Sardar Patel University

(Accredited with 'A' Grade by NAAC, CGPA-3.11)

4th Research Scholar Meet

NATIONAL CONFERENCE ON ADVANCES IN SCIENCE: INNOVATION, SUSTAINABLE FUTURES AND RESEARCH HORIZONS

12th – 13th February, 2026

Unite • Innovate • Sustain • Transform the Future

RSM 2025-26

Organized by
Research and Development Cell (RDC)

About the Research & Development Cell (RDC)

The Research and Development Cell (RDC) at Sardar Patel University established on June 2, 2022, serves as a cornerstone for promoting a culture of innovative and impactful research within the institution. The RDC aligns its objectives with the vision of Atma Nirbhar Bharat and the National Education Policy (NEP) 2020. The cell is committed to fostering a multidisciplinary, transdisciplinary, and translational research ecosystem that addresses industrial and societal challenges.

In its mission to create a sustainable research environment, the RDC has undertaken several key activities. The RDC organized programs, seminars, and workshops to provide faculty and students with platforms for knowledge exchange and skill enhancement. One of its significant initiatives was the allocation of SEED money project proposal grants to university faculty, encouraging innovative research and development.

Through these efforts, the RDC is shaping a robust research ecosystem, emphasizing knowledge generation, technological innovation, and meaningful contributions to society, in alignment with the broader national agenda of self-reliance and academic excellence.

Prof. Niranjan P. Patel
Vice-Chancellor

Sardar Patel University
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MESSAGE

Dear Research Scholars,

It gives me great pleasure to extend my warm greetings to all participants of the *National Conference on Advances in Science: Innovation, Sustainable Futures and Research Horizons* and the *4th Research Scholars Meet* of Sardar Patel University.

Science today thrives on curiosity, collaboration, and courage to explore the unknown. The themes of this conference — from **fundamental scientific advances** to **sustainability**, **data-driven research**, **translational science**, and **interdisciplinary convergence** — truly reflect the direction in which modern research is moving. They remind us that knowledge must not only expand boundaries but also address societal needs and contribute to national development.

Young researchers are the driving force of innovation. Platforms like this Meet nurture scientific temper, creative thinking, and cross-disciplinary dialogue — all essential for building a progressive and knowledge-driven society.

I congratulate the Research and Development Cell and the organizing team for creating this valuable academic forum. I am confident that this gathering will spark new ideas, meaningful collaborations, and future research pathways.

I wish all participants a stimulating and rewarding experience.

Date : 9-Feb-26
Place : Vallabh Vidyanagar

Prof. Niranjan Patel
Vice-Chancellor

Organizing Team

Patron and Chairman

Prof. (Dr.) Niranjan P. Patel, Vice Chancellor

Convenor

Prof. (Dr.) Arun Anand, Director, RDC
Mr. Saim Khatri
Mr. Yatrik Patel

Coordinator

Dr. Brijesh M. Patel

Co-coordinator

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Prof. (Dr.) Kirit Lad
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Nehaba Solanki


Ashenafi Tessema


KalpitkumarVaniya


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Harsh Rana


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Alpa Rathod

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Dr. Umesh Shaligram
Executive Director
Serum Institute of India Pvt. Ltd.

Professional Experience:

- **Executive Director & Board Member**, Serum Institute of India Pvt. Ltd. (SIIPL)
- Spearheading scientific development, manufacturing, and commercialization of vaccines
- (especially COVID-19 vaccines) and biologics (including biosimilars and biobetters).
- Oversight of global disease burden reduction and disease elimination strategies through unique "Detect, Treat, and Prevent" models.

Key Responsibilities:

- Leadership in development and manufacturing of vaccines, including COVISHIELD® (India's first indigenously manufactured COVID-19 vaccine) and Covovax/Neuvaxovid (first vaccine supplied from India to the USA).
- Led efforts to secure international regulatory approvals for SIIPL vaccines from agencies like the US-FDA, EMA, MHRA, and others.
- Focus on disease eradication and elimination, including programs for TB, Malaria, Pertussis, HPV, AMR and Point of Care CART-cell therapies.
- Steering the global efforts to address various public health challenges, utilizing trace and track modules.

Research and Publications:

- Over **50** peer-reviewed publications in high-impact international journals.
- Holder of more than **15** patents in vaccine and biologics technology.

Awards and Recognitions:

- Recognized nationally and internationally for contributions to COVID-19 pandemic
- Featured at the London Science Museum as part of an exhibition highlighting his leadership and contributions to science and public health.
- Acknowledged by the National Council of Science Museum, Ministry of Culture, Government of India for his value-added contributions in science and healthcare.

Leadership and Vision:

- Leadership in Global Health: Instrumental in shaping and directing SIIPL's focused efforts toward eradicating diseases such as TB, Malaria, Pertussis, and HPV, and addressing AMR (Antimicrobial Resistance).
- Commitment to Innovation: Forefront of implementing cutting-edge technologies in vaccine and biologics development, ensuring the delivery of high-quality vaccines and therapeutics to fight infectious diseases.

Expert Session Topic: Bridging the Valley of Death; Cost-Effective Vaccinations – Developing World

Prof. (Dr.) Sudipta Roy Barman
Emeritus Scientist
UGC-DAE CSR,
Indore

Academic Qualifications:

- **Ph.D. in Physics**, Indian Institute of Science (IISc), Bengaluru *(1994)*
- **M.Sc. in Physics**, University of Calcutta *(1987)*
- **B.Sc. (Hons.) in Physics**, Presidency College, University of Calcutta *(1985)*

Professional Experience:
Dr. Sudipta Roy Barman has extensive research and academic experience, including postdoctoral work at leading international institutions:

- **Laboratori Nazionali di Frascati**, Rome, Italy *(Postdoctoral Researcher – 1995)*
- **Institute for Solid State and Materials Research (IFW)**, Dresden, Germany *(Postdoctoral Researcher – 1995)*
- **Fritz-Haber-Institut der Max Planck Society**, Berlin, Germany *(Postdoctoral Researcher – 1996–1997)*

Scientific Career:

- Joined **UGC-DAE Consortium for Scientific Research (CSR), Indore Centre** in *(1997)*
- Served as **Scientist-H**
- Currently designated as **Honorary Emeritus Scientist** *(from February 2024)*

Research Interests:

- Electron spectroscopy
- Surface science and interface phenomena
- Photoemission spectroscopy
- Angle-Resolved Photoemission Spectroscopy (ARPES)
- Electronic structure of materials
- Investigation of advanced functional materials using spectroscopic tools

Expert Session Topic: Photoelectron Spectroscopy: A Versatile Surface Science Technique.

Prof. (Dr.) Santosh B. Mhaske

Senior Principal Scientist,
Division of Organic Chemistry
CSIR-National Chemical Laboratory (NCL), Pune, India
Email: sb.mhaske.ncl@csir.res.in

Academic Qualifications:

- **Ph.D. in Chemistry**, University of Pune / CSIR-National Chemical Laboratory (NCL), Pune
- **M.Sc. in Chemistry**, University of Pune
- **B.Sc.**, University of Pune

Professional Experience:

His professional experience includes **postdoctoral research** at leading international institutions:

- Illinois Institute of Technology, Chicago, USA
- Wayne State University, Michigan, USA
- Humboldt Fellowship, University of Hannover, Germany

Research Interests:

- Total synthesis of bioactive natural products
- Development of novel synthetic methodologies
- Carbon–carbon and carbon–heteroatom bond formation
- Aryne chemistry for complex molecule construction
- Organophotoredox catalysis
- Heterocyclic synthesis with medicinal relevance
- Synthetic strategies for drug-like scaffolds

Contributions and Achievements:

- More than **50** publications in reputed international journals
- Listed with **12** Patents
- Guided several Ph.D. students to successful completion, with additional scholars currently working under his supervision.
- Completed three industry-sponsored projects as a project leader
- Completed two DST projects as a project leader
- Completed two mega projects under major programs, as one of the project investigators
- One DST project and one mission mode project under progress

Expert Session Topic: Emerging Trends in Organic Chemistry and Allied Sciences for a Sustainable Future

Prof. (Dr.) Bivudutta Mishra
Department of Mathematics,
Birla Institute of Technology & Science,
Pilani, Hyderabad, Telangana, India

Professional Experience:

- **Chairman**, Department Level Shortlisting Committee, Faculty Recruitment since 09/08/2021.
- **Member**, Department Level Shortlisting Committee, Faculty Recruitment 01/06/2021 to 08/08/2021
- **Member,** Sustainability Committee since 01/05/2024.
- **Senate Member**, BITS-Pilani University.
- **Associate Dean**, International Programmes and Collaboration (13/07/2018 to 15/09/2024)
- **Member,** Departmental Committee on Academics (DCA), 01/12/2018 to 30/11/2024
- **Member,** Additional Competitive Research Grant (ACRG) (02/02/2018 to 01/02/2022).
- **In-charge**, Feedback and Monitoring, Instruction Division (01/02/2017 to 17/07/2018).
- **Head of the Department,** Department of Mathematics, (01/09/2012 to 30/09/2016).
- **Nucleus Member**, Instruction Division, BITS-Pilani, Hyderabad Campus (Jan 2014 to Jan 2017).
- **Nucleus Member**, Instruction Division, BITS-Pilani, Hyderabad Campus (Aug 2009 to July 2012).
- **In-charge, Timetable**, BITS-Pilani, Hyderabad Campus (Aug 2009 to July 2011)

Key Responsibilities:

- He is reviewer of 20 different journals.
- **Visiting Professor:** Bauman Moscow State Technical University, Moscow.
- **Visiting Associate,** Inter University Centre for Astronomy and Astrophysics, Pune
- **Fellow,** Royal Astronomical Society, UK.
- **Fellow,** Institute of Mathematics and Applications, UK.

Research and Publications:

- He has 187 publications in total among the various journals.
- He has presented more than 40 papers at various universities outside India.
- He has delivered more than 60 invited talks/lectures across the world.
- He has completed 3 research projects and currently working in 5 projects.
- 8 students have completed their Ph.D. currently 4 working under his guidance.

Awards and Recognitions:

- He has more than 20 foreign visits other than invited talks.
- **Among Top 2%** scientists by the author databases of standardised citation indicators.

Expert Session Topic: Geometrical Approaches for Modified Gravity: The Late Time Phenomena

BIOSCIENCES

Sardar Patel University
Vallabh Vidyanagar, Anand, Gujarat

Abstract ID: RSMOBIO01

Human Milk–Derived Potential Probiotic *Bacillus Sp*. Producing Broad-Spectrum Bacteriocin: A Promising Antimicrobial Candidate

Simran Panjabi[1,2], Yati Vaidya[1], Shailja Dhiman[2]

[1]***Department of Microbiology, Shri Alpesh N Patel Postgraduate Institute of Science & research, Anand, Affiliated to Sardar Patel University, Vallabh Vidyanagar, Anand, 388001 Gujarat, India.***

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The increasing prevalence of antimicrobial resistance has necessitated the exploration of alternative and biologically safe antimicrobial agents. Human breast milk is recognized as a natural reservoir of beneficial microbiota with probiotic and antimicrobial properties. The present study aimed to isolate probiotic bacteria from healthy human breast milk and evaluate their ability to produce bacteriocins with broad-spectrum antimicrobial activity. Five bacterial isolates (HMP1–HMP5) were obtained from breast milk samples collected in the Anand district of Gujarat, India, using Lactobacillus MRS agar. The isolates were screened for essential probiotic characteristics, including survival under acidic conditions (pH 2) and tolerance to bile salts (0.3% w/v). Among them, isolate HMP1 exhibited superior tolerance and was selected for further characterization. Morphological, Gram staining, and biochemical analyses identified the isolate as a Gram-positive bacillus, later characterized as *Bacillus Sp*. Antagonistic activity of the cell-free neutralized supernatant revealed broad-spectrum inhibition against *Staphylococcus aureus, Staphylococcus epidermidis, Listeria monocytogenes, Pseudomonas aeruginosa*, and *Aspergillus niger*. Bacteriocin production was followed by purification using ammonium sulfate precipitation, dialysis, and cation-exchange chromatography. The purified bacteriocin exhibited enhanced antimicrobial activity with a specific activity of 38095.2 AU mg-1 and approximately 18-fold purification compared to the crude extract. SDS-PAGE analysis indicated a low-molecular-weight antibacterial protein. Additionally, alginate nanoparticles were successfully synthesized using the ionotropic gelation method with $CaCl_2$ as a crosslinking agent, providing a foundation for future bacteriocin–nanoparticle conjugation. The findings demonstrate the therapeutic potential of human milk–derived *Bacillus Sp*. bacteriocin as a promising candidate for the development of novel antimicrobial and nanotechnology-based interventions.

Keywords: Human breast milk, Probiotic bacteria, Bacteriocin, *Bacillus Sp*., Alginate nanoparticles

Abstract ID: RSMOBIO02

Nesting Ecology of Black-headed Ibis (*Threskiornis melanocephalus*) in Anand District, Gujarat, India

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The Black-headed Ibis (*Threskiornis melanocephalus*), a Near Threatened colonial waterbird, has experienced population decline in recent decades due to habitat degradation, pollution, and anthropogenic pressures. Limited information on its breeding ecology and nesting distribution in western India necessitates region-specific studies to support conservation planning. The present study aimed to assess the current population status, habitat preference in relation to seasonal variation, and nesting characteristics of the Black-headed Ibis in Anand District, Gujarat. Road transects surveys covering all wetlands within the study area were conducted to locate breeding colonies. Nesting trees and colonies were geo-referenced using a handheld GPS, while nest counts and identification were performed using binoculars. Nest height, tree height, canopy cover, girth at breast height, and distance of nests from the main trunk were measured using standard field instruments. Breeding colonies were recorded in six out of eight talukas, with the highest number of nests observed in Anand taluka (N = 859) and the lowest in Sojitra (N = 48). No nesting sites were recorded in Khambhat and Tarapur talukas. Rural ponds supported the majority of nesting colonies (N = 790), indicating strong dependence on wetland habitats. *Acacia nilotica* emerged as the most preferred nesting tree species. Natural disturbances such as storms and anthropogenic threats including habitat conversion, water pollution, pesticide use, and tree felling were identified as major factors affecting breeding success. This study provides baseline ecological data essential for monitoring population trends and highlights the need for habitat protection, wetland conservation, and community-based awareness programs to ensure long-term conservation of the species in central Gujarat.

