ecosystem by establishing a symbiotic relationship with plants and play an important role in controlling soil nitrogen emission. Meanwhile, constructed wetlands have been widely used in the nitrogen removal of rivers and lakes, but there are also some challenges restricting their development and application. Based on this, we elucidated the role of AMF in enhancing nitrogen removal of constructed wetlands inoculated with AMF. We found that inoculation with AMF decreased outflow concentrations of NH_4^+-N, NO_3^--N, and NO_2^--N by 34.6%, 30.0%, and 39.6%, respectively. In addition, inoculation with AMF inhibited nitrate accumulation in microcosms. AM effect was the highest under the condition of dry 12 h + wet 12 h. With higher total phosphorus concentration (greater than 0.3 mg L^{-1}), nitrate accumulation still existed, and the average AM effect on ammonia nitrogen removal decreased by 3.0%. Prolonging the wetting time inhibited nitrate accumulation, improved the AM effect of nitrite removal but reduced the AM effect of ammonia removal. Inoculation with AMF had no significant effect on N_2O emission in constructed wetland microcosms. In summary, this study clarified the role of AMF in enhancing nitrogen removal in constructed wetlands, which has practical significance for the application of AMF in constructed wetlands.

KEY WORDS: AMF, Nitrogen removal; constructed wetlands, Nitrate accumulation

Process Synthesis And Optimization Of Baobab Oil Methyl Ester Using Bio-Waste Mixed Heterogenous Catalyst.

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ABSTRACT

Biomass energy holds a great prospect towards accomplishing the energy-related targets of the Sustainable Development Goals (SDGs) on climate change and other environmental benefits. Biodiesel fuel is one of the superior bio-renewable, sustainable and eco-friendly fuel substitutes to petroleum fuel. In this study, a novel biodiesel synthesis from baobab seed oil was investigated by transesterification using bio-waste mixed heterogeneous catalyst derived from plant and animal biomass sources (chicken white eggshells and banana fruit peels). Equal proportion of each material (1:1 g) was combined and further calcined at high temperature of 800 ^{o}C for 4 h. The Box-Behken Design - Response Surface Methodology (BBD- RSM) was used for the experimental design and statistical data analysis of the transesterification reaction process. The investigated parameters and their range include process reaction time (40 – 80 min), molar ratio of oil to methanol (1:9 – 1:15) and catalyst loading (3 - 5 wt%). The properties of the developed catalyst were analysed using Scanning electron microscopy (SEM), Energy dispersive spectroscopy (EDS), Fourier transform infrared rays (FT-IR) spectroscopy, and X-ray Diffraction (XRD). The analysis results revealed that the synthesized catalyst contained majorly of basic ions (Ca^{2+} and K^{+}). The regeneration test of the catalyst conducted showed the potential of reusability and catalytic action for more than 4 cycles in biodiesel subsequent production processes. The ideal conditions instituted for the transesterification reaction were 75 min of reaction time, 12.8:1 molar ratio of oil to methanol, and 4.08 wt.% of catalyst loading at 65 ^{o}C and 650 rpm constant temperature and agitation speed respectively, with the corresponding biodiesel yield of 96.70 wt.%. The evaluation of the quality of the biodiesel produced showed that it complied with the standard specifications of ASTM D6751, EN 14241 and SANS 833. Hence, the renewable resources used in this study could serve as a sustainable source of alternative fuel for transportation.

KEYWORDS: Biodiesel, baobab seed oil, heterogeneous catalysts, renewable resources, transesterification, optimization

Short Review/Case Study:Recovery Of Value-Added Products From Fruit Waste: South African Perspective

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ABSTRACT

Fruit waste constitutes a large portion of accumulation in landfills, contributing to the production of gases that contribute to global warming. With South Africa's increasing consumption of fruits, the availability of waste from fruits and its disposal strategies is a serious concern. As a result of a global shift towards the conservation of the environment and sustainable growth, there has been an increase in research focusing on developing methods to produce or process waste for the production of biofuel, livestock feed, adsorbents, and the extraction of value-added products. In view of the useful features and composition of this waste , converting it into useful products or materials may be the most environmentally friendly way of managing it. In this study, we focus on the transformation of waste into valuable products using selected fruit waste (apple, banana, citrus, and grapes) as a case study. Bioenergy is the best green energy solution for meeting the growing demand for renewable energy and promoting sustainable development for agricultural waste. Fruit waste contains protease enzymes, glucose, sucrose, cellulose, and other important minerals, making it a potential precursor for the biosynthesis of many value-added products. The biofuel potentials were also evaluated using bioethanol, biodiesel, biogas, and biohydrogen as energies of interest. Despite this waste potential, the prospects and challenges of converting it into value-added commodities are also discussed. Fruit waste conversions have been shown to reduce waste generation, and the products derived from the conversion would support the waste-to-wealth concept. The study intends to highlight the development of sustainable green processes and the production of value-added products, with the potential for South Africa to expand into a multimillion-rand market globally.

KEYWORDS: agriculture; sustainability; biotechnology; fruit waste; technologies

Modeling Of A Bi-Solute Adsorption System Of Cu^{2+} And Pb^{2+} Using Fruit Peels

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ABSTRACT

In the application of the bio-sorption process for industrial-scale treatment of wastewater, it is essential to study the effect of the co-existence of metal ions because it is very rare for wastewater to contain a single metal ion. Many operating parameters are important for industrial treatment application and scale-up. However, the initial concentration is a major operating parameter influencing adsorption of heavy metals. In this study, the effect of initial metal ion concentrations on adsorption in binary solute system of Cu^{2+} and Pb^{2+} was investigated in a column study using orange peels. The existing dynamic models (Thomas, Yoon Nelson, and Bohart-Adams) were applied to the experimental data. An increase in the influent metal ion concentration resulted in a steeper breakthrough curve which resulted in a breakthrough curve closer to the origin as the binding site was quickly saturated. The breakthrough time decreased with increased initial concentration for both metals. The adsorption capacity of Pb^{2+} was consistently higher than that of Cu^{2+} for all three initial concentrations (10, 50 and 100 mg/L) considered, which was influenced by the binding strength of Pb^{2+}. The Thomas and Yoon Nelson models performed well with the experimental data with a high correlation coefficients ($R^2 > 0.9$). The results obtained have shown that the performance of the fixed bed column conducted at a laboratory scale was efficient throughout the experimentation hence, this can be scaled up for industrial treatment applications.

KEYWORDS: Bio-sorption, heavy metals, bi-solute, wastewater, modelling

Effect Of Metal Doping On The Stability And Deactivation Of A Novel Mesoporous HZSM-5 Catalyst For Ethanol-To-Hydrocarbon Conversion

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ABSTRACT

Due to the significant environmental impacts associated with fossil fuels in the energy sector, interest in the use of ethanol as a sustainable alternative energy source has increased. Catalytic conversion using protonated zeolite catalysts is a promising way to upgrade ethanol to transportation fuels and valuable chemicals. In addition, the selective incorporation of transition metals into these catalysts has shown remarkable potential to increase catalytic activity and selectivity for the desired end products. Nevertheless, it is important to carefully evaluate the potential impact on the catalyst itself. This work investigates the effects of metal doping on the stability, deactivation and performance of a novel HZSM- 5 zeolite catalyst in the conversion of ethanol to hydrocarbons. The catalysts, which were hydrothermally synthesised and modified using 0.5 wt% Ni, were characterised using different techniques and evaluated at 623 K and 7 h^{-1} for 96 h time-on-stream (TOS) for ethanol to hydrocarbon conversion. The results of catalyst characterisation confirmed the successful synthesis of mesoporous HZSM-5 and the incorporation of Ni species. The catalytic results showed that unmodified HZSM-5 exhibited high stability with 100 % ethanol conversion, while Ni/HZSM-5 catalysts maintained 100 % stability for 48 h before dropping. While HZSM-5 favoured aromatics (BTX), the Ni-doped catalysts showed a broader product distribution, favouring C5-C8, C9-C12, and C12+ hydrocarbons. The coking study showed that the Ni-doped catalysts produced more coke than the unmodified catalysts, which contributed to their deactivation, as evidenced by a decrease in ethanol conversion after 48 h TOS. It can be concluded that the metal modification improves the catalytic performance but increases the coking and deactivation tendencies compared to the unmodified catalyst, which limits the stability of the catalyst.

