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Northwest vs. Northeast India: Comparing the Causes and Impacts of Flash Floods

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Abstract
Flash floods have escalated into highly catastrophic and frequent occurrences across the Indian subcontinent, driven by compounding climate feedback loops and aggressive infrastructure deployment. This paper provides a rigorous comparative case study of two hyper-vulnerable yet meteorologically and topographically distinct zones: Northeast India (NEI) and Northwest India (NWI). Utilizing a synthesized hydro-geomorphic vulnerability framework, we analyze how distinct driving forces generate unique disaster profiles in each region.NEI flash floods are predominantly triggered by massive monsoonal and pre-monsoonal convective systems over low-strength sedimentary fold mountains, causing rapid catchment overtopping, high sediment loading, and chronic lowland inundation. Conversely, NWI flash floods are characterized by extreme orographic cloudburst events and anomalous interactions with Western Disturbances. These triggers interact with highly sheared, crystalline Himalayan thrust zones to yield extreme structural devastation, rapid landslide-dammed lake failures, and downstream kinetic destruction. Furthermore, this study evaluates the specific human interventions—such as vertical slope destabilization for linear transportation networks and unscientific riverbed extraction—that exacerbate flood consequences. We conclude with targeted strategic recommendations for sub-regional early-warning telemetry, geomorphologically informed civil engineering protocols, and transboundary floodplain zoning.

Keywords: *Flash Floods, Hydro-Climatic Forcing, Geomorphic Susceptibility, Cloudbursts, Anthropogenic Vulnerability, Catchment Dynamics.*

Ecological Consciousness in Ruskin Bond's Short Stories

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Abstract
Ecological awareness has emerged as a central topic in modern literary debate due to the decline of the environment, climate change, and the need for people to live in harmony with nature. Literature plays a pivotal role in fostering environmental awareness by exploring the complex relationships between people and nature. Indian English author Ruskin Bond brings in the element of nature to shape people's emotions, experiences, and ethics. His essays stress the importance of "ecological balance" and demonstrate his keen appreciation of the natural environment. This dissertation examines how the concept of 'ecological awareness' is explored in some of Ruskin Bond's short stories, using the theoretical framework of ecocriticism. It explores the impacts of human interference with the environment and the connections between human beings, animals, forests, and all the rest of nature, as Bond suggests. Through his stories, he has shown the value of trees, birds, animals, and landscapes that transcends their utility to humans. Through simple yet powerful descriptions of the Himalayan landscape, Bond appeals to the reader to appreciate nature, not merely as a resource to be exploited by humans, but as an integral part of human life.
The research method used to examine the ecological themes, ecological symbols, and environmental values in the selected stories is qualitative and interpretive, involving a careful text examination. The essay highlights Bond's depiction of the responsibility for the environment, empathy toward living things, and moral obligation to preserve natural ecosystems. The essay argues that Bond's vision in literature is against anthropocentric perspectives and emphasizes an ecologically responsible understanding of the relationship between humans and nature. The stories teach valuable lessons about environmental ethics, emphasizing the necessity of individual consciousness, a profound sense of place, and respect for biodiversity to contribute to a more sustainable future. The study concludes that Ruskin Bond's short stories are still relevant to the current environmental challenges and that literature can shape the environmental consciousness and awareness of society through the transformative effect it has.
Keywords: *human-nature relationship, ecological consciousness, the Ruskin bond, ecocriticism, environmental ethics, and sustainability.*

Climate Change and Its Implications for Sustainable Aquaculture Development

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Abstract
Climate change has emerged as a significant environmental challenge for the sustainable development of the aquaculture sector. Increasing temperatures, altered precipitation patterns, changing water availability, ocean acidification, salinity fluctuations, and the growing frequency of extreme weather events can influence aquatic ecosystems and aquaculture production. These climatic changes may affect fish and shellfish growth, reproduction, feeding efficiency, disease susceptibility, survival, and overall productivity. Changes in water quality and ecosystem conditions can also increase production risks and operational costs for aquaculture farmers. This paper examines the implications of climate change for sustainable aquaculture development, focusing on environmental, biological, technological, and economic dimensions. It highlights the importance of climate-resilient species selection, efficient water and resource management, improved farm infrastructure, early-warning systems, integrated aquaculture practices, and appropriate technological interventions. Sustainable adaptation strategies can reduce climate-related risks while supporting productivity, ecosystem health, and the livelihoods of aquaculture-dependent communities. The study emphasizes that strengthening the resilience of aquaculture systems requires coordinated efforts involving scientific research, innovative technologies, responsible management practices, environmental monitoring, and effective institutional support. Developing adaptable and resource-efficient production systems can contribute to the long-term sustainability and resilience of aquaculture under changing climatic conditions.