Keywords: Ibis, Ecology, Wetlands, Breeding, Charotar

Abstract ID: RSMOBIO03

Antidiabetic, antioxidative and antibacterial activity of *Lacticaseibacillus paracasei* subsp. tolerans isolated from the saliva of nondiabetic subject

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Recent research studies are focusing on connection between human microflora and various diseases. Diabetes mellitus is one of the most common metabolic disorders and is associated with other complications like kidney damage and cardiovascular diseases. Diabetic patients have decreased salivary flow rate, high amylase secretion and they often suffer from Hyposalivation and Xerostomia. Here, we have collected salivary sample from normal and diabetic individuals of Gujarat and isolated 107 bacteria and screened using alpha-amylase inhibition assay for checking anti-diabetic activity. One of our isolate AV47 showed 61.42% of alpha-amylase inhibition in vitro. AV47 was found to be gram positive, facultative anaerobe with antibacterial activity against *E. coli* (DH5α, DH10α) and *S. aureus.* It also showed antioxidant activity by DPPH assay. Identification using alignment by ez taxon of 16Sr RNA gene showed it to be *Lacticaseibacillus paracasei sub sp. tolerance.*

Keywords: Diabetes mellitus, alpha-amylase inhibition, *Lacticaseibacillus paracasei,* Anti-oxidant activity, Antibacterial activity

Abstract ID: RSMOBIO04

Understanding the Antimicrobial mechanism of *Pediococcus pentosaceus*

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Investigating novel antimicrobial agents is crucial due to the growing issue of antibiotic resistance. We screened 80 bacteria isolated from the human faecal sample for antibacterial activity against *Staphylococcus aureus*, *Micrococcus luteus*, and ampicillin and streptomycin-resistant *E. coli* strains. One of the potent gram-positive bacteria, showing a zone of inhibition of 24.3 mm against S. aureus, was identified by 16S rRNA gene sequencing as *Pediococcus pentosaceus.* To develop it into a therapeutic agent, a thorough understanding of its inhibitory mechanisms is essential. As it also inhibited the ampicillin and streptomycin resistant strains of *E.coli,* the mode of action (MoA) against target pathogens was not by inhibition of protein synthesis. Using a multifaceted approach, this study examined the MoA of *P. pentosaceus* and its extracted pediocin by assessing important cellular stress reactions, such as reactive oxygen species production, membrane potential disruption Membrane integrity assay and Bacterial viability assay via the BacLight live/dead assay. Mechanistic studies revealed that high ROS production and rapid disruption of cell membrane potential led to cell death. Additionally, marked biofilm inhibition was observed. In conclusion, the principal mechanism of *P. pentosaceus* involves membrane destabilization and pore formation to cause cell death.

Keywords: *Pediococcus pentosaceus*, pediocin, antimicrobial mechanism, membrane disruption, biofilm inhibition

Abstract ID: RSMOBIO05

Antiproliferative and Pro-apoptotic Potential of Benzyl Isothiocyanate Against A549 Non-small Cell Lung Carcinoma Cells

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Cancer metastasis and drug resistance remain significant problem in medical field, necessitating the discovery of novel therapeutic agents from natural sources. Benzyl isothiocyanate (BITC), a bioactive compound found in cruciferous vegetables, has shown a promising anti-cancerous activity. This study investigated the cytotoxic, apoptotic, and anti-migratory effects of BITC on human lung (A549) to elucidate its therapeutic potential. BITC demonstrated significant dose-dependent antiproliferative activity. The IC50 values found for A549 cells was 49.36 µM, which signifies its high potency. Treatment of BITC at IC50 concentration significantly inhibited colony formation compared to controls. Fluorescence microscopy of AO/EB-stained cells revealed distinct apoptotic features, including nuclear fragmentation and chromatin condensation in BITC-treated A549 cells. Furthermore, BITC treatment led to elevated intracellular ROS levels and markedly inhibited cell migration in the scratch assay compared to the untreated controls. These findings suggest that BITC exerts potent anticancer effects on A549 cells by inducing oxidative stress-mediated apoptosis. Our results show that BITC is a promising candidate for cancer management and therapeutic development.

Keywords: Cancer, Therapeutics, Apoptosis, Benzyl isothiocyanate

Abstract ID: RSMOBIO06

Exopolysaccharide from *Staphylococcus epidermidis* as Emerging Postbiotic

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Bacterial exopolysaccharides (EPS) have been reported with multiple clinical activities for example EPS from *L. casei* with anticancer activity, from *L. delbrueckii* subsp. *Bulgaricus,* and *Enterococcus faecium* K1 showing cholesterol lowering activities, and EPS of *L. fermentum S1* exhibiting antioxidant activity. We screened EPS producing bacterial strains isolated from human breast milk on sucrose-supplemented nutrient agar containing Congo red dye. One of the high EPS producing strain was identified as *Staphylococcus epidermidis*. Extraction of EPS was carried out using isopropanol precipitation, subsequently purified with trichloroacetic acid, and quantitatively estimated via the phenol–sulfuric acid assay. Additionally, a one-factor-at-a-time (OFAT) optimization strategy was employed to assess the influence of key parameters such as pH, temperature, carbon source concentration, and incubation duration on EPS yield. The anticancer activity of the purified EPS was evaluated through MTT assay using the A549 cells, which exhibited a dose-dependent cytotoxic response. In addition, the extracted EPS also exhibited antioxidant and antimicrobial activity against *S. aureus*. These findings highlight the significant bioactive potential of *S. epidermidis*-derived EPS, suggesting it as a promising candidate for therapeutic applications, with further clinical studies.

Keywords: Postbiotic, Exopolysaccharides, Microbiota, *S. epidermidis*, Anticancer Activity

Abstract ID: RSMOBIO07

Functional Evaluation of Plant Growth-Promoting Traits of *Enterobacter quasiroggenkampii* isolated from Soybean Rhizosphere

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Plant growth-promoting rhizobacteria (PGPR) play a vital role in sustainable agriculture by enhancing nutrient availability, producing phytohormones, and improving plant resilience. In the present study, from the 109 bacteria isolated from the rhizosphere of Soybean, one of the promising bacteria SV29 was found to produce high levels of Indole-3-acetic acid (IAA) in the presence of L-tryptophan, and it was able to solubilize Zinc, Potassium and phosphate with solubilization index of 2.19 ± 0.22, 3.42 ± 0.19 and 1.49±0.18 respectively. It also produced ammonia, and was capable of growing on Norris glucose nitrogen-free medium, indicating its nitrogen-fixing potential.
Strain SV29 was identified as *Enterobacter quasiroggenkampii* based on its 16S rRNA gene sequence. The diverse Plant Growth Promoting characteristics of *E. quasiroggenkampii* highlight its strong potential as a biofertilizer candidate for leguminous crops. This study provides the first experimental evidence supporting *E. quasiroggenkampii* as a promising PGPR for sustainable crop enhancement.

Keywords: *Enterobacter quasiroggenkampii*, IAA, zinc, potassium, nitrogen.

Abstract ID: RSMOBIO08

Studies on Isolation and Screening of White-Rot Fungi for Myco-remediation of Diclofenac

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Industrial wastewater discharge releases persistent pharmaceutical micro-pollutants that pose serious risks to ecosystems and human health, yet conventional treatment methods often do not fully eliminate them. Due to their chemical complexity and resistance, these compounds require sustainable cleanup approaches. Laccases are promising biocatalysts for removing pharmaceuticals because they have high oxidative power, a broad substrate range, and are environmentally friendly. In this study, white-rot fungi were isolated and evaluated for their ability to produce ligninolytic enzymes and their potential for mycoremediation. Initial screening involved Bavendamm's test, followed by secondary screening through solid-state fermentation on Asther medium. The Agaricomycetes sp. (AGAT) showed the highest laccase activity at 8638.86 ± 49.05 U/g. Significant lignin peroxidase activity (1376.34 ± 34.04 U/g) was found in *Tricholoma giganteum* AGDR-1, while manganese peroxidase activity (193.38 ± 4.06 U/g) was observed in isolate AGRK-2. The fungi's tolerance to emerging contaminants was tested at concentrations from 10 to 100 ppm. Large-scale enzyme production was later employed for the bioremediation of diclofenac (DCF). When combined with the redox mediator ABTS, approximately 93.56 ± 0.35% of 100 ppm DCF was degraded within 24 hours. This degradation was verified through UV–visible spectrophotometry, HPLC, and HPTLC analyses.

Keywords: Mycoremediation, Dicolfenac, White rot fungi, and Laccase

Abstract ID: RSMOBIO09

DNA Barcoding of *Commiphora stocksiana* (Engl.) Engl. using rbcL and matK

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The genus *Commiphora* comprises resin producing plant species of significant medicinal, ecological, and economic importance. Accurate taxonomic identification within the genus is often challenging due to high morphological similarity among species, phenotypic plasticity, and limited molecular data for several taxa. *Commiphora stocksiana* is one such underexplored species for which authenticated genetic information remains scarce. Reliable species level identification is essential for taxonomic clarity and for enabling future conservation and bioresource based studies.

In the present study, DNA barcoding was employed to authenticate and characterize *C. stocksiana* using the chloroplast barcode regions rbcL and matK, which are widely accepted as standard plant DNA barcodes. Genomic DNA was isolated from plant material and amplified using universal primers specific to both loci. The amplified products were sequenced, and the resulting sequences were subjected to similarity searches against publicly available databases. Phylogenetic analysis was performed to evaluate the taxonomic placement of *C. stocksiana* within the genus *Commiphora*.

Both rbcL and matK regions showed successful amplification and generated high quality sequence data. Sequence similarity analysis demonstrated clear discrimination of *C. stocksiana* from closely related species, while phylogenetic clustering supported its placement within the genus. The combined use of rbcL and matK enhanced the resolution and reliability of species identification.

This study provides validated barcode sequences for *C. stocksiana* and contributes novel molecular data to existing genetic repositories. The findings highlight the utility of a multi locus DNA barcoding approach for resolving taxonomic ambiguities in morphologically similar and underrepresented plant taxa.

Keywords: *Commiphora stocksiana*; DNA barcoding; molecular identification; plant taxonomy; phylogenetic analysis

Abstract ID: RSMOBIO10

Fungal Elicitor-Mediated Induction of Systemic Acquired Resistance (SAR) Against Late Blight (*Phytophthora infestans*) in *Solanum lycopersicum* L. (Tomato) Plant

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Tomato (*Solanum lycopersicum* L.) is highly susceptible to late blight caused by *Phytophthora infestans*, resulting in serious yield losses, while chemical control raises environmental and resistance concerns. This study explores fungal elicitors as an eco-friendly means to induce Systemic Acquired Resistance (SAR) in tomato plants. Crude fungal extracts were applied prior to pathogen challenge. Morphological traits, key biochemical constituents, defense enzymes (PAL, POX, CAT, β-1,3 glucanase), and SAR-related genes (PR1, PAL, LOX, WRKY, NPR1) were evaluated. Elicitor treatment enhanced growth, activated defense responses, and improved resistance to the pathogen, demonstrating the potential of fungal elicitors as a sustainable strategy for managing late blight in tomato.

Keywords: Tomato, *Phytophthora infestans*, Late blight, Fungal elicitor, Systemic Acquired Resistance, Defense enzymes, SAR genes.

Abstract ID: RSMOBIO11

Detoxification of the chemotherapeutic drug 5-fluorodeoxyuridine by two probiotic isolates

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A significant challenge in treating cancer with chemotherapeutics is the occurrence of gut dysbiosis. Gut dysbiosis negatively impacts the overall health of the patient, but also reduces the efficacy of the immune system, thereby making the treatment of cancer all the more difficult. Probiotic organisms have been shown to possess the ability to detoxify chemotherapeutic drugs, which can help improve therapeutic outcomes for patients undergoing chemotherapy. We use the nematode *Caenorhabditis elegans* as a model for identifying bacteria capable of detoxifying the chemotherapeutic drug 5-fluorodeoxyuridine (FUDR). In the presence of FUDR, the worm shows a worsening in pharyngeal pumping, body bending, and reversal frequency, all of which are indicators of healthy feeding behaviour in the worm. We show that in the presence of probiotic isolates VH09 and VH40, these parameters revert to the normal phenotype, suggesting drug detoxification by these isolates. The Cell Free Supernatant of the isolates also shows inhibition of cancer cell proliferation, suggesting the usefulness of the organisms in adjuvant therapy.

Keywords: Probiotics, Cancer, Chemotherapy, Drug Doxification, *C. elegans*

Abstract ID: RSMPBIO01

Biocontrol of bacterial soft disease and plant growth promoting potential of *Bacillus velezensis* CGS1.1

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Bacillus velezensis CGS1.1 is reported as a poultry probiotic. Its whole genome sequence is annotated in GenBank under the accession number JAHCXE000000000.1. The present study was undertaken to explore antagonist and plant growth promoting activity of CGS1.1. Bacterial culture CGS1.1 exhibits antibacterial activity against *Chromobacterium violaceum*, *Pectobacterium carotovorum subsp. carotovorum*, *Ralstonia solanacearum* as well as antifungal activity against phytopathogens. The antibacterial metabolite could be extracted from cell-free supernatant of CGS1.1 using acidified ethyl acetate, and antifungal metabolite by acid precipitation. Both antibacterial and antifungal metabolites could be separated on silica gel by thin layer chromatography and detected in antibiogram using *Chromobacterium violaceum* and *Aspergillus niger*, respectively. The culture CGS1.1 exhibited phosphate solubilization, siderophore production, and secretion of extracellular enzymes such as amylase, protease, xylanase, cellulase, pectinase, and esterase. CGS1.1 also exhibited *in-vivo* plant growth promoting potential in potato plants. In nursery trial, CGS1.1 significantly enhanced shoot length, fresh weight of plant, weight of potato tubers, and chlorophyll content of potato leaves. This study demonstrates both bacterial pathogen antagonistic and plant growth promoting potential of *Bacillus velenzensis* CGS1.1 for potato plants.

Keywords: Bacillus velenzensis; plant growth promoting; Pectobacterium carotovorum; Aspergillus niger; potato.