KEYWORDS: Ethanol, Hydrocarbons, Nickel, Zeolites, ZSM-5

POSTER SESSION – 1

CHEMICAL ENGINEERING AND TECHNOLOGY

Session Chair

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The Qualitative Risk Assessment Of Nitration Reaction To Produce Nitrochlorobenzene In Continuous Process

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ABSTRACT

The present study investigates the safety aspects of the nitration reaction in the continuous reactor. The nitration reaction considered here uses conc. nitric acid, sulphuric acid, mono-chloro-benzene to produce products like o-chloro-nitro benzene and p-chloro-nitro-benzene. The reaction is exothermic in nature, followed by cooling water to maintain a temperature of 35°C and 1 atm pressure. Considering the safety issues associated with the mentioned reaction, the study of Hazard and Operability Analysis (HAZOP), Fault Tree Analysis (FTA), Event Tree Analysis and Bowtie Analysis is performed in this work to identify the risks inherently present within complex process. The HAZOP analysis systematically scrutinizes the process parameters, detects process deviations that could lead to hazards such as uncontrolled reactions or operational failures. The findings of HAZOP study are incorporated into fault tree analysis by considering Thermal Runaway chances as top event. The critical parameters like temperature, pressure and flowrate severely affects the process may trigger possible thermal runaway and simultaneous overpressure occurrences. By integrating all Qualitative Analysis this study aims to ensure the safety, reliability, and efficiency of nitration reactions in batch processes.

KEYWORDS

Nitration Reaction, Safety Analysis, Hazard Operability, Fault Tree Analysis, Event Tree Analysis, Bowtie Analysis

From Trash To treasure: A Critical Review Of Waste-To-Energy Technologies For Solid Waste Utilization

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ABSTRACT

Efficiently managing the escalating global issue of solid waste necessitates sustainable strategies. Waste-to-energy technology emerges as a viable solution, offering a means to utilize solid waste while mitigating its environmental impact. This review comprehensively investigates waste-to-energy techniques, including incineration, anaerobic digestion, and gasification, evaluating their efficiency, environmental implications, and applicability. The environmental effects of waste-to-energy plants, encompassing aspects like air emissions, ash management, and wastewater treatment, are scrutinized. Additionally, the social acceptability of these projects is explored, considering factors such as costs, benefits, and public perceptions. The study incorporates case studies of successful global waste-to-energy initiatives, identifying key factors influencing their success. Challenges and barriers to widespread adoption are discussed, along with potential future developments and regulatory frameworks. The aim is to enhance understanding of waste-to-energy technology, its role in eco-friendly energy production, sustainable waste management, and environmental preservation.

KEYWORDS:

Resource-to-power innovation, effective management of refuse, combustion, microbial digestion, transformation into gas, ecological consequences, financial feasibility, communal approval, illustrative instances, impediments, prospective outlooks, sustainable management of refuse, power generation, ecological safeguard.

Removal Of Toluene And N-Hexane From The Air By Adsorption

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ABSTRACT

Improving air quality through the use of eco-friendly techniques in industries and indoor air quality is of much essence globally. Among the hazardous pollutants affecting air quality, volatile organic compounds (VOCs) pose significant risks, including respiratory irritation, carcinogenicity, and environmental degradation. Adsorption, which involves the capture of VOC molecules on the surface of a solid adsorbent is a promising technique for VOC removal. Activated carbon (AC) is a potential adsorbent due to its large surface area, pore structure, chemical stability and cost effectiveness. This work investigates VOC adsorption on activated carbon, focusing on toluene and n-hexane, prevalent VOCs in industrial emissions and indoor air. Batch experiments varied the mass of activated carbon and contact time with VOCs to measure adsorption capacity, crucial for assessing removal efficiency. The experimental data were fitted and analyzed using standard Adsorption isotherm models: Langmuir and Freundlich which describes the relationship between adsorption capacity and equilibrium concentration of VOCs. Results indicate that increasing activated carbon mass and contact time enhances adsorption capacity and also type of VOCs matters, as heavier and more polar VOCs have lower adsorption capacity than lighter and less polar ones. This work has practical applications in designing and optimizing Activated carbon-based systems for VOC removal from air in industry and indoor air purification. By showing interplay of mass, contact time, and VOC type, this study helps to create more efficient and customized solutions to reduce the negative effects of VOC pollution.

KEYWORDS: Volatile organic compounds (VOCs), VOC Activated carbon adsorption, Adsorption isotherms, Industrial emissions, Air quality, VOCs removal from air.

Study Of The Hydrogen And Acetylene Source Modelling Through Cylinder

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ABSTRACT

The present study contributes to the development of an early response strategy for hydrogen and acetylene cylinder leaks, incorporating source modelling and blast wave estimation. The findings offer valuable insights into enhancing preparedness and mitigating the risks associated with chemical plant accidents involving these hazardous substances. The study employs source models to describe the rate, total quantity, or time of discharge, as well as the state of the released material, whether it be solid, liquid, vapor, or a combination. The goal is to enhance the capabilities of first responders in handling chemical spills effectively. Special emphasis is placed on the leakage of hydrogen and acetylene, which are common in chemical plant accidents. By estimating blast wave values associated with these leaks, the research aims to provide critical insights into the potential consequences of the release. This includes understanding the impact zones, and the magnitude of the blast waves. Source modelling provides information that is essential for emergency responders to make informed decisions regarding evacuation, containment measures, and protection strategies.

KEYWORDS

Source modelling, Acetylene and Hydrogen leakage, Gas leak through cylinder

Sustainable Approaches Towards Carbon-Neutral Steel Sector

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ABSTRACT:

In this fast-growing economy, race is always there to be the best. Countries are growing in industrialization, population, transportation, and whatnot. The focus is on the basic requirements of infrastructure, and for almost all infrastructure, steel is an essential raw material. Thus, the progress of any country can be easily linked with the utilization of steel by the country and the availability and processing of steel are of utmost importance for any country. Like many other industries, the steel processing industries are currently experiencing ongoing enhancement to achieve greater environmental sustainability, sometimes referred to as "green" practices. The annual carbon dioxide (CO_2) emissions from steel corporations are substantial. The steel sector ranks 3rd after electricity (25%) and agriculture (24%) sector. Steel and cement industries emit around 21% of global CO_2 emissions. This is due to the steel industries primarily depend on coal in the iron-smelting process. The furnaces majorly used for the production are still based on old method (coal-dependent) although new method of incorporating green hydrogen in the process to reduce the emission of CO_2 is still under experimentation. Companies like SSAB, Vattenfall, and LKAB are collaborating on some new initiatives, and in India, Tata Steel and ArcelorMittal Nippon Steel are exploring similar initiatives. Currently, no steel producer company uses exclusively green hydrogen for commercial production as the technological infrastructure and availability of affordable green hydrogen remain significant challenges. This review deliberates optimizing pre-existing methods and the upcoming new technologies like the HYBRIT method, molten oxide method, etc., which provide sustainable solutions to GHG emissions from steel industries.

KEYWORDS:

Sustainable production of steel, green hydrogen, decarbonization.

Preparation Of Organic Pesticides, Organic Hair Dye And Lip Balm By Using Natural Ingredients

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ABSTRACT

Due to the increasing amount of chemical products, pollution is occurring, which has an impact on human life. So if we make natural products a part of life, then this kind of problem can be avoided and the product here is also made from natural material, so natural material is used and green chemistry is also boosted, so research in this direction is necessary. The intention is good. For this purpose I have undertaken the work in this direction and prepare organic pesticides, organic hair dye and lip balm by using Natural ingredients. Organic pesticides for plants are considered to be those made from natural ingredients. It doesn't mean that they're free from chemicals, just that they come from botanical and mineral sources. Even though they must still be used carefully, the chemicals break down more quickly than commercial sources and are considered less dangerous. Hair color is one of the oldest and most well-known cosmetics that have been used in various parts of the world; ancient cultures used this practice, not just for women but also for men. The most effective natural hair dyes were henna leaf and walnut huskm, Lip balm or lip salve is a wax-like substance applied typically to the lips to The lips can be moisturized and relieved of chapped or dry lips, angular cheilitis, stomatitis, or cold sores.. Most of the contain ingredients such as bees wax, cocoa butter, vitamins (C, E)to provide color, promote softness and moisture.

KEYWORDS: Natural ingredients, green chemistry, Organic pesticides, Hair color, Lip balm

The Hazop And Fault Tree Analysis Of Sulfuric Acid Production Plant

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ABSTRACT

The present study investigates the safety aspects of sulfuric acid production in the continuous process plant . The report that follows contains a detailed methodology of the approach adopted in this regard which includes a comprehensive survey of available literature and an overall selection of a manufacturing process; the feasibility of the design in terms of safety, environmental condition .Operability (HAZOP) Study and Fault Tree Analysis (FTA) is performed in this work to identify the risks inherently present with this complex process. The HAZOP analysis systematically scrutinizes the process parameters, detects process deviations that could lead to hazards such as uncontrolled reactions or operational failures. The findings of the HAZOP study are incorporated into fault tree analysis by considering the major incident in sulfuric acid plant as top event. The proposed fault tree has 3 main events , 12 intermediate events, and 41 basic events. The critical parameters like temperature and pressure and flow rate severely affect the process, i.e., exceeding the temperature may trigger possible thermal runaway and simultaneous overpressure occurrences and flowrate deviation leads to headloss or overflow condition . By integrating FTA and HAZOP, this study aims to ensure the safety, reliability, and efficiency of sulfuric acid production in continuous process plant.