***Keywords**: Climate Change, Sustainable Aquaculture, Aquaculture Development, Climate Resilience, Aquatic Ecosystems, Fish Production, Water Quality, Adaptation Strategies, Environmental Sustainability, Aquaculture Management.*

4,9-bis(methylthio)-2,7,12-trioxo-14-thioformyl-1,5a,6,10a,11,15a-hexahydro-2H,7H,12H-tripyrimido[1,2-a:1′,2′-c:1″,2″-e][1,3,5]triazine-3,8,13-tricarbonitrile.

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Abstract
*A facile and efficient synthetic strategy was developed for the construction of a novel fused heterocyclic framework through the reaction of **1,3,5-triazine** with **ethyl 2-cyano-3,3-bis(methylthio)acrylate**. The reaction afforded a highly functionalized polycyclic nitrogen- and sulfur-containing heterocycle, identified as **4,9-bis(methylthio)-2,7,12-trioxo-14-thioformyl-1,5a,6,10a,11,15a-hexahydro-2H,7H,12H-tripyrimido[1,2-a:1',2'-c:1",2"-e][1,3,5]triazine-3,8,13-tricarbonitrile**. The transformation involves a sequence of nucleophilic addition, condensation, and intramolecular cyclization events, leading to the formation of a densely fused molecular architecture comprising three pyrimidine rings annulated with a central 1,3,5-triazine core. The synthesized scaffold incorporates several synthetically versatile functionalities, including **cyano, carbonyl, methylthio, and thioformyl groups**, which may facilitate further structural diversification and functionalization. The successful assembly of this complex heterocyclic system highlights the synthetic utility of activated methylthio-substituted acrylates as valuable building blocks for the generation of structurally diverse fused heterocycles. Owing to its high heteroatom content and multifunctional architecture, the synthesized compound represents an interesting scaffold for further investigations in **heterocyclic, medicinal, and synthetic chemistry**. Overall, the present methodology provides a concise route to a structurally complex tripyrimido–triazine framework and expands the scope of sulfur- and nitrogen-rich heterocyclic synthesis.*

Keywords: *1,3,5-Triazine; Ethyl 2-cyano-3,3-bis(methylthio)acrylate; Condensation; Cyclization; Fused heterocycles; Tripyrimido–triazine; Heterocyclic synthesis.*

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Evaluating the Physiological and Histopathological Impact of Micro and Nanoplastic Exposure on the Reproductive system of Freshwater Fish *Lepidocephalus thermalis* (Valenciennes)

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Abstract
The freshwater ecosystem is contaminated by various types of pollutants in which microplastics (MPs) and nanoplastics (NPs) are harmful to the aquatic organisms. Due to their small size, long life span and ability to interact with biological tissues, they can accumulate and cause adverse physiological effects in freshwater fish. The present study aims to investigate the toxic effects of microplastics and nanoplastics on the reproductive system of the freshwater fish Lepidocephalus thermalis. The fish may be exposed to selected microplastic and nanoplastic particles at environmentally relevant concentrations for defined periods of exposure under controlled laboratory conditions. Reproductive toxicity will be assessed by determination of gonadosomatic index, gonadal histopathology, gamete quality, fecundity and other reproductive parameters. To understand the physiological mechanisms underlying the plastic induced reproductive impairment, changes in reproductive hormones and oxidative stress biomarkers will be studied. Biochemical changes in gonadal tissues and where facilities permit, expression of selected reproductive and oxidative stress related genes. Particular attention will be given to variations in gametogenesis, gonadal structure, oocyte development, sperm quality and reproductive performance. The reproductive toxicity between MP and NP exposed groups will be compared to clarify the role of particle size. The study will be expected to provide useful information on the potential reproductive risk of micro and nanoplastic pollution to the freshwater fish L. thermalis and to enhance the understanding of the ecological impact of plastic pollution in freshwater ecosystems. The results may also provide baseline information for the development of biomarkers to monitor plastic-induced reproductive stress and for conservation and management of freshwater fish populations.

