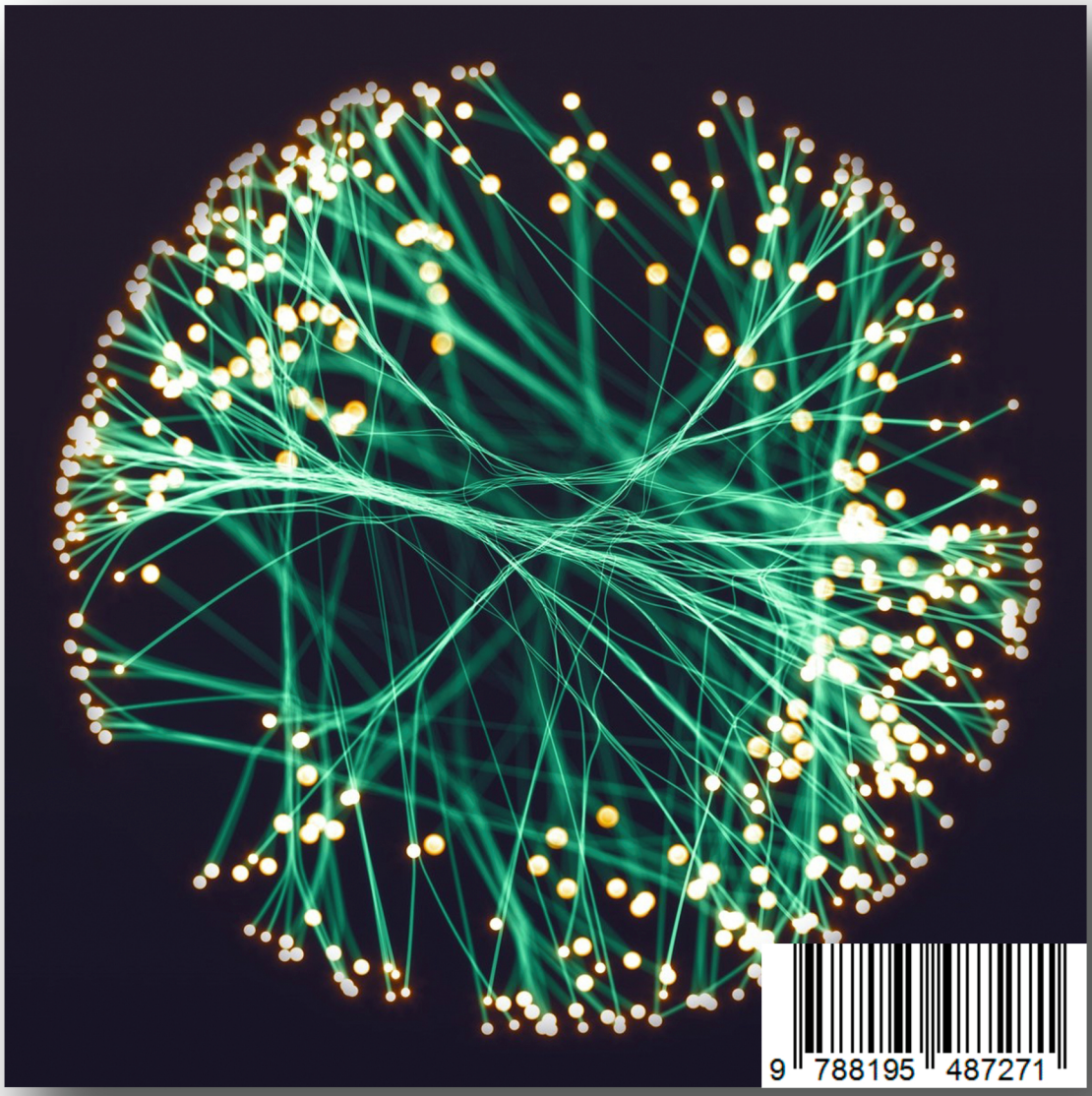

PROCEEDINGS OF

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Message

It is my privilege and honor to extend my warmest greetings to all of you through this message for the souvenir of the 2nd International Conference on Water, Energy & Environment. This exceptional event was orchestrated by the ISET Research India Society and Co-Organizing with Maejo University, Thailand, and Saigon University, Vietnam. We convene under a theme of utmost importance — the sustainable management of our natural resources, a defining challenge in our contemporary world. This conference is a testament to our collective dedication to confronting these pivotal issues, fostering an environment of meaningful dialogue, and driving the momentum for positive change.

I sincerely thank the organizers for their unwavering commitment to orchestrating this gathering. To each participant, your expertise and perspectives are invaluable, contributing significantly to our shared understanding and motivating us toward actionable strategies for sustainable resource management. I hope our virtual discussions will pave the way for innovative solutions, forge impactful collaborations, and strengthen our united commitment to preserving our environment and resources. I thank you all for your active participation in this conference. Your involvement is integral to the success of our shared mission, and I am filled with anticipation for the promising outcomes that will emerge from our collaborative efforts.

Warm regards,

(Weerapon Thongma)

President, Majeo University, Chiang Mai, Thailand

MESSAGE

It is with immense pleasure that I extend a warm welcome to each one of you joining us at the 2nd International Conference on Water, Energy and Environment (WEECON 2023). This conference stands at the nexus of critical global challenges, addressing the interconnected themes of Water, Energy and Environment, which currently face pressing quality issues on a worldwide scale.

Recognizing the pivotal role of Water, Energy, and Environment in driving development, it becomes imperative to prioritize these aspects for ensuring healthier lives and fostering overall well-being. These commitments align closely with the Sustainable Development Goals outlined by the World Health Organization, specifically SDG6, SDG7 and SDG15.

WEECON 2023 serves as a pivotal platform for deliberating upon the present landscape and shaping the future trajectories concerning Water, Energy and Environment. The conference aims to convene leading academicians, practitioners, educators, policymakers, social workers, and other professionals deeply invested in these crucial domains. Expect a global gathering enriched with distinguished speakers, insightful presentations, engaging panel discussions, and invaluable networking opportunities.

The success of WEECON 2023 owes a debt of gratitude to the dedication of numerous volunteers. I extend my heartfelt thanks to our esteemed Conference Chair, Prof. Weerapon Thongma, along with Co-chairs Dr. Yuwalee Unpaprom and Dr. Anantha Raman Lakshmipathi, as well as Organizing Secretary Dr. Deepanraj Balakrishnan and the diligent technical committee members who meticulously peer-reviewed and selected the presented papers. Their outstanding efforts promise an exciting and fruitful program for WEECON 2023. I would also like to acknowledge the silent yet invaluable contributions made by other key members, without which this conference wouldn't have been possible.

Lastly, I express gratitude to the authors who have chosen WEECON 2023 as the platform to showcase their research and to all the participants. May this event serve as a catalyst, fostering robust interactions among researchers and providing an enriching forum for the exchange and evolution of new ideas in the rapidly evolving realm of distributed Water, Energy, and Environment engineering.

Thank you immensely for your participation and contribution.

Assoc. Prof. Dr. Bui Manh Ha,
Co-Chair, WEECON 2023,
Saigon University, Vietnam.

MESSAGE

I am honored to serve as the co-chair for the 2nd International Conference on Water, Energy & Environment (WEECON 2023), organized by ISET Research India in association with Maejo University Thailand & Saigon University Vietnam. ISET Research, dedicated to gathering diverse scholars, provides an outstanding opportunity for students, academics, and industry researchers to share experiences and knowledge.

The overarching aim of WEECON is to bring together leading academic scientists, researchers, and scholars to exchange insights and research results on all aspects of Water, Energy, and Environment. It serves as a premier interdisciplinary platform for discussing the latest innovations, trends, and practical challenges encountered in these vital fields.

This conference brings together leading academicians, practitioners, educators, policymakers, and professionals for a global gathering with renowned speakers, presentations, panel discussions, and valuable networking opportunities. I express gratitude to the volunteers and key members who have contributed significantly to the organization of WEECON 2023, making it an exciting program.

I extend heartfelt congratulations to the WEECON 2023 organizing committees for their dedicated efforts in ensuring the success of this conference. My best wishes go out to all participants, and I hope this conference fosters fruitful intellectual discussions during and after the event.

Asst. Prof. Dr. Anantha Raman L.,
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BAYESIAN STATISTICAL ANALYSIS OF THE INFLUENCE OF ENVIRONMENTAL FACTORS ON THE OCCURRENCE AND PROLIFERATION OF MICROCYSTIS IN EUTROPHIC WATER BODIES

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Abstract: To elucidate the environmental factors that influence cyanobacterial growth, we conducted Bayesian statistical analysis on water body survey data. The surveys were carried out for mainly eutrophic ponds in Nagasaki Japan and Northern Thailand. Bayesian statistics can pull out the meaningful information from the limited data set. The copy number of PC gene and mcyB gene, which are surrogate data sets of cell densities of total Microcystis (toxic + non-toxic) and toxic Microcystis, respectively. Both genes were simultaneously quantified by a duplex-real-time PCR method by. using a mixture of both specific primers and Taq-man probes with different dyes. Since zero values in copy number of these genes were frequent in survey data of ponds, namely zero-inflated data, Bayesian hurdle-Poisson model, which is a combination of logistic regression and Poisson regression, is a suitable statistical model for such zero- inflated data. Stan software package was applied for Monte Carlo Markov Chain (MCMC) calculation to estimate the posterior probabilities in parameters in the model under the non-informative prior probabilities. We succeeded the probabilistic prediction of the occurrence and proliferation of total Microcystis and toxigenic Microcystis from trophic state index (TSI), rain fall and ambient temperature. Furthermore, it was revealed that toxigenic Microcystis was lower probability in proliferation in higher temperature condition than non-toxic Microcystis. This result is useful to consider on the risk of toxic Microcystis under climate change.

Keywords: *Microcystis, cyanobacterial growth*

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FLOODPLAIN CONNECTIVITY AND ITS INFLUENCE ON FISH SPECIES DIVERSITY IN THE CHAO PHRAYA RIVER, THAILAND

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Abstract: Floodplains are transitional areas between terrestrial and aquatic ecosystems, known as riparian ecotones. They are highly biodiverse and productive parts of aquatic ecosystems. This study conducted freshwater fish habitat surveys in various water bodies in the middle reaches of the Chao Phraya River in Thailand, with varying flood frequencies, to investigate the relationship between floodplains, floods, and fish diversity. The study results indicate a significant correlation between fish diversity and the floodplain area surrounding the study sites. This correlation is particularly strong in permanent water bodies like rivers and lakes, suggesting that the diversity of fish species is positively influenced by the connection with other water bodies due to flooding and the size of the floodplain. River comparisons indicate that the absence of riparian floodplain habitat may restrict floodplain-dependent fish species in the main river of the Ping River, where flood inundation is less frequent. This study utilized hydraulic analysis to reconstruct the floodplain environment that would exist in the absence of the major large dams in the basin, namely Bhumipol and Sirikit dams. The relationship between the timing of inundation initiation, duration, water depth, and fish diversity at each fish study site was analyzed using the hydraulic analysis model. MaxEnt was then used to predict the potential distribution of species on the map. It has been estimated that the dam's current flood control effect has resulted in a loss of species distribution of approximately 120,000 species x m2 in the target area.

Keywords: *Floodplains, Chao Phraya River*

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DC–DC CONVERTER USING COUPLED INDUCTOR FOR RENEWABLE ENERGY APPLICATIONS

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Abstract: In this paper, a novel high step-up DC-DC converter that utilizes a coupled inductor configuration is developed. This innovative converter offers several key advantages, including an exceptionally high voltage gain, reduced voltage stress on the power switches, and a consistent input current with minimal fluctuations. These features make the proposed converter particularly well-suited for applications in renewable energy systems. By incorporating a clamped circuit, the proposed converter effectively limits voltage spikes during the switch turn-off process. This design allows for the use of switches with low switch ON resistance, leading to decreased conduction losses and a more cost-effective converter solution. Additionally, the energy stored in the leakage inductance is used to enable zero voltage switching (ZVS) for both the primary and auxiliary switches. Another benefit of this approach is that it controls the rate at which the output diode current decreases, mitigating the challenges associated with reverse-recovery in the diode. The article covers a comprehensive analysis of the converter steady-state behavior and discusses important design considerations. To validate the theoretical analysis and to demonstrate the converter performance, a practical 50-W prototype is developed. The proposed high step-up DC-DC converter presents an effective solution for achieving efficient energy conversion in renewable energy applications.

Keywords: *Clamp circuit, continuous input current, high voltage gain, zero voltage switching.*

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DEVLOPMENT OF WASTE WATER PURIFICATION AND RECIRCULATION SYSTEM

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Abstract: The waste water purification and recirculation system project aim to design and construct a plant that can purify and recirculate wastewater for reuse. The system includes screening, layers of alum, marbles, charcoal and cotton processes to remove impurities from the wastewater. The purified water is then recirculated for reuse, which conserves water resources and reduces pollution. The project can be implemented in various settings, such as industries, residential areas, and agriculture, and it offers benefits such as cost savings on water bills and a reduction in the negative impact of untreated wastewater on the environment. Overall, the waste water purification and recirculation system project are a sustainable solution to address the growing problem of water scarcity and environmental pollution.

Keywords: *Screening, recirculation, Coagulant, Purification.*

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ALGAE BASED BIOLIPID: A SUSTAINABLE SOURCE OF BIOENERGY GENERATION

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Abstract: The need for sustainable and eco-friendly bioenergy sources is becoming increasingly important due to the growing global demand for energy and mounting concerns over climate change and dwindling fossil fuel resources. Bioenergy is one of the many diverse resources available to help meet our demand for energy. Algae-based biolipids, derived from diverse microalgae species, offer a promising solution for sustainable and eco-friendly bioenergy sources. This paper provides a concise overview of the potential of algae-based biolipids as a sustainable bioenergy source. Microalgae, as photosynthetic microorganisms, demonstrate significant potential for biolipid production. These lipids, mainly triacylglycerols, can be efficiently converted into biofuels like biodiesel and bioethanol. This paper underscores the advantages of algae-based biolipid production, including higher oil yields per unit area compared to traditional oilseed crops, rapid growth rates, and year-round cultivation potential. Furthermore, algae-based biolipid production holds immense promise, addressing challenges like cost-effective harvesting, lipid extraction techniques, and efficient strain selection and genetic modification is essential for realizing its full potential. Overall, algae-based biolipids presents a promising and sustainable bioenergy source with the potential to reduce greenhouse gas emissions and decrease dependency on fossil fuels.

Keywords: *Algae-based biolipids, Biolipid production, Triacylglycerols, Greenhouse gas emissions, Sustainable cultivation practices.*

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A SUSTAINABLE APPROACH FOR USE OF FRUIT POMACE FOR THE DEVELOPMENT OF FOOD SPOILAGE INDICATOR FILM

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Abstract: Advanced technologies are indispensable within the food processing industry for ensuring the quality and safety of food products. Monitoring the quality of milk at collection centres or milk booths presents unique challenges, primarily due to the diverse origins of vendors, making it a complex task. The study focuses on a system which is economic, reliable and dependable to determine milk quality. Therefore, a biopolymer indicator film having pH sensing property was developed. A carrageenan indicator film was prepared by incorporating anthocyanin extract in various proportions such as 1.5%, 2.5% and 4%. The change in film characteristics with respect to change in pH was studied. FT-IR, SEM, physical studies, mechanical properties were studied for the developed indicator film. The authenticity of film was studied by exposing the indicator film to fresh and spoilage milk. The change in colour of the indicator film proved to be a potential pH sensitive indicator film to detect spoilage.

Keywords: *Fruit pomace, anthocyanin, pH indicator, food spoilage.*

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EXPERIMENTAL INVESTIGATION OF EPOXY POLYMER COMPOSITE REINFORCED WITH NATURAL FIBERS AND MWCNT

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Abstract: Natural fibre have many objectives including renewability, less abrasiveness to equipment, biodegradability, high specific strength, low cost, non hazardous in nature, non corrosive and manufacturing flexibility. The main drawback of using natural fibre reinforced composite is that they will be producing lesser strength when compared to synthetic fibre based composites. For enhancing the strength of areca fibre based composites we are incorporating Multi Walled Carbon Nano Tubes (MWCNT). For further strengthening the areca fibre composite , alkali treatments are being done. The commonly used alkalies are NaOH and benzyl chloride The methodology used for fabrication is compression moulding technique. Compression moulding technique is relatively a simple process involving pressing, squeezing, deformable material charge between two halves of a heated mould and its subsequent transformation into a moulded part after cooling or curing. The natural fib – MWCNT mixture is prepared by adding epoxy resin, hardener, NaOH pellets etc. Then the mechanical, morphological, tribological, thermal characterstics are measured accordingily by using various experimental setups. This mixture composite is aimed to do an impact on the automobile industry as we are planning to do either fabricate a crankcase model or a chain cover by using this new material. The main advantage of this new material is lightweight and its low in price.

Keywords: *Natural fibre , Epoxy resin, Hardner, Morphology.*

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TO STUDY AND SIMULATE UNIDIRECTIONAL GRID CONNECTED SOLAR PV SYSTEM FOR SOLAR WATER PUMP

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Abstract: This study presents an innovative solar photovoltaic (SPV) water pumping system that uses an intelligent power-sharing design and an induction motor drive (IMD). The system includes a DC-DC boost converter that facilitates power transfer between the SPV array and the IMD and acts as a power factor correction unit and grid interface device. The study uses an incremental conductance-based maximum power point tracking control technique to optimize the SPV array's use. To keep synchronization with the voltage source inverter, a simple voltage/frequency control technique is used for IMD control. The performance of the system is verified using MATLAB simulation and hardware prototype. In addition, the research outlines future enhancements, as the project is designed to incorporate automation through the use of temperature sensors and moisture sensors. This automation is expected to further enhance the system's efficiency, highlighting its potential as a sustainable and practical energy solution.