KEYWORDS

Sulfuric acid production , Safety Analysis, Hazard Operability, Fault Tree Analysis

Review Of Sustainable Use Of Water In Hydrogen Fuel Cell By Electrochemical Electrolysis

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ABSTRACT

The Crude oil when broken down into petroleum products such as Diesel Fuel, Jet Fuel, Waxes, Petrol is estimated to last for some few 50 Years. There comes the option Of Electric Vehicle operated by battery, Hydrogen Fuel Cell, which helps in making the Mother Earth free from Carbon dioxide emission thus reducing the quantity of Green House gases and reducing temperature of Earth which downs the level of Global Warming. When it comes to working of Hydrogen Fuel Cell, it Produces Water, Heat and Electricity using Reverse electrolysis and Cell Consumes Hydrogen Gas and Oxygen Gas. The idea is to use a Electrolyser with Fuel cell so it can result in production of Hydrogen and Oxygen gases using Electrochemical Electrolysis which can be used as fuel and the products of fuel cell i.e. Water produced in fuel cell can be Feedback to the electrolyser so it can be re-used in the production of fuel gases. So the Change in the state of matter from Liquid to Gas in Electrolyser and Gas to Liquid Conversion using Reverse electrolysis in Fuel Cell can result in efficient use of water and increased efficiency of Hydrogen Fuel Cell. This method may have the potential of saving the environment from pollution and solves the problem of dependence on Petroleum products. Fuel cell with electrolyser can be just one time investment in the future and provides sustainability, longevity and added Reliabilty to the Electric Vehicle whether it can be Bike or Car.

KEYWORDS

Electrolysis, Reverse Electrolysis, Sustainability, Reliability, Longevity, Conversion.

Energy-Efficient Green Buildings: Technologies, Strategies, and Impacts

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ABSTRACT:

The proposed research paper renders an in-depth analysis of energy-efficient green buildings, focusing on the latest technologies, strategies, and environmental and economic impacts. The different elements of a green building showcased are: 1. sustainable site selection 2. Energy efficiency 3. Water efficiency 4. Material efficiency 5. Design. The paper reflects on designing and operating green buildings to reduce energy consumption and minimize environmental impact. It examines the integration of renewable energy resources, passive design principles, efficient HVAC (heating, ventilation, and air conditioning) systems, smart building technologies, green roofs, bio-walls, Geothermal Systems, and maximizing natural light. Our idea shows how different designs and angles of an architectural structure maximize power generation and light generation. Additionally, the environmental benefits of green buildings are reduced greenhouse gas emissions and conservation of natural resources. Overall, it emphasizes the role of green buildings in mitigating climate change and achieving sustainable development goals. The proposed paper shows four aspects of reducing the energy consumption of buildings, which results in mitigating CO_2 emissions. a. Comfortable passive building design and its planning for harnessing solar energy. b. low-embodied energy materials for building design. c. energy-efficient domestic appliances to conserve the building's operational energy. d. Creating integrated renewable energy technologies. In conclusion, it highlights the critical role of energy-efficient green buildings in addressing the challenges of climate change and promoting sustainable development. Through an in-depth exploration of various strategies and technologies, the paper underscores the significance of adopting energy-efficient practices in the design and operation of buildings.

KEYWORDS:

energy efficiency, HVAC systems, solar energy, climate change, green buildings

Review paper on Nano container based self-healing coating for anticorrosive applications.

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ABSTRACT

Corrosion of the metal has been serious problem to which researchers are committed to resolve on urgent basis. Nano container based self-healing coating extensively grabs attention of scientific community as they offer wide range of application in conjunction with long lasting inhibition performance. Those coatings often prevents the rate of crack progression by releasing active agent(corrosion inhibitors) from micro/Nano containers in controlled manner such as healing cracks, controlling pH, temperature sensitivity, thereby mitigating corrosion.

This review is comprehensive analysis of corrosion inhibitors and Nano containers used to manufacture self-healing anticorrosive coating. This paper also describes the methods for synthesis of Nano containers, corrosion inhibitors and their types and their applications. An attempt is made to cover the latest developments in the manufacturing Nano container based self-healing anticorrosive coatings in various industries. In conclusion, this paper summarizes the key findings of the review and provide future outlook for the development of Nano container based self-healing coatings. This review concludes that further research is needed to develop more effective, economical, multifunctional sensitive coating formulations for sustainable approach.

KEYWORDS:

Corrosion inhibitors, Nano containers, self-healing coating and sustainability etc.

Advancing Circular Economy in the Water Sector: A Comprehensive Review and Assessment

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ABSTRACT

Increasing urbanization and rapid depletion of resources have forced authorities to shift from traditional linear system of take-make-use-dispose to circular system of resource conservation. Circular Economy is a sustainable development approach that works on the waste management strategy of reduce, reuse, recycle, and recover. The objective of this study is to assess the global advancement of the Circular Economy concept within the water sector, examining its economic, environmental, social, and technical dimensions. Through a systematic literature review, 98 publications were identified and categorized based on economic, environmental, social, and technical criteria, employing a combination of multiple assessment factors. In a dynamic world, the desired ecosystems that society aims to preserve, establish, or restore play a crucial role in shaping the definition of suitable environmental water needs. Recycling and reuse are fundamental pillars of a circular economy strategy, presenting an opportunity to enhance water supply management through improved wastewater treatment. This approach must prioritize the safety of water reuse by implementing tailored water quality standards for each specific use. Additionally, it should guarantee the dependable operation of water reuse systems and enforce appropriate regulatory measures effectively.

KEYWORDS

Circular economy, Sustainable development, Waste water Treatment, Recycling, Ecosystem, Water quality Standards, Regulatory Enforcement

Eutectic Freeze Crystallization: For recovery of water and solid salts ($NaNO_2$) from aqueous solution”

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ABSTRACT

Eutectic freeze crystallization (EFC) is a valuable known for its ability to produce high-purity crystalline products. EFC can be considered as an alternative and environmentally friendly technology based on its process. It is beneficial in industries that require precise separations and stringent quality standards. EFC separates salt and water by cooling the solution to its eutectic temperature, where ice and salt crystals form simultaneously. EFC produces less waste and consumes less energy than other separation processes, making it a more environmentally friendly choice. This process is more energy-efficient and can produce higher-purity products than other processes such as evaporation, which rely on the application of heat. Commercially, $NaNO_2$ crystals are produced by evaporating water from its solution, which is highly energy-intensive and risky. This project delves into eutectic freeze crystallization for the recovery of $NaNO_2$ salts from its aqueous solutions. The study showcases the method's ability to selectively crystallize salt, providing insights into its potential application to salt recovery and purification as an innovative approach.

KEYWORDS

Crystallization, Eutectic, Green Technology, Salt recovery

Recent Developments And Studies On Earth Based Concrete: A Review

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ABSTRACT

Earth represents one of the oldest construction materials which is still been utilized in most of the countries. By using locally available natural sources such as clay, soil, sand, cement and sometimes stabilizers, earth based concrete can be made. Earth-based construction materials are adapted to various climates and can provide effective solutions in specific contexts. Earth based materials are often non-toxic and can contribute to healthier indoor air quality. Earth based Concrete has a lower carbon emission compare to the traditional concrete which can be useful in reducing global warming. The use of earth base materials aligns with sustainable building practise, promoting ecofriendly and environmentally conscious construction. This can encourage sustainable construction practices, the use of earth-based concrete can position a project favourably. This paper presents of review of the literature for the research and developments carried out on earth based concrete.