Keywords:*Microplastics, Nanoplastics, Freshwater fish, Lepidocephalus thermalis, Reproductive toxicity.*

Valorization of waste to catalyst for biorefinery application

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Abstract
Traditionally, selected post harvested agricultural waste are burn to ash to produce Khar a highly basic traditional food ingredient of North-Eastern part of India. These ash materials possesses very high pH and good mineral content. The ash of agricultural wastes generally composed of oxides, carbonates and chlorides of metals. In the locality of Assam, India, the tribal peoples have the common practice of utilizing ashes of some specific agricultural waste plants as a food ingredient and traditionally used as a soda which can substitute commercial soda. The ash materials are also conventionally used in cleaning utensils, as a medicine for acidity and gas as well as cleaning agent of hand and hair. Brassica nigra, Sesamum indicum, Heteropanax fragrans, Vigna mango, parts of banana, etc. are some of the commonly used plants. Characterization of the ashes and calcined materials of these agricultural waste plants shows the presence of high quantity of K along with Ca, Mg, Na, Si, etc., in the form of oxides and carbonates. K is found to be the key component for their high basicity. Biodiesel a prominent alternative of fossil fuel is emerging in the present-day situation, mostly prepared by catalytic transesterification of vegetable oil. These highly basic waste plant ash materials are tested as catalyst for transesterification of vegetable oil to biodiesel and found very good results. The present study concluded that these traditionally used waste plants ash materials can be popularized as a substituent of commercial soda and be recommend as catalyst in biodiesel industry as well as catalyst to carry out various other organic reaction too, which will valorize these agro wastes and contribute in waste management.
***Keywords**: Agricultural waste, catalyst, traditional soda, biodiesel, transesterification.*

Flash Flood Risk in Fragile Geologies: Nepal and India

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Abstract
Flash floods across the South Asian Hindu Kush Himalayan (HKH) region and its downstream floodplains have shifted from localized seasonal anomalies into complex, catastrophic regional crises. This paper presents a comparative geo-hydrological analysis of three highly vulnerable sub-regions: Nepal, Northeast India, and Northwest India. Historically, flash flooding in these sectors was attributed strictly to seasonal monsoon dynamics. However, recent empirical data reveals an evolving paradigm where climate-induced extreme weather—characterized by cloudbursts, Western Disturbance anomalies, and rapid cryospheric degradation—intersects with fragile tectonic geologies and unscientific infrastructure expansion.By synthesizing hydro-climatic triggers, geological susceptibilities, and institutional frameworks, this study demonstrates that modern flash floods function as "compound disasters." While Northwest India experiences extreme structural damage from steep mountain-gradient failures, Nepal faces unprecedented transboundary threats from cryospheric collapse, and Northeast India grapples with an expanding disaster geography bridging mountain catchments with unzoned urban plains. The paper concludes by presenting a multi-lateral policy framework for transboundary telemetry networks, geomorphologically stable engineering protocols, and climate-resilient regional development strategies.

Keywords: *Hindu Kush Himalaya (HKH), Compound disasters, Hydro-climatic triggers, Cloudbursts, Cryospheric degradation, Tectonic geology, Anthropogenic amplification, Transboundary risk.*

Plant-Mediated Synthesis of Silver Nanoparticles from Banana (*Musa spp.*) Leaf Extract

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Abstract
Plant-mediated synthesis of silver nanoparticles (AgNPs) has gained considerable attention due to its eco-friendly, cost-effective, and sustainable approach. In the present study, silver nanoparticles were synthesized using aqueous leaf extract of banana (Musa spp.), which acts as a natural reducing and stabilizing agent due to its rich phytochemical content, including phenolics and flavonoids. The formation of AgNPs was confirmed by a visible color change and UV–Visible spectroscopy, showing a characteristic surface plasmon resonance peak. Further characterization using Fourier Transform Infrared spectroscopy (FTIR), X-ray Diffraction (XRD), and Transmission Electron Microscopy (TEM) revealed the crystalline structure, predominantly spherical morphology, and nanoscale size of the synthesized nanoparticles. The biosynthesized AgNPs exhibited significant antimicrobial activity against selected pathogenic microorganisms and demonstrated notable antioxidant potential. These findings suggest that banana leaf extract provides an efficient and environmentally benign method for the synthesis of silver nanoparticles with promising applications in biomedical and pharmaceutical fields.

Keywords: *Plant-mediated synthesis; Silver nanoparticles; Banana leaf extract; Musa spp.; Green synthesis; Antimicrobial activity; Antioxidant activity*

Role of Government in Agriculture Sustainable Development: Review

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Abstract
India is largest country in the world based on agricultural productivity. The yield of the crops mainly depends on the weather condition. The agricultural segment delivers food, fodder and raw material to manufacturing. There is huge consumption rather than production. Therefore agricultural productivity increases significantly by application of green revolution. Indian farmers now a days are facing multiple problems such as input high cost, low profit gain, soil erosion and depletion water table. Farmer must be applied the new innovative strategies to overcome the loss in productivity including crop rotation, agro forestry, organic forming and carbon sequestration that support enrich soil health, minimizes the soil erosion and maintaining the environmental sustainability. Government of India have been provided number of policies such as Parampragat Krishi Vikas Yojna, National Mission on Sustainable Agriculture, PM Fasal Bima Yojna, Soil Health Card scheme and PM Krishi Sinchayi Yojna for the better sustainable development. The aim of the article is to discuss innovative practices and policies of government for sustainable development.
Keywords: *Agriculture, Environment, Government Policies and Sustainable development.*