Keywords: *Solar photovoltaic, Water pumping, Power sharing Induction motor drive, Maximum power point tracking, DC-DC boost converter , Grid integration, Renewable energy, Energy conversion, Sustainability.*

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A TYPICAL REVIEW ON THE PROPERTIES AND ENHANCEMENT OF INDIAN STANDARD NATURAL RUBBER 5 (ISNR 5)

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Abstract: Indian Standard Natural Rubber 5 (abbreviated as ISNR 5), an Indian made block rubber, derived by Hevea Brasiliensis Tree has recently proven its extraordinary properties when some natural and synthetic materials are added as reinforcements. It is expected that addition of natural materials (such as biofiber from aquatic plants, Cardanol, Crumb rubber, and Short Coir Fiber) and synthetic materials (such as Nano Titania, Styrenated Phenol Modified Nanosilica, PEG, and PET) as reinforcements enhances its mechanical and physical properties as well as its rheological properties. Improved tensile strength, elongation at break, tear resistance, and abrasion resistance are some of these modifications. The improved stability and durability of the modified natural rubber also make it appropriate for a variety of uses in the building, automotive, and textile sectors. Some of the benefits of processing this kind of natural rubber into blocks similar to synthetic rubbers are that it is cost-effective and technically certified rather than visually graded, as in the case of RSS and crepe grades of natural rubber, consistency in quality, compact packaging, and low contamination in handling and transportation. This paper gives a brief portrayal of the different types of modifications that can be made to natural rubber and their impact on its properties. It also highlights the potential applications of modified natural rubber in various industries and emphasizes the importance of these advancements in enhancing the performance and longevity of rubber-based products.

Keywords: *Natural Rubber, Cardanol, Styrenated Phenol modified silica, Physical properties, Rheological properties.*

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LIGHTWEIGHT AND THIN WITH HIGH-FREQUENCY PERFORMANCE MICROWAVE ABSORBING HETEROSTRUCTURE CARBON DERIVED FROM ASHOKA-LEAFS ASH

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Abstract: In today's world, there is a significant focus on addressing acute electromagnetic pollution and developing efficient stealth materials. This involves extensive efforts to create high-performance microwave absorption materials (MAMs), with a strong emphasis on sustainability and eco-friendliness. To contribute to proper waste and agriculture waste management, a recent study introduces a novel approach using carbonized leafs as single-layer microwave absorbers made from Ashoka-leafs Ash (AA).These absorbers are extremely slim and lightweight, with a thickness of just 0.5 mm. They have a weight ratio of 1:1 when combined with paraffin wax, and they are engineered to perform efficiently within the high-frequency range of 27- 40 GHz (Ka-band). This frequency range is also pertinent to 5G communication technology. The absorbing characteristics of this substance are affected by the greater surface area resulting from the heterostructure. This, in turn, leads to an increase in its capacity for losses, dielectric constant, and conductivity. Consequently, it improves its efficiency in absorbing microwaves. The outcomes reveal that the material attains an impressive reflection loss value of - 45 dB at 34 GHz, with a thickness of 0.5 mm, corresponding to a high attenuation constant and an absorption rate of 99.99%.This exceptional performance suggests that the proposed microwave-absorbing material could be utilized in the development of military, anechoic chambers and low-cost stealth materials. Notably, these results outperform many other carbonaceous materials derived from biomass that have been previously reported. Before conducting the absorption studies, performed various microstructural characterizations on the material to better understand its properties and behavior.

Keywords: *Ashoka-leafs Ash (AA), Heterostructure, Microwave Absorption, High-Frequency Environments.*

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INTEGRATING NATURE BASED SOLUTIONS IN THE URBANIZATION PROCESS BY URBAN AGRICULTURE - A CASE OF BHUBANESWAR CITY, INDIA

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Abstract: Nature-based solutions are solutions that are inspired and supported by nature, and can provide environmental, social and economic benefits for urban resilience and sustainability. Land use change due to urbanization processes is one of the main drivers of global environmental change. One of the greatest land use changes affecting the urban and peri-urban landscape is agricultural land conversion which affects the food security. Urban agriculture should become a mandatory urban function to make cities self-sufficient in its per capita vegetable and fruits requirements. Not only will it generate livelihood opportunity for the urban poor but be the urban lung, heat sink, solid and water waste disposal and opportunity to bring about eco-cultural community bonding. In India, agricultural land loss is occurring around smaller cities more than around bigger cities and is predominantly in states with higher agricultural land suitability. This paper tries to examine through remote sensing data, in a time series between 2011 to 2023, the loss in agricultural land in one such smaller city-Bhubaneswar, a Tier 2 city ranked 58th in India in terms of population, which lies on a very fertile agricultural belt. Precise methodology for quantifying urban land use conversion is still debatable, mainly because of different geographic boundaries depending on the scales (e.g., the city proper, the metropolitan area, urban cluster or the urban agglomeration). The present research takes the Bhubaneswar Development Planned area which encompasses an area of 419 sqkm and includes the Bhubaneswar Municipal Corporation (BMC) of 186 sqkm. The Sustainable Development Goals(SDG) encourage a substantial increase in food security to achieve zero hunger and promote sustainable agriculture (SDG 2) while minimizing the conversion of undeveloped land into developed land (SDG 11). SDG target 11.3 presents the dynamics of Land conversion rate per person and aims to achieve an increased rate of built-up land that does not exceed the rate of the increase in population. This paper examines the loss of agricultural land versus the increase in built up area within this period and goes on to suggest a nature based solution which makes the city self-sufficient in terms of food security. This methodology using Spatial mapping of supply and demand in ecosystem services, quantifies the impact of Agriculture Land Use conversion on agriculture production which can become an important indicator for food security from a long-term perspective.

Keywords: *Land use change, urbanization, Urban agriculture, remote sensing, Land conversion rate, food security, nature based solution.*

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EVALUATING THE CURRENT LEGAL REVISIONS ON ENVIRONMENTAL IMPACT ASSESSMENT IN VIETNAM: CHALLENGES AND ENHANCEMENTS

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Abstract: The Law on Environmental Protection 2020 has only been in effect for just over a year. The amendments to the new legislation have brought positive values to the environmental protection and sustainable development in Vietnam. Particularly, in the proceeding of environmental impact assessment (EIA), the law has made more appropriate amendments in line with international standards compared to the previous regulations. This includes the classification of projects required EIA, reporting, consultation, and appraisal procedures. However, during the time of implementation and application, the law still exposes certain limitations, making this activity not yet achieve the desired outcomes. Therefore, this article will further evaluate the current legal revisions on EIA in Vietnam and propose improvements for a more effective implementation of the law.

Keywords: *Environmental impact assessment (EIA), Vietnam, amendments.*

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THE ROLE OF GREEN MARKETING AND COMPETITIVE INTENSITY ON THE PERCEPTION OF CUSTOMERS' GREEN PURCHASE INTENTIONS TO ACHIEVE SUSTAINABLE DEVELOPMENT GOALS

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Abstract: The aim of this empirical study is to analyse how consumers react to green marketing efforts that promote sustainable development goals. This study investigates the moderating role of green marketing between competitive intensity and consumers' purchasing decisions. This study collected 340 questionnaires regarding customers' intentions to use green goods and services for fast-moving consumer goods (FMCG) in Ho Chi Minh City (HCMC). A total of 291 samples of valid data were analysed using Smart-PLS software to confirm the hypotheses. The results indicate that there are several key factors, including green product innovation, green distribution, and green price, that have a positive impact on consumers' green purchase intentions in the FMCG sector in HCMC. In addition, competitive intensity serves as the moderating factor. This study has also discovered that competitive intensity does not act as a moderator between green brand positioning, green advertising, and green purchase intention. According to the findings, the management of FMCG enterprises should reposition their products, services, and business and marketing strategies in terms of green policies to keep pace with green policies and sustainable development. When FMCG enterprises implement green policies for their products and services, they can motivate and inspire customers who intend to use and accept their products and services. This research output also provides researchers and practitioners with invaluable knowledge about the green marketing concept and the evidence required to implement green marketing policies, which can aid FMCG in developing and addressing environmental concerns.

Keywords: *Green marketing, competitive intensity, green purchase intention, green policies, environmental concern, sustainable development.*

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ASSESSMENT OF THE LEVELS OF CERTAIN HEAVY METALS IN FISH SPECIMENS FROM FINCHA, AMERTI, AND NASHE (FAN) LAKES OF HORO GUDURU , OROMIA , ETHIOPIA

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Abstract: Fish contamination with heavy metals poses a threat to worldwide public health. Fish that live in lakes absorb these metals, and because they enter the food chain and are subsequently digested by living systems, this can have negative consequences. The goal of the current study was to measure the concentration of heavy metals in fish species, specifically Tilapia (Oreochromis niloticus), that were gathered from the FAN Lake in the Horo Guduru Wollega Zone, Oromia region, Ethiopia, and compared with fish from other lakes. Tilapia (Oreochromis Niloticus), one of the fish species found in FAN Lake, was chosen for this study because it is the most often consumed fish in the Fincha, Amarti, and Nashe Lake regions. Fish gill samples were taken from the Fincha, Amarti, and Nashe sampling lakes. A method for digesting fish samples' gill tissue that uses a 12 mL mixture of HNO3-H2O2 (1:1 of v/v) was created. Using Flame Atomic Absorption Spectroscopy, the concentrations of eight metals in fish accumulation in the edible gill tissues of the Tilapia fish species were found in these fish samples taken from the FAN lakes. Cu 1.567, Zn 55.267, Fe 70.967, Mn 108.8, and Cr 0.043 were the average heavy metal concentrations in mg/kg fish samples for Fincha Lake; Cu 1.667, Zn 44.617, Fe 57.80, Mn 80.9, Ni 3.5, and Cr 0.109 were found for Amarti Lake; and Cu 0.70, Zn 37.147, Fe 49.733, Mn 50.567, and Ni 3.8 were found for Nashe Lake. The largest quantities of iron (Fe) and manganese (Mn) among the elements found were found in the FAN lakes; nonetheless, the levels of Fe in three of the lakes do not exceed the WHO/FAO guideline. In contrast, three lakes have levels of Pb and Cd below the detection limit. Strongly positive and negative correlations were found using Pearson correlation for the particular FAN Lakes in the Tilapia fish species. When it came to the accumulation of heavy metals, there was no discernible difference between the three lakes; nonetheless, Lake Fincha and Amarti had larger concentrations. Thus, it is imperative that society refrain from discharging waste into Fincha, Amarti, and Nashe lakes.

Keywords: *Fish, Heavy metal, Fincha Lake, Amarti Lake, Nashe Lake, Oreochromis niloticus.*

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ENVIRONMENTAL IMPACT ASSESSMENT ON LAND USE WITH SPECIAL FOCUS ON MINING INDUSTRY IN TAMIL NADU

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Abstract: The Environment Assessment is considered as important planning tool that plays a major role to support the decision-making process and will be useful for larger planning and policy making also. The major role of environmental impact assessment is to gather information for the purpose of implementing with most suitable knowledge of its impact. It has gained the significant movement because environment assessment is a legal process and pave the way for complete information about all development. The Environment Protection Act,1986 has assured the ways and means for having the Environment Impact Assessment (EIA) in India and focused much on various methodology and multiple processes. It was used during 1976-77 by the Department of Science and Communication through planning commission. During 2006, the Environment Impact Assessment legislation has been brough by the Ministry of Environment, Forest, and Climate Change (MoEFCC). On the other hand, Mining Industry has contributed the major economic activity in India and more than 2% of the country gross value added. Mining sector in India has highly regulated but there are issues on for the use of land for the same. It is worthwhile to note here that there is an administration of the mining sector in India and collective responsibility of the Central and State governments. There are legislations for the regulation of mining industry in India. In this paper, the role of environmental impact assessment on land use and particularly with mining industry in Tamil Nadu will be discussed.

Keywords: *Climate Change Environment Mining.*

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BIOENERGY POTENTIAL OF SACCHARUM BENGALENSE THROUGH PYROLYSIS, REACTION KINETICS, TG-FTIR-GCMS ANALYSIS OF PYROLYSIS PRODUCTS, AND VALIDATION OF THE PYROLYSIS DATA THROUGH MACHINE LEARNING

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Abstract: Saccharum bengalense grows throughout the world on non-arable lands. Here, oven-dried S. bengalense plant biomass was pyrolyzed under an inert environment using four heating rates (β: 10, 20, 40, 80°Cmin-1). Thermal degradation occurred in three consecutive regions where main transformation occurred during the second stage. Thermogravimetric data was subjected to isoconversional models including Friedman, KAS, and FWO to assess the pyrolytic behavior. Biomass showed High Heating Value of 18.05±0.37 (MJkg-1), higher percentage of volatile matter 76.47 ±0.58%, and with lower emission of SOX (0.46±0.04%). The average activation energies were 186.01 kJ mol-1, 169.56 kJ mol-1, and 170.99 kJ mol-1 assessed through Friedman, KAS, and FWO methods, respectively, which indicated its promising feasibility for pyrolysis. The product formation was favored due to a very low difference between activation energy and enthalpy change (≈3 kJmol-1) at each conversion point. The TG-FTIR-GCMS showed that pyrolytic gases contained acetone, aromatic compounds, hydrocarbons, phenols, ketones, alcohols, esters, and aldehydes. The structure of the network that performed the best was MLP 3-6-1 and used to understand the conversion process. Activation energies were accurately determined using the MLP-based ANN regression model, where values of R2 (0.999) indicated perfection in training, test, and validation. The data from the ANN model were consistent with the TG-based interpretation of the pyrolysis and represented the first-rate thermal degradation. The M-DAEM model had a good fitness with the experimental data because the dα/dt and R2 of α were greater than 99.98% and 99.99%, respectively. The pyrolytic products were copious because of the high percentage of carbon atoms. Hence, S. bengalense biomass has a great potential to generate energy and chemicals in terms of cost-effectiveness and environment-friendliness.

Keywords: *Net-zero carbon emissions, pyrolysis, TG-FTIR-GCMS, ANN, M-DAEM, green energy and chemicals.*

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EVALUATING BIOENERGY POTENTIAL OF THE PARA GRASS (BRACHIARIA MUTICA) BIOMASS PRODUCED ON A LAND-FREE CULTIVATION SYSTEM WHILE KEEPING THE WATER-ENERGY-ENVIRONMENT NEXUS SUSTAINABLE

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Abstract: Producing biomass as a renewable bioenergy feedstock is challenging due to scarcity of agricultural lands. In the present study, a land-free cultivation system was employed to produce the Para grass biomass using industrial and urban wastewaters as growth media. The biomass was pyrolyzed at four different heating rates (10 ºCmin -1 , 20 ºCmin -1 , 30 ºCmin -1 , 40 ºCmin -1) under an inert environment. The pyrolysis data were analyzed using three isoconversional models namely Flynn-Wall-Ozawa (FWO), Kissenger-Akahira-Sunose (KAS) and Starink. The pyrolysis of both samples occurred in three stages, while major pyrolysis occurred during the second stage (200- 400 ° C) at the corresponding conversion points (α) ranging from 0.20-0.65. The high heating values (HHV) of the biomasses produced on wastewaters were shown to be 18.85 MJKg-1 and 18.14 MJKg-1 , respectively. The activation energies ranged from 136.45-149.18 kJmol-1 , 133.35-146.71 kJmol-1 , 133.85-147.23 kJmol-1 estimated through for FWO, KAS and Starink methods, respectively. Pre-exponential factors showed the first order reaction kinetics and a lower difference.

Keywords: *Para grass, land-free cultivation, phytoremediation, pyrolysis, bioenergy, biochemicals.*

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IDENTIFICATION OF THE SUITABLE POPULATION FORECASTING METHOD FOR VILLAGES IN THE IPPALA VAGU WATERSHED, INDIA.

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Abstract: Generally, population forecasting is primarily conducted in towns or cities, with less emphasis on villages. The rate of population growth in villages differs from that in towns or cities. Village-level population forecasting is necessary to support rural area development activities and water supply schemes. Development activities carried out within watershed boundaries yield superior results compared to administrative boundaries. Hence, the Ippala Vagu Watershed is chosen as the study area. Based on simplicity, a few existed population forecasting methods, along with a proposed method named as the Altered Geometrical Increasing Method (AGIM), are selected for estimating the population for the year 2011. A set of statistical equations is employed to evaluate the performance of these selected methods, and based on their performance, AGIM is found to be exceptionally well-suited for forecasting the population in villages. AGIM is used to estimate the population for both the current and future decades, and these estimations are then used to calculate annual percentage growth rates for each village within the Ippala Vagu watershed for the period from 2021 to 2051, with values ranging from 0.25% to 0.75% for most of the villages.