KEYWORDS

Earth based concrete, Sustainability, Global warming, Green Concrete, Pollution

New Process For The Synthesis Of Nano Iron Oxide By Using Hydrodynamic Cavitation Process

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ABSTRACT

To enhance the quality of the product and to reduce the production cost, industries are gradually inclined towards greener processing technologies. Cavitation-based technologies are gaining interest among processing technologies due to their cost effectiveness in operation, minimisation of toxic solvent usage, and ability to obtain superior processed products compared to conventional methods. Also, following the recent advancements, cavitation technology with large-scale processing applicability is only denoted +to the hydrodynamic cavitation (HC)-based method. The nano iron oxides have been synthesised by almost all the known wet chemical methods which include precipitation at ambient/elevated temperatures, sol-gel, hydrothermal, surfactant mediated-precipitation, emulsion-precipitation, micro emulsion -precipitation, electro-deposition, and microwave assisted hydrothermal technique. Iron oxides in nano-scale have exhibited great potential for their applications as catalytic materials, wastewater treatment adsorbents, pigments, flocculants, coatings, gas sensors, ion exchangers, magnetic recording devices, magnetic data storage devices, toners and inks for xerography, magnetic resonance imaging, bio separation and medicine. Synthesis of iron oxides in the nano range for various applications has been an active and challenging area of research during the last two decades. The processes include careful choice of pH, concentration of the reactants, temperature, method of mixing, and rate of oxidation. The morphology of the iron oxide particles depends on the competition between several processes like nucleation, growth, aggregation and adsorption of impurities . several colloidal chemical synthetic procedures have been developed to produce mono-disperse nanoparticles of various materials. Hydrodynamic cavitation is a process that involves the formation, expansion, and collapse of bubbles in a flowing liquid, resulting in high pressures and temperatures for a short duration. The principle of hydrodynamic cavitation is based on liquid passing through a constriction, causing an increase in velocity and a decrease in pressure. Cavities are formed due to the low pressure. Cavities implode when liquid jets expand downstream of the constriction. The system includes a feed tank, a pump, a pressure gauge, and a cavitation chamber with different types of constrictions. Hydrodynamic cavitation can be categorised based on its operating ways.

GREEN HYDROGEN

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ABSTRACT

Hydrogen can be made in different ways, using things that can be used again and again and things that can't. Some methods release very little carbon, which is good for the environment. People have come up with ways to make sure the hydrogen they use is clean and comes from good sources. This can depend on how companies report their carbon usage and whether the hydrogen is made using clean energy. Fossil fuels, like gas and oil, are causing a lot of pollution, especially in transportation and big industries. Hydrogen could be a cleaner way to power things in the future. There are ways to make hydrogen using renewable energy sources, like plants and animals. In many places, people still use plants and animal waste as fuel. To make hydrogen from waste, it's put in a special container without air for a few weeks. This process creates gases, including methane. We need to clean the methane before using it to make hydrogen. We use water and other things to get rid of impurities like carbon dioxide and moisture, and to remove harmful gases like hydrogen sulfide. It's important to clean the gas because it can damage pipes and storage tanks before it's used by people.

KEYWORDS: Green hydrogen, Composting of biomass, Renewable Energy, Application and uses.

Aspen Based Simulation On Green Hydrogen From Autothermal Reforming

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ABSTRACT

Due to increasing interest in green hydrogen production technologies, the researchers are evaluating the environmental and/or economic feasibility of producing green hydrogen. A holistic assessment is much needed. Very limited information is available in the literature on overall green hydrogen production through various production pathways. The uncertainty and sensitivity analyses have also been found missing in the earlier studies. In this study aspen-based simulations were carried out for autothermal reforming (ATR) process and by carrying out sensitivity analysis the energy requirement is minimized to make the process close to thermo neutral. Encouraging results were obtained that suggest a complete thermo neutral process could be achieved.

KEYWORDS

Green hydrogen, Autothermal reforming, Thermo neutral

Heterogeneous Azeotropic Distillation Of N-Butanol/Water System

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ABSTRACT

This study investigates the renewed interest in biofuels amid escalating oil prices and environmental concerns, focusing on n-butanol as a superior alternative to ethanol. Despite the promising prospects, challenges such as low concentration in batch fermentation and the separation of by-products impede large-scale production in a continuous process. The research highlights the sensitivity of simulation results to property method changes, specifically utilizing UNIQUAC and NRTL methods in flash calculations. The poster emphasizes the impact of 0.5-atmosphere process conditions on boiling points and recommends the use of the CAPE-OPEN plugins for azeotropic mixtures. Additionally, the study identifies key opportunities, including addressing China's demand-supply gap and leveraging Saudi Arabia's oil & gas sector investments, alongside a growing interest in biobased butanol.

KEYWORDS: Bio-fuels, vapor-liquid equilibrium, liquid-liquid equilibrium, Azeotropic mixtures, Distillation.

Co-Pyrolysis Behaviour Of De-Oiled Mahua Cake And Waste LDPE Using Thermogravimetric Analysis And Artificial Neural Network

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ABSTRACT

Energy production from waste biomass and plastic should be prioritized, with a focus on the future. Waste plastic and biomass have emerged as key resources for generating liquid fuel in an environmentally friendly manner and addressing the serious environmental problems caused by plastic waste. Non-isothermal thermogravimetric (TG) experiments of mixture (1:1 weight ratio) of de-oiled mahua cake and waste LDPE carried out at three distinct heating rates (5, 10, and 20 °C) under a nitrogen (N_2) atmosphere. Further, the artificial neural network (ANN) was used to train the recorded TGA data and to compute the kinetics and thermodynamics. The computed kinetic outcomes align closely with the experimental findings. The kinetic triplets obtained by FWO, KAS, Starink, Tang, and Boswell mathematical methods. The average activation energy (E_a) exhibited a robust dependency on conversion and was determined through isoconversional techniques, yielding values of 217.56, 217.17, 217.46, 217.47, and 223.06 kJ/mol using FWO, KAS, Starink, Tang, and Boswell mathematical methods respectively. Changes in enthalpy, entropy, and Gibbs free energy were calculated within the ranges of 194–237 kJ/mol, -21–132 J/(mol·K), and 210–278 kJ/mol, respectively. Using ANN prediction modeling for predicting TG-DTG data consistently yielded an R^2 value of 1 for training, validation, and testing, with minimized Mean Squared Error (MSE) across all heating rates. The ANN network (feed forward back propagation network (FFBPN)) was modelled and tested by following guidelines such as training function: TRAINLM, Adaption learning function: LEARNGDM, performance functions: (MSE, AARD % and R^2), transfer function: TANSIG (for hidden layer) and PURELIN (for output layer). Based on these results, combining deoiled mahua cake with waste LDPE appears to be a viable alternative that could enhance the overall process.

KEYWORDS: Mahua cake, LDPE, Pyrolysis, artificial neural network (ANN), kinetic triplet

Sustainable Process

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ABSTRACT

In Sustainable process something that is able to sustain and be kept at a certain level. In a sustainable process we can consider green space, waste to energy conversion, improve energy efficiency, reduce packaging, and sustainable construction. Sustainable process will help to describe policies, projects and investments that provide benefits today without sacrificing environmental, social and personal health in the future. The outcomes include conservation of biodiversity, reduced pollution and waste, improved air and water quality,
preservation of natural resources, and the promotion of sustainable land use practices.

KEYWORDS: Definition, Sources, process, use, disposal, reuse.

Nanomaterials And Nano-Technology

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ABSTRACT:

The accumulation and excessive use of waste plastics has caused serious environmental issues due to their unbiodegradable nature. It possesses challenging issues to environment and ecosystem. Statistically, more than trillions of waste plastic are generated and discharged on unused lands resulting to landfills. Each passing day it is chocking our ecosystem. We know it is a “technical century”. So, with the help of evolving technologies, we will try to reduce the waste plastic and convert it into carbon nano material. There are different types of plastics like, Acrylic or Polymethyl Methacrylate (PMMA), Polycarbonate (PC), Polyethylene (PE), Polypropylene (PP), Polyethylene Terephthalate (PETE or PET), Polyvinyl Chloride (PVC), Acrylonitrile-Butylene-Styrene (ABS). There are also different types of nano materials, they are Carbon Nanotubes, Biological Nanomaterials, Graphene, Composite material, Hydrothermal, Organic Nanoparticles. Converting waste plastic to nano materials will help reduce pollution and then carbon nanoparticles can be used at different places like, Biosensors to remediation of pollutants. Detection of hazardous compounds in food, pharmaceutical products, gene and drugs delivery. They are also used in tissues regeneration. Fertilizers can also be formed.

KEYWORDS: Accumulation, Unbiodegradable, Ecosystem, Landfills,

Study Of Green Hydrogen

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ABSTRACT

Green hydrogen has emerged as a promising and sustainable energy carrier, offering a solution to the challenges posed by climate change and the transition towards a low-carbon economy. This poster presentation explores the production and applications of green hydrogen. We discuss various types of hydrogen along with production method of electrolysis powered by renewable energy sources such as solar and wind, and highlight the environmental benefits compared to conventional hydrogen production methods. Additionally, we examine the diverse applications of green hydrogen which are application of green hydrogen as fuel, in industry and its domestic use. Furthermore, the economic feasibility and policy frameworks supporting the adoption of green hydrogen are addressed, underscoring the importance of collaboration between governments, industries, and academia in scaling up its production and utilisation.. Through this poster presentation, we aim to raise awareness about the transformative potential of green hydrogen in shaping a sustainable energy future.