Abstract ID: RSMPBIO02

Efficient Plant Regeneration System for *Zea mays* L. using Immature Embryos as Explant

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Among cereal crops, the maize plant has high genetic yield potential. It is cultivated globally and serves as a staple food worldwide. To enhance the nutritional value of maize, plant tissue culture and genetic transformation methods are useful. In plant tissue culture, both mature and immature embryos respond and regenerate well, but for genetic transformation, immature embryos are preferred over mature embryos. Plant tissue culture offers a better way for improving crop quality and quantity by producing multiple copies of a high-yielding variety. In this method, the explant is inoculated in the Murashige & Skoog media under aseptic conditions. The present work shows the in vitro response of immature maize embryos, supplemented with different plant growth hormones. The MS media, supplemented with 0.3 mgL^{-1} BAP hormone, initiates shoot formation, while zeatin hormone induces shooting at 2.0 mgL^{-1} concentration. In 2,4-D media, at 3.0, 4.0 & 5.0 mgL^{-1} concentration, embryos form a slightly yellowish, friable callus. Further study is required for generating shoot & root from the callus of the immature embryo.

Keywords: Plant tissue culture; Maize; Immature embryos; Staple food.

Abstract ID: RSMPBIO03

Characterization of Probiotic Attributes of *Bacillus velezensis* BFSR3 isolated from Bakrol farm soil"

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The phasing out of antibiotic growth promoters (AGPs) in poultry production has created an urgent need for effective and sustainable alternatives. Probiotics—beneficial live microorganisms that enhance gut health—have gained significant attention due to their potential to improve growth performance without contributing to antimicrobial resistance. The present study aimed to investigate the probiotic features of isolate BFSR3 screened amongst isolates obtained from Bakrol farm soil. The culture exhibited bile salt hydrolase activity and acid tolerance at pH 2, simulating the gut conditions. It displayed notable aggregation, cell surface hydrophobicity, biofilm formation, and antimicrobial activity against gram-negative bacterial pathogens. Interestingly, the cultures completely inhibited the growth of *Escherichia coli* O157:H7 and *S. typhimurium* strains ATCC 13311 and 14028 within 24 h in liquid co-culture assay. The culture exhibited secretion of amylase, cellulase, pectinase, xylanase, esterase or lipase, caseinase, and phytase in medium. The 16S rRNA sequence analysis revealed its identity as *Bacillus velezensis* (Accession No. MW341484.1). The results suggest the prospects of BFSR3 to be employed as antibiotic growth promoter substitute in poultry.

Keywords: probiotics; poultry, Antibiotic growth promoter; Bacillus velezensis.

Abstract ID: RSMPBIO04

Multi-Assay Evaluation of Clot-Degrading Enzyme in *Bacillus subtilis*

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Microbial enzymes have attracted considerable interest due to their potential relevance in thrombolytic applications. In the present study, a systematic and multi-tiered strategy was employed to evaluate the clot-degrading enzymatic activity of four *Bacillus subtilis* isolates obtained from different environmental and fermented food sources. The isolates were previously identified through comprehensive biochemical characterization and 16S rRNA gene sequencing. Primary screening of extracellular proteolytic potential was carried out using the casein plate assay, followed by quantitative estimation of enzyme activity through the Folin–phenol Ciocalteau–based caseinolytic assay. The functional relevance of the observed activity was further examined using blood clot dissolution by the Holmstrom method, while substrate-specific clot degrading activity was confirmed using the fibrin plate assay. Two standard reference strains were included for comparative evaluation. The isolates exhibited clear strain dependent variability across qualitative, quantitative and functional assays, indicating diversity in clot-degrading potential among the evaluated strains. The convergence of results obtained from multiple complementary assays underscores the robustness of the evaluation strategy and supports the reliability of the observed trends. Overall, the study highlights the structured experimental framework for assessing enzymatic activity of *Bacillus subtilis* isolates and demonstrates the effectiveness of a multi-assay approach for proteolytic activity assessment, providing a foundation for future downstream functional and application-oriented investigations.

Keywords: *Bacillus subtilis*; clot-degrading enzyme; caseinolytic activity; blood clot dissolution; fibrin degradation.

CHEMISTRY

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Abstract ID: RSMOCHEM01

An Innovative Multiscale Assessment of Acrylic Copolymers Combining Computational Molecular Docking, Experimental Biocidal activities, Spectroscopic validations, and Synthetic Engineering

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In this study, the functional methacrylate monomers 2,4-dichlorophenyl methacrylate (2,4-DMA) and vanillin methacrylate (VMA) were synthesized and subjected to free-radical copolymerization at controlled feed ratios to generate a compositionally tunable copolymer series. Monomer-to-polymer conversion and chain microstructure were verified using FT-IR, ^{1}H-NMR and HPLC. The disappearance of vinyl proton resonances and the loss of C=C stretching bands, combined with high chromatographic purity (>99%), confirmed efficient propagation and minimal side reactions. Compositional variations in the copolymers were further reflected in systematic shifts in carbonyl and aromatic vibrational domains, consistent with differing contributions of the 2,4-dichlorophenyl and vanillin units to the polymer backbone. Biological evaluation demonstrated a clear composition-dependent antimicrobial response, with 2,4-DMA-rich copolymers exhibiting the highest inhibition against both bacterial and fungal strains. To complement the experimental findings, a molecular docking analysis was also performed against *E. coli* DNA gyrase (PDB: 1KZN). The selected copolymer fragment displayed a binding affinity of −5.20 kcal/mol, supported by hydrogen bonding with ASN46 and stabilizing π-alkyl, π-sigma, and alkyl interactions with residues such as ALA47, THR165, VAL43 and VAL167, consistent with the observed antibacterial potency. Based on the results, this study establishes 2,4-DMA/VMA copolymers as a structurally adaptable platform with tunable antimicrobial performance enhanced by favourable protein binding interactions. These materials show promising aspects for antimicrobial coatings, protective films and biologically responsive polymer systems.

Keywords: Acrylic copolymers, 2,4-Dichlorophenyl methacrylate, Vanillin methacrylate, Docking studies, Biocidal activity.

Abstract ID: RSMOCHEM02

Green Plasticization of PLA: A Novel Approach Using Epoxidized Simarouba Glauca Seed Oil

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Flexible PLA/ESGO films were made using a solution casting method with chloroform as the solvent. Films were prepared with and without stabilizers and coloring agents, with and without filtration, and stirred continuously at room temperature (~25°C) for 24 hours. - FTIR analysis confirmed ESGO incorporation, showing a C-O-C absorption band at 870.34 cm^{-1}. Thermal stability improved with ESGO addition. Mechanical testing showed increased elongation at break and decreased tensile strength and Young's modulus, indicating enhanced flexibility. XRD analysis revealed stronger PLA-ESGO interactions. Minimal plasticizer loss in water, higher in petroleum ether. Volatility of ESGO increased with plasticizer content. Thermo-kinetic analysis showed enhanced activation energy values. Glass transition temperature decreased from 59°C to 14°C, indicating high flexibility. Optical microscopy revealed compact structure in neat PLA, spherical microvoids in ESGO-plasticized films.

Keywords: Poly (lactic acid), Epoxidized Simarouba Glauca seed oil, Plasticization effect, Thermal stability

Abstract ID: RSMOCHEM03

Cerium-based perovskite oxides as a catalyst for the thermolysis of ammonium perchlorate and its Artificial Neural Network investigation

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Cerium based transition metal perovskites were synthesized $CeFe_xCo_{1-x}O_3$(x=0.2, 0.4, 0.6, 0.8) via a sol-gel combustion method. This study aims to examine the impact of changing the stoichiometric composition of B-site metal substitutions on the catalytic activity of ammonium perchlorate (AP), with particular focus on the tunable effects arising from Fe–Co substitution. Of the four compositions studied, the sample with x = 0.4 demonstrated superior performance, achieving the lowest decomposition temperature as measured by DSC (Differential Scanning Calorimetry). The band gap first decreases till x=0.4 and then increases as the Fe substitution increases. $CeFe_{0.4}Co_{0.6}O_3$ exhibited lowest band gap of 3.5 eV amongst all. IR spectroscopy results show the successful synthesis with existence of M-O bond. With increasing Fe content, the peak shifts to higher wavenumbers, reflecting enhanced polarity in the metal–oxygen bonds, except in the x = 0.8 composition. The XRD patterns were of pure cubic phase with average crystallite size of 7.4 nm. The main peak shifts from 28.48° (x = 0.2) to 28.52° (x = 0.4, 0.6), and then to 28.51° in the x = 0.8 sample. Raman study insights into the various modes of vibration within the perovskite structure. A BET surface area of 25.2 m^2/g was measured for the $CeFe_{0.4}Co_{0.6}O_3$ catalyst, indicating its high surface area. N_2 adsorption-desorption curve signifies its porous nature. Its catalytic behavior towards AP was established by TGA analysis which shows single exothermic peak in the DSC thermogram. Artificial Neural Networks (ANNs) were applied to forecast the TG curves and KAS (Kissinger-Akahira-Sunose) activation energy values (kJ mol^{-1}).

Keywords: ammonium perchlorate, artificial neural network, perovskites, cerium

Abstract ID: RSMOCHEM04

NCS-Mediated Transition Metal-Free C(sp^2)–H Thiocyanation of 2-Iminothiazolines

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In this study we have developed a simple, metal-free method for introducing thiocyanate groups into 2-iminothiazolines. The reaction uses N-chlorosuccinimide (NCS) together with potassium thiocyanate (KSCN) and runs smoothly under mild, room-temperature conditions in air, needing only a 1.2 equivalent of NCS. This approach is highly efficient, giving a wide variety of thiocyanated 2-iminothiazolines in consistently good to excellent yields. Key advantages of this transition-metal free approach include a broad substrate scope, high functional group tolerance, mild reaction conditions, excellent product yields, scalability, and synthetic versatility. Mechanistic investigations suggest an ionic pathway for this transformation.

Keywords: Transition-metal-free synthesis; C–H thiocyanation strategy; Thiazoline-based heterocycles; Sustainable organic methodology.

Abstract ID: RSMOCHEM05

PSF/PEES Blended Montmorillonite Clay Composite Nanofiltration Membrane For Congo Red Dye Separation

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In present work, by applying phase inversion technique PSF/PEES (polysulfone/poly 1,4-phenylene ether ether sulfone) blended and PSF, PEES core membranes with and without incorporation of Montmorillonite (MMT) clay were synthesized with polyvinylpyrrolidone (PVP) as the porogen and N-methyl pyrrolidone (NMP) as the solvent. Membranes performance were investigated on cross flow nanofiltration system for removal of Congo Red (CR) dye. From the studies, it is found that PSF/PEES blended membrane with incorporation of MMT clay having 98.15% rejection for CR dye with higher flux. Contact angle analysis and water uptake study confirms the hydrophilic nature of membranes. Lowest contact angle and maximum water uptake capacity was obtained for PSF/PEES blended membrane (membrane with 50% PSF and 50% PEES). Scanning electron microscopy (SEM), Atomic force microscopy (AFM), Thermal gravimetric analysis (TGA) and Fourier Transform Infrared Spectroscopy (FTIR) have been used for the morphological, surface, thermal and chemical characterization of prepared membranes respectively. From all above characterization studies; it is found that, for PSF/PEES blended membrane with incorporation of MMT clay optimized results were obtained.

Keywords: PSF/PEES blend, MMT clay, Nanofiltration, Congo Red, Rejection

Abstract ID: RSMOCHEM06

Modified Halophyte Biochar for Congo red Removal: Adsorption and Neural Prediction

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This study investigates a novel adsorbent—ferrite composite of biochar (FCOB) for Congo red (CR) dye removal. It was synthesized by pyrolyzing *Suaeda monoica* leaf powder to obtain biochar, followed by base treatment to produce base treated biochar, and subsequent coprecipitation with $NiCuZnFe_2O_4$ ferrite spinel. The XRD analysis of FCOB confirmed the successful incorporation of spinel $NiCuZnFe_2O_4$ into FCOB, as evidenced by the presence of two prominent characteristic peaks of the spinel structure. The SEM image revealed the irregular-crumpled structure of FCOB. BET analysis revealed the mesoporosity in FCOB, with a surface area of 44.64 ± 0.2396 $m^2\ g^{-1}$. The optimum adsorption was achieved at a pH of 2, adsorbent dosage of 20 mg, initial CR concentration of 50 mg/L, contact time of 320 min, and temperature of 85 °C. The maximum CR dye removal percentage (R%) was 99.75%. At pH = 2, the strong electrostatic attraction between protonated FCOB adsorbent and anionic CR seemed to be the dominant adsorption mechanism. The adsorption data was best ($R^2 = 0.99$) described by the Redlich–Peterson isotherm model, indicating a heterogeneous surface with some degree of monolayer adsorption. The maximum adsorption capacity estimated from the Langmuir model was $q_{max} = 239.80$ mg/g. The adsorption kinetics data was best described by pseudo-second-order model ($R^2 = 0.99$), suggesting that chemisorption is likely the rate-limiting step. The CR adsorption process was spontaneous and endothermic with $\Delta H° = 71.02 \pm 1.41$ kJ/mol. ANN analysis revealed that both BR and LM algorithms accurately predicted removal efficiency and adsorption capacity, achieving R values greater than 0.995. FCOB could also be regenerated and recycled up to 5 cycles retaining ≅65% removal efficiency for CR. Therefore, FCOB can serve as a biodegradable, cost-effective, nontoxic, and renewable adsorbent in treating CR-dye contaminated wastewater.

Keywords: Congo red, Adsorption, Biochar, *Suaeda monoica*, Ferrite spinel

Abstract ID: RSMOCHEM07

Identification of Imidazo[1,2-a]pyridine–Pyrazole–Pyran Hybrids as G6PD Inhibitors

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In this work, we aimed to discover novel anticancer agents by synthesizing a series of imidazo[1,2-a]pyridine–pyrazole–pyran hybrids (**7a–g**) in good yields (75–85%) using microwave irradiation. The target compounds were prepared *via* a one-pot, three-component cyclocondensation reaction of 2-(p-substituted imidazo[1,2-a]pyridine-3-carbaldehydes (4a–g), malononitrile (5), and 5-methyl-2,4-dihydro-3H-pyrazol-3-one (6) in acetonitrile, employing triethylamine as a catalyst. All synthesized compounds were thoroughly characterized using standard spectroscopic techniques. Their anticancer activity was evaluated *in vitro* by an MTT-based assay against the A549 lung cancer cell line. Among the series, compounds 7b, 7c, and 7e exhibited pronounced antiproliferative activity, while compound 7e displayed markedly reduced fluorescence generation—approximately 24-fold lower—in the G6PD inhibition assay compared to the other derivatives.