Keywords: *Population Forecasting, Population Growth, Watershed, Arithmetical Increase Method, Geometrical Increase Method.*

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BIOWASTE-DERIVED CO/COO DECORATED-BIOCHAR FOR ADSORPTION OF MALACHITE GREEN

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Abstract: This study reports on an innovative method for synthesizing Co/CoO enhanced biowaste derived biochar nanocomposites using an environmentally friendly carbothermal technique. Outstanding activity and effective removal of organic pollutants and malachite green dye from wastewater were exhibited by the most active cobalt nanocomposite. By investigating the biochar composite before and after the malachite green adsorption operation were able to report on the removal process. The synthesis of Co/CoO decorated biochar composite was confirmed using various chemo-analytical techniques. Magnetic susceptibility testing also verified these findings. The effects of initial malachite green concentration, dosage effect, solution pH, equilibrium studies, kinetics, thermodynamic studies, and reusability were all investigated and studied on Co/CoO biochar composite. It was observed that the Langmuir isotherm model (R2 = 0.999), pseudo-second order kinetics (R2 = 0.999), and over 99 % of the malachite green dye removal efficiency on the Co/CoO biochar composite by adsorption. The process of synthesizing bio-wastes into a highly effective dye adsorbent shows great potential for both environmental and economic sustainability.

Keywords: *Neem Leaves, CoCl2, adsorption, biochar, malachite green.*

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THE IMPACT & ROLE OF THE ENVIRONMENT ON IOT

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Abstract: A number of elements, including the economy, high-quality education, agriculture, industries, and many more, are necessary for the globe to grow sustainably, but the environment is one of the most crucial ones. The sustainability of humanity and the advancement of any nation are largely dependent on health and hygiene, which are products of a clean, safe, and pollution-free environment. Therefore, it becomes imperative to monitor it to guarantee that every country's population may live healthy lives. Smart Environment monitoring (EM) includes managing and planning disasters, reducing pollutants, and successfully resolving issues by Smart Sensor that occur from unhealthful environmental circumstances. Environmental medicine (EM) addresses air and water pollution, dangerous radiation, shifting weather patterns, earthquakes, and more. The origins of contamination are contributed by a number of variables, some of which are man-made and others of which are the result of natural causes. EM's job is to specifically address these issues in order to safeguard the environment by Wireless Sensor Networks for a world and civilization that are healthy.

Keywords: *Environment, Pollution, Internet of Things (IoT), Sensors, Smart Environment Monitoring (SEM), Smart sensor, Wireless Sensor Networks (WSNs).*

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TOWARDS SUSTAINABLE FUTURE: A COMPREHENSIVE ENERGY STRATEGY FOR COEP TECHNOLOGY UNIVERSITY CAMPUS

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Abstract: Amid the global grappling with profound climate change issues, the imperative to transition towards sustainable practices becomes paramount. Therefore, the paper explores the intricate repercussions of climate change on human life, underscoring the critical necessity for a comprehensive shift to renewable energy sources. A significant portion of energy consumption in the ambient environment is primarily concentrated within academic campuses. Consequently, the study directs its attention to the adoption of sustainable and environmentally friendly energy sources, with a focus on exploiting renewable resources such as wind and solar energy. Nonetheless, the central emphasis is on creatively applying Biomass energy and extracting energy through the implementation of piezoelectric harvesting methodologies. Employing COEP Technological University as a reference, the paper introduces innovative approaches to address energy requirements and alleviate environmental challenges.

Keywords: *Keywords: Climate Change, Energy Consumption, Academic Campuses, Wind Energy, Solar Energy, Biomass Energy, Piezoelectric Harvesting.*

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EXPERIMENTAL INVESTIGATION ON COMBUSTION CHARACTERISTICS OF REFUSE DERIVED FUEL USING MUNICIPAL SOLID WASTE BLENDED WITH CORN STOVER

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Abstract: Municipal Solid Waste (MSW) management throws a formidable challenge to urban planners and engineers due to its heterogeneity and quantity. India produces around 62 million tons of waste annually at the rate of 182.5kg/head/year. Producing secondary fuels from the waste is an option which not only saves the primary fuel but also helps in reducing the quantity of waste stream entering the landfills. Refuse derived fuel (RDF) is one of the waste to energy(WtE) option, offers an alternative fuel produced from energy rich MSW. Experimental investigations were carried out to assess the suitability of using segregated urban municipal solid waste along with Corn Stover (Zea mays). The segregated urban waste and the pre-processed Corn Stover were analyzed for its composition, Physico-chemical and thermal characteristics. The segregated recyclable portion of MSW were blended with Corn Stover (Zea mays) by partial replacing it with 10% of pre-processed corn stover to a maximum of 90% using binder. The results of the study reveals that the calorific value of RDF using municipal solid waste blended with Corn Stover offers a higher calorific value and found to be a chemically stable secondary fuel with reduced green house emission.

Keywords: *Municipal solid waste, Refuse Derived Fuel, Corn Stover, landfills, Waste to Energy, Sustainable technologies.*

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ACCESS TO CLEAN WATER AS A BASIC HUMAN RIGHTS OF THE INDIGENOUS COMMUNITY IN INDIA: A SUSTAINABLE DEVELOPMENT PERSPECTIVE

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Abstract: Unsafe water and lack of access to sanitation are not the only threat to the health of the indigenous community but it is a deprivation of basic human right. Commercialization of water and climate change has resulted in the global water crisis. The health and well-being of the indigenous community are affected at large by the deprivation of such basic rights. Indigenous communities from ancient times have managed the land and other natural resources through sustainable measures. The indigenous community who lives in mountains and forests is marginalized to a greater extent when compared to indigenous communities who live in other regions. Such highly dense mountain region experiences clean water scarcity and unplanned sanitation systems. This problem majorly attracts four significant sustainable development goals (SDGs) viz., SDG-3, 6, 10, and 16 that emphasize good health and well-being of the community, clean water and sanitation, reduced inequalities among people, and justice respectively. Water being a core of world politics also becomes a symbol of good governance when it is efficiently managed by the governments. In India, though there are legislations such as The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, which provides the right to water to the indigenous community, the legislation is silent on the position of indigenous people in terms of access to water and there are major problems in accessing clean water and proper sanitation facilities. The present study aims to identify the complications involved in the implementation of water management laws and analyses the existing legislation and government policies in India relating to water management and indigenous communities. It also aims to analyze the international best practices and case studies relating to water management strategies of the indigenous communities. Further, it also attempts to suggest measures to improve the water management laws in India.

Keywords: *Indigenous people, SDGs, water, access, sanitation, governance.*

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ASSESSMENT OF RIVER BANK EROSION AND ITS IMPACT ON THE LAND USE LAND COVER OF THE JIADHAL RIVER, ASSAM

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Abstract: The alluvial river channels often change their morphology to attain equilibrium conditions, which is a continuous river process. The Jiadhal River is a northern tributary of the Brahmaputra River, and it is known for changing the river course and large-scale erosion in the lower course of the river catchment region. The river experiences large-scale river bank erosion near the Jiadhalmukh region due to the high river discharge rate throughout the monsoon season. The Jiadhal River changed both the right and left bank due to the continuous erosion and deposition phenomena that occurred in the river basin, which impacted the land use pattern and mostly affected the agricultural fields of the region. The main objective of the present study is to evaluate the river bank erosion scenario and its impact on the land use and land cover of the Jiadhal river basin. The Survey of India Toposheet (SOI), LANDSAT Satellite imagery from 1973 to 2022, and geospatial technology have been used in the present study. The output of the present study will be helpful for government organizations, planners, and researchers in preparing the management plan for the Jiadhal River basin.

Keywords: *Jiadhal River, erosion & deposition, LULC, GIS & Remote sensing.*

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HIGH SEAS: THE DUMPING GROUND OF NUCLEAR WASTES – ADDRESSING THE SERIOUS ENVIRONMENTAL CONCERN

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Abstract: The first formal recognition of the international implication of environmental pollution occurred in the context of terrestrial, not marine, pollution. Even today, despite the fact that seventy one percent of the earth's surface is covered by water, most environmental legal energy is directed toward terrestrial pollution and its effects. The dumping of nuclear waste into the high seas is one of the most controversial environmental issues. It has been a topic of debate for decades as it poses significant risks to the marine ecosystem and human health. The London Convention of 1972 was the first international agreement to regulate the dumping of waste at sea. It aimed to prevent the dumping of waste that could harm human health and the marine environment. In 1993, the Protocol to the Convention was adopted, which prohibited the dumping of all forms of radioactive waste, including low-level waste, into the high seas. While the dumping of nuclear waste into the high seas was banned in 1993 by the London Convention, some countries continue to do so. It is essential that countries work together to enforce these laws and regulations to prevent the dumping of nuclear waste in the high seas and protect the environment and human health. Holding countries liable for dumping waste on high seas can help discourage this illegal activity. The countries should be held responsible for any damage caused to the environment and human health as a result of the dumping. It can also promote international cooperation and collaboration to address the issue of waste dumping on high seas. The international community must work together to enforce international law and hold countries accountable for their actions. The United Nations Sustainable Development Goal (SDG) 14 on 'life below water', which focuses on 'conserve and sustainably use the oceans, seas and marine resources for sustainable development. This SDG urges the world community for urgent action to safeguard Earth's largest ecosystem, the ocean, where the humans are largely dependent. This study aims to discuss on the relevant SDG and its nexus with environmental protection. In this research paper, we will discuss the history of nuclear waste dumping in high seas, the effects of nuclear waste on the marine ecosystem and human health. Further, the study will analyze the laws and regulations governing the disposal of nuclear waste at national and international level.

Keywords: *High seas, Nuclear waste, Dumping, Marine pollution, Ecosystem, Human health, SDGs.*

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INVESTIGATION ON NON-DEFECTIVE COMPLIANT DEVICES THROUGH MOLD FLOW MANUFACTURING ANALYSIS – WASTE MINIMIZATION APPROACH

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Abstract: Value Engineering design is used in various industries for waste reduction, cost optimization and value addition to the Product, Optimized Design to reduce waste during development of product. This paper emphasizes more on and investigation of non-defective Compliant Mechanism design for desirable parts with reference to previous research on materialistic feasible Compliant devices using Pseudo Rigid Body Method (PRBM) with defined geometry. In this paper authors analysed Topology Optimized cobra shaped Compliant bicycles Footstool design with suitable mass reduction, Optimization of stress and deformation. Author protracted the analysis and further investigation in exploring manufacturing feasibility through numerical analysis on injection mould flow analysis with safety characteristics, this mould flow analysis results in defect free parts production through additive manufacturing or injections moulding process. This analysis and results will avoid minimize the waste in development and make the objective functions first time right during testing in static and dynamic situations.

Keywords: *Waste Minimization,Numerical Analysis,Mould flow Analysis,Complaint mechanism design.*

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MODIFIED POMEGRANATE PEEL WASTE AS SUSTAINABLE BIO-ADSORBENT FOR REMOVAL OF CHROMIUM FROM WASTEWATER"

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Abstract: Improper discharge and disposal of chromium-contaminated wastewater poses a hazard to human, plant, and animal life. As with other heavy metals like copper or lead, chromium can enter waterways and drinking water supplies when industrial wastewater is not discharged responsibly, potentially resulting in harm to aquatic plant and animal life, accumulation in soil, and other environmental and agricultural damage. Experimental work was carried out by preparing activated carbon by chemical activation of pomegranate peel powder. The various parameters such as pH, contact time, PPAC (pomegranate peel activated carbon) dosage impact on removal of chromium were investigated. It revealed that, the highest percentage of chromium removal reported at pH 2 and stirring speed of 100 rpm. It also shows the equilibrium time was 60 minutes and optimum concentration is 100 ppm. The PPAC adsorbent dosage of 1.0 gms showing highest percentage removal and adsorption capacity..From the results it was concluded that, PPAC will be one of the best green and ecofriendly bio-adsorbent to remove chromium from wastewater.

Keywords: *Wastewater, Bio adsorbent, Heavy metal, Chromium, PPAC.*

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CARBON CREDIT TRADING SCHEME IN INDIA: OPPORTUNITIES, CHALLENGES, AND SUSTAINABLE DEVELOPMENT IMPACTS

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Abstract: India is now involved in various environmental initiatives, one of which is the adoption of carbon credit trading as a strategy to address the issue of greenhouse gas emissions. The country actively engages in the Clean Development Mechanism (CDM) as outlined by the Kyoto Protocol. The act of participating in such endeavours allows the country to actively partake in activities aimed at facilitating the mitigation of carbon emissions, hence leading to the generation of carbon credits. The implementation and adoption of environmental-friendly energy initiatives, such as wind, solar, and hydropower, present significant opportunities for obtaining carbon credits. There is potential for the generation of carbon credits through the further enhancement of energy efficiency in the industrial, transportation, and architectural sectors. Furthermore, it is noteworthy that endeavours focused on the establishment and restoration of forests have a substantial impact on the carbon sequestration process, hence offering potential opportunities for the manufacture of carbon credits. Nevertheless, engagement in carbon credit trading sometimes entails complex procedures that combine project design and credit issuance, potentially presenting challenges for smaller enterprises. The potential effects of price volatility and uncertainty in carbon credit markets on the economic feasibility of a project should be considered. Thus the task of establishing a reliable baseline for emissions reduction and accurately assessing the subsequent reductions can present significant challenges. The Energy Conservation (Amendment) Act of 2022 represents a significant advancement in India's pursuit of transitioning towards an economy marked by diminished carbon emissions. The legislation grants the Central Government the ability to establish a carbon credit trading scheme. The carbon trading plan enables enterprises and organisations to accrue carbon credits through the reduction of their emissions below the government-established baseline. Subsequently, these credits possess the potential to be traded to other businesses that are incapable of fulfilling their obligations to reduce emissions. The carbon credit trading plan in India incentivizes firms to follow environmental-friendly practices by offering financial rewards for reducing emissions. This approach contributes to the broader objective of decreasing carbon emissions in the country. Therefore, within this particular framework, the authors endeavour to evaluate the potential, obstacles, and enduring effects on sustainable development resulting from the implementation of a carbon trading scheme in India.

Keywords: *Carbon Trading, Emission, Energy, Environment.*

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A REVIEW OF BIOFUEL PRODUCTION FROM WATER HYACINTH AND SALVINIA MOLESTA

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Abstract: This review paper aims to provide an overview of the research and developments in the production of biofuel from water hyacinth (Eichhornia crassipes) and Salvinia molesta, two invasive aquatic plants. The utilization of these plants for biofuel production offers a sustainable solution for their management and provides an alternative source of renewable energy. The paper discusses the various aspects of biofuel production from water hyacinth and Salvinia molesta. Furthermore, the properties, challenges, and opportunities associated with their utilization are explored, along with potential future research directions.

Keywords: *Biofuel, Water Hyacinth, Salvinia Molesta, Invasive Aquatic Plants, Sustainability.*

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THERMAL POWER IN THE ERA OF GREENOLUTION

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Abstract: The aim of this article is to present highlights on Importance of Thermal Power Generation in current scenario of India's today's context and for next 25 years. Power is essential element for Nation's growth and holistic progress as well as quality of life for each & every component of society. Currently world is focusing on GREENOLUTION, green energy and India has observed exponential growth in green energy generation - GREENOLUTION. But still there is uncertainty of Renewable Power Generation due to various limitations like environmental issues, Generation gap in day & nighttime, seasonal & weather limitations, and impact of other technical factors like power storage, micro grid concept etc. which are under research and development stage. On the other side, increasing population, Industrial & economic growth and changing way of lifestyle has led to increase in energy demand & consumption. So Thermal Power Generation is an essential contributor in current scenario. To ensure sustainability, Power Generation cost, quality, and reliability of generation, it is crucial to develop & implement the best Operational Strategy to run the established Thermal Power Station at the best Plant Load Factor with compliance of Environmental requirements and within possible lowest cost.

Keywords: *Thermal Power Generation, Renewable Energy, Strategy for Sustainable Power.*

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ENVIRONMENTAL JUSTICE TO EVERYONE IN INDIA: AN APPRAISAL OF THE ROLE OF PUBLIC INTEREST LITIGATION IN ENVIRONMENTAL PROTECTION

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Abstract: Decline in Environmental quality has become a matter of national as well as global concern. Increasing pollution, loss of bio-diversity, concentration of toxic chemicals in air at excessive level, environmental accidents, climate change and threat to food security, have been witnessed by the entire global community. The very survival of the mankind itself is at the state due to the threat to life support systems. The judiciary has acquired a syndicate role as an active participant in the society because it exists for the purpose to make good the deficiencies in law while providing relief to the needy people. Judiciary has invented the technique of public interest litigation to bring justice within the reach of everyone. Particularly in environmental issues, Public Interest Litigation has played a dominant role in the prevention of pollution and protection of environment thereby promoting the interests of community at large. The emergence of public interest litigation in India has become an effective instrument in expanding the scope of Article 21 by explicitly recognizing the right to whole some environment. Therefore, this research paper makes an attempt to appraise the role of public interest litigation in the context of environmental protection.

Keywords: *Environment, Judiciary, Public interest litigation, India.*

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DETECTING AND MONITORING THE OCCURRENCE OF LAND SUBSIDENCE IN KARNATAKA REGION OF INDIA

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Abstract: One of the geological disaster that is on rise across the globe is land subsidence. The vertical displacement of ground downwards caused by the compaction of soil pore pressure by over exploitation of ground water is predominantly the factor behind the occurrence of land subsidence. Besides,the growth of population, land reclamation, urbanisation, mining activity, and other land intensive activities increase the risk of occurrence of land subsidence. Moreover the impact of land subsidence is very disastrous, ranging from rise in sea level, inundation of low lying areas to damage of civil infrastructure.Many parts of India like, Delhi, Mumbai and Joshimat of uttarkhand have witnessed more number of land subsidence events in the start of year 2023.Further,the Bangalore,the fastest growing silicon city of Karnataka with increasing migration and urbanisation has levid undue pressure on ground water resources thus disturbing the acquifer system which is linked to occurrence of land subsidence. The prior and regular monitoring of emergence of land subsidence zones in parts of India enables early detection and initiate mitigatory measures for sustainable development. The presentation focuses on monitoring the occurences of land subsidence events in Bangalore and Ramanagara regions of Karnataka for the year2023 as this area has been subjected to rapid industrialisation and mining .Further, the evolution of land subsidence in spatial and temporal resolution, hints on the condition of ground acquifer system. The interferometric SAR offers an effective method of measuring land displacement. The Sentinel -1 SAR data in interferometric wide swath mode with moderate spatial resolution enables monitoring land subsidence on large scale.