Study of the interaction of 2CA4MBA with Bovine Serum Albumin at varying pH using gel exclusion chromatography

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Abstract
In this study, we reported the interaction of carboxamide derivative of amino acids 2-{[2- (cyclohexycarbamoyl) benzoyl] amino}-4-(methylsulfanyl) butanoic acid(2-CA4MBA) with Bovine Serum Albumin (BSA) using gel exclusion chromatography at pH 3, 4, 5, and 7.4. The association constant for 2CA4MBA was calculated using the Scatchard Plot, which was found to be 0.5807, 0.5706, 0.5616, and 0.5503 at pH levels of 3, 4, 5, and 7.4, respectively. It was found that the value of the association constant of 2CA4MBA decreases with an increase in pH value. The association of the compound with BSA has also been confirmed through a molecular modelling study using HEX software. The efficient energy value for the 2CA4MBA-BSA complex, neglecting the effect of any solvent, is found to be -235.66.
Keywords: *Gel Exclusion Chromatography, protein-drug binding, Scatchard analysis*

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Anti-Diabetic and Organ Protective Effects of Bioactive Fractions from Betula utilis Bark in streptozotocin-induced Diabetes Mellitus

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Abstract

Background: Diabetes mellitus is a chronic metabolic disorder associated with hyperglycemia and complications affecting vital organs such as the liver and kidneys. Limitations of current antidiabetic therapies necessitate the search for safer natural alternatives. Betula utilis is a medicinal plant rich in triterpenoids and phenolic compounds with promising pharmacological properties. ***Objective:*** *To evaluate the antidiabetic and organ protective effects of bioactive fractions isolated from Betula utilis in streptozotocin-induced diabetic rats.* ***Methods:*** *Experimental diabetes was induced in Wistar rats using streptozotocin (60 mg/kg, i.p.). Animals were treated with standard drug and bioactive fractions of Betula utilis. Blood glucose and body weight were monitored during the study. Hepatic and renal biomarkers including SGPT, SGOT, bilirubin, serum creatinine, and total protein were estimated using biochemical kits. Histopathological studies of liver and kidney tissues were also performed.* ***Results:*** *Diabetic control rats showed marked hyperglycemia, with blood glucose levels increasing from 341.50 ± 0.88 mg/dL to 375.17 ± 1.60 mg/dL by day 21, accompanied by significant body weight loss (−19.41 ± 0.72 g). Treatment with the chloroform fraction (BUMF-2, 200 mg/kg) significantly reduced blood glucose levels to 99.51 ± 1.05 mg/dL and improved body weight loss to −0.47 ± 0.04 g, comparable to glimepiride-treated animals. The same fraction also improved renal biomarkers by reducing serum creatinine from 2.29 ± 0.03 mg/dL to 1.26 ± 0.01 mg/dL and urine total protein from 28.63 ± 0.44 g/dL to 13.03 ± 0.27 g/dL, while increasing serum total protein to 5.16 ± 0.03 g/dL. Hepatic parameters were similarly restored, with SGPT, SGOT, and bilirubin levels reduced to 54.81 ± 0.37 IU/L, 54.86 ± 0.48 IU/L, and 1.03 ± 0.02 mg/dL, respectively. Histopathological examination further confirmed protection against diabetes-induced hepatic and renal tissue damage.* ***Conclusion:*** *The present study demonstrates that bioactive fractions of Betula utilis possess significant antidiabetic, hepatoprotective, and nephroprotective activities in streptozotocin-induced diabetic rats. The chloroform fraction (BUMF-2) exhibited the highest therapeutic efficacy, suggesting the involvement of bioactive phytoconstituents such as betulin, betulinic acid, lupeol, flavonoids, and phenolic compounds.*

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Synthesis, Characterization and Biological Evaluation of 5-Amino-3-(methylthio)-1-(pyrimidin-2-yl)-1H-pyrazole-4-carbonitrile Derivatives

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Abstract
Pyrazole and pyrimidine-containing heterocycles represent an important class of bioactive compounds with various pharmacological properties. The present work focuses on the synthesis and structural modification of 5-amino-3-(methylthio)-1-(pyrimidin-2-yl)-1H-pyrazole-4-carbonitrile as a versatile precursor for the development of novel heterocyclic derivatives. The presence of amino, cyano, methylthio, and pyrimidinyl functionalities provides multiple reactive sites for cyclization and functionalization, permitting the creation of structurally different molecules. The compound 5-amino-3-(methylthio)-1-(pyrimidin-2-yl)-1H-pyrazole-4-carbonitrile on condensing with different amines, phenols, heteryl amines and active methylene compounds to form different derivatives. The structures of the newly synthesized compounds were characterized using IR, ^{1}H and ^{13}C NMR spectroscopy. All the newly synthesized compounds were investigated for their antimicrobial activity.
Keywords: *Bis(methylthio)methylene malononitrile, DMF, Potassium carbonate*