Keywords: DFT study; Molecular docking; A549; G6PD; ADME

Abstract ID: RSMOCHEM08

Point-of-need detection of Pb^{2+} ions using a smartphone-enabled fluorescent paper sensor with modified calix[4]arene scaffold

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In this study, we report the development of a novel fluorescence sensor based on calix[4]arene-crown[5] (C4CBy) functionalized with bansyl chloride as a fluorophore. The synthesized probe was characterized using various spectroscopic techniques, including MALDI-TOF-MS, FT-IR, ^{1}H NMR, ^{13}C NMR, and 135 DEPT NMR. Emission spectroscopy analysis demonstrated that C4CBy exhibits high selectivity towards Pb^{2+} ions, leading to a significant enhancement in fluorescence intensity. This fluorescence enhancement is attributed to the ligand-to-metal charge transfer (LMCT) mechanism, with a linear response observed over a Pb^{2+} concentration range of 0 nM–100 nM ($R^2 = 0.9927$) and a detection limit of 1.65 nM. A Job's plot analysis confirmed a 1:1 stoichiometric binding ratio between C4CBy and Pb^{2+} ions via fluorescence spectroscopy. To evaluate the practical applicability of C4CBy, the sensor was tested in real sample matrices, including drinking water, lake water, laboratory water, cow milk, buffalo milk, orange, lake soil, industrial soil, and farm soil samples, within a Pb^{2+} detection. concentration range of 0 nM – 30 nM. Additionally, a disposable paper-based analytical device was developed, along with a smartphone- integrated portable sensing platform, providing a cost-effective, user-friendly, and highly selective approach for Pb^{2+} detection.

Keywords: Calix[4]arene-crown[5]ether; Fluorescence technique; LMCT mechanism; Paper and; smartphone-based portable device; Computational and real sample analysis

Abstract ID: RSMOCHEM09

Efficient One-Pot Synthesis of Dispiro[Oxindole/Acenaphthylenone-Benzofuranone]pyrrolidines *via* Regioselective 1,3-Dipolar Cycloaddition

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Spiro- and dispiro-oxindole frameworks represent privileged heterocyclic motifs with broad pharmacological relevance, particularly as antiproliferative agents. The 1,3 dipolar cycloaddition of azomethine ylides has emerged as a powerful strategy for assembling such complex architectures in a regio and stereoselective fashion. Building on this approach, we report an efficient one-pot synthesis of dispiro[oxindole/acenaphthylenone benzofuranone]pyrrolidines via in situ generation of azomethine ylides from isatin or acenaphthoquinone and diverse secondary amines. The dipoles were trapped by 4′ chloroaurone under [DBU][Ac] catalysis in methanol, affording the target scaffolds in high yields within short reaction times. The structures were validated through NMR, IR, Mass, and single-crystal X-ray diffraction, which revealed the favoured regioselective routes governed by the steric and electronic influences of the amines. The synthesized heterocycles were evaluated for antiproliferative activity against a panel of six human solid tumor cell lines (A549, HBL-100, HeLa, SW1573, T-47D, WiDr), revealing several derivatives with sub-20 μM GI50 values and activity comparable to cisplatin, etoposide, and camptothecin. Molecular docking studies demonstrated favorable binding of representative scaffolds within the hydrophobic pocket of the MDM2 receptor, consistent with inhibition of the MDM2/p53 protein–protein interaction. These findings highlight aurone-based dispiro scaffolds as promising leads for the development of new antiproliferative agents.

Keywords: Dispiro-heterocycles, 1,3-Dipolar cycloaddition, Azomethine ylide, Antiproliferative agent

Abstract ID: RSMOCHEM10

Naphthyl-amine calix[4]resorcinarene based fluorescence sensor for selective detection of Ag^{+} and Fe^{3+} metal ions

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A novel naphthylamine-functionalized calix [4] resorcinarene (C4RNA) based fluorescent chemosensor was successfully synthesized and was characterized by ^{1}H NMR, ^{13}C NMR, FT-IR and ESI-MS. The fluorescence sensing behaviour of C4RNA was thoroughly explored towards a wide range of metal ions including Mg^{2+}, Na^{+}, Cd^{2+}, Fe^{2+}, Fe^{3+}, K^{+}, Ni^{2+}, Co^{2+}, Cr^{3+}, Th^{4+}, Sr^{2+}, Ba^{2+}, Pb^{2+}, La^{3+}, Ag^{+}, and Ce^{3+}, by using fluorescence spectroscopic techniques. The C4RNA exhibited a distinct fluorescence enhancement in the presence of Ag^{+}, however with Fe^{3+} showed decreasing fluorescence intensity, demonstrating a distinctive dual-response sensing behaviour. Remarkably, C4RNA displayed a higher binding preference toward Fe^{3+}, as evidenced by the marked decrease in fluorescence intensity of the preformed C4RNA-Ag^{+} complex upon addition of Fe^{3+}. This competitive displacement further confirms the strong affinity of the probe for Fe^{3+} ions. The sensor showed excellent selectivity toward Ag^{+} and Fe^{3+}, with limits of detection 4.47 µM and 9.09 µM, respectively. The formation of C4RNA–Ag^{+} and C4RNA–Fe^{3+} complexes was verified by ESI-MS and FT-IR analyses. Furthermore, the binding constants for Ag^{+} and Fe^{3+} were determined to be 5.85×10^{6} M^{-1} and 6.05×10^{6} M^{-1}, respectively, indicating strong and stable complex formation. To demonstrated real-world application of C4RNA, this probe was tested in real sample media, industrial water, tap water, drinking water, contaminated water, E-waste for Ag^{+} and spinach, E-waste samples for Fe^{3+} detection.

Keywords: calix[4]resorcinarene ; Fluorescence sensor; metal ions; LMCT; Binding constant.

Abstract ID: RSMOCHEM11

Efficiency of TiO_2 photocatalyst for photocatalytic degradation of polyethylene

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Plastic waste has been found in the environment as a result of the extensive manufacture of plastic, raising concerns about its negative impacts on the ecosystem on a global scale. Eliminating pollution caused by plastics is therefore crucial for the sustainability of the ecosystem and the human life cycle. We herein investigate degradation of the polyethylene (PE) films by photocatalysis reaction process. The photocatalytic degradation of PE was carried out using titanium dioxide(TiO_2) as a photocatalyst under illumination of ultraviolet light for time durations of 12 to 144 h. Thus, the persistent problem of polyethylene (PE) pollution was addressed by the developing a new photocatalytic system. The TiO_2-H_2O_2 system can effectively and economically degrade PE with a substantial variation in surface morphology of the film. PE characterization after degradation was accessed by various techniques like Optical Microscopy, AFM, FT-IR, XPS,TGA-DTG etc.

Keywords Degradation mechanism · Mass loss · Polyethylene Films · Photodegradation · Reactive radicals

Abstract ID: RSMOCHEM12

Green and Sustainable Development of Spiro Quinoxaline–Pyrimidone Derivatives: Biomolecular Interaction Studies

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Cancer is a severe and dangerous disease for humans that has proved to be the most fatal disease with about 70% of mortality cases, i.e., about 2nd leading disease worldwide. The current study highlights the use of a green catalyst to synthesized novel spiro quinoxaline-pyrimidone-based heterocyclic compounds. Their binding modes and affinities for biomolecules were investigated using spectroscopic analysis and molecular docking. Effective DNA binding is essential for a compound to exhibit potential anticancer activity. Therefore, the binding affinity of all synthesized compounds toward calf thymus (CT) DNA and bovine serum albumin (BSA) was evaluated using UV-visible absorption titration studies. The binding constants of compounds QP1-QP12 with CT-DNA and BSA were found to be in the ranges of 0.6 - 1.45 × 10^5 M^{-1} and 0.16 - 2.19 × 10^4 M^{-1}, respectively. The compounds were screened against two Gram (+ve) and three Gram (-ve) bacteria, and the MIC values of heterocyclic spiranes were found in the 135-195 µM range. The cytotoxic activity of the synthesized compounds was evaluated using the brine shrimp lethality assay. Anticancer activity was evaluated on MCF-7 using an IC_{50} value that ranges from 76.67 to 138.34 µg/mL. To determine the drug-likeness of all synthesized compounds, the pharmacokinetic profile were evaluated using online platforms SwissADME and admetSAR.

Keywords: Spectral characterization, Green synthesis, Biomolecular interaction, Docking analysis

Abstract ID: RSMOCHEM13

SILICA SUPPORTED BIOSYNTHESIZED SILVER NANOPARTICLES AS AN EFFICIENT ADSORBENT AND PHOTOCATALYST FOR REMOVAL OF METHYLENE BLUE DYE FROM WATER

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Acquiring clean and affordable water is a great challenge across the globe nowadays. Herein, we focused on removing a dye from the water. We demonstrate a facile synthesis of a promising photocatalyst for the removal of cationic dye (methylene blue;MB) from water under visible light irradiation. The silica-supported silver nanoparticle (Ag@SG) based photocatalysts were prepared by using different concentrations of biogenic silver nanoparticles (AgNPs; 0.25-5 mM) solutions prepared from *Cicer arientinum* pod extract. Detailed characterization of AgNPs was carried out by UV-Visible spectroscopy, HR-TEM, EDX, powder XRD, and FT-IR spectroscopy. The synthesized AgNPs were wet impregnated on silica gel (SG), and the resultant composites were characterized by using ICP-OES, BET, XPS, and HR-TEM analyses. Among them, the Ag@SG composite prepared using 1.25 mM AgNPs solution (Ag1.25@SG) contained Ag^0 species as nanoparticles, whereas the samples prepared by higher concentrations contained both Ag^0 and Ag^+ (silver oxide) species. All the Ag@SG composites exhibited good adsorption capacity but Ag1.25@SG exhibited higher photocatalytic activity for the degradation of MB. The study reveals that the plasmonic Ag^0 species supported on silica are catalytically more active than Ag^+ species. Also, AgNPs (Ag^0) in supported form exhibit much higher (~5-fold) photocatalytic activity than unsupported AgNPs. The Ag1.25@SG composite containing a very small amount of silver (0.037×10^{-2} mol%) showed the highest photocatalytic efficiency, achieving 88% removal of MB. The synergistic effect of the adsorption property of silica surface and plasmonic photocatalytic activity of AgNPs in the synthesized composites is found to be effective for the removal of MB. The fine dispersion of AgNPs on the internal surface of silica is found to be a key factor for improved photocatalytic activity.

Keywords: Methylene blue, Silver nanoparticles, Silica, Adsorption, Photocatalysis

Abstract ID: RSMOCHEM14

Development and Investigation of Dual-Crosslinked, pH-sensitive hydrogels for regulated Drug Delivery

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Hydrogels from alginate (ALG) have received high interest in the biomedical research field because they display mild gelation, controlled release and natural biocompatibility. In this study, we have fabricated a series of dual-crosslinked and pH-responsive (DP) materials composed of ALG-g-poly(AAm-co-MAn). To enhance functionality, we have further incorporated hydroxypropyl-β-cyclodextrin (HP-β-CD) & chitosan nanoparticles (CTS NPs) were loaded into the resulting DP hydrogels to improve functional performance. Structural and compositional analysis through Fourier transform infrared spectroscopy (FTIR), thermal stability determination through (TGA-DTG), differential scanning calorimetry (DSC), and X-ray diffraction (XRD) analysis confirmed monomer grafting and crosslinking into the fabricated hydrogels. Zeta-potential measurements and particle size distribution assay were used to analyse the colloidal properties and surface morphology of the DP hydrogels, which were analyzed by Scanning electron microscope. A whole set of physicochemical parameters was examined, including point of zero charge (pHpzc), swelling behaviors, water retention capacity, sol-gel fraction and crosslinking efficiency. In vitro drug release studies were conducted using riboflavin (RF) as a model hydrophilic drug under 1.2, 6.8, 7.4. The release profiles of the synthesized hydrogel and nanocomposites were investigated using a spectrofluorometer.

Key words: Hydrogel, Drug release, pH sensitive, Dual Crosslinking

Abstract ID: RSMOCHEM15

An Efficient Chitosan-Catalyzed Domino/Aldol-*hetero*-Diels–Alder Approach to Cyclic Heptanoid Scaffolds

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Pyranopyran frameworks, especially those in which the pyran ring is tethered to alkyl, olefin, or aryl fragment through its anomeric carbon, are important classes of bioactive structures, distributed widely in natural products. For example, phytochemicals, marine polyethers and fungal phytotoxins[3], found in plant metabolites. The pyran ring when attached to a two-carbon fragment through its anomeric carbon is called a cyclic heptanoid unit. The cyclic heptanoid core is found in several bioactive molecular assemblies and inspires synthesis of many pyran-fused compounds. In present study, a chitosan-catalyzed, domino aldol-*hetero*-Diels-Alder (DAHDA) reaction has been developed in glycerol at 90° C after combining 2-alkenyl-oxynaphthaldehydes, *O*-alkenyl-salicylaldehydes,5-alkenyl-sulfanyl-pyrazole-4-carbaldehydes with the poorly enolizable CH activated but-3-en-2-ones; monobenzalacetone, 4-methoxy-3-but-2-ene, mesityl oxide to achieve pyrano[3,4-c]chromenes /thiopyrano[2,3-c]pyrazoles all are containing cyclic heptanoid core. Proposed all new structures were confirmed by mass, IR, ^{1}H, and ^{13}C NMR spectral data, and single-crystal X-ray.

Keywords: Aldol-*hetero*-Diels-Alder, Chitosan, Cyclic heptanoid, Green chemistry, Sulfur heterocycles

Abstract ID: RSMOCHEM16

Sustainable DES-Based Approach for the Preparation of Bioactive Quinolin-8-one Scaffolds: Antioxidant Assessment and in silico studies

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A series of novel quinolin-8-one derivatives were efficiently synthesized using an environmentally benign deep eutectic solvent (DES) composed of citric acid and tetrabutylammonium bromide (TBAB). This green synthetic protocol afforded high product yields (65–85%) while eliminating the need for toxic organic solvents. The chemical structures of the synthesized compounds were unequivocally confirmed by 1H NMR, 13C NMR, and high-resolution mass spectrometry (HRMS), verifying the formation of the desired heterocyclic frameworks and high purity. The antioxidant potential of the compounds was evaluated in vitro using DPPH and ABTS radical scavenging assays. Several derivatives exhibited potent antioxidant activity, with IC_{50} values ranging from 7 to 33 µg/mL, surpassing the activity of the standard antioxidant, ascorbic acid, in certain cases. Density functional theory (DFT) calculations at the B3LYP/6-311G(d,p) level were employed to investigate the electronic properties, revealing HOMO–LUMO energy gaps in the range of 2–5 eV, indicative of favorable chemical reactivity. Furthermore, molecular docking studies against antioxidant-related enzyme targets (e.g., PDB ID: 1CB4) demonstrated strong binding affinities (−5.5 to −8.2 kcal/mol), supported by key interactions within the active sites. Collectively, these results demonstrate a sustainable synthetic approach to biologically active heterocycles with significant antioxidant potential, corroborated by computational analyses, and suggest their promise for further development in antimicrobial and pharmaceutical applications.