Keywords: *Land subsidence, Bangalore, sentinel-1 Interferometric SAR, acquifer system, monitoring.*

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MODELING AND OPTIMIZATION OF ULTRASOUND-ASSISTED EXTRACTION OF COLD BREW COFFEE

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Abstract: The objective of this research was to study the optimal conditions of ultrasonic-assisted extraction (UAE) of cold brew coffee on total phenolic compounds and DPPH radical using a Box-Behnken Design (BBD) and response surface methodology (RSM). Variables were used to study the optimal conditions of solid-liquid ratio (5-15%), extraction time (40-50 min) and ultrasonic power (70-80%). The results showed that all three factors impacted total phenolic compounds and DPPH radical. Statistical analyses indicated that the experimental data were best fitted to a quadratic polynomial equation with high decision coefficient (R2) at 0.9981 and 0.9799 for total phenolic compounds and DPPH radical, respectively. The 3D surface and contour plots derived from the mathematical models were used to define the best conditions for total phenolic compounds and DPPH radical from cold brew coffee extraction. The highest yields of total phenolic compounds and DPPH radical were obtained when samples were extracted at 10% solid-liquid ratio, 45 min extraction time and 75% ultrasonic power. Under this optimal conditions, total phenolic compounds and DPPH radical were 64.10 ± 0.31 gGAE /ml.) and 61.90± 0.14%, respectively with maximum caffeine content was 213.13 ± 0.23 mg/L. Gamma irradiation at 1 kGy also reduced microbial content in cold brew coffee. This research may be a new alternative for producing cold brew coffee that will not only save time but also help extend the shelf life as well.

Keywords: *Cold brew coffee, Ultrasonic extraction, Box-Behnken Design (BBD), Gamma irradiation.*

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OPTIMIZATION OF MICROWAVE-ASSISTED EXTRACTION OF CORILAGIN AND TOTAL PHENOLIC COMPOUND FORM DIMOCARPUS LONGAN LOUR USING BOX-BEHNKEN DESIGN

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Abstract: Longan (Dimocarpus longan Lour) is a tropical and subtropical fruit that is widely farmed and consumed in Southeast Asia on a commercial basis. The pulp and seeds of longans are rich in essential natural compounds. The application of the longan pulp and longan seeds is the primary subject of this study. The purpose was to extract the total phenolic compound and corilagin from Longan by microwave-assisted extraction method. The variables of the ratio of the sample (0.5-1.5 g/30ml), extraction time (10-20 min), and microwave power (600-700 W) were used to study the optimal extraction conditions by response surface methodology (Box-Behnken Design). Statistical analyses indicated that the experimental data were best fitted to a quadratic polynomial equation with a high decision coefficient (R2) at 0.9956 and 0.9485 for total phenolic compound and corilagin, respectively. The result was that the optimal conditions to obtain the highest total phenolic compound and corilagin from longan extract are 22.214 mgGAE/gDW and 55.137 mg/gDW, respectively. The sample was extracted under a ratio of sample 0.97 g/30 ml set at microwave power at 695.74 W, an extraction time of 15 min. The analytical results obtained from this research can enable the development of concentrated longan extracts to promote good health. It is also environmentally friendly because it uses an aqueous solution for extraction. Moreover, extraction using microwave-assisted extraction is an extremely effective technique, and high yields of corilagin and total phenolic compounds were obtained.

Keywords: *Longan, Total phenolic compound, Corilagin, Microwave-assisted extraction, Response surface methodology.*

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DEVELOPMENT OF ALGINATE BEADS FROM DIMOCARPUS LONGAN LOUR. EXTRACTS BY ENCAPSULATION TECHNIQUE

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Abstract: Encapsulation can be accomplished by a variety of methods. Extrusion is used to obtain granules with encapsulated liquid active ingredients for food and pharmaceutical applications and has been used for volatile and unstable active compounds. The aim of this work was to study the microencapsulation of the total phenolic compound of longan extract through the extrusion method. According to the findings of the study of the encapsulation process of longan extract, the optimized condition of longan beads was 1.5% of sodium alginate and 4% of calcium chloride. Under these conditions, the total phenolic compound, antioxidant activity, and encapsulation efficiency of longan extract beads were 3.845 mgGAE/gbead, 55.06 %, and 66.95 %, respectively. A study of the combination of sodium alginate with natural polymers (gelatin, pectin, and gum arabic) found that alginate/gum Arabic longan beads had the highest encapsulation efficiency of 74.86 ± 0.171%. Then study the effect of pH on the stability of total phenolic compounds (pH 2, 5, and 8) found that longan beads exhibited good stability under acidic conditions. Finally, to study the effect of gamma irradiation on sterilization and the physical of longan beads, A gamma irradiation dose of 7.5 kGy could effectively sterilize microorganisms and strengthen the longan beads. These results indicate that longan beads can produce beads rich in phenolic compounds that can be used as natural supplements and antioxidants in various food products.

Keywords: *Longan bead, Sodium alginate, Encapsulation efficiency, Gamma irradiation.*

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REVIEW ON ENERGY STORAGE SYSTEMS

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Abstract: The increasing demand for sustainable and clean energy solutions has spurred significant advancements in renewable energy technologies. Among the critical challenges facing the widespread adoption of renewable energy sources, the intermittent nature of renewable power generation stands out prominently. To address this challenge, energy storage systems have emerged as integral components in enhancing the reliability and efficiency of renewable energy integration. This paper provides a comprehensive review of various renewable energy storage technologies like Pumped Hydroelectric Energy Storage (PHES), Compressed Air Energy Storage (CAES), Battery Energy Storage (BES), Flywheel Energy Storage (FES), Supercapacitor Energy Storage (SCES), Hydrogen Energy Storage System (HESS), Thermal Energy Storage (TES), Gravity Battery, etc. The paper also investigates the role of smart grid technologies and demand-side management in optimizing renewable energy storage and distribution. The interplay between renewable energy storage and various energy management strategies is discussed, highlighting the importance of a holistic approach in achieving a reliable and resilient energy infrastructure.

Keywords: *Pumped Hydro Energy Storage, Compressed Air Energy Storage, Battery Energy Storage, Flywheel Energy Storage.*

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A NOVEL APPORACH TOWARDS A SUSTAIBABLE ENERGY STORAGE: VACUUM BASED ENERGY STORAGE

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Abstract: The United Nations and its member states have committed to eradicating all fossil fuel-based electricity production in order to reach net-zero emissions by 2050, as the world moves toward sustainable energy. The necessity for novel and inventive energy storage strategies is highlighted by the quick transition to variable renewable energy sources. These techniques are essential for handling the hourly and seasonal fluctuations in renewable electricity output and controlling the impact on the power grid. Creating an energy storage system is the aim to keep the grid dependable and stable despite rising demand. Presently, the market offers a wide range of energy storage options, such as flywheel energy storage systems, electrochemical batteries, pumped hydro energy storage systems, compressed air energy storage systems, and more. All these solutions do, however, have limitations of their own concerning robustness, scalability, and life cycle. To address these issues, we have created a unique and complementary energy storage system. This novel method includes storing potential energy, or energy, in a vacuum. An alternator can effectively transform the potential energy that has been stored into electrical energy. With the help of this innovative strategy, it may be possible to maintain a stable and dependable power grid while also efficiently controlling the intermittent nature of renewable energy sources.

Keywords: *Renewable energy, sustainability, mechanical energy storage, grid stability, climate change.*

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APPLICATION OF BRANCH SOFTWARE 3.0 FOR DESIGN OF RURAL WATER SUPPLY DISTRIBUTION SYSTEM

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Abstract: This project demonstrates the design of a rural water distribution system for an area located in a rural region. The water supply distribution network is designed for a population estimated for future 30 years till 2052. BRANCH 3.0 has been used for designing the best economical water distribution system. Intermittent water supply is planned for the “Katangi Kala” considering 70 lpcd water consumption. The economical diameter of the water supply distribution system is designed by considering constraints such as residual nodal pressure, flow in a pipe, pipe material, design of branches through, peak factor, and available commercial pipe diameters, etc. The water supply distribution system is designed for the Katangi Kala region of the state of Maharashtra, India. Based on the results, PVC pipe in the range from 63mm to 280mm internal diameter with Hazen William's constant value of 140 were observed to be most optimal design solution. The cumulative cost of the water distribution network is found to be Rs. 6,24,960/- for the desired diameters of pipes. It can often concluded that the successful solution of provident design of the water distribution system using BRANCH.version 3.0 is one of the most suitable linear programming methods for design computations.

Keywords: *Branch, Design, Distribution, Network, Supply, Water.*

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CRACKING THE CODE: IDENTIFYING AND UNDERSTANDING LOW-VALUE PLASTICS FOR SUSTAINABLE SOLUTIONS

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Abstract: This study delves into identifying low-value plastics, aiming to decipher the characteristics that designate them as such. Through a detailed analysis of physical attributes such as density, flexibility, and visual characteristics, we present a systematic categorization of low-value plastics prevalent in various environmental contexts. The research not only focuses on the "what" but also explores the "why" behind their classification as low value. Material composition, degradation potential, and limited recycling viability contribute to their low-value designation. This comprehensive understanding aids in developing targeted strategies for mitigating the environmental impact of these plastics, emphasizing the need for sustainable alternatives.

Keywords: *Low value plastics, recyclability, multilayer plastic, environmental impact, single-use plastic, plastic pollution.*

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EXPERIMENTAL STUDY ON PERFORMANCE OF CEMENT-BASED BATTERIES

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Abstract: A battery is generally defined as a device that has an electrolyte that is maintained in contact with electrodes. Electricity will be produced as a result of enhanced electron release due to the ion exchange between the electrodes and electrolytes. In this research, batteries were created using water, activated charcoal, manganese dioxide, cement, treated zinc dust, and polyethylene glycol, a self-curing agent. Porewater serves as the liquid electrolyte in these batteries. When a self-curing chemical is added, moisture is always present. This raises the ion exchange and improves ion mobility. After the specimens were finished being observed, they were moulded in foam sheet moulds. The electrode plates used in the cement-based battery specimens under study in this work served as the cathode and anode terminals of a standard battery, sometimes known as the "probe-style" battery. In this work, detailed investigations were carried out to quantify the characteristics of the electrode plates used, evaluate the internal resistance of the cement electrolyte, thereby offering performance comparisons of the batteries, and estimate the mass loss of one of the terminals (e.g. zinc dust) which was used as the anode. A part from this class of batteries, a preliminary step for future development of cement-based battery in the form of cement-layered battery was proposed. The findings from this study helped to arrive at critical discussion and construct a formidable understanding of its feasibility in ICCP systems.

Keywords: *Activated charcoal, manganese dioxide, zinc dust, and polyethylene glycol.*

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MERCERIZED BAMBOO COMPOSITES IN HIGH-FRICTION ENVIRONMENTS

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Abstract: The global bamboo market, valued at approximately USD 59.30 billion in 2021, foresees substantial growth, with a projected compound annual growth rate (CAGR) of 4.5% from 2022 to 2030. Despite the significant market presence of bamboo composites, akin to other natural fibers, they inherently possess limitations such as modest thermal stability and hydrophilic characteristics resulting from hydroxyl groups in their molecular structure. However, these constraints can be effectively mitigated through strategic chemical treatments. This study endeavors to delve into the tribological properties of bamboo fiber composites post-mercerization, specifically concentrating on their suitability for high-friction scenarios in alignment with sustainability objectives. P. stocksii fibers, chosen for their exceptional mechanical properties, serve as the primary material. Before the fabrication of composites through hot compression molding, bamboo fibers undergo mercerization, transforming into powder form. Subsequently, they are intricately blended with other components to create composites tailored for high-friction applications. Comprehensive analyses, encompassing physical, chemical, and thermal evaluations, alongside a water immersion test, were conducted to validate the replacement of hydroxyl groups and assess alterations in the crystallinity and thermal stability of the resulting composite materials. The fabricated composites then underwent tribological testing using a Pin-on-Disc tribometer. Morphological analysis, coupled with the findings from this study, underscores the promising potential of mercerized bamboo-reinforced composites in terms of their tribological performance.

Keywords: *Bamboo, P. stocksii, Mercerization, Natural Fibre Composites, Tribology.*

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IMPACTS OF URBANIZATION ON LAND SURFACE TEMPERATURE IN THIRUVANANTHAPURAM CORPORATION KERALA

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Abstract: Urban sprawl and the emergence of urban clusters are problems any city faces. This in turn creates an impact on the micro-scale climate of that area. Generation of urban heat islands (UHIs), waning of urban green cover, increase in carbon emissions and air pollution deteriorate the living environment. In this context, an urban ecology study mainly concentrates on anthropogenic emissions, heat stress-induced changes to human beings, and monitoring of urban heat with special reference to Thiruvananthapuram is planned. In this research, we collected both the Landsat 7 (2001) (2011) & Landsat 8 (2021) images are used in the calculation of the temperature. Understanding the distribution of Land Surface Temperature (LST) and its spatial variation will help decipher its mechanism and find possible solutions. From the temperature map, a gradual increase in land surface temperature was noticed from 2001 to 2021. Normalized difference vegetation index (NDVI) identified in the study area. The Vegetation content in urban areas has a great influence on the temperature variation of those areas. The study reveals that appropriate strategies are necessary for the sustainable management of the urban area.

Keywords: *Urbanization, Land surface temperature, NDVI.*

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DESIGN, SIMULATION OF PYROLYSIS REACTOR FOR VALORIZATION OF BIOMASS TO BIOCHAR

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Abstract: The biomass pyrolysis reactor (BPR) for biochar conversion has been designed for medium-scale production in a user-friendly mode. The design has intended to fabricate a low cost BPR for farmers/domestic consumers with an effective conversion rate. The feedstocks of rice husk, paddy straw, coconut petiole and yard waste have been selected based on the major agricultural produce of southern India and urban waste. The biomass had been converted into biochar by widely accepted thermochemical pyrolysis under anoxic conditions with a temperature range of 300℃ - 800℃, yielding a high solid biofuel product. The preliminary lab scale study was conducted by slow pyrolysis between 300 – 650℃. The selected feedstocks were processed to reduce the particle size and slow pyrolyzed with different temperatures and residence times using a muffle furnace. The experimental results of slow pyrolysis have given 31% carbonization efficiency on rice husk sample. The SEM results revealed the presence of a more porous structure (in 50 µm) on rice husk carbonized biochar. The optimized conditions were considered to design BPR with SOLIDWORKS simulation software. Further, the model was analyzed in ANSYS workbench for its strength, stability, deformation, transformation, etc.,. The BPR has been designed to stable up to 500℃ temperature and 2200 MPa pressure, which produced the total deformation of only 0.006027m max, equivalent stress of 2.342e8 Pa max with the safety factor of 0.875 to 15 max. Carbonized biochar posses many commercial applications in rechargeable batteries, as electrodes in supercapacitors, energy storing devices, catalysts in bio-diesel production, activated carbon in pollution remediation etc., and it has a prominent role as a fertilizer in agri farming.

Keywords: *Biochar, Solidworks, Carbon, Biomass Pyrolysis Reactor.*

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EMISSION OF AIR POLLUTANT FROM MUNICIPAL SOLID WASTE MANAGEMENT SITES: A COMPREHENSIVE REVIEW OF THE STUDIES POST 2000

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Abstract: Despite rigorous restrictions, a significant amount of waste is disposed of in landfills in both industrialised and developing nations without segregation or processing. The degradation generates air pollutants as well as landfill gases such as CH4 and CO2, both of which have substantial greenhouse gas potential. Landfill sites in developing nations, such as India, are prone to unorganised activities, generating health problems for disadvantaged populations and people. This evaluation is specifically designed to examine the impact of municipal solid waste dump sites on environmental pollution, public health, and climate change. This paper focuses on a comprehensive review of existing studies on air pollution from municipal solid waste disposal sites dating back to the year 2000. The goal of this comprehensive review study is to evaluate the numerous studies on measuring atmospheric air pollutants surrounding waste sites, to suggest proposals for future research, and to establish the significance of this complete analysis. The study additionally emphasises the current research trend, effective solid waste management processes, and the existing scenario of emerging sustainable practices such as waste-to-energy. As a consequence of the review, various gaps in the requirement for local collaboration to successfully manage solid waste in accordance with country-specific rules and standards, community awareness and engagement, system responsibilities, and the usage of innovative technologies have been highlighted. This will contribute to reducing the negative consequences of municipal solid waste disposal, as well as its influence on human health and climate change, and will assist to accomplishing development goals.