Green Synthesis of Indolyl Quinolines via $InCl_3$-Catalyzed Microwave Irradiation and Their Antibacterial Evaluation

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Abstract
*A fast and effective microwave-assisted process was developed for the preparation of substituted indolyl quinoline compounds through $InCl_3$-catalyzed annulation of indolyl chalcones with anilines on a silica gel surface. The practice of microwave irradiation facilitated the reaction with short reaction times and afforded the target compounds in excellent yields. The formed compounds were purified with recrystallization from ethanol and assessed for antibacterial activity against Bacillus licheniformis,Bacillus species, Escherichia coli andStaphylococcus aureus, with ciprofloxacin as the standard drug. Among all the derivatives, compounds **3c**, **3d**, and **3e** exhibited promising antibacterial activity, with compound **3e** showing particularly strong activity against Staphylococcus aureus. MIC evaluation further indicated notable antibacterial potential for compounds **3c-3e**. Overall, the combination of mild Lewis-acid catalysis and microwave activation provides a convenient, effective approach for the synthesis of indolyl quinoline derivatives with probable antimicrobial applications.*

Keywords: *Indium(III) chloride; Indolyl chalcone; Aniline; Microwave Irradiation; Antibacterial activity.*

Ultrasound induced synthesis of benzyloxy-substituted 2-pyrazoline derivatives as antimicrobial agents

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Abstract
An improved sonochemical condensation has been reported between benzyloxy-substituted hydroxyl chalcones and hydrazine hydrate in 2-ethoxy ethanol as an efficient & alternative reaction medium in presence of sodium acetate and acetic acid to afford 2-pyrazolines. The pyrazolines were obtained in good to excellent yields (80–90%), and were characterized by conventional spectral data and evaluated for their antimicrobial potential. It is observed that the work-up is simple and the results obtained indicate that, unlike classical heating, ultrasound irradiation results in higher yields, shorter reaction times (1.5–2.5 h) and milder reaction conditions. The investigation of antimicrobial potential revealed that all the synthesized compounds shows good to moderate growth inhibiting effect against microorganism tested.

Keywords: *2-pyrazolines, 2-ethoxy ethanol, benzyloxy-chalcones, Ultrasound, Antimicrobial activity*

Innovative Agrochemistry for Sustainable Agriculture

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Abstract
Agriculture is at a critical crossroads, facing the combined challenges of increasing food demand, climate change, declining soil health, water scarcity, biodiversity loss and the environmental consequences of excessive agrochemical use. In this context, innovative agrochemistry offers significant opportunities to transform conventional agricultural practices into more productive, resource-efficient and environmentally sustainable systems. The responsible application of chemical science can contribute substantially to achieving global food and nutritional security while protecting natural resources. Recent advances in controlled- and slow-release fertilizers, nano-fertilizers, bio-based agrochemicals, biopesticides, plant growth regulators and precision application technologies have the potential to improve nutrient-use efficiency and reduce chemical losses to soil, water and the atmosphere. Smart formulations and targeted delivery systems can minimize fertilizer and pesticide requirements, reduce residues and greenhouse-gas emissions, and enhance crop productivity. Integrating these innovations with integrated nutrient management, integrated pest management, organic amendments, beneficial microorganisms and precision agriculture can further improve the sustainability and resilience of farming systems. However, technological progress must be accompanied by strong environmental ethics and responsible chemical stewardship. Sustainable agrochemical practices should prioritize soil and water quality, biodiversity conservation, farmer safety, food safety and long-term ecosystem health. The future of agriculture therefore requires a balanced integration of chemistry, biology, technology and ecological responsibility. This paper highlights emerging chemical innovations in sustainable agriculture and examines their potential to support climate-resilient farming, efficient resource utilization, circular agriculture and global food security. Responsible innovation in agrochemistry can provide a practical pathway towards a productive, environmentally ethical and sustainable agricultural future.