KEYWORDS

Green Hydrogen, sustainable solutions

Chronological Evolution of Mathematical Models for the Supercritical Fluid Extraction Processes: A review

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ABSTRACT

The main aim of mathematical modeling of a supercritical fluid extraction (SFE) process is to predict the extraction curve as the function of the experimental parameters such as temperature, pressure, solvent flow rate, particle size, co-solvent amount and other parameters such as bed height, matrix of seed particles and solubility parameters. As the actual experiments at large scale are extremely expensive therefore, the mathematical models are being used to overcome this problem. In other words, mathematical models also help in scaling up. It is evident that various models differ not only in the form of mathematical representation but also due to mass transfer mechanisms, which control the SFE of different matrices. Thus, a single model may not be fitted to all type of experimental data. Since, the strength of a model is measured by the number of different systems it can accurately predict, and the spans of its applicability within acceptable limits of accuracy and precision. Therefore, it has become crucial to review all available mathematical models for the SFE processes for the selection of the best one or to develop a new one if required. In this sense, more than 35 models have been proposed by various authors based on different assumptions, nature of model equation, tuning parameters, % error and method of solution. It is evident that various authors due to its analytical solution, which incorporates different extraction periods, have used Sovova's model (Sovova, 1994) extensively. From the propagation of mathematical models for SFE process it can be concluded that most of the work has been done on DDDM (desorption-dissolution-diffusion models). Based on this mechanism (e.g. DDDM), various models (e.g. ADSM, WADSM, DLM, LDFM, SSM and BICM) have been developed which are differ from each other due to different simplifications and assumptions made during modeling.

KEYWORDS: Supercritical fluid extraction, Modeling, Overall extraction curve, Scaling up, Mass transfer.

POSTER SESSION – 2

PHARMACEUTICAL INDUSTRIES

Session Chair

Dr. Mehul Patel

Session Co-Chair

Prof. Dipali Shah

Development and Evaluation of directly compressible nanocomposite material for microbially triggered delivery system to target colon

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Abstract:

Colon drug delivery is advantageous in treatment of colonic disease and oral delivery of drugs that are unstable and susceptible to enzymatic degradation in upper GI tract.. An accurate targeting is challenging due to intra- and inter individual variability in intestinal parameters such as fluid pH and transit times which occasionally lead to formulation failure. The nanocomposite material was formed using resistant starch guar gum and nanocellulose whiskers. In order to make the resistant starch more digestible by bacterial enzymes, retrogradation process of the starch was given, to allow disruption of the crystalline structure of the starch granules. The nanocellulose whiskers were prepared through acid hydrolysis method. The characterization of nanocomposite material was carried out. The swelling index was also studied. As such, a unique nanocomposite material was formed. Further it was used as directly compressible tablet material and also in the form of the film which was further incorporated in the capsule. The in vitro dissolution study of tablets and film incorporated with mesalamine in capsules was carried out. Results, showed that the developed nanocomposite material can be used as film forming and the directly compressible material for tablets.

Key words: Nanocomposite, guargum, Resistant starch, Colon drug delivery

Preparation Of Organic Pesticides, Organic Hair Dye And Lip Balm By Using Natural Ingredients

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Abstract

Due to the increasing amount of chemical products, pollution is occurring, which has an impact on human life. So if we make natural products a part of life, then this kind of problem can be avoided and the product here is also made from natural material, so natural material is used and green chemistry is also boosted, so research in this direction is necessary. The intention is good. For this purpose I have undertaken the work in this direction and prepare organic pesticides, organic hair dye and lip balm by using Natural ingredients. Organic pesticides for plants are considered to be those made from natural ingredients. It doesn't mean that they're free from chemicals, just that they come from botanical and mineral sources. Even though they must still be used carefully, the chemicals break down more quickly than commercial sources and are considered less dangerous. healthier plants Pests can't develop a resistance, Less odor because of natural ingredients, Safer for children and other outdoor animals. Hair color is one of the oldest and most well-known cosmetics that have been used in various parts of the world; ancient cultures used this practice, not just for women but also for men.Natural appearance of use of real human hair fiber. May be styled as a natural hair. Able to color and perm. Moves like natural hair. More resistant to heat damage Lip balm or lip salve is a wax-like substance applied typically to the lips to The lips can be moisturized and relieved of chapped or dry lips, cold sores.. Most of the contain ingredients such as bees wax, cocoa butter, vitamins (C, E)to provide color, promote softness and moisture. It could make lips more softer and lighter,It could make lips more softer and lighter,It make your lips moisturize and nourish.

Keywords:

Natural ingredients, green chemistry, Organic pesticides, Hair color, Lip balm

Development And Evaluation of Biodegrdable Plastic Using Fenugreek Based Mucilage And Soy Based Polyols.

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ABSTRACT

Traditional plastics made from petrochemicals have poor biodegradability and can persist in the environment for hundreds of years. Additionally, these plastics have become associated with environmental problems, health risks and limitedrecycling. The development of bio-plastics has gained increasing attention in recent years as a sustainable alternative to conventional plastics. In this study, fenugreek mucilage and soya-based polyols were used to create a bio-plastic with desirable mechanical and thermal properties.Fenugreek mucilage is a natural polysaccharide that can act as a binder and provide a certain degreeof elasticity to the bio-plastic. Soy polyols, are derived from soybeans and act as a natural plasticizer, helping to improve the flexibility and durability of the bio-plastic. Starch is also a commonly used bio-plastic raw material.It can help to improve the mechanical strength of the bio-plastic and reduce its cost. PEG is a synthetic polymer that is often used as a plasticizer and can improve the bio-plastic's flexibility and toughness. PVA, is often used as a component in biodegradable plastics due to its ability to biodegradein natural environments. When PVA-based biodegradable plastics are exposed to moisture, bacteriain the environment can break down the material, converting it into water and carbon dioxide. Thisprocess is known as biodegradation, and it is a more environment friendly alternative to traditionalplastics that do not break down easily in nature. However, it should be used in moderation to maintain the bio-plastic's biodegradability. Overall, the use of fenugreek mucilage and soya-based polyols provides a promising pathway for the development of sustainable bio-plastics with desirable properties.

Keyword:

Plastics, Fenugreek mucilage, Soy polyols, Biodegradability, Durability

Formulation Development and Evaluation of Dispersible Anti-Retroviral Paediatric Tablet

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ABSTRACT

The development of dispersible anti-retroviral paediatric tablets represents a crucial endeavour in paediatric HIV/AIDS treatment, aiming to enhance drug administration, compliance, and therapeutic efficacy in children. This abstract encapsulates the formulation development and evaluation processes involved in creating such tablets.The formulation development begins with a meticulous selection of excipients, considering their compatibility with active pharmaceutical ingredients (APIs) and their ability to confer desirable properties to the tablets. Key considerations include taste-masking agents, disintegrates, binders, and sweeteners to ensure palatability and rapid disintegration in aqueous media, crucial for paediatric dosing.The optimization process involves systematic adjustments in excipient ratios, granulation techniques, and compression parameters to achieve uniformity in drug content, acceptable hardness, and rapid dispersibility without compromising the stability and bioavailability of the APIs.Evaluation of the dispersible antiretroviral paediatric tablets encompasses a battery of tests, including physicochemical characterization, dissolution studies, drug release kinetics, moisture uptake, and stability assessments under simulated storage conditions. These evaluations ascertain the tablets' compatibility with various environmental factors and their ability to maintain drug potency over an extended period, essential for widespread distribution and utilization in resource-limited settings.Furthermore, the in vitro and in vivo performance of the dispersible tablets is assessed to validate their efficacy in delivering accurate doses, promoting patient adherence, and achieving therapeutic outcomes comparable to conventional antiretroviral formulations.In conclusion, the formulation development and evaluation of dispersible antiretroviral paediatric tablets represent a multidisciplinary effort aimed at addressing the unique challenges associated with paediatric HIV/AIDS treatment. By optimizing formulation strategies and rigorously assessing product quality, these tablets hold immense promise in improving treatment access, adherence, and health outcomes among children living with HIV/AIDS worldwide.

KEYWORD: Dispersible, anti-retroviral, paediatric tablet, HIV/AIDS treatment, In-vitro and In-vivo performance.

Starch Nanoparticles: Preparation, Properties And Applications

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ABSTRACT

Throughout the world, starch is a naturally occurring polymer that is extensively employed in many different sectors. Starch nanoparticle (SNP) preparation techniques can generally be divided into two categories: "top-down" and "bottom-up." SNPs can be utilized to enhance the functional characteristics of starch by producing it in smaller sizes. They are therefore taken into account for the different chances to raise the caliber of starch-based product creation. Information and reviews about SNPs, their general preparation techniques, the traits of the resulting SNPs, and their applications—particularly in food systems—such as Pickering emulsion, bioplastic filler, antimicrobial agent, fat substitute, and encapsulating agent—are presented in this literature study. This paper provides an overview of the characteristics of SNPs as well as data on how widely they are used.