Keywords: *Solid waste management, air pollution, criteria pollutants, greenhouse gases, health and climate impact.*

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VALORIZATION OF MASS CULTURED MARINE MACROALGAE CHETOMORPHAI SP FOR BIODIESEL AND VALUE ADDED PRODUCTS

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Abstract: Biodiesel production from third-generation biomass has seized worldwide attention because it effectively solves future energy constraints and thereby reduces the 'food versus fuel' debate. The present work aims to develop an exploratory approach to the mass cultivation of Chetomorphai sp. a marine macroalgae collected from east-coast of Pondicherry, India for biodiesel production with higher cost-effectiveness. Macroalgae, a photosynthetic autotrophic organism, is rich in lipids and carbohydrates. This versatile organism has the ability to reduce greenhouse gases and climatic changes. The valorization of Chetomorphai sp biomass by sequential two-phase solvent extraction obtained a 10% bio-oil yield with optimized pretreatment condition, temperatures, which ascertain adequate fatty acid concentrations. The overall status of biodiesel production from macroalgae biomass shows inadequacy in coping with the global demand due to the lack of large-scale production. The current work presented elemental analysis and morphological edifice on dry weight and sample biomass. To emphasize the vast potential of macro algae and its conversion rate into biodiesel, the strategic cultivation has been tried to mass culture at the laboratory level with low-cost mineral supplements.

Keywords: *Bio-oil, Algae, Chetomorphai sp, Massculture, Biodiesel.*

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FAST PHOTOCATALYTIC TREATMENT OF SURGICAL COTTON WASTEWATER USING HIGH YIELD, LOW-COST COMPOSITE

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Abstract: In this study, a hydroxyapatite (HAp) / Zinc Oxide (ZnO) composite was prepared with a simple in-situ deposition method, the phosphate group of HAp was utilized to make HAp/ZnO composites, which were then applied for photo catalytic treatment of surgical cotton waste water (SWW). The production of surgical bandages and surgical gauze is on raise to more than two folds especially post COVID period, leading to excess discharge of these effluents containing very high COD (11000 mg/l), alkaline pH (9.7), TDS (2100mg/l) but less BOD (310 mg/l). The photocatalysts such as ZnO, HAp and HAp/ZnO composites were tested in batch experiments for pollutant degradation in SWW. The synthesized composite oxidized more than 90% COD in just 5 hours compared to 79% and 76% removal in 10 and 15 h respectively in ZnO and HAp photocatalysts under LED illumination. The composite sample was characterized using Fourier Transform Infrared (FTIR), Scanning Electron Microscopy (SEM) and X-Ray Diffraction (XRD). The re-usability of HAp/ZnO composite outflanked ZnO and HAp in stability and performance. The yield of HAp/ZnO composite was higher compared to individually obtained HAp and ZnO with much lesser production cost for equal amount of photocatalysts prepared. The results suggest the better efficacy, high yield, low cost, and faster degradation of pollutants using HAp/ZnO composite.

Keywords: *Zinc Oxide, Hydroxyapatite, HAp/ZnO composite, photo catalysis, surgical cotton wastewater.*

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PARAMETER OPTIMIZATION AND PERFORMANCE STUDY OF A LABORATORY SCALE SEQUENTIAL BATCH REACTOR (SBR) FOR COMBINED CARBON AND NITROGEN REMOVAL FROM FISH MARKET WASTEWATER

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Abstract: Retail fish market wastewater (FMWW), specially found in Indian subcontinent and south-east Asia, comprises of greater organic and nutrient load. In this investigation, it was studied how much a laboratory-grown mixed microbial culture would be able to reduce organic carbon and nitrogenous nutrient from real-life FMWW samples with a laboratory scale sequential batch reactor (SBR). Fish market effluent was collected 15 times, and its quality was statistically characterized for pH, total dissolved solids (TDS), total suspended solids (TSS), biochemical oxygen demand (BOD), soluble chemical oxygen demand (SCOD), ammonia nitrogen (NH4+-N), total phosphate and oil & grease, which were found to be 7.2±0.3, 4100±120 mg/L, 5200±180 mg/L, 3000±80 mg/L, 4200±105 mg/L, 450±60 mg/L, 60±8 mg/L and 35±7 mg/L respectively. Operational conditions for the SBR were optimized for the operational parameters such as initial MLVSS concentration, aeration period in aerobic phase (AP), wastewater fill Period (FP), solid retention time (SRT) against different initial SCOD concentration taken as 1000±50 to 2500±50 mg/L. MLVSS was varied from 1800±50 mg/L to 2500±50 mg/L within the reactor. It was found that initial MLVSS concentration of 2000±50, 2100±50, 2300±50 mg/L suitable for targeted initial SCOD concentration of 1000±50, 2000±50, 2300±50 mg/L respectively for satisfactory carbon oxidation in SBR. 0.5-hour FP was observed to provide the best result among three sets of FP variation viz. 0.5, 1 and 1.5 hour, in terms of both SCOD and NH4+-N removal in the subsequent aerobic period. SRT of reactor was varied from 5 to 40 days under same conditions. From the study it was found that SRT of 20-25 days would achieve maximum SCOD utilization and aerobic nitrification. On the other hand, SRT of not more than 5 days was best suited for achieving maximum anoxic denitrification. All the performance studies were run under three sequences of combination of 8 hr react phases viz. (3 hour aerobic + 5 hour anoxic), (4 hour aerobic + 4 hour anoxic) and (5 hour aerobic + 3 hour anoxic). Under all circumstances (4 hour aerobic + 4 hour anoxic) sequence was found to give the best result in terms of combined carbon and nitrogen removal from the FMWW. After optimizing different reactor parameters, performance study of SBR were carried out under optimized condition varying initial SCOD and initial NH4+-N concentration. SCOD, ammonia nitrogen (NH4+-N), nitrate nitrogen (NO3--N) and Nitrite Nitrogen (NO2- -N) were analyzed during the performance study and the results showed that organic carbon and nitrogen can be removed significantly, as 85-90% and sometimes over 90%, from the FMWW.

Keywords: *Fish market wastewater (FMWW), Sequential Batch Reactor (SBR), Combined carbon-nitrogen removal, Parameter optimization, SCOD/NH4+-N ratio, Specific SCOD loading rate, Specific NH4+-N loading rate.*

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A DISTINCTIVE APPROACH TO PREDICT THE THERMAL PERFORMANCE OF HEAT PIPE WITH TIO2 NANO FLUIDS USING RESPONSE SURFACE METHODOLOGY

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Abstract: The creation of heat is unavoidable as electronics get more sophisticated and capable of doing multiple tasks at once. As a result, the heat transfer assembly is utilized to enhance the devices' ability to dissipate heat. The higher the operational temperature of electronic devices and circuits, the more likely they are to fail. The main aim of this paper is to predict the thermal performance of a heat pipe by considering the heat transfer coefficient. By adopting RSM, the experimental parameters were used to predict and optimize the operating parameters such as heat loads, tilt angle and volume concentration of TiO2 nanofluid. The output values are identified as 200 W, 570 and 0.16 %.

Keywords: *Heat Pipe, RSM, Nano fluids, heat transfer coefficient.*

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STUDIES ON CELLULOSE EXTRACTION AND ITS CHARACTERIZATION OBTAINED FROM AN INEXPENSIVE AND ECOFRIENDLY SOURCE

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Abstract: The present study focused on extraction and characterization of cellulose from palm frond an agricultural waste which can be used as an inexpensive and environmentally friendly renewable resource for its potential application in developing green composites. Cellulose was isolated from oil palm frond waste by chemo-mechanical treatments including alkali and bleaching were performed using sodium hydroxide and sodium hypochlorite to increase its functionality. The prepared cellulose was disintegrated to enhance dispersion and compatibility with matrix using 64% of sulfuric acid (H2SO4), mechanical and chemical treatments were performed. Morphological, chemical, crystallinity and thermal properties of extracted fibers were investigated by scanning electron microscopy (SEM), Fourier transform infrared, spectroscopy (FTIR), X-ray diffraction (XRD), thermogravimetry analysis (TGA), differential scanning calorimetry (DSC), respectively. The FTIR data revealed, that the functional groups corresponding to lignin and hemicelluloses in raw fibers were absent in the FTIR spectra of extracted cellulose. Alkali treatment helped in removal of hemicelluloses, while bleaching assisted in delignification. The extracted cellulose nanofibers showed high crystalline index of 69% and thermal stability of fibers has improved to above 300oC resulted from removal of lignin and hemicelluloses via alkali and bleaching treatments. The SEM showed extracted cellulose nanofibers were found to have smaller diameter and smoother surface compared to the untreated fibers which may be useful in enhancing reinforcement capabilities in composites.

Keywords: *Agricultural waste, chemo-mechanical treatments, Cellulose.*

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INVESTIGATION AND OPTIMIZATION OF A SYSTEM FOR TREATMENT OF OIL PRODUCED WATER

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Abstract: This study focuses on the treatment of crude oil wastewater to eliminate contaminants and obtain treated water suitable for diverse applications. The samples were collected from local industry specializes in treating wastewater, particularly crude oil wastewater. The treatment process involves separating the wastewater using a column containing four different media with varying heights, aiming to assess the impact of changes in media height on the quality of the produced water. Specific media sizes were employed in this wastewater treatment study, including different sizes of gravel, sand, anthracite, and cotton. The gravel size ranged from 2.40 to 4.80mm, fine sand from 0.50 to 1.00mm, and anthracite from 1.40 to 2.50mm, effectively removing contaminants from crude oil wastewater. Further, the study examines the influence of sand height on crude oil wastewater. Various parameters were tested to evaluate the quality of the treated water, including pH, conductivity, turbidity, total suspended solids (TSS), iron, free chlorine, total chlorine, total organic carbon (TOC), and dissolved oxygen (DO). Additionally, a media filtration process was employed to eliminate contaminants from crude oil wastewater, ensuring that the treated water meets the standards for different applications. Optimization studies were conducted for different parameters, including total organic carbon and chemical oxygen demand.

Keywords: *Wastewater treatment, Oil produced water, optimization studies, media, sand and anthracite.*

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COMBINED HYDROLYSIS AND FERMENTATION OF PRETREATED BANANA PSEUDO-STEM LIQUID PHASE BY A THERMO AND ETHANOL TOLERANT PICHIA KUDRIAVZEVII MCRCY9'

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Abstract: In this research, wasted banana pseudo-stem (BPS) was utilized for ethanol production, especially pretreated BPS liquid phase using a thermo and ethanol tolerant yeast Pichia kudriavzevii MCRCY9 (MTCC10641) with higher theoretical yield. The main constitutions of BPS (glucan, xylan, arabinan, and lignin) were analyzed in the widely cultivated five varieties of Tamil Nadu, India. The BPS-Poovan (var. Mysore AAB) was selected as the proper combination of substrate for ethanol production. In the present study, the sulphuric acid treatment was investigated as an optimal pretreatment to increase the production of total sugars in the liquid phase. The total and monomeric sugars in the acid-pretreated liquid phase of BPSP were 57 ± 1.25 and 24.4 ± 0.1 g/100g of substrate dry weight, respectively. Noteworthy is that the liquid phase of BPSP after acid pretreatment was used as a substrate for enzyme hydrolysis instead of a solid-pretreated substrate. The cellulase of Aspergillus foetidus MAF1-1 (MTCC 10563) was used to hydrolyze the total sugars of the liquid phase. As the way, the significant improvement of monomeric sugars in the pretreated liquid phase of BPSP (57 ± 0.001g/100g substrate dry wt.) after enzymatic hydrolysis has improved the ethanol production from 13 to 27g / 100g BPSP substrate dry wt. by an ethanol tolerant P. kudriavzevii MCRCY9. The tolerance ability was developed by adapting the yeast strain to ethanol and thermal conditions. The P. kudriavzevii MCRCY9 was also an efficient strain for lignocellulosic ethanol production, with an increased theoretical yield of 95.6%.

Keywords: *Ethanol, banana pseudo-stem, Aspergillus foetidus, ethanol tolerant Pichia kudriavzevii.*

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AN INVESTIGATION OF WIND SPEED DISTRIBUTION AT UNIDENTIFIED, GEOGRAPHICALLY POTENTIAL LOCATIONS OF WIND PASSES IN TAMIL NADU

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Abstract: The increasing rate of energy consumption demands safe and sustainable alternatives for clean energy production. Numerous studies have been conducted to examine India's potential for wind energy as the most flexible option for large-scale contribution for electricity production. However, due to the different geo-climatic factors that affect the distribution of wind speed, there is a large range in the wind energy potential across India. The variations in wind speed distributions are generally addressed using the fitness of various distribution models. The present work intends to propose a streamlined technique for normalized wind energy predictions using the Weibull distribution model to make an accurate prediction of average wind speed. In this study, wind speed variability at a few unidentified, geographically potential locations of wind passes in Tamil Nadu, India were examined with the aim of enhancing the accuracy of wind resource assessments and supporting informed decision-making in the renewable energy sector. Analysis of wind speed were carried out at a height of 10m and 50m, for the selected four locations for a period of 23 years using various forms of Weibull distribution model. It has been found that rather than climatic variables, the model parameters are heavily reliant on topographical features that affect wind speed forecasts. We also employed a statistical comparison over multiple time-scales based on variance, skewness, and kurtosis measures. The results indicate that a normalized variation of the Weibull distribution model can be useful in accurately and dependably describing the wind power potential for the selected locations. The outcomes of this investigation have the potential to expand the geographical scope of wind energy development in Tamil Nadu, contributing to the optimization of renewable energy portfolios and bolstering the state's commitment to sustainable power generation.

Keywords: *Renewable energy, wind pass locations, Weibull distribution model, wind speed variability, ANOVA.*

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DESIGN OF MODIFIED COLD STORAGE SYSTEM FOR INCREASING SHELF- LIFE OF TOMATO

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Abstract: Recent price hikes in tomatoes and other vegetables highlighted the importance of cold storage. After the post-harvest supply chain or cold storage chain play an important role in fruits and vegetable delivery to customers. Normal cold storage systems are more energy consuming and not suited with shelf-life consideration of individual agriculture products. This paper deals with modifications required in cold storage systems considering enhancing the shelf life of tomatoes. Comparison between the evaporative and vapor compression cycles are detailed studied in this project. Basic performance features of cold storage are taken into consideration. With calculation of heat load for modified cold storage and parameters of design are helping to achieve enhancement of shelf life of tomatoes. From sustainable development, energy saving and food nutrition perspective this design is promising future.

Keywords: *Cold Storage, Humidity, Temperature, Shelf Life, Heat Load.*

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ENHANCING SOLAR PANEL EFFICIENCY THROUGH WIND-DRIVEN COOLING: A COMPUTATIONAL STUDY

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Abstract: The increasing dependency on renewable energy sources in response to environmental concerns, notably the sudden growth of photovoltaic (PV) systems, drives research attempts to improve their efficiency. Even one percent improvements in efficiency tend to be vital to sustainable energy development. Surprisingly, several aspects of PV systems, like wind speed, remain unexplored. This research paper aims to investigate the impact of wind interaction on the temperature distribution and overall efficiency of solar panels. The study employs computational fluid dynamics (CFD) simulations using ANSYS Fluent to analyse the cooling effect of natural wind on solar panels under various environmental conditions. The goal is to provide insights into optimizing solar panel performance and increasing energy output by harnessing the cooling potential of ambient wind.

Keywords: *Wind Interaction, Solar Panel Efficiency, Computational Fluid Dynamics (CFD), Cooling Effect, Optimization.*

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CLIMATE JUSTICE IN INDIA: ISSUES AND CHALLENGES

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Abstract: Climate justice is a concept involving the term justice but lacks implication of the meaning. Climate change is an ongoing concept and it does not have an exact origin. Climate justice refers to fair practice where the planet and the humans are treated in a fair manner. The term Climate justice does not have an absolute meaning as only the poorest countries and the most vulnerable population within it are subjective to the adverse impacts of Climate change. Climate justice states that the burdens and benefits of Climate change must be shared fairly and equally among the nations and the population. The concept of climate justice arose due to differentiation in physical geography, uneven development between and within nations and the last contributing factor is the differentiation in the history and growth of the country. Climate justice is likely to be achieved when industrialized countries reduce their greenhouse gas emissions, provide short term and long-term finance for the most vulnerable countries to adapt to climate impacts and to ensure to ensure technology transfer and capacity building such as salt-resistant crops and clean energy solutions. In this paper, the importance of climate justice will be discussed in detail.

Keywords: *Lacks implication, vulnerable population, technology transfer, capacity building.*

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NICKEL (II) REMOVAL IN AN ELECTROCOAGULATION REACTOR: PARAMETRIC OPTIMIZATION BY RESPONSE SURFACE METHODOLOGY

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Abstract: In this study, the process of electrocoagulation was opted for to optimize for higher removal efficiency of nickel from wastewater with low energy consumption. In this experiment, the process of electrocoagulation was employed using iron electrodes in a cylindrical reactor for the removal of nickel from an aqueous solution. Response surface methodology (RSM) for a four-factorial central composite design (CCD) was applied to study the effects of process parameters on removal efficiency and energy consumption. Maximum Ni (II) removal efficiency of 92.6% was attained on optimization at an applied current of 0.3 A, an initial nickel concentration of 28 ppm, an application time of 13 min, and a pH of 7.6. With the help of the obtained 3-D plots, the interaction between the process variables was evaluated. By analyzing the variance (ANOVA), the generated models were validated. The study shows that electrocoagulation can be used as a low-cost, efficient, and promising alternative to conventional technologies used for the removal of Ni (II).

Keywords: *Electrocoagulation, nickel concentration, response surface methodology, central composite design.*

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COLD STORAGE THERMO REFRIGERATOR

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Abstract: A cold storage thermo refrigerator is a device that uses the peltier effect to cool and maintain a desired temperature inside a storage compartment. The peltier effect is the phenomenon of creating a temperature difference by applying an electric current across two dissimilar conductors. A cold storage thermo refrigerator project is a research that aims to design, develop, test, and optimize a cold storage thermo refrigerator for a specific purpose and context. The global increasing demand for refrigeration in field of refrigeration air conditioning, food preservation, vaccine storages, medical services, and cooling of electronic devices, led to production of more electricity and consequently more release of CO2 all over the world which it is contributing factor of global warming on climate change. Thermoelectric refrigeration is new alternative because it can convert waste electricity into useful cooling, is expected to play an important role in meeting today's energy challenges. Therefore, thermoelectric refrigeration is greatly needed, particularly for developing countries where long life and low maintenance are needed. The objectives of this study is design and develop a working thermoelectric refrigerator interior cooling which that utilizes 4L the Peltier effect to refrigerate and maintain a selected temperature 13°C. The design requirements are to cool this volume to temperature within a time period of 5 hrs and provide retention of at least next half an hour.