Keywords: *Sustainable agriculture, Agrochemistry, Chemical innovations, Nanofertilizers, Biopesticides, Precision agriculture, Environmental ethics, Climate resilience, Food security.*

Synthesis, characterization and antimicrobial activity of Zinc (II) complexes of some 2-hydroxy-4, 5-dimethyl substituted chalcones

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Abstract
The present paper deals with synthesis and characterization of metal complex of some novel 2-hydroxy-4,5-dimethyl substituted chalcones. The substituted chalcones were prepared by reacting 2-hydroxy-4,5-dimethyl acetophenone with corresponding aromatic aldehydes like 2-chorobenzaldehyde, 3-bromobenzaldehyde, 4-fluorobenzaldehyde and 4-cyanobenzaldehyde. The Zinc (II) metal complexes of general formula ML_2 with newly prepared chalcones synthesized and characterized by several physiochemical techniques like Melting point, Elemental analysis, molar conductance, magnetic susceptibility, Electronic absorption and Infrared spectral studies. The analytical data confirmed 1:2 stoichiometry of M: L and the electronic spectral data suggest that all Zn (II) complexes have distorted octahedral geometry. The conductivity data show that all these complexes are non-electrolytes. Furthermore, biological activities of complexes with selected bacterial strain carried and the results have been compared with commercial standards.
Keywords: *Transition metal complexes, Chalcones, Spectral characterization and biological activities*

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Plant-Mediated Synthesis of Cerium Oxide Nanoparticles with Emphasis on Phytochemical Mechanisms and Oxygen Vacancies: A Review

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Abstract
Cerium oxide nanoparticles (nanoceria) derive much of their functional versatility from reversible Ce^{3+}/Ce^{4+} redox cycling and associated oxygen vacancies. Plant-mediated synthesis offers a simple, environmentally compatible alternative to conventional physical and chemical routes, with phytochemicals proposed to act as reducing, capping, and stabilizing agents. However, how specific phytochemicals govern Ce^{3+} chelation, defect formation, and surface chemistry remains incompletely resolved. Published experimental reports on plant-mediated CeO_2 synthesis were qualitatively examined and organized thematically by phytochemical source, synthesis conditions, physicochemical characterization (XRD, FTIR, UV–Vis, electron microscopy, XPS), and functional performance. Phenolic- and flavonoid-rich extracts were repeatedly proposed to mediate Ce^{3+} chelation, reduction, and capping, with FTIR indicating surface-bound organic moieties. Where reported, XRD confirmed the cubic fluorite phase, with particle sizes spanning roughly 2–75 nm. Although limited, defect-focused studies linked oxygen vacancies and surface Ce^{3+} to antioxidant and nanozymebehavior; higher calcination temperatures reduced both vacancies and radical scavenging. Smaller particles favoredphotocatalytic dye degradation. Antibacterial, cytotoxic, and plant-growth responses were dose-, strain-, and system-dependent, without consistent Gram-selectivity. Collectively, the evidence suggests that plant-mediated synthesis is a tunable route to defect-rich nanoceria, although mechanistic interpretations remain largely inferential. Future work should identify active phytochemicals (e.g., by HPLC–MS), quantify Ce^{3+}/Ce^{4+} ratios and vacancy concentrations (XPS, Raman), standardize bioassays, and evaluate toxicity, reproducibility, and scalability before application.

Keywords: *cerium oxide nanoparticles; green synthesis; phytochemicals; oxygen vacancies; Ce^{3+}/Ce^{4+} redox*

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Antimicrobial activity of different plant extract of *Gardenia gummifera fruits*

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Abstract
New therapeutic compounds developed from conventional medicinal flora must be quickly identified and validated because to the growing worldwide concern about antibiotic resistance. Using the agar diffusion method, the antimicrobial activity of a number of Gardenia gummifera solvent extracts against Staphylococcus aureus, Pseudomonas aeruginosa, and Escherichia coli was investigated. The ethanolic extract of Gardenia gummifera exhibited the highest level of antibacterial activity among all the species examined. Using the agar diffusion technique, a number of solvent extracts of Gardenia gummifera were evaluated for antibacterial activity against Escherichia coli (35 µg/ml), Staphylococcus aureus (58 µg/ml), and Pseudomonas aeruginosa (72 µg/ml), and they showed significant effects. Out of all the species studied, Gardenia gummifera's ethanolic extract had the strongest antibacterial activity. A common antibacterial medication called gentamicin was used to compare the outcomes.
Keywords: *Gardenia gummifera, fruits extract, antimicrobial activity, agar diffusion method etc.*

Novel Pincer complexes from Tridentate Schiff Bases: Synthesis, Characterization and Antimicrobial Profiling