Keywords: Deep eutectic solvent, NMR, HRMS, DFT, Antioxidant

Abstract ID: RSMOCHEM17

Design, green synthesis, and in silico investigations of a 1,2,3-triazole linked 1,8-dioxooctahydroacridine scaffold as possible inhibitors of α-glucosidase and α-amylase

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In a continued effort to identify novel α-glucosidase and α-amylase inhibitors for the management of type 2 diabetes mellitus (T2DM), we report the synthesis of acridine-linked 4-(phenoxymethyl)-1-phenyl-1H-1,2,3-triazole derivatives 6(a–j). The synthetic strategy employed an ultrasound-assisted deep eutectic solvent (DES) as a green and biodegradable reaction medium, affording an efficient and environmentally sustainable process with excellent yields. This DES system is cost-effective, exhibits dual catalytic activity, and can be recycled, making it a task-specific solvent. Biological evaluation revealed that compounds 6g, 6h, 6i, and 6j displayed potent inhibitory activity against both α-glucosidase and α-amylase, with IC_{50} values ranging from 3.24 ± 0.07 to 5.03 ± 0.05 μM and 3.28 ± 0.07 to 4.68 ± 0.07 μM, respectively. Enzyme kinetic analyses of the most active compounds indicated a mixed-type mode of inhibition toward both enzymes. In vitro cytotoxicity studies using the MCF-7 breast cancer cell line showed that the majority of the synthesized compounds were non-toxic. Molecular docking investigations supported the experimental results, demonstrating that the active derivatives form multiple interactions within the active sites of both target enzymes. Based on these significant findings, the derivatives provide promising pathways for future research on type 2 diabetes and may pave the way for innovative treatments.

Keywords: Acridine; Triazole; Deep eutectic solvent (DES); Molecular docking study.

Abstract ID: RSMOCHEM18

A Chitosan *N*-ium acetate-catalyzed domino synthesis of pyrazolyl-xanthene-dione scaffolds: Characterization and DFT studies

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Xanthene is dibenzo-fused pyran, an important class of heterocycles found in many naturally and synthetically derived products, exhibiting various biological importance such as anticancer, antimicrobial, antimalarial, antioxidant agents, anti-SARS-CoV-2 agent, antitumor, anti-inflammatory. Over the last decade, the xanthene core has emerged as a privileged scaffold, sparking significant interest in the design of novel chemical systems containing the xanthene core. Here we report highly efficient domino/Knoevenagel-Michael-dehydrative cyclization (DKMDC) synthetic sequences for the construction of pyrazolyl-appended xanthene-diones, after reacting 3-methyl-1- (*o*-/*m*-Cl-phenyl)-5-hydroxy/2-(*N*)-alkyl/alkenyl)/- pyrazole-4-carbaldehydes with dimedone/cyclohexanedione using chitosan *N*-ium acetate as a catalyst. Notably, the pyrazole unit undergoes regioselective alkylation in starting or final domino products, allowing antipyretic/ analgesic Novalgin analogous skeleton. The structures of all DKMDC products have been confirmed based on mass, ^{1}H NMR, ^{13}C NMR, and single-crystal X-ray data. Also, density functional theory (DFT) calculations were used to calculate optimized structure, HOMO-LUMO energy, and MEP to establish structural information.

Keywords: Domino, Knoevenagel-Michael- dehydrative cyclization, Xanthene, chitosan *N*-ium acetate, X-ray diffraction, and DFT

Abstract ID: RSMPCHEM01

Removal of anionic/cationic dyes by chitosan poly (acrylamide-co-crotonic acid)/Fe_3O_4 composite hydrogel: kinetics, isotherm and removal mechanism

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An industrial and natural wastewaters contain an eclectic assortment of multifunctional organic pollutants. Therefore, multifunctional adsorbents must be industrialized that can disinfect effluent. Magnetite CS/AM-CA composites were prepared using one-pot method. Using reactive and basic dyes, representing anionic (MO) and cationic (MG) dyes, the intrinsic interplay between these composites was examined through spectroscopic analysis. Notably, interactions between dyes of opposite charges with composite exhibited significant effects on dye removal. The performance of the magnetite CS/AM-CA composite was evaluated as an adsorbent by removal of MG and MO dyes from water. The methodological % removal behaviour of the composites was accomplished by monitoring dynamic factors such as pH, adsorbent dosage, adsorption time and dye concentration. Besides, composites have showed removal efficiency greater than 95% after regenerated and reused after up to five times. Also, it followed pseudo-second-order kinetics and an isotherm best fit with Langmuir model. Overall remarkable % removal capacity and reusability of magnetite CS/AM-CA composites elucidate the scope as environmental remedy for dye removal applications.

Keywords: chitosan; Removal of anionic/cationic dyes; scope as environmental.

Abstract ID: RSMPCHEM02

SYNTHESIS, CHARACTERISATION AND MICROBIAL SCREENING OF ACRYLIC CO-POLYMERS BASED ON SCHIFF BASE

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In this research, the co-polymers were prepared by using a newly chlorine containing MSB and ethyl acrylate (EA). The MSB monomer was synthesized using Schiff Base and methacryloyl chloride. Homo-and co-polymers of MSB with EA were obtained with different feed ratios using N, N-di-methyl formamide as a solvent and 2,2'-Azobisisobutyronitrileas a free radical initiator at 70±2°C. The composition and characterization of the resultant polymers were ascertained using 1H-NMR, IR and HPLC techniques. Homo-and co-polymers were characterized for their thermal properties using Thermogravimetry Analysis and Differential Thermal Analysis. Further, the traditional linearization technique of Fineman-Ross and Kelen-Tudos was used to calculate the monomer reactivity ratios. All polymers were tested for their antimicrobial properties against various microorganisms.

Keywords: Copolymers; Reactivity ratio; Thermal analysis; Antimicrobial properties.

Abstract ID: RSMPCHEM03

Silica functionalized phenylsulfonic acid: A heterogeneous water tolerant Brønsted acid catalyst for ketalizaton of glycerol to solketal

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A heterogeneous Brønsted acid catalyst named as silica functionalized phenylsulfonic acid (SPS) was synthesized and characterized. The grafted phenyl groups possess -SO_3H groups, which act as Brønsted acidic sites. The catalytic activity of SPS was studied for ketalization of glycerol to solketal. The SPS was found to be an effective water tolerant solid acid catalyst for ketalization without leaching. The glycerol with acetone yields 4-hydroxymethyl-2,2- dimethyl-1,3-dioxolane (Solketal; 73% conversion and 94% selectivity) in 30 min at room temperature (309.15K) under solvent free condition. The reaction gives solketal as major product, and 5-hydroxy-2,2-dimethyl-1,3-dioxane as by-product, and water as co-product. The phenyl groups help in repelling water molecules produced during the reaction thus acting as a water tolerant solid acid catalyst. The reaction parameters such as amount of catalyst and time were optimized to achieve highest conversion and selectivity of solketal.

Keywords: Solid acid catalyst; Silica supported catalyst; Brønsted acidic site; Ketalization; Solketal.

Abstract ID: RSMPCHEM04

Fluorescent CHEF-CHEQ identification of lanthanum and dichromate in environmental samples via smartphone-assisted paper-based analytical device

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We have reported a calix[4]arene-pyrene-appended fluorescence sensor DC4SPy for La(III) and $Cr_2O_7^{2-}$ detection based on chelation enhanced fluorescence (CHEF) and chelation fluorescence enhanced quenching (CHEQ) mechanism. The proposed DC4SPy system exhibited high selectivity and sensitivity, with a low detection limit of 0.375 nM and 0.963 nM for La(III) and $Cr_2O_7^{2-}$. The enhancement as well as quenching response of DC4SPy: La(III) and DC4SPy: $Cr_2O_7^{2-}$ have been observed between the range of 0–140 nM possessing binding constants to be $3.4415 \times 10^9\ M^{-1}$ and $3.4965 \times 10^9\ M^{-1}$, respectively. The ligand-ion binding confirmation has been carried out using different techniques such as ESI mass spectrometry, ^1H NMR, FT-IR, and powder X-ray diffraction (PXRD). The practical applicability of DC4SPy was evaluated using real environmental samples, including soil for La(III) detection and industrial wastewater for $Cr_2O_7^{2-}$ analysis. In addition, a disposable and rapid smartphone-assisted paper-based sensing platform was successfully used for La(III) and $Cr_2O_7^{2-}$ recognition with excellent capability, demonstrating the potential applications of La(III) and $Cr_2O_7^{2-}$ monitoring.

Keywords: Calix[4]arene; Fluorescence sensor; lanthanum and dichromate; Real sample analysis; Smartphone based sensor.

Abstract ID: RSMPCHEM05

Photocatalytic activity of NH_2-MIL-125 metal organic framework for water splitting reaction in base free condition

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The photocatalytic water splitting reaction for hydrogen production is a sustainable pathway for generating clean hydrogen fuel. The amine functionalized metal organic frameworks (MOF), particularly NH_2-MIL-125(Ti), have been extensively studied for photocatalytic water splitting reaction. The crystalline structure of the synthesized MOF was confirmed by X-ray diffraction (XRD), ensuring phase purity and successful framework formation. Thermal stability was evaluated using TGA and DTG, which demonstrated that the material remains stable up to the tested temperature range. The water splitting reaction is catalysed in the presence of a base. The present work reports the activity of NH_2-MIL-125 photocatalyst without use of a base for water splitting reaction. Photocatalytic experiments under varied conditions confirmed efficient hydrogen generation. These findings establish NH_2-MIL-125 as a robust, green, and cost-effective candidate for sustainable hydrogen production.

Keywords: NH_2-MIL-125; photocatalyst; water splitting; hydrogen evolution.

Abstract ID: RSMPCHEM06

Sustainable One-Pot Synthesis of Xanthene Derivatives using a Choline Chloride–Tartaric Acid-Based Deep Eutectic Solvent

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Deep eutectic solvents (DES) have gained considerable attention as environmentally friendly and sustainable substitutes for traditional solvents in chemical processes. In this work, a deep eutectic solvent composed of choline chloride and tartaric acid was employed as the reaction medium for a one-pot multicomponent reaction (MCR) to synthesize xanthene derivatives. The prepared DES was comprehensively characterized using FT-IR, TGA, and DSC analyses. This solvent system exhibited remarkable catalytic performance, along with good recyclability and biodegradability, in accordance with the principles of green chemistry. Under optimized conditions, the reaction proceeded with high efficiency and selectivity, demonstrating the practicality of this method for the eco-friendly synthesis of xanthene derivatives. Overall, the findings underscore the promise of choline chloride–tartaric acid-based DES as a sustainable platform for developing efficient organic synthetic methodologies.

Keywords: Xanthene; Deep eutectic solvents (DES); One-Pot Multicomponent Reactions (MCRs).

Abstract ID: RSMPCHEM07

Development and biological assessment of new oxindole–indole-based 1,2,3-triazole hybrids: antimicrobial activity and molecular docking studies

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A series of novel indole–oxindole–linked 1,2,3-triazole hybrids (5a–o) were rationally designed and synthesized using the copper-catalyzed azide–alkyne cycloaddition (CuAAC) click reaction to combine the biologically relevant indole, oxindole, and 1,2,3-triazole frameworks. The compounds were characterized by ^{1}H-NMR, ^{13}C-NMR, and mass spectrometry. Their antimicrobial activity was evaluated by the broth microdilution method against three Gram-negative bacteria (*Escherichia coli, Pseudomonas aeruginosa, Klebsiella pneumoniae*), three Gram-positive bacteria (*Bacillus subtilis, Staphylococcus aureus, Streptococcus pyogenes*), and two fungal strains (*Candida albicans, Aspergillus niger).* Compound 5e displayed the strongest antibacterial effect, with a MIC of 25 µg/ml against Escherichia coli. Molecular docking supported these results by showing strong interactions between 5e and the DNA gyrase active site.

Keywords: Indole-Oxindole; 1,2,3-Triazole, Click reaction; antimicrobial activity; Molecular Docking study

Abstract ID: RSMPCHEM08

Meglumine-Encapsulated CuI: An Eco-friendly Heterogeneous Catalyst for 1,2,3-Triazole Scaffold Access Derived from Meglumine

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1,2,3-Triazoles are widely appeared components in many drug-like compounds and are highly valued for their remarkable stability and excellent biocompatibility. Their pharmacological profile is varied and include antimitosis, anticancer, antibacterial, antiviral properties. Catalyst design has become more popular as a result of biomass to chemical technologies, which are regarded as an important tool because of their economic and ecological significance. So, one of example is Meglumine which is derived from reduction of condensation product of glucose and methylamine. Meglumine is a cheap, easily accessible, and FDA-approved amino sugar that is utilized as an active ingredient in medications and medical products. It is water miscible, stable in moisture and air, biocompatible and biodegradable. Some homogeneous catalysts are reported for the synthesis of 1,2,3-triazoles but they suffer from several disadvantages like separation from reaction mixture, expensive, tedious work up process, toxic reagents etc. So, now a days researchers are focus on the development of heterogeneous catalysts due to their some key advantageous features like low cost, easy separation from reaction mixture, recyclability etc.