Keywords: *Peltier effect, thermoelectric cooling, cold storage, refrigerator, design, optimization, efficiency.*

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THERMOELECTRIC AIR CONDITIONER

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Abstract: This abstract introduces a portable and cost-effective thermoelectric air conditioner designed for versatility and energy efficiency. Operating on a 12-volt power supply, the device offers portability and compatibility with solar power sources, making it suitable for various settings. The innovative thermoelectric technology employed enables the system to achieve a cooling capacity capable of lowering ambient temperatures to 16 degrees Celsius. This solution addresses the demand for sustainable, affordable, and portable cooling solutions in diverse environments, contributing to energy conservation and enhanced comfort.

Keywords: *Portable, Cost-effective, Thermoelectric Air Conditioner, 12 Volts, Solar Power, Energy-efficient, Cooling Capacity, 16 Degrees Celsius, Sustainability, Versatile, Innovative Technology, Portable Cooling Solution, Ambient Temperature, Comfort.*

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ORGANIC SUPERHYDROPHOBIC MAIZE SILK DERIVED CELLULOSE ACETATE NANOFIBER SYNTHESIS FOR ENVIRONMENTAL REMEDIATION

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Abstract: The issue of oil spills and the ensuing process of oil-water separation during cleanup continues to be a worldwide concern. The study presents a novel superhydrophobic oil-water sequestration membrane made from a mixture of cellulose acetate produced from maize silk and polyacrylonitrile nanofibers. The viscosity and conductivity of cellulose acetate (CA) and polyacrylonitrile (PAN) solutions incorporating various PAN concentrations were assessed. Electrospinning has been employed for developing a superhydrophobic and oleophilic CSCA nanofiber membrane. The morphological aspects of the membrane were studied by applying different characterization techniques. In pure water solutions, CSCA nanofibers showed their superhydrophobicity by forming a nearly spherical bead with an absolute maximum contact angle of 156° (>120°). A variety of oil-water mixtures and emulsions were tested, and it was shown that both can reap the benefits of the oil-removal characteristics of the membranes. This is because gravity is the only force that enables the system to move forward. Among the tested compounds, mineral oil exhibited the best oil sorption performance at 908% and toluene the worst at 664 %. The CSCA membrane achieves the highest separation efficiency (up to 99.67%) and largest separation flux (442 L/m-2h-1) for mineral oil-water combinations. These results offer credence to the idea that the as-prepared CSCA nanofiber membrane could be a useful reusable oil sorbent for cleaning up oil spills.

Keywords: *Maize silk, cellulose acetate, nanofiber membrane, superhydrophobic, oil-water separation.*

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A REVIEW ON EFFECT OF EMISSION AND PERFORMANCE CHARACTERISTICS OF A CI ENGINE FUELED WITH HYDROGEN ENRICHED EDIBLE AND NON-EDIBLE BIODIESEL

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Abstract: Compression ignition (CI) engines used in the transportation sector run on fossil diesel are one of the biggest contributors to air pollution. Extensive research has been carried out over the past two decades to replace fossil diesel with biofuels, thereby reducing carbon dioxide (CO2) emissions. However, the performance of the engine using this oil is not good, and many long-term problems arise. For this reason, many scientists recommend hydrogen together with biofuels. This study looks at the results of the hydrogenation of edible and non-edible biodiesel in a CI engine. Engine efficiency (brake thermal efficiency, brake specific fuel consumption), combustion parameters (in-cylinder pressure and heat release rate), and emissions (unburned hydrocarbons (HC), carbon monoxide (CO), nitrogen oxides (NOx) and smoke emissions) A detailed analysis has been done. The results show that hydrogen induction generally improves engine performance compared to diesel/edible/non-edible biodiesel, but is similar / inferior to diesel. Except for NOx emissions, all other emissions decrease with the addition of hydrogen. To avoid this phenomenon, researchers have proposed several post-treatment systems such as Selective Catalytic Reduction (SCR), Exhaust Gas Recirculation (EGR), Selective Non-Catalytic Reduction (SNCR), and Non-Selective Catalytic Reduction (NSCR).

Keywords: *CI engine, Edible and non-edible biodiesel, hydrogen, Performance, Emission.*

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EXPERIMENTAL AND THEORETICAL ANALYSIS OF BIOGAS PRODUCTION THROUGH ANAEROBIC DIGESTION

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Abstract: The gas generated by decomposition of organic waste is called Biogas. Biogas is rich with CH4 (Methane) and when burnt produces energy, which can use for heating, lighting etc. It satisfies several criteria of appropriateness - meets a basic need as cooking fuel; makes optimal use of local resources and other organic wastes; helps to develop indigenous growth using local skills and technologies; Biogas technology is one of the most appropriate options for meeting the growing energy needs of the rural areas in India. Biogas is a clean and convenient fuel for cooking and lighting in the households; it can supply motive power for irrigation and small industries, and the effluent slurry, a by-product, can be used as organic manure. More importantly, biogas makes use of a local resource in an environmentally and economically viable manner. The extraction of fossil fuels needs to be reduced if we are to meet new environmental and climate targets and prevent the growing greenhouse effect. In contrast to fossil fuels, biogas is CO2-neutral and renewable. The biogas process lets us reuse society's organic waste, and make it a resource. The specific objectives of this research are, to optimize the methane gas evolution from the oil cakes such as Neem oil cake, Rapeseed oil cake, Cotton oil/Rubber oil cake and by conducting a lab scale study and hence to investigate the biogas yield at an anaerobic digestion temperature conditions. Finally, biodegradable waste is one of the major emitters of CH4 gas in an anaerobic digestion process which makes it a good feedstock for biogas production.

Keywords: *Biogas, Anaerobic Digestion, Renewable, Feedstock.*

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PARAMETRIC OPTIMIZATION OF AIR BIOMASS GASIFICATION PROCESS: A COMPARATIVE ANALYSIS OF RESPONSE SURFACE METHODOLOGY AND PARTICLE SWARM OPTIMIZATION

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Abstract: The world is facing the dual challenges of the energy crisis and Greenhouse gases caused by climate change. Biomass-derived energy is a potential solution that may help overcome this issue. It may help complement the renewable energy bouquet and also it can mitigate the greenhouse gas issue as it is a carbon-negative fuel. Biomass gasification is a viable and attractive process towards this end. However, it is a complex and non-linear process In the present study, the attempt is made to model and optimize the process with response surface optimization (RSM). The control factors chosen in the present study were feedstock size, airflow rate, and temperature while the gas composition was the response variable. RSM was used for the design of experiments, modeling, and desirability-based optimization. For the comparative analysis, the optimization process with RSM was compared with a metaheuristic approach namely Particle swarm optimization (PSO). It was observed that while the RSM was efficient for model prediction, the PSO was superior in optimization. The sensitivity analysis revealed that temperature was the most critical factor. The optimum setting for this process was 880 ° C temperature, 1.2 l/min airflow rate, and 8mm biomass particle size.

Keywords: *Biomass, Renewable, Carbon-negative, RSM, PSO.*

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STATISTICAL EVALUATION AND MACHINE LEARNING PREDICTION-OPTIMIZATION FRAMEWORK FOR A SMALL BIODIESEL-DIESEL POWERED AGRICULTURAL ENGINE FOR IMPROVING ENGINE POWER AND EMISSION REDUCTION

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Abstract: Currently, the global community is confronted with the simultaneous issues of an energy crisis and the presence of greenhouse gases resulting from climate change. This problem is more enhanced with the use of diesel engines. They are blamed for excessive oxides of nitrogen (NOx) emission. The biodiesel from third-generation microalgae can be a viable solution to some extent. Unlike food-based feedstocks, microalgae do not affect the human food chain and are also cultivated at large scale. The standard process of transesterification can be employed for biodiesel synthesis. In the present study, different ratios of microalgae biodiesel–diesel blends were employed as a fuel in a small engine typically employed for agriculture. The employment of alternative fuel in diesel engines is an attractive approach but the modeling is a complex process. Thus, two different approaches i.e., statistical (Response surface methodology) and machine learning (Support vector regression) were employed for this purpose. RSM was used to design experiments, modeling, and desirability-based optimization. RSM-based optimization revealed that 82% engine load and 20% biodiesel blends provided the best result as 30.89% brake thermal efficiency, 82 bar cylinder pressure, 86 ppm hydrocarbon emission, 76 ppm carbon monoxide, and 768 ppm NOx emission. The RSM-based prediction models provided prediction accuracy in the range of 86% to 82% while the support vector regression ML could predict the results with a good accuracy of 95% to 98% showing robust prognostic efficiency.

Keywords: *Alternative fuel, combustion, modeling, SVR, RSM, optimization.*

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OZONE FUNCTIONALIZED CNT FILTERS FOR HEAVY METALS REMOVAL FROM AQUEOUS SOLUTIONS

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Abstract: Nanostructures have physical and chemical properties that make them particularly attractive as sorbents. Multiwalled carbon nanotubes (MWNTs) have shown a promising efficiency as an adsorbent owing to their large surface area and empathy for heavy metal ions. Room temperature ozone treatment was used as a dry method to functionalize the surface of MWNTs and enhance its adsorption property. Filtration efficiency of Ni(II) from aqueous solution using pristine (P-MWNTs) and ozone functionalized MWNTs (O3-MWNTs) filters was investigated as a function of Ni(II) ion concentration, pH, contact time and filter mass. It was found that compared to P-MWNTs, O3-MWNTs have a lower degree of entanglement and reduced nanotube diameters. These functional groups in O3-MWNTs filters were found to play a pivotal role to remove Ni (II) from aqueous solutions. The adsorption mechanism of Ni (II) onto the surface functional groups of O3-MWNTs was confirmed by FTIR spectrum. The filtration results showed that the removal efficiency of Ni (II) is strongly dependent on pH and could reach 95% at pH=8 which is very high removal compared with previous studies. O3-MWNTs filters can be reused through many cycles of regeneration with high performance. O3-MWNTs filters possess a promising adsorbent candidate for heavy metal removal from wastewater.

Keywords: *Multiwalled carbon nanotubes filters, Ozone functionalization, Nickel removal, Filtration efficiency.*

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A STUDY OF FOUR-CYLINDER DIESEL ENGINE USING NEAT SCHLEICHERA OLEOSA (KUSUM) BIO-DIESEL AND NEAT DIESEL AS FUEL

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Abstract: A qualitative test has been conducted on a 4-Stroke 4-Cylinder Toyota Innova Crysta DI with 148 bhp at 3500 rpm water cooled compression ignition engine to study the effect on neat diesel (B-0) and neat Schleichera Oleosa (Kusum) bio-diesel (B-100) on the various engine parameters. A conventional engine has been set with standard NOP of 220 bar and a SIT of 18° bTDC are retained during the test to calibrate the impact of the engine with B-0 and B-100 for various speed ranges from 1400 rpm to 3400 rpm under steady state conditions. From the experiment, it has been observed that the neat Schleichera Oleosa (Kusum) bio-diesel (B-100) gives slightly lower percentage reduction in BTE of 3.44% and reasonable percentage drop in carbon monoxide, hydrocarbon of 11.76% and 21.33% respectively as compared with B-0 at inferior speed whereas at greater speed, the B-100 gives lesser brake thermal efficiency of 4.15% and reasonable reductions in carbon monoxide and hydrocarbon of 23.81% and 26.19% respectively while compared with neat diesel. However, neat bio-diesel gives little higher NOx as compared with B-0 for all speed ranges. Finally, it has been concluded that B-100 could be used as a substantial alternate fuel to operate any kind of multi-cylinder conventional compression ignition engine without any changes of the settings.

Keywords: *Multi-Cylinder Engine, Schleichera Oleosa (Kusum) Oil, Performance, Heat Release Rate, Emissions, Neat Bio-diesel.*

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NUMERICAL STUDY OF NATURAL AND MIXED CONVECTION IN AN ISOTHERMALLY HEATED CYLINDER IN A LID DRIVEN CAVITY WITH EXTENDED SURFACES FILLED WITH NANO-FLUID AND ENCAPSULATION OF NANO-PCM

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Abstract: A computational study of an isothermally heated circular cylinder incorporated with horizontal fins is positioned at various locations within a square enclosure is investigated numerically using Ansys Fluent The numerical work is performed to study the heat transfer characteristics through steady, natural and mixed convection in the enclosure filled with pure water and MWCNT–water nanofluid. The study is performed for different conditions such as cylinder position (CP1–CP9), nanoparticles concentration ($0 \leq \phi \leq 0.05$), Richardson number (Ri=0.1–10) and Rayleigh number (30400-124000). The results observed from investigation are that the average Nusselt number is significantly changed with the cylinder locations and is found maximal at the cylinder position close to the surface of the cavity. It was found also that the Nusselt number enhances in addition, with the increment of nanoparticle concentrations, for lower value of Richardson number and higher values of Rayleigh number. It was also observed that with increase in the number of encapsulations the Nusselt number reduced significantly.

Keywords: *Mixed convection, Nano-fluid, PCM, MWCNT, Encapsulation, Lid driven cavity, horizontal fins, Orientation.*

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NUMERICAL INVESTIGATION OF HEAT TRANSFER ANALYSIS WITH LID DRIVEN CAVITY INCORPORATED WITH RECTANGULAR AND CIRCULAR OBSTACLES

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Abstract: In the study of numerical heat transfer analysis of a lid-driven cavity incorporated with rectangular blocks and circular obstacles, two cases were considered, one is the numerical analysis of mixed convection in a square cavity with two parallel blocks of different orientations and the other is the thermal performance of the magnetohydrodynamics mixed convection flow in a triangular cavity with a circular obstacle. In the case of the square cavity, numerical simulations are conducted for a laminar mixed convection problem in two different orientations. A wide range of Reynolds numbers, Grashoff numbers, Richardson numbers and the distance between the two blocks are considered. Results indicated that varying the distance W/L is an important influence on the Nusselt number. With the increase in the Grashoff number and Reynolds number, the increase in the Nusselt number is observed. The Nusselt number is higher in the case of vertical blocks compared to that of the horizontal block in the square cavity. The maximum Nu obtained for the vertical block is at W/L = 0.5 and for the horizontal block was at W/L = 0.2. The new correlation of the Nu number versus Re, Gr and the spacing ratio between the blocks W/L are derived for possible utilization in the engineering design. In the case of the triangular block, A triangular cavity filled with water with a circular block is the working system. Non-linear partial differential equations are the governing equations that use the finite element method. The moving upper wall and temperature difference contribute to the convection heat transfer. The upper wall is heated and maintained at high temperatures. The other walls are kept as adiabatic. The obstacle at the center is kept at a low temperature. A constant magnetic field is applied in the x - direction. The physical parameters are non-dimensional numbers like the Reynolds number, Richardson number and Hartmann number that influence the heat transfer rate. The Richardson number and Reynolds number impact positively and the Hartmann number tend to decrease heat transfer rate.

Keywords: *Mixed convection, Nano-fluid, PCM, MWCNT, Encapsulation, Lid driven cavity, horizontal fins, Orientation.*

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WEAR BEHAVIOUR OF ELECTRODEPOSITED NI P AND NI P AL2O3 NANO COMPOSITE ON STAINLESS STEEL 304 MATERIAL

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Abstract: Initially, uncoated AISI 304 stainless steel substrate was analysed for their microstructure and composition (EDX). The surface hardness and surface roughness of the uncoated AISI 304 SS was investigated. As the sliding distance was increased beyond 5000 m, the COF value reduced with vi increasing sliding distance. Furthermore, it was observed that the COF value reduced with increasing temperature. However, an optimum value of temperature for lowest COF was found to be with the COF value of In this present work, also presents the comparison of specific wear rate and Coefficient Of Friction (COF) of uncoated AISI 304 SS, Different ceramic layer coatings at same dry sliding wear test condition.

Keywords: *Electroless coating , wear behaviour, 304ss cof.*

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APPLICATION OF FE ANODE-CATHODE ELECTRO-AEROBIC MBRS IN THE REMOVAL OF TEXTILE INDUSTRY WASTEWATER AND MEMBRANE FOULING MITIGATION

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Abstract: Membrane bioreactors (MBR) are widely applied in wastewater treatment due to their high organic load and small footprint. However, fouling of the membrane leads to frequent chemical cleaning or replacement of the membrane module, which aggravates the maintenance burden and limits the application of MBRs. Recently, electro-MBR technology, which combines the electrocoagulation process within the mixed liquid of a membrane bioreactor, has become a suitable option for the effective reduction of membrane fouling. In this study, electro-MBR technology was used for color and COD removal from real textile wastewater with 1495 mg/L COD and 585 mg/L Pt-Co color content. A laboratory-scale aerobic Electro-MBR was operated using a solid retention time of 10 days, a hydraulic retention time of 24 hours, and 300 A/m2 Fe anode and cathode electrodes. pH, conductivity, COD and color measurements were carried out in the tank and permeate daily for 10 days. At the end of the 10th day, 78.33% and 82.31% mg/L COD removal efficiency was achieved in the bioreactor tank and permeate, respectively. At the same time, 93.6 mg/L Pt-Co and 95.16%, 98.53%, and 99.67% color removal were achieved at λ436, λ525, and λ620, respectively. The flux of the membrane remained constant at 25.32 L/m2/h for 10 days. The results obtained from this study are clearly promising for future applications of Iron Electro-MBR in COD and color removal applications in the textile industry.