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Abstract
The rational design of metal complexes with biologically active ligands has become an important strategy in modern coordination and medicinal chemistry. Among the various ligand systems explored in bioinorganic chemistry, Schiff bases have attracted considerable attention because of their facile synthesis, structural diversity, versatile coordination behavior, and broad range of reported biological activities. The azomethine nitrogen present in Schiff bases acts as an effective donor site for metal coordination, while the incorporation of additional donor atoms enables the formation of stable tridentate and pincer-type coordination frameworks. Modification of the ligand environment and incorporation of different metal ions can significantly influence the physicochemical and biological properties of the resulting complexes. In particular, metal complexes containing tridentate Schiff-base ligands have emerged as promising candidates for biological applications, including antimicrobial therapy. However, comparatively limited attention has been devoted to the systematic development and biological assessment of pincer-type metal complexes derived from tridentate Schiff bases. In the present study, novel pincer metal complexes derived from tridentate Schiff-base ligands are synthesized and investigated using appropriate spectroscopic and physicochemical techniques. Their antimicrobial properties are evaluated against selected bacterial and fungal strains to examine the influence of metal coordination and ligand architecture on biological activity. The study aims to establish a relationship between the molecular structure of the synthesized complexes and their antimicrobial performance, thereby providing insights into the development of Schiff-base-derived metal complexes as potential antimicrobial agents.
Keywords: *Schiff bases; tridentate ligands; pincer ligands; antimicrobial activity; metal-based drug*

Effect of Basin Water Depth on the Thermal Performance and Freshwater Productivity of a Single-Basin Solar Still

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Abstract
Solar distillation represents a sustainable and environmentally friendly approach for obtaining potable water from saline and brackish water sources using solar energy. The performance and freshwater productivity of a basin-type solar still are considerably influenced by the depth of water maintained in the basin, as it directly affects the thermal response of the system. In the present experimental study, the effect of basin water depth on the performance of a fabricated single-basin, single-slope solar still was investigated under outdoor conditions at the Department of Physics, P. N. College, Pusad. Experiments were conducted for three water depths of 1 cm, 2 cm, and 3 cm. The incident solar irradiance (It), ambient temperature (Ta), basin-water temperature (Tw), and daily distillate yield were recorded throughout the experimental period. The results revealed that the 1 cm water depth exhibited a faster thermal response and attained the highest peak water temperature of 67.4 °C, compared with 58.9 °C and 49.1 °C for the 2 cm and 3 cm depths, respectively. The corresponding daily distillate productivity was 1.76 L/m²·day, compared with 1.52 L/m²·day and 1.29 L/m²·day for water depths of 2 cm and 3 cm, respectively. The estimated daily thermal efficiencies were 20.2%, 17.5%, and 14.8% for 1 cm, 2 cm, and 3 cm water depths, respectively. The findings demonstrate that reducing the basin water depth decreases thermal inertia and promotes faster heating and enhanced evaporation, thereby improving freshwater productivity. Among the investigated conditions, a water depth of 1 cm showed the best overall performance and may be considered a suitable operating depth for locally fabricated solar stills under the climatic conditions of the study region.

Keywords: *Solar still; Basin water depth; Distillate yield; Thermal efficiency; Solar desalination*

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Organ-specific Protein Allocation and Biochemical Status of *Channa punctata* (Bloch, 1793) from Water Bodies of Nanded (M.S.) India

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Abstract
Proteins are essential biochemical components involved in growth, metabolism, energy storage, and tissue maintenance in fishes. The distribution of protein content among different organs reflects the physiological condition, nutritional status, and functional activity of tissues. The present study was undertaken to estimate the protein content in different tissues of Channa punctata collected from selected freshwater bodies of Nanded region, Maharashtra during January 2026 - March 2026. The protein concentration was estimated in major tissues including muscle, liver, gills, kidney, gonads, and intestine using standard Lowry's method. Variation in protein content was observed among different tissues, indicating differences in metabolic activity and physiological functions. The highest protein content was recorded in muscle tissue (16.82–20.46 mg/g wet tissue) followed by liver (12.64–16.28 mg/g), gonads (10.52–14.76 mg/g), kidney (9.34–12.58 mg/g), intestine (8.42–11.36 mg/g) and gills (7.26–10.18 mg/g). The variation in tissue protein content reflects differences in metabolic activity, nutritional status, and functional roles of organs. The study provides baseline information on protein distribution in C. punctata useful for assessing fish health and physiological condition.
Keywords: *Channa punctata, Protein content, Biochemical analysis, Tissues, Nanded, Maharashtra.*

Synthesis, Characterization, and Environmental Sensing Applications of Nanocrystalline Metal Oxides

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Abstract
Environmental pollution caused by hazardous and toxic gases has created an increasing need for sensitive and reliable gas-sensing technologies. Nanocrystalline metal oxides have attracted considerable attention for environmental monitoring because of their surface-dependent electrical and chemical properties. In this work, nanocrystalline indium oxide (In_2O_3), zinc oxide (ZnO), and bismuth oxide (Bi_2O_3) are considered as promising semiconductor metal-oxide materials for gas-sensing applications. The materials are synthesized using hydrothermal decomposition, co-precipitation, and ethyl-alcohol-mediated decomposition routes, respectively. Structural and morphological properties are investigated using X-ray diffraction (XRD), transmission electron microscopy (TEM), and scanning electron microscopy coupled with energy-dispersive spectroscopy (SEM-EDS). Their environmental sensing performance is evaluated toward gases including ethanol, hydrogen sulfide, ammonia, and liquefied petroleum gas. The influence of dopant concentration, operating temperature, and test-gas concentration on sensing performance is discussed. Particular attention is given to sensing mechanism, selectivity, response-recovery characteristics, and stability. The study demonstrates the potential of nanocrystalline metal oxides for environmental gas monitoring and industrial safety applications.