We prepared CuI nanoparticles (NPs) encapsulated by environmentally friendly low value biomass meglumine (Meg-Cu). The synthesized meglumine-enclosed CuI NPs (Meg-Cu) material was characterized by various analytical techniques. It was observed that meglumine molecules interacting with the −NHMe and −OH functions of meglumine encapsulated CuI NPs. Meg-Cu was proved as a good catalyst for the synthesis of diversely substituted 1,2,3-triazole scaffolds. 1,2,3-Triazoles were synthesized using both two- and three-component methods. Additionally, 1,2,3-triazole initiated from anilines through the in-situ production of aromatic azides was effectively synthesized using the procedure. Three successful recycling cycles of the catalyst were achieved without a decrease in catalytic activity. FT-IR and TGA measurements were used to examine the structural integrity of the reused catalyst. Short reaction time, broad substrate scope, environmentally friendly reaction conditions and good to excellent yields are some of the key features of the developed protocol.

Keywords: Click Reaction; CuAAC, CuI Nanoparticles; Green Synthesis; Meglumine; 1,2,3-Triazoles.

Abstract ID: RSMPCHEM09

Supramolecular Fluorescent Chemosensor for Highly Selective and Sensitive Pb^{2+} Ion Detection in field collected water sample

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The detection of lead (Pb^{2+}) is critically important due to its high toxicity and widespread presence in environmental, biological, and aquatic systems, where even trace concentrations pose serious health risks. Conventional supramolecular sensing systems often lack the selectivity and sensitivity required for reliable detection at nanomolar levels essential for safe water monitoring. In this study, we report the design, synthesis, and characterization of a novel tetramethoxyresorcin[4]arene-based fluorescent chemosensor (TMT-PBAP) for the selective and ultrasensitive detection of Pb^{2+} ions. The synthesized probe was thoroughly characterized using ^{1}H NMR, ^{13}C NMR, and mass spectrometry. TMT-PBAP features a well-defined supramolecular binding cavity that facilitates strong and selective coordination with Pb^{2+}, achieving a remarkably low detection limit of 1.16 nM, significantly below the World Health Organization (WHO) permissible limit for lead in drinking water (~48 nM). The sensor exhibited excellent analytical performance in real water samples, including tap and river water, with results consistent with ICP-AES measurements. Additionally, TMT-PBAP was successfully employed in constructing molecular logic gate operations, highlighting its potential for real-time monitoring of lead in complex environmental matrices. This study presents a robust supramolecular sensing platform for practical lead detection and environmental safety monitoring.

Keywords: Tetramethoxyresorcin[4]arene-supramolecule; chemosensor; Nanomolar Pb^{2+} detection; Environmental water monitoring; Molecular logic gate.

Abstract ID: RSMPCHEM10

Resorcin[4]arene-Based Supramolecular Sensor for Cyanide Detection with Smartphone-Assisted RGB Analysis

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Cyanide (CN^-) is an extremely toxic inorganic anion that poses serious threats to environmental safety, food quality, and human health even at trace concentrations, demanding highly sensitive and selective detection strategies. In this study, a novel organic chemosensor, **RI**, was rationally designed and synthesized for the selective detection of cyanide ions in aqueous and aqueous–organic media. The structure of RI was confirmed by ^1H NMR, ^{13}C NMR, and ESI-MS analyses. The sensing performance was systematically evaluated using UV–visible and fluorescence spectroscopy. Upon interaction with CN^-, RI exhibited pronounced and concentration-dependent spectral changes in spectra, enabling reliable dual-mode optical detection. Binding analysis revealed a strong 1:1 host–guest interaction between RI and CN^- with a high binding constant of **4.62×10^9 M^{-1}**, indicating exceptional affinity. RI demonstrated an ultralow limit of detection (**LOD = 0.654 nM**) and a limit of quantification (**LOQ = 2.18 nM**), well below the World Health Organization guideline value for cyanide in drinking water. pH-dependent studies confirmed stable sensing performance over a broad working range, while interference experiments demonstrated excellent selectivity toward CN^-. RI exhibited good reversibility and reusability, and smartphone-assisted RGB colorimetric analysis enabled rapid, low-cost, on-site quantification for real-time cyanide monitoring.

Keywords: Supramolecular sensors; Fluorescence quenching; Cyanide detection; Environmental analysis.

Abstract ID: RSMPCHEM11

Eco-Friendly Synthesis and Biological Evaluation of a Schiff Base Using Natural Acid Catalysis"

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A Schiff base was synthesized using a lemon juice as acid catalyst, providing an eco-friendly and efficient methodology aligned with green chemistry principles. The structure of the synthesized compound was confirmed through standard analytical techniques. Its biological activity was assessed via in vitro antimicrobial and antifungal studies against *E. coli.* and *Aspergillus niger* strains. The compound demonstrated significant inhibitory effects, indicating effective activity against both bacterial and fungal species. These results underscore the role of the Schiff base framework in microbial growth inhibition. Overall, the study highlights the potential of natural acid catalysis as a sustainable strategy for the synthesis of biologically active compounds with promising antimicrobial and antifungal properties.

Keywords: Lemon juice acid catalysis; Schiff base; Antimicrobial activity; Antifungal activity

Abstract ID: RSMPCHEM12

Computational and Experimental Insights into Novel Heterocyclic Triazoles: Synthesis, Spectral Analysis, and Biological Activity

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1,2,3-Triazole is a prominent heterocyclic scaffold widely found in compounds exhibiting diverse biological activities, including antimicrobial, antiviral, and antitumor properties. Owing to its versatile structural features, the 1,2,3-triazole ring can mimic various functional groups, making it an attractive framework for the design and development of novel bioactive molecules. In this study, a series of triazole-based organic compounds were synthesized and thoroughly characterized using CHN elemental analysis, ^{1}H NMR, IR spectroscopy, and mass spectrometry. Biomolecular interaction studies were carried out through molecular docking and fluorescence quenching assays involving DNA and bovine serum albumin (BSA). The antimicrobial potential of the synthesized compounds was evaluated against three Gram-negative bacteria (*Serratia marcescens*, *Pseudomonas aeruginosa*, and *Escherichia coli*) and two Gram-positive bacteria (*Staphylococcus aureus* and *Bacillus subtilis*). Furthermore, in silico ADME analysis using the SwissADME web server revealed that most of the compounds comply with established drug-likeness criteria.

Keywords: Triazole; Molecular docking; ADMET; Cytotoxicity; DNA and BSA binding; Antibacterial activity.

Abstract ID: RSMPCHEM13

ONE-POT SYNTHESIS, STRUCTURAL, THEORETICAL, AND BIOLOGICAL STUDIES OF INDOLE-BASED DIBENZODIAZEPINES

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Benzodiazepine scaffolds have shown various medicinal applications including anti-anxiety,[1] platelet-activating factor inhibitory,[2] muscarinic receptor (M1) antagonist.[3] Present work demonstrates, one-pot synthesis of indole-based dibenzo[b,e][1,4]diazepin-1-ones from various indole-based aldehyde derivatives, *o*-phenylenediamine derivatives and dimedone by stirring at room temperature in EtOH as a solvent and AcOH as a catalyst. Further, the representative product indolyl-dibenzo[b,e][1,4]diazepine showed regiospecific allylation, established by MESP analysis. Synthesized compounds were characterized by spectral data, crystal, study and DFT analysis. All the synthesized compounds were studied for their anti-proliferative and anti-microbial activities. Compound 15a showed cytostatic behavior studied by live cell imaging.

Keywords: Indolyl dibenzo-diazepine; MESP; DFT; Live cell imaging.

Abstract ID: RSMPCHEM14

Synthesis of Copper Intercalated Hydrotalcite Catalyst for Borrowing Hydrogen reactions

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Copper-intercalated hydrotalcite (Cu-HT) catalyst were synthesized through a two-step approach, first step involving co-precipitation of hydrotalcite and second step is copper impregnation into the layered doubled hydroxide structure. The prepared catalyst was thoroughly characterized using various techniques to confirm successful copper impregnation into layered doubled hydroxide structure, preservation of the layered double hydroxide framework, and favorable textural properties. The catalytic activity of Cu-HT was evaluated in borrowing hydrogen reactions, specifically the transfer hydrogenation of imine to the corresponding amine. The catalyst exhibited excellent activity and demonstrating efficient hydrogen transfer using benzyl alcohol as hydrogen source. The synergistic effect between the copper species and the basic sites of the hydrotalcite support played a crucial role in enhancing catalytic performance. The Cu-HT catalyst also showed good stability and reusability, highlighting their potential as sustainable heterogeneous catalyst for borrowing hydrogen transformations.

Keywords: Hydrotalcites; Alcohols Dehydrogenation; Transfer hydrogenation; Hydrogen auto transfer.

Abstract ID: RSMPCHEM15

Synthesis of Biologically Potential Pyrazolo[5,1-*b*]quinazoline-3-carboxylates using Sustainable Three Component Deep Eutectic Solvent

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Volatile organic compounds (VOCs) are accessible from non-renewable fossil resources which leads to environmental worsening. Hence, many countries have implemented stringent regulations to limit and control VOC emissions. Therefore, chemists are putting efforts continuously to design other innovative ways that replace conventional poisonous solvents with greener solvents derived from renewable sources. Implementation of deep eutectic solvents (DESs) attracts more consideration among all long-lasting solvents due to their advantageous aspects, i.e. negligible vapor pressures, high biodegradability, reusability, non-cytotoxic nature, high solvation power due to their high polarity. Meglumine is an amino sugar derivative of carbohydrate. It is an FDA-approved excipient in pharmaceuticals and medicine. It possesses amazing physical and chemical properties such as biocompatibility, biodegradability, stability to air and moisture, and water miscibility. It is also economical and easily available in the market. Pyrazolo-quinazoline is a widespread heterocyclic core with a magnificent biological profile. Due to its immense pharmaceutical and biological significance, an abundance of reaction methodologies have been established to manufacture the pyrazolo-quinazolines. An uncommon meglumine-based three-component deep eutectic solvent (3c-DES), MegPAc, was developed as a renewable and non-toxic reaction medium. MegPAc is composed of meglumine, *p*-toluene-sulfonic acid (PTSA), and acetic acid. MegPAc was employed as an eco-friendly solvent–catalyst system for the efficient synthesis of pyrazolo[5,1-b]quinazoline-3-carboxylates (PQCs), functioning simultaneously as both solvent and catalyst. This sustainable protocol afforded the desired products in good to excellent yields (69–94%) within short reaction times (67–150 min). The synthesized PQCs were subsequently evaluated for their in vitro antiproliferative activity against six human solid tumor cell lines.

Keywords: Deep eutectic solvents; Volatile organic compounds; Pyrazolo-quinazoline; Antiproliferative activity

Abstract ID: RSMPCHEM16

A domino/Knoevenagel/*hetero*-Diels–Alder synthetic sequence for angular pyrazol- and isoxazole-heterocycles using [DBU][Ac] as an effective promoter cum medium

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A domino/Knoevenagel-*hetero*-Diels–Alder (DKHDA) synthesis sequence remained a powerful tool to afford complex heterocycles effectively from simple starting materials, in one-pot procedure[1,3,4]..Among the heterocycles, pyrazoles and isoxazoles revealed promising biological properties[2].In the present work, [DBU][Ac] has been used as a catalyst cum medium, to promote DKHDA reaction between pyrazole/isoxazole with varied methyl ketone units having olefine in the side chain and to afford synthesis of angular pyrazole and isoxazole heterocycle frameworks. The reaction goes smoothly, when alkene-tethered methyl ketone units are used with pyrazole/isoxazole. However, ZnO is used to promote the reaction employing propargyl-tethered methyl ketone substrates. Moreover, no chromatographic isolation required for isoxazole-derived heterocycles. The stereochemistry of all new polyheterocycles was confirmed by ^{1}H NMR, ^{13}C NMR, 2D NMR NOESY followed by single crystal X-ray diffraction study.

Keywords: Domino reaction; pyrano [2,3-c] pyrazole; Ionic liquid, one pot; Ketone-based DKHDA substrates.

Abstract ID: RSMPCHEM17

AN EFFICIENT, INTRAMOLECULAR AZOMETHINE YLIDE-TRIGGERED 1,3-DIPOLAR CYCLOADDITION REACTION: ACCESS TO ISOQUINOLINE-ANNULATED PYRROLO-HETEROCYCLES

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The isoquinoline continued to be an important class of heterocycles with broad-spectrum bioactivities such as anticancer, antimicrobial, antioxidant properties, fascinating research fields of medicines and pharmaceuticals. Those heterocycles incorporating pyrrolidine ring with isoquinoline have gained significant attention due to their diverse pharmacological profiles. In view of these facts, incorporation of pyrrolidine with isoquinoline unit results into interesting conjugates. Present work demonstrates the one-pot, catalyst-free synthesis of isoquinoline-annulated thiopyrano/pyrrolo heterocycles after assembling olefin-tethered mercapto-pyrazole-carbaldehyde/indole-carbaldehyde with tetrahydroisoquinoline derivatives in refluxing toluene. The transformation proceeds via intramolecular 1,3-DC reaction involving an *in-situ* generated azomethine ylide dipole, reacting with olefine dipolarophile and leading to form pyrrolidine ring. It was observed that olefin-tethered mercapto-pyrazole-carbaldehydes formed relatively in higher yields. All proposed structures were confirmed by the mass, ^{1}H NMR, ^{13}C NMR, and single-crystal X-ray diffraction study.

Keywords: 1,3-Dipolar cycloaddition, azomerhine ylide, isoquinoline, thiopyrans, pyrrolo fused heterocycle

COMPUTER SCIENCE & TECHNOLOGY

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Abstract ID: RSMOCOM01

RayOrtho: A Real-Time Deep Learning Framework for Monitoring Knee Joint Space Changes Associated with Synovial Health and Clinician-Guided Lifestyle Recommendations

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Changes in the radiographic joint space of the knee are a common indirect indicator related to the health and degenerative status of the synovial joint, but their assessment is still a subjective and inefficient process. Decision-support systems based on artificial intelligence have the potential to improve consistency, efficiency, and interpretability of orthopedic imaging assessment.our research work, RayOrtho is proposed as a real-time deep learning system for the automatic monitoring of changes in the joint space of the knee joint through X-ray images, along with lifestyle recommendations based on the guidance of a clinician related to the support of synovial health.