Keywords: *Electro membrane bioreactor, textile industry, color removal, COD removal, fouling mitigation, electrocoagulation.*

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ENHANCED BATTERY MANAGEMENT TECHNOLOGY FOR SOLAR-POWERED ELECTRIC VEHICLES

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Abstract: With a focus on the creation and refinement of a Battery Management System (BMS) specifically designed for solar-powered electric vehicles (SPEVs), this conference paper explores the crucial nexus between renewable energy and electric vehicles. Electric vehicles provide special problems for solar energy integration; therefore, a complex BMS that takes fluctuating energy inputs, storage capacity, and best practices for charging schemes is required. We investigate new control strategies and algorithms that aim to improve SPEV battery performance, longevity, and efficiency. Our BMS is both reliable and adaptive, optimizing solar energy use and maintaining battery system dependability through extensive simulations and real-world testing.

Keywords: *Battery Management System(BMS), Solar-Powered Electric Vehicles(SPEV).*

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ETHANOL AS OXYGENATED FUEL ADDITIVE IN DIESEL ENGINE: A REVIEW

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Abstract: Depletion of fossil fuel like coal and petroleum products and harmful emissions emitted by burning of these energy sources are the main reasons which are forcing mankind to search alternative energy sources which should be renewable and ecofriendly. Fuel additives are used to enhance properties of fuel to improve combustion, performance and emission characteristics. Techniques such as co-combustion, fumigation, dual injection, blending and emulsification are some of the promising methods to use two fuels in dual fuel mode of an engine. Ternary and quaternary blends are also reported as performance enhancers. Biofuels are already in use which may solve above problems to some extent however research and development still going on to optimize the production and blending techniques of biofuels. In this regard, ethanol is a liquid phase fuel which is already in use for blending with gasoline in petrol engines. Ethanol may be derived from renewable energy sources such as natural fermentation of sugars. The present study carries out a critical review on the use of ethanol with diesel in diesel engines. Ethanol may be used in diesel engine through a number of pathways such as fumigation, co-combustion, dual injection, blending with diesel and emulsification with diesel. It has been concluded in many studies that the use of alcohol such as ethanol, improves performance and emission characteristics of diesel engine. Several studies have reported that use of ethanol in diesel engine improves cylinder pressure and heat release rate, increases brake thermal efficiency, reduces brake specific fuel consumption, decreases emissions of carbon monoxide, oxides of nitrogen, unburnt hydrocarbon, particulate matter and opacity of smoke. Ethanol contains 34.8 wt.% of oxygen which helps in combustion as well as lowers emissions of carbon monoxide, oxides of nitrogen, unburnt hydrocarbon, particulate matter and opacity of smoke. However, some studies reported an increase in oxides of nitrogen emission due to high oxygen availability during combustion.

Keywords: *Ethanol, Additives, Biodiesel, Dual Fuel, Co-combustion.*

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IMPACT OF COMPRESSION RATIO VARIATION ON THE PERFORMANCE OF A MANGO SEED BIODIESEL FUELLED DIESEL ENGINE

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Abstract: Increasing demand and cost of fuel as well as increasing pollution levels encouraged researchers to search alternative energy resources in fuel sector. Biofuels such as biogas, producer gas, alcohols, biodiesels can be produced from different feedstocks which can play the role of alternative fuel for transportation. In this regard, waste mango seeds are utilized for biodiesel production through transesterification process. For performance testing of the biodiesel, the compression ratio was altered from 17.5 to 18 and five different engine loading (20% to 100%, with increment of 20% after each step) were examined on a 3.5 kW single cylinder, four stroke, direct cooled diesel engine. The engine testing revealed that mango seed biodiesel produces equivalent performance to diesel fuel when used in diesel engine at a compression ratio of 18. Increasing the compression ratio from 17.5 to 18 resulted in improved engine outcomes when running on Mango Seed biodiesel mode. Higher compression ratio enhances the performance parameters such as increases the brake thermal efficiency and decreases the brake specific fuel consumption as well as reduces exhaust emissions. CO, HC, and smoke opacity for Mango seed biodiesel at compression ratio 18 were found to be less in comparison with diesel mode However, emissions of NOx were higher for Mango Seed biodiesel mode as compared to diesel mode.

Keywords: *Mango seed biodiesel, Compression ratio, Diesel engine, Emission.*

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SYNTHESIS AND CHARACTERIZATION OF BIOBASED POLYMERIC NANOCOMPOSITES AND ITS APPLICATION IN FOOD PACKAGING

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Abstract: The majority of the world's packaging materials used in the last hundred years have been synthetic polymers made from fossil fuels, which aren't renewable. It is too late to reverse the devastating effects of plastic on the ecosystem. Due to these reasons, as well as the increasing cost, specialists are considering biodegradable food packaging. Typically, the cost of synthesizing biopolymer through microbial fermentation is high. Employing cheese whey as a base material also helped bring down production costs. Bionanocomposites based on poly(3-hydroxybutyrate) (PHB) were created using the solution casting approach. The nanocomposites included varying amounts of ZnO nanoparticles, ranging from 2% to 10%. The biopolymer comprised nanoparticles that, when dispersed, considerably altered the material's shape, crystallization behaviour, thermal stability, mechanical and barrier characteristics, and rate of biodegradation. A variety of analytical tools were used to assess the films, including XRD, SEM, FT-IR, UTM, and degradability behaviour. Additionally, 30 days of storage at 7°C was spent with soft white cheese that was manufactured and placed inside the bionanocomposite sheets. In comparison to pure PHB, the nanocomposites showed better gas and vapour barrier characteristics and less water absorption. Their antibacterial efficacy against Gram-positive and Gram-negative bacteria was enhanced as the ZnO content was increased. Lastly, we discovered that the bionanocomposite films that were made by combining ZnO-NPs in various ratios had superior qualities when compared to the conventional polystyrene packaging. This suggests that these films could be an excellent choice for food packaging. Foodstuffs packaged in these bionanocomposites have a longer shelf life and better quality than those packaged in synthetic plastics.

Keywords: *Bionanocomposites, food packaging, shelf life, degradability behaviour.*

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COMPARATIVE OIL YIELDS AND FATTY ACID PROFILES FOR THE MICROALGAL BIOMASS RAISED PHOTOAUTOTROPHICALLY AND MIXOTROPHICALLY

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Abstract: With the increasing energy demand and elevated depletion rate of fossil fuels, there is dire need of a cheap and environmentally stable fuel. Furthermore, the environmental and human health issues due to the overdependence on fossil fuels has well addressed. Currently, mixotrophic (MT) cultivation of microalgae is gaining interest to overcome the world's energy thirst. In the current study, a pre-isolated and pre-characterized C. vulgaris was obtained and cultivated under photoautotrophic (PT) and MT cultivation for 20 days of incubation. PT cultivated C. vulgaris was provided with atmospheric CO2 and BG-11 medium. While MT C. vulgaris was cultivated on four kinds of agro-industrial wastes i.e. sewage sludge, poultry wastes, pressmud and livestock manure. The oil yield of both cultivations were extracted by using Soxhlet apparatus and statistically compared. It was found that sewage sludge raised biomass produced highest oil content (25.5±0.35%) followed by poultry wastes (18.51±0.16%), pressmud (18.51±0.16%), PT (10.58±0.35%) and livestock manure (10.32±0.09%). The lower oil yield of livestock manure raised biomass was due to the fact that microalgae lack cellulolytic enzymes. Furthermore, the extracted oils were subjected to GC-MS for the analysis of fatty acid methyl esters (FAME). Higher the content of poly unsaturated fatty acids (PUFA) and unsaturated fatty acids (UFA) ensured the production of high quality biofuel. The FAME analysis showed for sewage sludge raised biomass showed highest PUFA content of 60.61% with UFA content of 22.87% followed by the poultry waste (18.1%, 25.29%), livestock manure (49%, 8.2%) and pressmud (13.3%, 22.3%) raised biomasses. While, the PT raised biomass showed 19.03%, 30.7% of PUFA and UFA respectively. Based on these results, the MT mode of C. vulgaris can be utilized more often. The MT mode of nutrition on different wastes can ensure cost effective production of biofuels.

Keywords: *Algal lipids, Biomass, Biofuel, Economical cultivation, Green energy.*

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IMPROVED BIOETHANOLOGENESIS FROM POTATO PEELS USING ZINC OXIDE NANOPARTICLES

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Abstract: Biomass, like potato peels (PPs), has emerged as a promising feedstock for renewable bioethanol production, addressing energy needs and waste disposal simultaneously. This study is an effort that examines the influence of ZnO nanoparticles (ZnONPs) derived from PPs extract on PPs hydrolysis and ethanol fermentation. Proximate analysis of Ammonia (NH3) pretreated PPs reveals a composition of 14% cellulose, 23% lignin, 10.3% hemicellulose, and 40% starch. ZnONPs were synthesized using PPs extract and zinc acetate dihydrate at a pH of 12. The PPs mediated ZnONP further characterized using Scanning Electron Micrograph (SEM), and it was found that at the 300,000 magnification it showed flower shaped chemistry with apparent size from 100 to 300 nm. The. Distinct signals were observed in the EDX spectra at an energy level of 15 KeV, revealing the presence of oxygen (O) and zinc (Zn) in the material, with their relative proportions being 20% for O and 50.3% for Zn, totaling 70.3% for the overall elemental composition. Zeta Sizer of the ZnONPs displayed 198.4 d nm as average particle size whereas Zeta potential analysis showed stability and good colloidal properties with a peak of 15.4 mV. The alkali-thermophilic bacterial strain Bacillus licheniformis strain N (OQ740163), having amylolytic activity (0.719 ± 0.018 µmol/min) and cellulolytic activity (0.213 ± 0.03 µmol/min) enabled the isolates as potential candidate for biomass hydrolysis. It was found that hydrolysis of alkali pretreated PPs (4.5%) by Bacillus licheniformis strain N (OQ740163) yielded highest reducing sugar content of 9.58±0.053 g/l employing ZnONP whereas without nanoparticle 5.915 ±0.025 g/l glucose was obtained. This elucidates that 61.96 % improved sugar yield was obtained with ZnONPs from alkali-treated PPs. ZnONPs-treated potato peels hydrolysates (ZnONPs-PPH) were further subjected to ethanologenesis using Saccharomyces cerevisiae K7. This yeast strain yielded high ethanol from PPs hydrolyzates when the fermentation was carried out using ZnONP i.e. 0.460 g of ethanol/g of glucose compared to 0.399 g ethanol /g glucose yielding 15.288 percent improved ethanol. In conclusion, this study underscores ZnONPs' potential as catalysts in saccharification and fermentation of PPs, highlighting their role in sustainable bioethanol production.

Keywords: *Bioethanol, Potato peels, Fermentation, Biomass, Nanoparticles, ZnONPs.*

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SMART WIRELESS WATER LEVEL MONITORING SYSTEM

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Abstract: The Arduino nano board is a central monitoring station, it senses the water level in overhead tank by using ultra sonic sensor, the NRF24L01 sensor will transmit water level information to the receiver sensor. After receiving information if water level is below the motor will be TURNON or water level above the motor TURNOFF. This process will be done through the wireless communication.

Keywords: *Wireless Water Monitoring, Internet of Things, Wireless Communication, Smart Home Automation.*

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DESIGN OF MULTIPURPOSE SMART SOLAR GRASS CUTTER

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Abstract: From the time immemorial, the sun is the major source of energy for life on earth used for heat and lighting. Nowadays, solar energy has been known as a renewable energy source. It is an alternative energy to that of fossil fuel and it can be collected from the renewable resources such as sun, wind and hydro. This paper introduces a new development of grass cutter, named as Smart Solar Grass Cutter, by using solar irradiance as a primary energy source with the presence of a solar panel. Also, an IC engine requires periodic maintenance such as changing the engine oil, mechanical maintenance. It is an innovative technology of cutting grass without any pollution, electric solar grass cutter are environmentally friendly. Nowadays, the labour charge is increased day by day. This technology can help the people who are living in rural areas. This project is mainly proposal for reduce the manpower and usage of electricity. Our main aim in pollution control is attained through this we added remote control for unskilled person can operate easily and maintain the lawn very fine and uniform surface look. In our project, solar grass cutter is used to cut the different grasses for the different applications.

Keywords: *Solar grass cutter, Design, 3-D modelling, SolidWorks, Solar Panel, Solar array design, Atmega 328-p.*

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RECENT DEVELOPMENTS IN THE DESIGN AND FABRICATION OF FDM 3D PRINTERS

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Abstract: The present review paper explores the recent advancements in the design and manufacturing of a low-cost fused deposition modelling (FDM) 3D printer. Recently, the usage of FDM 3D printers has increased exponentially in many engineering applications to fabricate various components. The advancements in FDM printers are related to the printing of new materials with improved mechanical properties, multi-material and multi-nozzle systems, improved resolution and speed, enclosures with heated beds for improving print quality, integration of temperature sensors, filament sensors, and even cameras for remote monitoring, etc. Even with the addition of these advancements in FDM printing, the technology is still facing some challenges, mainly related to cost, size of the components, production rate, and low strength. So, this review paper highlights the above-mentioned parameters and summarizes the recent developments in the fabrication of low-cost FDM printers aimed at small-scale users.

Keywords: *FDM, 3D printing, technology development, manufacturing.*

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IMPROVING WIND TURBINE EFFICIENCY WITH AN INNOVATIVE CURRENT CONTROL APPROACH FOR INDUCTION MOTORS

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Abstract: In order to improve overall system reliability and efficiency, this conference paper presents a novel method of current regulation for wind energy turbine induction motors. The suggested approach maximizes induction motor performance by utilizing creative control tactics, resolving issues brought on by fluctuating wind conditions. The study offers promising outcomes in terms of energy output, system stability, and maintenance cost reduction by combining theoretical analysis and practical application to illustrate the effectiveness of the unique current control technique. This study presents a novel approach to optimizing the production and longevity of induction, which advances the continuous development of renewable energy systems, especially in the field of wind power.

Keywords: *Current Control, Wind Energy.*

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DESIGN AND FABRICATION OF LOW COST ELECTRO PLATING SETUP

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Abstract: Electro plating has been considered as an effective approach to provide protection and enhancement for metallic materials with many excellent properties in engineering field. This paper begins with a brief introduction of the fundamental aspects underlying the technological principles and conventional process of electro nickel-phosphorus (Ni-P) coatings. Then this paper discusses different electro nickel plating, including binary plating, ternary composite plating and nickel plating with nanoparticles and rare earth, with the intention of improving the surface performance on steel substrate in recent years in detail. Based on different coating process, the varied features depending on the processing parameters are highlighted. Separately, diverse preparation techniques aiming at improvement of plating efficiency are summarized. Moreover, in view of the outstanding performance, such as corrosion resistance, abrasive resistance and fatigue resistance, this paper critically reviews the behaviors and features of various electro coatings under different conditions.

Keywords: *Electroplating , ni p coating.*

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A REVIEW OF THE SURFACE COATING PERFORMANCE OF THE ALUMINIUM ALLOY BY SURFACE MODIFICATION THROUGH AN ADVANCED MACHINING PROCESS

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Abstract: Today, advanced machining processes such as electrical discharge machining (EDM) play a vital role in the machining of hard-to-cut materials as well as nonferrous materials to produce components with complex shapes. Also, EDM is used to modify the characteristics of the material surface by changing its process parameters, such as current, voltage, pulse on time, pulse off time, etc. Depending on the EDM process parameters, the depth of recast layers varies with the formation of voids, microcracks, pores, etc., which influences the surface roughness of the machined component surface. With the different surface roughness, the surface coating has been done to improve the coating adhesion and increase scratch resistance, wear resistance, and corrosion resistance. This paper gives a detailed discussion on the surface coating performance of aluminium alloys with different surface roughnesses.

Keywords: *EDM, surface roughness, aluminium alloy, process parameters.*

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INVESTIGATING THE BIOMETHANE YIELD OF SWEET SORGHUM BAGASSE AS RAW MATERIAL IN THERMOPHILIC SOLID-STATE ANAEROBIC DIGESTION USING AI

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Abstract: Approximately 23 million tonnes of stubble are burned annually across northern India, contributing to severe air pollution and health risks. For instance, biomethane produced from sweet sorghum bagasse (SSB) could be a sustainable replacement to fossil fuels and associated chemicals. However, it is very essential to monitor and maintain distinct biological, physical and chemical parameters at optimum level to achieve maximum yield of bioenergy from biomass. BMP assays are set up for SSB anaerobic digestion at thermophlic conditions and high solids over 50 days. The impact of physio-chemical parameters on SSB AD dynamics is validated using 16 s rRNA metagenomic sequencing. Modeling of LCB conversion process using artificial intelligence techniques such as neural network and fuzzy systems would help to delineate the complex process dynamics and physical performances accurately in a simple way. Those multi-scale modeling applications after fitting to optimally chosen experiments can result potential tools to design a bioenergy system to assess its technical and economical feasibility along with environmental influences.