Keywords:

starch nanoparticles, top down, bottom up, preparations, applications

The Green Synthesis of Nanomaterial

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ABSTRACT

Nanoscale metals are widely used in a variety of fields, including engineering, medicine, and the environment. Currently, the physical methods used to create nanoscale materials are aerosol, UV radiation, thermal decomposition, and chemical methods include toxic reagents .Unintentional consequences of this chemical and physical approach include environmental contamination, high energy consumption, and potential toxicity when used in humans. Green synthesis techniques for nanoparticles have been developed in response to these problems. The green synthesis of metallic nanoparticles (such as iron, copper, gold, and silver) has emerged as a novel and exciting area of study in recent years. Green synthesis is more advantageous than conventional methods since it is less expensive, produces less pollution, enhances environmental quality, and protects public health. Natural and environmentally acceptable materials are used in green synthesis (i.e. reducing agent). Currently, green synthesis mostly uses extracts from leaves, flowers, roots, peelings, fruits, and seeds of different plants, as well as microorganisms (fungi, bacteria, and algae). Protein and polyphenols found in green materials can take the place of chemical reagents when used as reducing agents to lower the valence state of metal ions. It is economical, ecologically friendly, and safe for biological systems to employ microorganisms and plants in green synthesis technologies for nanoparticles. A standardized procedure to manufacture nanoparticles with plant extract includes selecting a certain plant material, extracting it with an appropriate solvent, and then filtering the result. Different spectroscopy techniques, such as ultraviolet method, are used to assess their optical nature after synthesis, and FTIR helps identify the functional groups present on the surface of nanoparticles. Microscopic techniques, such as scanning and transmission electron microscopy, are used to assess size ,structure ,shape ,surface charge ;play crucial role in characterizing green synthesized nanoparticle.

Keyword:
nanoparticle, green synthesis ,microorganism, plant, biocompatible

A Novel Approach On Nanotechnology : Green Synthesis Of Silver Nanoparticles With Anticancer Properties Using Various Plant Extracts

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ABSTRACT

Recent advancement in nanotechnology; researchers are now interested in green synthesis of metallic or silver nanoparticles using various phytochemical containing plants extract due to its various advantages over conventional approaches including its simplicity in procedure, Economical benefit , Biocompatibility, speed and efficiency in manpower energy of whereas Traditional methods have numerous drawbacks, including targeting deficiencies, resistance to treatment, genotoxic drugs that change gene expression, and other side effects include extreme fatigue, hair loss, upset stomach, anaemia, and skin-related issues. Greatest method for combating cancer like fatal disease is to combine plant extracts that include phytoconstituents with anticancer effects and silver nanoparticles that have both antibacterial and anticancer capabilities this can combine with nanotechnology for superior result as it can distinguish between normal and malignant cells. In this review we discuss regarding the various plants, their specific part extract from which we can synthesise silver nanoparticles that having potential therapeutic effect for anticancer activity. Plants like Azadirachta indica (neem) leaf , Mentha pulegium extracts , Thespesia populnea Bark Extract , Conocarpus Lancifolius plant extract, amygdalina Leaf Extract and Vernonia amygdalina (VA) are useful for preparation of silver nanoparticles which are reported for their cytotoxic effect against cancerous cells. It is characterized by UV-vis spectroscopy, transmission electron microscopy(TEM), atomic force microscopy, dynamic light scattering, zetasizer, energy-dispersive X-ray spectroscopy (EDAX) , powder X-ray diffraction (P-XRD), scanning electron microscopy (SEM)and Fourier transform infrared spectroscopy (FTIR).

KEYWORDS

Nanotechnology , Silver nanoparticle, Anticancer, phytoconstituents, Plant Extract, Green synthesis.

DESIGN AND DEVELOPMENT OF HERBAL FILM FORMING SPRAY FOR WOUND HEALING

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ABSTRACT

The design and development of herbal film-forming sprays for wound healing signify a significant advancement in modern wound care management, integrating traditional herbal medicine with innovative pharmaceutical technology. This abstract encapsulates the key elements involved in the creation of such sprays and their potential implications in wound healing therapy. The formulation process begins with the selection of herbal extracts known for their wound healing properties, considering factors such as antimicrobial activity, anti-inflammatory effects, and tissue regeneration capabilities. These botanical ingredients are carefully processed and standardized to ensure consistency and efficacy in the final product. The incorporation of film-forming agents and mucoadhesive polymers facilitates the formation of a protective barrier over the wound site, promoting moisture retention, preventing microbial contamination, and accelerating the healing process. Stability assessments under various storage conditions ensure the maintenance of product efficacy and quality over time, essential for widespread clinical use. In vitro and in vivo studies are conducted to evaluate the biocompatibility, antimicrobial activity, wound closure kinetics, and tissue regeneration potential of the herbal film-forming sprays. In conclusion, the design and development of herbal film-forming sprays represent a promising approach in wound healing therapy, combining the synergistic effects of traditional herbal medicine with modern pharmaceutical innovation. By harnessing the therapeutic potential of natural compounds and advanced formulation techniques, these sprays offer a safe, effective, and patient-friendly alternative for promoting wound healing and tissue repair in diverse clinical settings.

KEYWORD: Selection of herbal extract, film-forming agents, mucoadhesive polymers, development.

EVALUATION OF FRUITS BASED PROBIOTIC DRINK (FRU-BIOTIC)"

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ABSTRACT

This research report focuses on the production and evaluation of a probiotic beverage using citrus fruits and the probiotic bacteria Lactobacillus casei Shirota. The objective was to investigate the viability of Lactobacillus casei Shirota in a citrus-based medium, evaluate sensory quality, and assess probiotic activity of the resulting beverage. Citrus fruits are known for their health benefits due to antioxidants, vitamins, and minerals they contain, making them a suitable choice for functional beverages. Lactobacillus casei Shirota, a well-known probiotic strain, was explored for its potentialin a citrus medium. The study evaluated the impact of various citrus fruit juices on bacterial growth and survival, as well as optimized fermentation conditions. Orange juiceshowed the highest viable cell numbers, indicating its suitability for the growth and survival of Lactobacillus casei Shirota. To refine the production process, ideal fermentation parameters were identified. A temperature of 37°C, pH of 5.5, and fermentation period of 24 hours yielded the best results for creating the probiotic beverage. These conditions provided an optimal environment for the growth and activity of Lactobacillus casei Shirota in the citrus medium. However, further research is needed to explore the stability and shelf-life of the beverageunder different storage conditions. By combining the health-promoting properties of citrus fruits with the probiotic benefitsof Lactobacillus casei Shirota, this research opens up new possibilities for the development of functional beverages that support both gut health and overall well-being.

Keywords:

Citrus Fruits, Lactobacillus Casei Shirota, Fermentation, Probiotic.

Hydrogen and Ammonia: The Renewable Future

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ABSTRACT

As the demand for clean and sustainable energy sources increases rapidly, green hydrogen and ammonia have become increasingly popular low-carbon sources and an important part of the green energy transition. However, production and storage problems hinder its widespread use. The aim of this study is to provide an overview of the latest technologies for hydrogen and ammonia production and storage. This deals with the synthesis and storage of hydrogen and ammonia. We explore new technologies in the fields of electrolysis, reforming, C-ZEROS, HYSATA, DAE, sulfide, SRBW, etc. and new storage technologies such as solid storage, plasma kinetics and POWERPASTE. This article examines the history of ammonia production and discusses newer, more sustainable technologies for ammonia production, such as electrical and biological methods. The study will also explore how artificial intelligence (AI) and additive manufacturing (AM) can be used to convert hydrogen and produce green ammonia, focusing on new innovations in design, AI-assisted animation and 3D printed reactors.

KEYWORDS:

Hydrogen generation, hydrogen storage, ammonia production, artificial production, artificial intelligence

Biocompatible Materials & Technologies For Enduring Growth

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ABSTRACT

One of the most studied subjects these days is Green Chemistry. Green chemistry study endeavours to minimize or eliminate the creation of detrimental byproducts while optimizing the intended product in an environmentally sustainable manner. To reduce the harm caused to the environment by the manmade materials and processes used to manufacture, green chemistry is necessary. Green chemistry is the study that results from scientific findings regarding effluence responsiveness. 12 principles make up "green chemistry," which reduces or completely does away with the use of toxic substances in manufacturing or use. With the useful idea of green chemistry, scientists and chemists can greatly reduce the risk to human health and the environment. The use of environmentally friendly, safe, and repeatable chemicals can help realize the goals of green chemistry. The use of harmless, reproducible environment-friendly solvents and catalysts in medical manufacturing and research can help achieve the goals of green chemistry. Green chemistry could involve anything from reducing waste to safely disposing of waste. The best approach should be taken to dispose of any chemical waste to not harm the environment or other living things. A few examples of applying the concepts of green chemistry to everyday activities are shown in this article.