Keywords: *Nanocrystalline metal oxides, In_2O_3, ZnO, Bi_2O_3, gas sensor, environmental monitoring, XRD, SEM, TEM, gas sensing.*

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Diversity Assessment of Spider Communities (Arachnida: Araneae) Across Different Habitat Types Around Digras Town, Maharashtra, India

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Abstract
This study presents a comprehensive diversity assessment of spider communities (Arachnida: Araneae) across different habitat types around Digras town, Maharashtra, India. Spiders play an important role as critical bioindicators of environmental health and natural predators in terrestrial ecosystems. However, baseline information regarding their community structure in this region remains limited. Sampling was conducted across diverse ecosystems, including agricultural fields, grasslands, and human-modified or built-up areas, utilizing standard collection techniques such as pitfall traps, sweep netting, and active visual searches from Sept 2025 to August 2026. The collected specimens were analyzed to evaluate family-level richness, abundance, and guild structures. Preliminary findings indicate that dominant families like Araneidae having 07 species, Lycosidae having 06 species, and Salticidae having 07 species exhibit distinct distribution patterns heavily influenced by microhabitat complexity and structural vegetation. Total 27 species were identified among 06 families. Alpha and beta diversity indices reveal significant variations in species composition across sites, with heterogeneous agricultural and natural ecosystems supporting higher species richness compared to highly disturb anthropogenic zones. Foraging guild analysis demonstrates a functional balance between active hunters and web-builders. Ultimately, this research provides vital baseline data on arachnid biodiversity across different habitat types around Digras town Maharashtra, emphasizing the impact of land-use practices and supporting the conservation of these essential predators amid ongoing environmental changes.
Keyword: *Communities, Diversity, Digras, Composition*

Studies on Ethanomedicinal Plants Used In Arni Tahsil District Yavatmal

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Abstract
The present study aims to document and analyze the traditional knowledge of medicinal plants used by local people and tribal communities in the Yavatmal district of Maharashtra. The study focuses on identifying plant species used to treat various ailments and understanding their ethnobotanical significance. The research involved field surveys, interviews with local healers, villagers, and tribal members, as well as the collection of plant specimens from different regions of Arni. The collected plants were scientifically identified and classified with the help of standard floras and herbarium consultations. A total 40 medicinal plant species were recorded along with their botanical names, local names, families, plant parts used, and methods of preparation. Commonly used plant parts include leaves, roots, bark, fruits, seeds, and whole plants. Among these, leaves were the most frequently used due to their easy availability and effectiveness. The study revealed that these plants are widely used to treat various ailments such as fever, cough, cold, digestive disorders, skin diseases, wounds, diabetes, and inflammation. Preparation methods include decoctions, pastes, powders, juices, and infusions. This knowledge is mainly transmitted orally from one generation to the next. However, it was also observed that modernization, deforestation, and changing lifestyles are leading to the gradual loss of this valuable traditional knowledge.
Keywords: *Ethnobotany, Medicinal Plants, Traditional, Crude drug.*

Investigation of Bioactive Compounds from Stem Bark Extracts of *Ailanthus excelsa* Roxb.

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Abstract
Skin infections negatively impact a person's social life by producing physiological and structural problems. Dermatological problems have been found to benefit greatly from the use of traditional medical resources, especially botanicals. Plant-based therapies can effectively treat both acute and chronic skin disorders. There is an urgent need to investigate the possible biological activity of numerous therapeutic plants against skin diseases. The most important bioactive constituents of plants are alkaloids, tannins, flavonoids, glycosides and phenolic compounds. Thus, the current study was initiated to investigate the phytochemical components of the Ailanthus excelsa Roxb. stem bark extract using three solvents benzene, petroleum ether, and acetone. It is revealed that stem bark extracts contained carbohydrates, saponins, flavonoids, alkaloids, phytosterols, and phenols, according to preliminary phytochemical research. This suggests that the stem bark of Ailanthus excelsa Roxb may be used to treat skin conditions.
Keywords : *Dematological, Chronic, flavonoids, Phytosterols.*