RayOrtho combines femur-tibia segmentation using a convolution neural network with automatic estimation of joint space width and trend analysis over a series of radiographs. The system was tested on a clinical dataset of knee X-rays annotated by clinicians, using metrics based on error and agreement analysis for comparison with measurements by orthopedic specialists. A guidance module produced non-invasive dietary and exercise advice approved by a clinician based on joint space width trends. The proposed system showed high agreement with expert opinions, with low joint space width estimation error and high intraclass correlation coefficients. Our research analysis allowed for accurate tracking of progressive changes in joint space, while real-time inference enabled efficient clinical practice. The outputs of lifestyle recommendation tasks were always consistent with joint health advice endorsed by clinicians. RayOrtho illustrates the promise of explainable deep learning for enabling real-time and longitudinal synovial health-related changes in the knee joint space. By integrating automated image analysis with lifestyle advice from clinicians, the framework offers a useful and morally sound AI-based decision support solution for the orthopedic community.

Keywords: Osteoarthritis, Biomedical informatics, Deep learning, Joint space width; computer vision

Abstract ID: RSMOCOM02

A Web Mining Framework for Skill-Based Job Domain Classification and Academic-Industry Alignment in the IT Sector

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The Computer Science job market is changing fast, making it harder to know which skills are needed for different careers. This research introduces a web mining framework to help identify the gap between what universities teach and what the IT industry needs. The framework organizes key job skills by domain and matches them with academic program syllabi. The study uses a dataset of 29,901 IT job postings from online sources like naukari.com, Timesjob.com, monster.com, internshala.com, and myamcat.com. It applies natural language processing, job title normalization, and skill extraction techniques. Job titles are grouped into sub-domains and domains using rule-based filtering and advanced AI models. The study builds a machine learning model using several classifiers: Random Forest, Decision Tree, K-Nearest Neighbors, and Support Vector Machine. The Random Forest algorithm gives the best results for finding common key skills in a domain and predicts job domains from those skills with up to 87% accuracy. This Machine learning model is implemented in an academic syllabus to compare the extracted key skills of the IT industry with university syllabi, using heuristic and semantic similarity methods to identify missing or outdated topics. This web mining framework aims to close the gap between industry needs and academic curricula by offering career insights, improving job title classification, and suggesting relevant skills for students and educators.

Keywords: Web Mining, Web Scraping, Natural Language Processing, Curriculum Mapping, Machine Learning

Abstract ID: RSMOCOM03

Enhanced segmentation technique for Gujarati character extraction from natural scenes for optical character recognition

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A computer does not know that an image of a signboard is really a signboard—it just identifies that the first pixel is of x color and the next pixel is of y color, and displays all of its pixels for us to perform operations on it. The study of natural scene or signboard text detection obvious plays an increasingly important role in people's daily lives. Although scenes text contains a lot of important semantic information. In recent years, text detection in natural scenes has been widely studied using image processing techniques, and has made many achievements. Detection and recognition has very important role in human life, as it may be helpful in the language translation. Text variation that are related to size, style, alignment and direction, as well as low image contrast and complex backgrounds make the problem of automatic text detection extremely challenging. For the visually impaired, the inability to independently access printed information remains a significant barrier to social and professional autonomy. While Optical Character Recognition (OCR) has advanced, achieving seamless, real-time text transformation for complex Indic scripts—specifically Gujarati—on resource-constrained edge devices remains an unresolved challenge owing to intricate character modifiers (maatras) and varying environmental conditions. Detection and recognition has very important role in human life, as it may be helpful in the language translation. With these reasons, the text recognition/detection plays very important role in our everyday life also in future it can be taken as so many computer applications and new researches. Text extraction in images includes five stages, among which text detection and text localization are the closely related processes of detecting and locating the text regions from a given image and are the early steps in obtaining textual information. This study introduces a comprehensive, end-to-end character extraction using enhanced segmentation technique for the instantaneous transformation of text from visual scenes into both machine-readable text and audio output. The main aim is to achieve high accuracy in recognizing the Gujarati language within natural scene settings.

Keywords: Text detection, Image Processing, Optical Character Recognition, Segmentation, Visual Scene, Gujarati language

ELECTRONICS

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Abstract ID: RSMOELE01

A Modular and Affordable IoT- Based Multi-Sensor Framework for Sustainable Smart Agriculture

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Agricultural productivity and sustainability depend on timely awareness of soil and environmental conditions, yet affordable and farmer-friendly monitoring solutions remain limited. This paper presents the A Modular and Affordable IoT- Based Multi-Sensor Framework for Sustainable Smart Agriculture. The proposed system integrates temperature, humidity, light intensity, soil moisture and soil nutrient (NPK) sensors within a compact sensing unit, along with motor-driven actuators for automated water flow control. The sensor node enables continuous evaluation of soil quality and microclimatic factors that directly influence crop growth, irrigation efficiency and nutrient management. All sensed data are transmitted to an IoT cloud server, where they are securely stored, processed and visualized. A responsive web interface and mobile application provide live and historical data access from any location, allowing farmers to monitor field conditions and take timely, data-driven decisions. Automated irrigation based on soil moisture thresholds reduces water wastage, labor dependency and operational cost while improving crop health. The system architecture emphasizes low power consumption, modularity and scalability, making it suitable for deployment across small and marginal farms. Field-level validation demonstrates reliable sensor performance, stable wireless communication and accurate real-time data delivery under practical conditions. The proposed solution bridges the gap between precision agriculture technologies and resource-constrained farming environments. By combining multi-parameter soil sensing, cloud-based monitoring and remote actuation in a cost-effective framework, this research contributes toward sustainable smart agriculture and improved agricultural productivity. The framework supports future integration of analytics, decision support and policy-driven agricultural advisory services nationwide adoption.

Keywords: Smart agriculture, Internet of Things (IoT), Precision farming, Soil quality monitoring, Multi-sensor node, NPK sensor

HOME SCIENCES

Sardar Patel University
Vallabh Vidyanagar, Anand, Gujarat

Abstract ID: RSMOHOM01

Viability and Stability of the Probiotic Strain through microencapsulation in Green gram and Red gram split Protein-Alginate Matrix

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The alteration in human microflora results in an increase in the population of the pathogenic bacteria, which gives rise to gastrointestinal diseases. Therefore, the supplementation of food products with probiotics may eliminate the pathogenic microbiota from the adhesion sites and regulate the immune response via regulating host gene expression within the human Gastrointestinal Transit (GIT). However, despite their various health benefits, probiotics face challenges in terms of stability during food processing, storage, and gastrointestinal digestion. Therefore, this study aimed to improve the stability and survivability of probiotics. Thereby, the study was designed to microencapsulate *Lacticaseibacillus casei* within legume proteins [specifically Green gram Split (GSP) and Red gram Split Protein (RSP)] and Alginate (ALG) matrix by extrusion technique. The encapsulation efficiency (EE%), the viability after simulated gastrointestinal digestion, thermal stability, and shelf- life study of the microcapsules were examined. The results demonstrate that alginate beads exhibited a lower encapsulation efficiency(EE%) (70%); however, the RSP-ALG matrix showed an EE% (86%) then GSP-ALG matrix (83%). RSP- ALG matrix encapsulated probiotic cells exhibited maximum survival upon gastrointestinal transit, with 8.62 and 7.93 CFU g^{-1} after gastric and complete stimulated gastrointestinal digestion, respectively. The thermal tolerance of probiotics was assessed at 50°C, 60°C, and 80°C for 5 and 10 min each, with RSP-ALG capsules retaining higher viability, followed by GSP - ALG and ALG capsules. Shelf-life studies using curd as a model product over a 30-day incubation period at 4°C demonstrated significantly better survival of entrapped cells with RSP - ALG followed by GSP – ALG and ALG capsules. In conclusion, legume protein–ALG capsules, especially RSP-ALG, demonstrate a better matrix for the encapsulation of probiotics in food applications.

Key Words: Microencapsulation, Probiotic, *Lacticaseibacillus casei*, Green gram split protein, Red gram split protein

Abstract ID: RSMOHOM02

Assessment of Consumption Pattern, Knowledge, Attitude and Practice regarding Millets among Adults of Anand District

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Millets are traditional nutri-cereals recognised for their high nutritional value, climate resilience, and potential to promote food and nutritional security. Despite their health benefits, millet consumption has declined over time due to changing dietary patterns and urbanisation. The present study is aimed to assess the consumption pattern, knowledge, attitude, and practices (KAP) related to millets among adults in Anand District. The study was conducted among 271 adult participants selected through random sampling. Data were collected using a structured, pretested questionnaire administered via a Google Form, covering demographic characteristics, dietary habits, frequency of millet consumption, and KAP components. The Food Frequency Questionnaire (FFQ) and the KAP assessment tools were used to evaluate consumption trends and behavioural factors influencing millet intake. The findings revealed that major millets such as bajra, ragi, and jowar were consumed more frequently, whereas minor millets such as proso, little, and foxtail were lesser consumed. Most respondents were aware of the nutritional benefits of millets, particularly their fiber content and their role in managing lifestyle disorders such as diabetes and hypertension. Statistical analysis indicated a significant positive correlation among knowledge, attitude, and practice scores ($p < 0.01$), suggesting that greater awareness is associated with more favourable attitudes and improved consumption practices. Age was significantly associated with knowledge levels, whereas education was directly associated with attitude towards consumption of millet. The study highlights the need to target millet specific nutrition education and awareness programs to promote millet consumption and diversification of the daily the dietary practices. Enhancing public awareness and increasing the accessibility of millet-based foods may contribute in improvising health and environmental sustainability.

Keywords: Millets, Nutri-Cereals, Millet Consumption, KAP Survey

Abstract ID: RSMPHOM01

Development and Analysis of Papaya Fruit Leather

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Fruit leather is a flexible strip prepared from fruit puree/ fruit juice concentrate by hot or cold air drying. It is a convenient and ready-to-eat fruit based product. Papaya (*Carica papaya*) is a rich source of antioxidants like vitamin C, vitamin E, carotenoids, phenolic acids and phytoestrogens that scavenges the effects of free radicals, generally known as unstable molecules that regulates a range of diseases, including cancers, cardiovascular and neurodegenerative diseases. The present study is planned with the objective to develop and analyse papaya fruit leather. Three different papaya fruit leathers were developed with 0%, 1% and 2% agar-agar and analyzed for physicochemical parameters namely pH, titratable acidity, total phenolic content, flavonoid estimation and di-phenyl picric hydrazine radical scavenging activity (DPPHRSA) and sensorial attributes namely appearance, texture, flavor, taste and overall acceptability. The titratable acidity ranged from 1.17 to 1.52 % and pH ranged from 4.47 to 5.37. There is a significant ($p<0.05$) difference in total phenolic and flavonoid content of papaya fruit leathers with the range of 154.86-321.66 mgGAE/100g and 67.61-108.67 mgRE/100g respectively, whereas no significant difference was observed for DPPHRSA with the range of 454.14-640.53 mgTE/100g. The sensorial analysis showed highest overall acceptability for papaya leather incorporated with 2% agar-agar, especially for texture, flavor and taste while the papaya leather incorporated without agar-agar powder had higher mean score for appearance. In conclusion, papaya fruit leather is a significant source of antioxidants and well accepted by sensory panelists and it can be considered as a functional food.

Keywords: Fruit leather; papaya; agar agar; convenience product.

RSMPHOM02

Food Consumption Pattern of Tribal People of Banaskantha District

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Gujarat encompasses a multitude of tribal communities characterized by their rich cultural traditions, which include distinctive culinary practices. The tribal populations residing in the Banaskantha district of Gujarat, India, exhibit unique cultural expressions, notably in their food consumption behaviors, which are shaped by a confluence of environmental, economic, and socio-cultural influences. This research endeavor seeks to investigate and systematically document the dietary consumption patterns of the tribal inhabitants of Banaskantha district, with a particular emphasis on their eating habits, seasonal food availability, and traditional culinary practices. A cross-sectional survey methodology was employed, engaging 120 individuals from 15 villages within Banaskantha district. Data were collected on respondents' personal details, dietary practices during regular days and special occasions, and a food frequency questionnaire through field visits and structured interviews. Seasonal availability of food and preferences for local versus non-local foods were also assessed. The findings of the survey revealed that the majority of the respondents had three major meals in a day; breakfast, lunch and dinner. Commonly consumed cereals and legumes include wheat, maize, Bengal gram, red gram dhal, and black gram dhal. Seasonal edibles constitute a significant component of their nutrition, such as green leafy vegetables (GLVS) during the winter months. Seasonal fruits including mango, sapota, watermelon, amla, mulberries, bael fruit, blackberry, and other regionally cultivated fruits are extensively consumed. Cottonseed and mustard seed oils are predominantly utilized for culinary purposes, while dairy products such as milk and buttermilk are frequently consumed. Although fast foods and packaged commodities are typically infrequent in their diet, biscuits, wafers, and frymes are relatively prevalent. In conclusion, the indigenous populace of Banaskantha district engages in dietary practices that uniquely combine traditional nutritional customs with locally accessible resources and culturally significant foods.

Keywords: Food consumption pattern; Seasonal foods; tribal people.

RSMPHOM03

Rooftop Solar Photovoltaic System adoption at the Household Level: A Systematic Review

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The widespread adoption of rooftop solar photovoltaic (PV) systems at the household level is a critical component of the global transition toward low-carbon and decentralized energy systems. Despite significant technological advancements and policy support, household adoption rates remain uneven across regions. This study presents a systematic review of the existing literature on household rooftop solar PV adoption, with the objective of synthesizing current evidence on key drivers, barriers, and adoption patterns. Following established systematic review protocols, relevant peer-reviewed studies were identified, screened, and analyzed based on predefined inclusion criteria. The review reveals that economic factors—such as installation costs, financial incentives, and electricity prices—are the most frequently cited determinants of adoption. Non-economic factors, including environmental attitudes, social influence, household characteristics, information availability, and policy and regulatory frameworks, also play a significant role. Additionally, the findings highlight substantial regional disparities in adoption behaviour, reflecting differences in market maturity, institutional support, and socio-economic contexts. This review identifies key research gaps, including limited longitudinal studies and insufficient attention to equity and inclusiveness in solar PV adoption. The synthesized insights provide a comprehensive understanding of household-level rooftop solar PV adoption and offer valuable implications for policymakers, researchers, and practitioners aiming to accelerate residential solar energy deployment.