KEYWORDS

Man-made materials, Environment Friendly, Toxic Substances, Catalysts.

Formulation And Evaluation Of Oro- Dispersible Zolmitriptan Film

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ABSTRACT:

Oro-dispersible films (ODFs) offer a promising drug delivery system for patients who experience difficulty swallowing conventional tablets. This study aimed to formulate and evaluate an oro-dispersible film containing zolmitriptan, a selective serotonin receptor agonist used in the treatment of migraines. The formulation process involved selecting suitable film-forming polymers, plasticizers, and disintegrants to ensure rapid disintegration and dissolution of the film upon contact with saliva. Various concentrations of hydroxypropyl methylcellulose (HPMC), Polyethylene glycol (PEG), and cross carmellose were evaluated to optimize film properties such as mechanical strength, flexibility, and disintegration time. Method used for preparation oral fast dissolving film was solvent casting method.In this study, factorial design was used to optimize the concentrations of the film forming polymer (HPMC), super disintegrant (CROSSCARMELLOSE). Three factors, two levels (2^3) full factorial design was used to evaluate their effects on fast dissolving oral films disintegration time and % elongation. The effect of these formulations variables was investigated for the optimized formula. Physicochemical characterization of the formulated films was conducted using techniques such as Melting point study and UV-visible spectrophotometric method to assess compatibility between the drug and excipients. The results indicated no chemical interactions that could potentially compromise drug stability or efficacy. Furthermore, the developed formulations underwent organoleptic evaluation, including taste masking assessment, to ensure patient acceptability. Flavoring agents such as mannitol and artificial sweeteners were incorporated to improve palatability and mask any unpleasant taste of the drug.

KEYWORDS: Oro-dispersible films, UV light, Optimisation, tablet.

Nanorobots: Advances In Targeted Drug Delivery Systems

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ABSTRACT

Nanorobotics is the technology of creating machines or robots at or close to the scale of a nanometre (10-9 meters), machine constructed at the molecular level (nanomachines) may be used to cure the human body of its various ills. This application of nanotechnology to the field of medicine is commonly called nanomedicine. Nanotechnology promises futuristic applications such as microscopic robots that assemble other machines or travel inside the body to deliver drugs or do microsurgery. Taking inspiration from the biological motors of living cells, chemists are learning how to utilize protein dynamics to power microsize and nanosize machines with catalytic reactions. Nanorobotics toolkit contains features like medicine cavity containing medicine, probes, knives and chisels to remove blockages and plaque, microwave emitters and ultrasonic signal generators to destroy cancerous cells, two electrodes generating an electric current, heating the cell up until it dies, powerful lasers could burn away harmful material like arterial plaque. To cure skin diseases, a cream containing nanorobots may be used which remove the right amount of dead skin, remove excess oils, add missing oils, apply the right amounts of natural moisturizing compounds, and even achieve the elusive goal of deep pore cleaning, other fields of applications are to clean the wounds, to break the kidney stones, to treat gout, for parasite removal, for cancer treatment, treatment of arteriosclerosis.

KEYWORDS

Nanorobotics, Microsurgery, Nanomachines, Ultrasonic signals, Microwaves, Gout, Arteriosclerosis.

POSTER SESSION – 3

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

Session Chair

Dr. Vipul Dabhi

Session Co-Chairs

Dr. Jignesh Bhatt

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AI-Based Quiz Generation Using Chatgpt

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ABSTRACT

These days, solving issues in the real world depends heavily on artificial intelligence (AI). More individuals desire more effective methods for creating quizzes with the useful educational quiz generation tools. The goal of this research study is to make quiz creation easier, particularly for teachers and other individuals who require self-evaluation. Also, this research study identifies areas for improvement by examining existing approaches and their shortcomings. The proposed system generates dynamic quizzes using ChatGPT's LLM (Large Language Model). Through the use of AI, the system enables users to personalize quizzes according to particular criteria including topic, difficulty level, question type, and number of questions. Teachers save time with this method, which also guarantees the relevance of the questions provided. Students can also evaluate themselves on their own. Reducing the possibility of paper leakage and enabling effective result analysis are further ways that the system supports academic integrity. We highlighted how AI-driven solutions may improve teaching and learning experiences in education through our research study.

KEYWORDS

Artificial intelligence • quiz generation • education • self-assessment • Chat GPT • dynamic quizzes • customization • academic integrity • teaching and learning experiences

Review On Sun Trailing Solar Panel System For Improving Energy Efficiency

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ABSTRACT

This extensive review study, which is based on the open-loop idea, critically analyse the Automatic Sun Tracking Solar Panels' design, operation, and applications. The main goal is to present a thorough review of the solar tracking systems that are currently in use, highlighting their role in optimizing solar energy use for effective electrical energy conversion. The open-loop technique, as first investigated in the cited study, aims to maximize power output through solar panel alignment perpendicular to the sun's rays, a method that improves absorption of sunlight. The review carefully examines the technical nuances of sun tracking systems, assessing how well they work to pinpoint the sun's coordinates and automatically modify the position of the solar panel. Comprehensive insights into the effectiveness and dependability of these systems are provided by a thorough analysis of the advantages, difficulties, and constraints related to them. The open-loop system's capacity to function consistently in different environmental situations is demonstrated by its independence from sun radiation intensity. The analysis also looks at how these solar tracking devices might be incorporated into nearby towns, especially in conjunction with huge battery banks. With this connection, communities may autonomously meet their energy needs while also presenting a sustainable and eco-friendly energy option. This review's main objective is to shed light on the ways in which these technological developments support the wider use of solar power systems, encourage the broad use of renewable energy sources, and create a more sustainable and environmentally friendly future.

KEYWORDS

Sun tracking, Solar panel, Solar energy, Electricity generation, Environment friendly, Battery, Open loop, Everlasting, Decentralized.

Pinnacle Of Sustainability: Orchestrating Perovskite Solar Cell Excellence Through Enhanced Stability, Environmental Stewardship And Cutting-Edge Hybrid Applications.

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ABSTRACT

In the field of photovoltaics, perovskite solar cells (PSCs) have become a revolutionary impact, providing a strong substitute for conventional solar cell technologies. Perovskite materials, which are distinguished by their distinct crystalline structure, have remarkable light-absorbing capabilities and offer a platform for very efficient solar energy conversion. PSCs' intrinsic benefits include high efficiency, low-cost fabrication processes, tunability, flexibility, transparency and potential for a wide range of applications. The perovskite solar cell (PSC) technology is explored in this study and review work, with an emphasis on significant developments for sustainable development. After providing a thorough introduction to PSCs, we explore their improved stability mechanisms and the complexities of material engineering and encapsulating techniques to increase operational lives. This study delves into the necessity of ecological consciousness for PSCs, evaluating the effects on the environment and suggesting sustainable solutions for a more sustainable future. Additionally, the study explores PSC hybrid applications, presenting creative methods for smooth integration into various energy systems. This work seeks to advance PSCs towards a sustainable approach by fusing fundamental knowledge with innovative advancements, with a focus on stability, environmental responsibility, and adaptable hybrid applications in the search for clean energy solutions.

KEYWORDS

Improved Stability, Encapsulating techniques, Operational lives, Ecological consciousness, adaptable hybrid applications

Comparative Analysis Of Deep Learning Algorithms Used For Tomato Leaf Disease Detection.

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ABSTRACT

India is the second biggest exporter of tomatoes and it is also the most popular crop in the world but due to unseasonal rain, climate change, and other reasons the production of tomatoes is going down in India. It is crucial to diagnose and identify these diseases. identification of early-stage tomato leaf diseases accurately helps to use the proper fertilizer for the particular tomato leaf diseases and stop these diseases as fast as possible.There are various categories of tomato leaf diseases that harm these tomato leaves on a very large scale like Late Blight, Bacterial Spot, Early Blight, Septoria Spot, Mosaic Virus, etc. We are using machine learning and deep learning algorithms to identify tomato leaf disease and also classify it. Already there are lots of models available for identifying the object that is used for the detection of tomato leaf disease. We compared several pre-trained Convolutional Neural Networks (CNNs): InceptionV3, VGG16, and others, to determine their suitability for tomato leaf disease detection. We leveraged a Kaggle dataset containing over 10,000 images representing 10 classes: 9 different diseases and healthy leaves.we have Implemented InceptionV3 and it gives us 99.66% accuracy and 87.80% val_accuray on adm optimizer.

KEYWORDS

Tomato, Disease, Machine Learning, CNN, InceptionV3, VGG16, Detection.