Keywords: *Sweet sorghum bagasse, ANN, high solids, thermophillic, biomethane.*

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RESEARCH STATUS ON MECHANICAL AND MICROSTRUCTURAL CHARACTERISTICS OF WIRE ARC ADDITIVE MANUFACTURING (WAAM) OF NICKEL BASE ALLOYS

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Abstract: Wire Arc Additive Manufacturing (WAAM) processes, particularly those involving nickel-base alloys such as Inconel and other high-performance alloys, have been an active area of research and development for many researchers in recent times. Inconel, a nickel-chromium-based superalloy, is widely used in aerospace and other high-temperature applications. Research in WAAM processes often focuses on optimizing the parameters for Inconel deposition to ensure the desired mechanical properties and reduce the risk of defects such as porosity and cracking. Also, understanding the microstructure of WAAM-deposited Inconel and heat treatments is inevitable to get the desired properties. This research paper highlights the many mechanical and microstructural characteristics of the WAAM-manufactured nickel-base alloys.

Keywords: *WAAM, Inconel, mechanical properties, microstructure.*

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DEVELOPING SUSTAINABLE AND RENEWABLE BIOSYNTHETIC ROUTES FOR CHEMICAL PRODUCTION: INVESTIGATING THE INFLUENCE OF CANDIDA TROPICALIS CELLULASE ON BIOETHANOL PRODUCTION USING SUGARCANE BAGASSE

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Abstract: Developing sustainable and renewable biosynthetic routes for chemical production involves efficient utilization of waste biomass feedstock by microorganisms. One approach is consolidated bioprocessing, which involves the conversion of lignocellulose waste into advanced fuels and chemicals. However, lignocellulose is a complex network of polymers that is difficult to degrade. Cellulolytic enzymes work synergistically to release sugars, and their extracellular localization complicates this process. The use of thermozymes for hydrolysis of cellulosic biomass significantly affects the conversion of lignocellulosic ethanol. Facultative thermophiles, also known as moderate thermophiles, can survive below 50°C (122 °F) and at high temperatures. The strain Candida tropicalis NITCSK13 (KX198669) was isolated from sugarcane juice and produced a maximum of 44 ± 0.2 g/L ethanol from sugarcane bagasse, showing its ability to tolerate high ethanol content. Molecular docking of cellulase in thermophilic microorganisms showed a higher inhibition constant towards cellobiose at 50°C, with a lower inhibition constant (kd) than the binding affinity. This strain did not exhibit any physiological differences during the ethanol tolerance test (16%). Crude cellulase of NITCSK13 exhibited high cellulolytic and ethanol-fermentative production at 50°C. This study aimed to investigate the influence of Candida tropicalis cellulase on bioethanol production using sugarcane bagasse using various process parameters such as pH, time, and temperature. An artificial neural network's (ANN) feed-forward backpropagation predicted the optimal process conditions. Maximum ethanol yield was expected, with a coefficient of determination (R2) of 0.998 and an absolute average deviation (AAD) of 1.23% at 55°C and pH 3.5.

Keywords: *Bioethanol, Sugarcane bagasse, Thermophiles, Candida tropicalis, ANN.*

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EFFECT OF HIGHER ALCOHOL AND CERIUM OXIDE NANOPARTICLE AS ADDITIVES ON JULIFLORA BIODIESEL MIXTURES ON THE WORKING CHARACTERISTICS OF DIRECT INJECTION COMPRESSION IGNITION ENGINE

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Abstract: In this study, a novel biodiesel was extracted from raw Juliflora oil can be used as an alternative fuel for diesel engines. Oxygenated additives and nano-particle additives may be taken into consideration to enhance combustion, increase fuel efficiency, and reduce pollutants and these additives aid in raising the biodiesel's quality. This study looks into the performance analysis of CI engine behavior using a 30% combination of Julia flora biodiesel (JB30) with 10%, 20%, and 30% of 1-hexanol and 100ppm of cerium oxide nanoparticle. The blends were prepared with diesel, biodiesel, different proportions of n-butanol with 100ppm of cerium oxide nano-particle. The blends were designated as B1(70%Diesel+ 30% Juliflora biodiesel), B2(60% Diesel +30% Juliflora biodiesel+ 10% 1-hexanol+100ppm of CeO), B3 (60% Diesel + 30% Juliflora biodiesel+ +20% 1-hexanol +100ppm of CeO), and B4 (40% Diesel + 30% Juliflora biodiesel+ +30% 1-hexanol +100ppm of CeO) on a volume basis. These blends undergo magnetic stirring and ultrasonication to provide the long-term stability and a homogeneous dispersion of nanoparticles inside the mixture. These fuel combinations were put to the test under various operating conditions in a diesel engine. According to the findings of this study, the BTE of the nano-particle blended fuel B2,B3 and B4 were improved by 0.9-2.6% when compared to diesel with decrease in BSFC across the entire load. The HC and CO emissions were substantially lowered by 36% and 20% respectively with the reduction in NOx and smoke emissions of 10% and 40%, respectively. Overall, it has been suggested that JB30 mixed with 30% butanol and 100 ppm of cerium oxide nanoparticles enhance engine performance and significantly lower NOx and smoke, suggesting that they may greatly reduce the need for fossil fuels while also acting as an environmentally friendly additives.

Keywords: *Diesel engine, Juliflora biodiesel, 1-hexanol, Emission, Combustion, Performance, nano-particle.*

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A COMPREHENSIVE REVIEW ON CRYOGENIC TREATMENT OF WIRE ARC ADDITIVE MANUFACTURING OF METALS

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Abstract: Cryogenic treatment, which involves subjecting materials to extremely low temperatures, can be applied as a post-processing step to enhance the properties of metal components. Recent times alloys of ferrous and nonferrous metals are fabricated by Wire Arc Additive Manufacturing (WAAM) for various applications such as aerospace, marine and automotive etc. The specific effects of cryogenic treatment on WAAM-produced metals can vary based on factors such as material composition, process parameters, and the intended application. This review paper provides an overview of the cryogenic treatment of various metal components fabricated by WAAM to achieve refined microstructure, enhanced mechanical properties, and disregard residual stress. Also, provides recent trends and future research aspects of WAAM of various metals.

Keywords: *WAAM, cryogenic treatment, mechanical properties, post processing.*

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PROCESS PARAMETER OPTIMIZATION ON TITANIUM ALLOY BY USING ELECTRIC DISCHARGE MATERIAL ADDITION PROCESS

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Abstract: In this study, Electrical discharge machining (EDM) is one of the earliest non-traditional machining processes. This process is based on thermoelectric energy between the workpiece and an electrode. Electrical discharge machining is basically a nonconventional material removal process. This process is widely used to produce dies, punches and moulds, finishing parts for aerospace and automotive industry, and surgical components. Irrespective of their hardness, shape and toughness, this process can be successfully employed to machine electrically conductive parts. Titanium alloys are of an increasing importance in engineering applications because of their excellent combination of high strength, low density and corrosion resistance. Titanium alloy has wide applications in field of aerospace, automotive, nuclear, chemical, marine and biomedical industries' major objective of an electrical discharge coating machine is to apply a coating to a workpiece through a process known as electrical discharge machining (EDM).

Keywords: *EDM coating , Titanium alloy , wear , surface roughness.*

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3D PRINTING OF POLYMER MATRIX COMPOSITES USING SCREW-BASED EXTRUSION METHOD

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Abstract: The 3D printing of polymer matrix composites using screw-based extrusion is a process that involves the extrusion of a composite material through a nozzle to build up a three-dimensional object layer by layer. This technique is commonly referred to as Fused Filament Fabrication (FFF) or Fused Deposition Modeling (FDM) when applied to polymer composites. Screw-based extrusion is the primary method in FFF/FDM 3D printing. In this process, a filament composed of the polymer matrix and reinforcing material is fed into a heated extruder. The extruder typically consists of a rotating screw that melts and pushes the composite material through a nozzle. Advancements in this field are ongoing, with researchers exploring new composite formulations, optimizing printing parameters, and developing techniques to further improve the mechanical properties of 3D-printed polymer matrix composites. In this paper, the key aspects of 3D printing polymer matrix composites using screw-based extrusion are explored in terms of reinforcement dispersion, print parameters, post processing and challenges.

Keywords: *3D printing, polymer matrix composite, screw-based extrusion.*

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THE POTENTIAL OF WATER HYACINTH BIOMASS IN SECOND-GENERATION BIOETHANOL PRODUCTION: PAVING THE WAY FOR RENEWABLE FUEL AND A GLOBAL ENERGY SHIFT

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Abstract: The study identifies lignocellulosic biomass as a potential substrate for biofuel production and discusses the role of algae and aquatic plants in the energy cycle. It also explores bioenergy as a sustainable alternative to fossil fuels. The paper concludes by discussing bioethanol, a renewable fuel produced by the anaerobic digestion of organic waste, and its potential as a fossil fuel alternative. It also examines the two generations of bioethanol production, critiquing the impact of first-generation production on food supply and emphasizing the cost-effectiveness of second-generation production from lignocellulosic biomass. This study investigates the potential of water hyacinth as a biomass source for bioethanol production. The plant was collected, cleaned, dried, and pulverized. The biomass was then pretreated with different concentrations of NaOH and left at room temperature for three days. Total sugar and reducing sugar were determined after centrifugation. The pH of each pretreated solution was adjusted, followed by the addition of surfactant and commercial cellulase. The mixture was then maintained at 30 °C for two days. The optimization of bioethanol content was achieved through a statistical technique using the design of experiment (DoE) method. The response surface methodology (RSM) was used to design tests to determine the optimal conditions for the projected response within the specified range of variables. A central composite design (CCD) was employed to develop the perfect environment for maximal bioethanol production. The reduction and total sugar concentrations were estimated using sulfuric acid and 5% phenol, respectively, and the DNS method. The fermented concoction's alcohol percentage was checked using an ebulliometer. Saccharomyces cerevisiae TISTR5020 was cultured at 35 °C for 24 h in a YPD broth, and the medium was sterilized in an autoclave. The study demonstrates the feasibility of using water hyacinth as a viable source for bioethanol production.

Keywords: *Water Hyacinth, Aquatic Biomass, 2G fuel, Bioethanol Production.*

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HARNESSING THE POWER OF METAL OXIDES: A NOVEL APPROACH TO BOOST PYRAMID SOLAR STILL EFFICIENCY

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Abstract: Accessing potable water is essential to life on Earth, but it may be difficult in many places, especially in isolated and desert locations like southern Algeria. Solar distillation is a successful, non-conventional way of purifying brackish or saltwater that is also ecologically benign. Through the addition of distinct units holding various metal oxides zinc oxide (ZnO), copper oxide (CuO), and iron oxide (Fe2O3) at varied weight concentrations (0.05%, 0.10%, 0.15%, and 0.20%), this investigation seeks to increase the efficiency of traditional pyramid solar still. These metal oxides function as photo-catalysts at all concentrations, according to research done at Saveetha University. With a weight concentration of 0.20% of metal oxide and a salty water depth of 1 cm, the productivity of the test stills rises by 23.13%, 17.04%, and 14.12% for CuO, Fe2O3, and ZnO, respectively, in comparison to the traditional still. The distillate's physical examination indicates its quality is more excellent than that of distillates made without metal oxides. For CuO, Fe2O3, and ZnO, the projected costs for 1 kg of distillate are $0.0090, $0.0089, and $0.0096, respectively, whereas the baseline case's price is $0.0092.

Keywords: *Composite nano particles, Pyramid solar still, Metal oxides, Desalination, Solar still efficiency.*

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STATISTICAL OPTIMIZATION, KINETIC, EQUILIBRIUM ISOTHERM, AND THERMODYNAMIC STUDIES OF CATIONIC DYE USING LOW-COST BIO-ADSORBENT

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Abstract: In the present study, the degradation and decolorization of the cationic dye were carried out by using biochar as a natural adsorbent. The experimental results show that the removal of cationic dye as 93.5 % onto biochar as a natural adsorbent. The characterization of adsorbents was done to identify the functional group, surface characteristics, and elemental constituents using scanning electron microscopy, and Fourier transform infrared spectroscopy of biochar before and after treatment. The decolorization of dye under optimized conditions was obtained as optimum removal of (93.5%) of dye obtained at pH of 7, adsorbent dose of 10mg/l at equilibrium time of 60min, and rotation speed per minute is 220 with a dye concentration of 100ppm at a temperature of 200 k. The kinetic models and isotherms were analyzed and the results reveal that the pseudo-second-order model is a best-fit one and Langmuir and Temkin isotherms fit well.

Keywords: *Degradation, Proximate, Endothermic, Ultimate, Decolorization, Cationic Dye.*

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EFFICIENT BIODIESEL PRODUCTION FROM THE LIPIDS OF PHORMIDIUM UNCINATUM USING FE2O3 PHOTOCATALYST

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Abstract: In this present study, biodiesel is produced by the utilization of cyanobacterial lipids through photocatalysis. The cyanobacteria from the coastal region were collected, identified, and grown and lipid was extracted from the Phormidium uncinatum. Iron oxide semiconductor nanomaterial photocatalyst was synthesized by co-precipitation method and characterized by different techniques such as Fourier transform infrared spectroscopy (FTIR) X-ray Diffraction (XRD) Scanning Electron Microscopy (FE-SEM) energy dispersive X-ray spectroscopy (EDX) UV-Visible Diffuse reflectance spectroscopy (DRS). The synthesized and characterized nanomaterial was used for the transesterification of lipids extracted from the Phormidium uncinatum. Gas chromatography-MS characterized the fatty acid methyl ester produced. Biodiesel conversion efficiency was enhanced by using a Fe2O3 Semiconductor photocatalyst.

Keywords: *Phormidium uncinatum., Iron oxide, Photocatalyst, Biodiesel.*

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BIOSYNTHESIS OF LIPASE-IMMOBILIZED ZINC OXIDE NANOPARTICLE AND ITS ROLE AS A NANOCATALYST IN THE BIODIESEL PRODUCTION OF THE LIPID FROM ANABAENA CYANOBACTERIAL ISOLATED FROM SALINE WATER

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Abstract: In the present research work, lipase-immobilized zinc nanoparticles were used for biodiesel production. In the current study, the fungus Aspergillus Niger (KP001169) was exposed to gamma radiation to create the lipase enzyme, which was later immobilized in ZnO nanoparticles. The synthesized zinc oxide nanoparticle was characterized using FTIR, XRD, SEM-EDAX, and analytical methods. By varying temperature and pH levels, the activity of the lipase enzyme, both free and immobilized, was assessed. According to the experiment, ZnONPs-Lipase (5%) can be reused in the production of biodiesel without being treated for up to five cycles, its activity was decreased by 15% after the 5th cycle. The optimized reaction conditions for the production of biodiesel from the lipid obtained from Anabaena species were found to be methanol: oil ratio (1:4), Reaction temperature (45ºC), Reaction time (6 hours), and Reaction speed (400 rpm).

Keywords: *Anabaena species, Lipids, Biodiesel, ZnO, Lipase enzyme, and Transesterification.*

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EXPERIMENTAL AND STATISTICAL OPTIMIZATION FOR BIODIESEL PRODUCTION FROM MIMUSOPS ELENGI L

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Abstract: Biodiesel is an eco-friendly, renewable and potential biofuel that can help us to bring down greenhouse gas emissions and manage energy demands. In this paper, we will be focusing on the statistical optimization of biodiesel production from the non-edible seed "Mimusops Elengi L" via base-catalyzed transesterification using sodium hydroxide as a catalyst and testing it in a diesel engine. This Study evaluates and compares the prediction and simulating efficiencies of the Response Surface Method (RSM) and Artificial Neural Network (ANN) for biodiesel yield achieved from the transesterification of Mimusops Elengi L. The Process Influence variables involved in the transesterification process are oil-to-methanol molar ratio, catalyst content, reaction temperature and time. The statistical analysis of experimental yield performed in RSM and ANN gives R2 values of 0.9923 and 0.9992 for each respectively. The mean square error of ANN is 0.2356 which is 0.1667 less than that of RSM indicating ANN as the better method to predict the yield efficiency for our study. The optimum yield of biodiesel achieved is 83% at 1:7.5 molar ratio experimentally. Finally, the biodiesel produced was tested for its engine characteristics.

Keywords: *Mimusops Elengi L, Transesterification, RSM, ANN, Biodiesel, Engine.*

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BIODIESEL PRODUCTION FROM THE SEEDS OF MARTINIYA ANNUA L USING GREEN SYNTHESIZED SILVER OXIDE AS A NANOCATALYST

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Abstract: The present study focuses on producing biodiesel using the seeds of Martiniya Annua L using silver oxide. Silver oxide nanocatalyst was synthesized by green synthesis of Madhuca Longifoli seeds and characterized by different techniques such as Fourier transform infrared spectroscopy (FTIR) X-ray Diffraction (XRD) Scanning Electron Microscopy (FE-SEM). The synthesized and characterized nanomaterial was used for the transesterification of bio-oil extracted from the seeds of Martiniya Annua L. Gas chromatography-MS characterized the fatty acid methyl ester produced. Biodiesel conversion efficiency was enhanced by using a silver oxide nanocatalyst. The optimized reaction parameters of the produced biodiesel samples were determined using Response surface methodology analysis. The polynomial equation formed by the second-order model was obtained for the transesterification reaction. The independent variables used to obtain the percentage yield of biodiesel were the M/O molar ratio, reaction temperature, and reaction time Catalyst Concentration. Biodiesel has higher lubricity than petroleum diesel so it is easier on the prone-to-wear engine parts. Biodiesel usually contains zero sulphur content making it very environment friendly and the fact that biodiesel has increased oxygen content, the fuel gets a clean and complete burn without any unburned fuels getting out through the exhaust pipe. This also makes the biodiesel a very less toxic compared to the biodiesel.

Keywords: *Biodiesel, Martiniya Annua L, Silver Oxide, RSM.*

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