Skin Disease Classification Using Machine Learning

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ABSTRACT

Skin diseases are reported to be the major global health problem associated with the number of people. Diagnosis of these skin diseases is the most ambigious and complicated branch of medical science. Thus, skin disease recognization and classification is a major challenge looked by the medical science industry. Recently, Artificial Intelligence science has been used for diagnosing of skin disease with the help of computer vision and machine learning algorithms using the vast number of data available from clinics, health centres and hospitals. We use Skin Disease Dataset from Kaggle which consist of 8 different skin-disease classes with 1159 images in it. We perform a comparative study by applying different machine learning models on the dataset. We used algorithms like Resnet50, VGG16, SVM, KNN, Random Forest algorithms. The study provides the clear comparison between the algorithms in which VGG16 leads to the highest accuracy of greater than 94%.

KEYWORDS

Machine learning, Skin-disease recognization and classification, dataset, extraction algorithms, VGG16 algorithm

Youtube Comment Analyzer With NLP

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ABSTRACT

The exponential growth of textual information, particularly in the context of YouTube comments, underscores the need for effective sentiment analysis using machine learning (ML) and natural language processing (NLP) techniques. This is especially pertinent for content creators, where understanding the sentiment of their YouTube family's comments is crucial for engagement and community interaction. Furthermore, in a country like India, where 67% of users communicate in local languages. sentiment analysis becomes challenging. We have used 100,000 comments data available in Kaggle in English, Hindi, Gujarati languages. We preprocess the data using NLP techniques. On the cleaned data we applied well known supervised learning models to generate sentiment analysis out of it. We also provide analysis and finding on results of all ML models we used. The main focus of our work is to apply sentiment analysis to Gujarati textual data.

KEYWORDS

Textual Information, Sentiment Analysis, NLP, Pre-Processing, Supervised Learning Models

RTL-to-GDS Implementation of a High-Speed On-Chip 32:1 Serializer using Open-Source Tools

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ABSTRACT

Exploring the RTL-to-GDS implementation of a high-speed on-chip 32:1 serializer, this study investigates the integration of open-source tools within VLSI design, emphasizing sustainable practices in the semiconductor industry while operating at the nanometer scale. Addressing methodologies for optimizing power consumption and chip area utilization, particularly focusing on efficient use of non-renewable resources, the study is set against the backdrop of advanced 7nm FinFET technology, critical for enabling efficient data transmission in modern System-on-Chip (SoC) architectures. The paper intricately delineates the journey from RTL description to physical layout, harnessing the capabilities of Yosys and OpenROAD, prominent open-source tools, in conjunction with the ASAP7 Process Design Kit (PDK). The design achieves optimization in key performance metrics such as power dissipation and chip area utilization, while achieving a remarkable data transmission rate of 6.8 Gbps. Through meticulous experimentation and analysis, this implementation not only showcases the effectiveness and adaptability of open-source tools in contemporary semiconductor design but also underscores their potential to democratize access and drive innovation in IC development workflows.

KEYWORDS

VLSI design flow, Serializer, Open-source tools, RTL-to-GDS flow, 7nm technology

Study Of The Implementation Of Green Chemistry In Hydrogen Production

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ABSTRACT

The present study contributes to the development of implementation of Principal's of Green Chemistry in different methods of Hydrogen production. The study employs the 12 principal of Green Chemistry which includes Prevention of waste, Atom economy, Less hazardous chemical synthesis, Designing safer chemicals, Safer solvent and auxiliaries, Design for energy efficiency, Use of renewable feedstock, Reduction of derivatives, Catalysis, Design for degradation, Real-time analysis for pollution prevention, Inherent safer chemistry for accident prevention. By applying these principles to different hydrogen production methods, researchers and engineers can contribute to the development of more sustainable and environmentally friendly processes for producing hydrogen, supporting the broader goals off green chemistry. The research Poster aims to provide critical insight about implementation of green chemistry in five type of hydrogen production. This includes following methods: Steam methane reforming, Electrolysis, Hydrocarbon pyrolysis, Thermochemical water splitting, Photoelectrochemical water splitting. The goal is to minimize the impact of chemistry on human health and the environment.

KEYWORDS

Principal's of Green Chemistry, Different methods of production of Hydrogen.

Noise-Resilient QPSK Modem For Green Communication Systems

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ABSTRACT

This paper introduces a noise-free algorithm for QPSK demodulation, addressing a critical challenge in the realm of communication systems. The interference of noise in received signals significantly degrades the performance of the demodulation process. In this work, an innovative approach is presented wherein predicted and stored sampled values for noisy signals enable precise comparisons with received noisy signals. The proposed algorithm is implemented using the Verilog language and synthesized with Altera Quartus Prime Lite Edition, as well as validated through simulations using ModelSim Simulator. The performance of the algorithm is rigorously assessed, demonstrating its effectiveness through comprehensive Bit Error Rate (BER) measurements across various Signal-to-Noise Ratios (SNRs). The approach is subjected to chip-level evaluations for both Conventional and Noise-Proof QPSK MODEMs using the OpenROAD EDA tool. These real-world tests affirm the robustness and practicality of the demodulation methods, even in the presence of substantial noise. Remarkably, the implementations are validated using open-source process design kits (pdks), specifically Skywater SKY130HD, achieving a maximum operating frequency of 533MHz.

KEYWORDS

Power Efficient, Digital Modulation, MODEM, AWGN and Verilog

Energy-Efficient Image Classification On Edge Devices: Implementation And Evaluation

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ABSTRACT

This paper presents the implementation of real-time image classification for edge devices, focusing on the utilization of Deep learning methods for efficient processing. The study employs the GPU enabled board, known for its capabilities in visual computing tasks, to execute the Convolution Neural Network based classification algorithm. GPU-based deep learning accelerates image analysis by extracting features and building neural networks, enhancing efficiency in processing both static and real-time data. The inherent efficiency of edge devices, coupled with GPU acceleration, demonstrates the potential for robust image classification in real-world applications. Two distinct classification tasks are explored: dual-class classification of cats and dogs, and multi-class classification involving various animals and automobiles.

KEYWORDS

GPU, Deep Learning, Convolution Neural Networks

Optimizing Image Processing: Energy-Efficient Algorithm Implementation

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ABSTRACT

Digital image processing plays a big role in many things we use, like medical scans, camera filters, and even social media. In this context, the present project endeavours to contribute to the advancement of image processing by implementing both point-to-point and convolution-based algorithms. The paper's unique contribution lies in its hardware structure, which employs a three-stage pipelining approach for image processing. In the first stage, the algorithm fetches pixel values, followed by the second stage, which carries out the necessary operations on these values. Finally, the third stage involves writing the processed data to designated memory locations. The inherent parallelism and optimized hardware implementation result in faster and more efficient image processing, making it imperative to explore and develop such hardware-based solutions in the realm of digital image processing.

KEYWORDS

Pipelining, Convolution, Verilog HDL

Performance Analysis Of Schmitt Trigger Circuit For A Noise Free Chip

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ABSTRACT

Due to lower node CMOS technology, noise within a chip increases due to drastically increment in interconnects in a given area. To improve noise immunity of a chip, as a buffer schmitt trigger circuit is used instead of simple CMOS inverter at various interval along the metal interconnect. Use of schmitt trigger circuit not only make chip noise immune but at the same time increases speed of operation. The different topologies of schmitt trigger circuits like 4T, 6T and 6T with body bias are implemented and analysed on the basis of Speed, Area, Power and Hysteresis. Since there is a trade off between such parameters, Figure of Merit is determined and the best one will be chosen as per requirement. The schmitt trigger circuit is also used in IO pads available surrounding the chip and in a bidirectional bus as a tristate buffer in a communication system. The 6T body bias schmitt trigger found best choice for bidirectional bus due to its lower power and optimum hysteresis voltage.

KEYWORDS

Schmitt Trigger, Hysteresis, Buffer, body bias, Noise Margin

Health Monitoring and Predictive Maintenance of DC Motor

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ABSTRACT

The health monitoring of induction motor is a technology which involves the measurement of machine during operating condition like temperature rising, burning of winding, over current, over voltage etc. Predictive maintenance is the way to improve asset management in every manufacturing industry, while handling advance costlier machinery in the industry, the predictive maintenance knowledge will be essential to protect the machinery before gets degradation performance. Nowadays the maintenance of AC or DC motor is most common requirement in industries. Routine maintenance is essential to reduce plant downtime which is costly in any manufacturing facility. The goal of our device which is connected to motor is to calculate the run time values and continuously compare these values with standard values of motor. Using vibration, current and temperature sensor, we can predict the values. If the values are exceeds the limits then VI developed in LabVIEW will pop-up a message. This can determine a fault for an overhaul or replacement of motor. We can easily connect this wireless device to AC or DC motor. This maintenance programs is to reduce maintenance cost by detecting problems early which allows for better planning and less expected failure. The use of DC motor is done in a maximum way, to avail advantages of high starting toque, preferably in crane applications.

KEYWORDS

DC Motor, Predictive maintenance, Health monitoring, VI Developed

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