Keywords: Rooftop solar photovoltaic; Household; Environmental awareness

RSMPHOM04

Association between Screen Time and General Well-Being among Adolescents in Borsad Taluka of Anand District

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Adolescence is a critical developmental period marked by significant physical, cognitive, emotional, and social changes. In the contemporary digital era, adolescents are increasingly exposed to screen-based technologies, which may influence their overall well-being. The present study aimed to examine the association between screen time and general well-being among adolescents. The sample comprised 320 students studying in grades 9 to 12, selected from different schools in Borsad taluka of Anand district. Data were collected using the standardized General Well-Being Scale developed by Kalia and Deswal (2010) and a self-developed Screen Time Scale. The findings revealed that the majority of adolescents exhibited an average level of general well-being while reporting higher levels of screen time with average screen time of 6.17 hours. Adolescents with higher screen time demonstrated comparatively lower levels of general well-being than those with lower screen time. Students who reported less than two hours of daily screen time obtained the highest mean scores across all domains of well-being, including physical, emotional, social, school, and overall general well-being, irrespective of gender, area of school, and type of school. Overall girls, students studying schools of urban area and private schools reported lesser screen time and better well-being as compared to their counterparts. Screen time was negatively correlated with physical, emotional, social, school, and general well-being. However, a significant negative relationship was observed only between screen time and school well-being. The findings underscore the importance of promoting balanced screen use to enhance the general well-being of adolescents.

Keywords: Screen time; general well-being; adolescent.

RSMPHOM05

Impact of Physical Frailty on Quality of Life Elderly Population

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Physical frailty is a common condition among the elderly, characterized by reduced strength, endurance, and physiological reserve, which increases vulnerability to adverse health outcomes. This study aimed to **assess the impact of physical frailty on the quality of life** among the elderly population. A cross-sectional study was conducted involving 150 elderly participants aged 65 or more than 65 years, using standardized tools to measure frailty. and quality of life .The findings revealed a significant negative correlation between the degree of physical frailty and overall quality of life, with frail individuals exhibiting lower physical, psychological, and social well-being compared to non-frail counterparts. Factors such as age, comorbidities, and level of physical activity were found to influence both frailty status and quality of life. These results underscore the importance of early identification of frailty and the implementation of targeted interventions, including physical exercise programs, nutritional support, and social engagement activities, to enhance the well-being and independence of the elderly population.

Keywords: Frailty; Physical Frailty; Quality of life.

MATERIAL SCIENCES

Sardar Patel University
Vallabh Vidyanagar, Anand, Gujarat

Abstract ID: RSMOMAT01

Sulphuric Acid-treated Biosorbent for Efficient Methylene Blue Dye Removal

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Human health and aquatic ecosystems are seriously threatened by industrial dye effluents, which require efficient and environmentally friendly treatment methods. In order to remove the methylene blue (MB) dye from wastewater, a low-cost biosorbent was developed in present study using waste cotton flower shells treated with sulphuric acid. XRD, FTIR, SEM-EDAX and TGA analyses were performed to investigate the physicochemical characteristics of the sulfuric acid-treated cotton flower shell (SACFS), confirming effective surface modification and improved adsorption capabilities. The effects of operational parameters such as solution pH, biosorbent dosage, initial dye concentration, contact time and temperature were evaluated via batch adsorption experiments. SACFS demonstrated remarkable adsorption capacities, with the highest adsorption capacity of 454 mg g^{-1}. Adsorption kinetic findings indicated that the adsorption mechanism follows a pseudo-second-order model, while adsorption equilibrium data were well represented by the Langmuir isotherm model. The thermodynamic study revealed that methylene blue adsorption onto SACFS is endothermic and spontaneous. The results demonstrates SACFS ability as an efficient, low-cost and ecologically friendly biosorbent for wastewater treatment.

Keywords: Sulphuric acid, Methylene blue, Cotton flower shell, Biosorbent

Abstract ID: RSMOMAT02

Electrochemical Investigation of High-Entropy Spinel Oxide for Supercapacitor Applications

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High-entropy oxides (HEOs) have emerged as promising multifunctional materials due to their multicomponent composition and structural stability. In this work, a high-entropy oxide composed of multiple transition metals was successfully synthesized via a sol–gel auto-combustion method followed by calcination at 950 °C. X-ray diffraction confirmed the formation of a single-phase cubic spinel structure, while SEM and EDS mapping revealed uniformly distributed, nanosized particles with homogeneous elemental distribution. The synthesized HEO exhibited excellent electrochemical performance when evaluated as a supercapacitor electrode. Cyclic voltammetry and galvanostatic charge–discharge studies demonstrated high specific capacitance of 241.1 F g^{-1} at 1 A g^{-1} and good rate capability. Furthermore, the electrode showed good cycling stability with 86% capacitance retention after 2000 cycles, indicating its potential for supercapacitor electrode.

Keywords: High-Entropy Oxide, Supercapacitor, Cycling Stability

Abstract ID: RSMPMAT01

Low-Cost Activated Carbon from Tea Waste for Methylene Blue Dye Removal

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Activated carbon obtained from biomass waste is an effective and versatile adsorbent for the removal of hazardous chemicals. In comparison with other porous materials, biomass-derived activated carbon shows higher adsorption capacity. In this work, tea waste was used as a precursor for the synthesis of activated carbon. Phosphoric acid (H_3PO_4) was employed as the activating agent using a two-step activation method. Initially, tea waste powder was carbonized at 500 °C under a nitrogen atmosphere to form tea waste biochar. In the second step, the biochar was impregnated with phosphoric acid in a 2:1 (v/w) ratio using a magnetic stirrer and activated at 800 °C in a nitrogen environment. The prepared activated carbon was ground to a particle size below 150 µm and washed with distilled water until neutral pH. The point of zero charge (PZC) was determined by the salt addition method. Methylene blue (MB) was chosen as a model dye to investigate the adsorption performance of the activated carbon. Batch adsorption study was carried out by varying parameters such as initial dye concentration, contact time, solution pH and adsorbent dosage. These parameters were optimized to achieve effective removal of dye pollutants from aqueous solutions. The results indicate that tea waste derived activated carbon has strong potential as a low-cost adsorbent. Electrochemical analysis were also carried out using cyclic voltammetry (CV) and galvanostatic charge–discharge (GCD) techniques. The CV study shows that the prepared activated carbon has a working potential range of −0.6 to 0.2 V. Within this range, the specific capacitance was calculated using GCD analysis.

Keywords: Activated Carbon; Tea waste; Phosphoric acid (H_3PO_4); Methylene blue dye; Adsorption

MATHEMATICS

Sardar Patel University
Vallabh Vidyanagar, Anand, Gujarat

Abstract ID: RSMOMATH01

Functions of bounded fractional differential variation using Caputo fractional derivatives

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The concept of functions of bounded fractional differential variation is introduced using the Caputo fractional derivatives of order $\alpha > 0$. Equivalent conditions and several other significant results are discussed. Authors have investigated some Special Functions and derived conditions on these Special Functions to be functions of bounded fractional differential variation.

Keywords: Functions of bounded variation, Caputo fractional derivatives, Special Functions

Abstract ID: RSMOMATH02

Determining safest-value for the number of primes in a multi-prime RSA and improvised GMMRSA

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Several attacks on the well-known RSA cryptosystem that can be extended to a multi-prime version of RSA reveal that it is preferable to use the modulus having more prime factors. On the contrary, the larger the number of prime factors of the modulus, the greater the risk of its factorization, due to the reduced size of its prime factors. In this paper, we derive an optimal value of the number of prime factors in a multi-prime RSA modulus and introduce the notion of the "safest-value" and determine such safest-values for moduli of different sizes. By utilizing this concept, we propose an enhanced version of our Generalized Multi-Moduli RSA (GMMRSA), which is now secure against even more attacks than its previous version.

Keywords: RSA cryptosystem, multi-prime RSA, multi-moduli RSA, safest-value, GMMRSA

Abstract ID: RSMOMATH03

Some Results on the Wright Function

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This paper discusses some new properties of the Wright function. New pure and differential recurrence relations are obtained, along with several integral representations. In addition, integral duplication formulae and multiplication theorems for the Wright function are derived. Various particular cases are presented as corollaries.

Keywords: Wright function, Mittag-Leffler function, Wright hypergeometric function

Abstract ID: RSMOMATH04

A new digital signature scheme based on Elgamal and RSA: A hybrid approach

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In this paper, we proposed a new hybrid digital signature scheme based on two well-known problems in cryptography: the integer factorization problem and the discrete logarithm problem. We will prove that, the proposed hybrid scheme is superior to both the Elgamal and RSA signature schemes.

Keywords: Elgamal digital signature scheme, RSA signature, the discrete logarithm problem, the integer factorization problem, hybrid scheme

Abstract ID: RSMOMATH05

Composite Operators and Their Differences Involving the Hypergeometric Distribution

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This article explores the concept of positive linear operators and their properties by combining known operators with operators of hypergeometric type. The composition of the generated operators determines the conditions under which they preserve positivity and convergence. We also study some approximation properties of these operators like difference of operators and order of convergence. We also demonstrated the graphical and numerical analysis for these operators to achieve better approximations for suitable parameters.

Keywords: Integral type operators, Hypergeometric distribution, Composition, Difference of operators, Korovkin type theorem.

Abstract ID: RSMOMATH06

Convergence of Fractional q Riemann Liouville Kantorovich type Operators

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The fractional q-Riemann Liouville Lupas Kantorovich operators are presented in this work. In Section 2, we calculate this operators moments and central moments. In Section 3, the Lipschitz class, Lipschitz-type maximal functions, Peetre's K-function, and the first and second order modulus of smoothness are used to analyze the Korovkin-type approximation theorem and convergence order of this operators. Sections 4 and 5 covered the Voronovskaja theorem and the weighted approximation properties of this operators.

Keywords: Riemann Liouville, Lipschitz class, Peetre's K-function, Voronovskaja theorem, weighted approximation

Abstract ID: RSMOMATH07

Basics of Basic Hypergeometric Series

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In this paper, we have studied a generalization of a complex number called the q-number. We have observed its combinatorial features. Also, q-Analogues of the hypergeometric, exponential, sine, cosine, gamma, and beta functions are defined and investigated. Additionally, the principles of q-calculus, q-derivatives, and q-integrals are defined and studied. At last their relationships to classical calculus is explored.

Keywords: q-derivative, basic hypergeometric series, q-exponential function, q-gamma and beta functions, q-integrals.

Abstract ID: RSMOMATH08

A study on the matrix analogue of the ℓ-Hypergeometric Function

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In this work, we explore the ℓ-Hypergeometric function with the matrix parameters ${}_1H_1^1(A;B,(C:\ell);z)$, which particularize the well-known confluent hypergeometric matrix function ${}_1F_1(A;B;z)$. Through the introduction of a type of hyper-Bessel matrix type operators, we examine a number of properties satisfied by this newly defined function (which we refer to as the ℓ-H-M function), including convergence, the order zero of these entire functions, integral representation, differential equations, and eigen function properties.We also go over some fractional calculus in relation to this ℓ-H-M function. Finally, the newly described ℓ-analogue of the matrix Laplace transform is used to discuss the applicability in terms of fractional kinetic equations.

Keywords: Matrix functional calculus, Integral representation, Differential formula, Eigen function, Fractional calculus

Abstract ID: RSMOMATH09

Asymptotic Expansion of Some Integrals

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Asymptotic expansion provides approximate series representations of functions and integrals in limiting cases when a parameter becomes large or small. It is widely used to study the behavior of Special Functions and Integrals that cannot be evaluated directly. This presentation provides the basic terminologies of asymptotic expansion and methods such as the Laplace method, Watson's Lemma, and the method of Steepest descent, which are used to obtain asymptotic approximations of integrals.

Keywords: Asymptotic series, Special Functions, Watson's Lemma, Steepest descent method

Abstract ID: RSMOMATH10

Dynamical System Analysis of the $f(R, L, T)$ Gravity Model

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Modified gravity theories have been extensively studied recently as viable substitutes for general relativity to deal with cosmological issues like dark energy and late-time cosmic acceleration. In this work, we investigate the dynamical behavior of the $f(R, L, T)$ gravity model with a scalar field utilizing exponential potential, where R represents the Ricci scalar, L is the Lagrangian density and T is the trace of the energy-momentum tensor. We concentrate on a specific type of modified gravity characterized by $f(R, L, T) = R + \alpha L + \beta T$, where α and β are positive constants. We study the dynamical behavior and late-time evolution of a cosmological model using a thorough phase-space analysis. We assess important cosmological parameters at the critical places, such as the density parameters corresponding to various cosmic components, the deceleration parameter, and the effective equation of state parameter. The nature of the cosmic phases such as matter-dominated, radiation-dominated, and accelerated expansion eras, described using these quantities.

Keywords: FLRW Cosmological Model, $f(R, L, T)$ Gravity, Dynamical System, Cosmological Parameters

Abstract ID: RSMOMATH11

A Mellin Transform Approach to Black-Scholes Equation for Generalized ML-Payoff Function

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This paper develops a novel analytical framework for pricing European put options using a generalized modified-log (ML) payoff function within the Black--Scholes model. By applying the Mellin transform, we derive a closed-form pricing formula that unifies several well-known special cases, including standard log and power-log options. The approach provides mathematical flexibility to represent a wide class of nonlinear payoffs through a finite series expansion $g(S) = \sum_{i=1}^{n} b_i S^{p_i}$. The study further analyses the sensitivity measures (Greeks).

Keywords: BS formula, generalized ML-payoff, Mellin transform, theta effect, vega effect

Abstract ID: RSMOMATH12

A Note on Homotopy Analysis Method

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The Homotopy Analysis Method (HAM) is a useful technique for solving ordinary and partial differential equations that often appear in science and engineering problems. Many traditional methods work only when a small parameter is present, but HAM does not have this limitation. The basic idea of HAM comes from topology, where a solution is gradually built by smoothly changing an initial guess into the actual solution of the problem. One special advantage of HAM is that it allows us to control how fast and how well the solution converges by using an adjustable parameter. This presentation explains the basic concept of HAM, how it works, and why it is effective for solving complex nonlinear problems.

Keywords: Homotopy Analysis Method; Analytical Approximation; Series Solutions

Abstract ID: RSMOMATH13

Operational Methods for a Generalized Three-Parameter Family of Laguerre Polynomials

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In this paper, a generalized three-parameter family of Laguerre polynomials is investigated, extending the classical Laguerre framework through advanced operational methods. New analytical properties are established, including generating functions, integral representations, finite summation formulas, and recurrence relations. Several notable special cases are examined, illustrating the versatility of the proposed polynomials.

Keywords: Generalized Laguerre Polynomials, Integral Representations, Recurrence Relation, Finite Summation formulae

Abstract ID: RSMOMATH14

Scale-Invariant Fractional Derivative with Respect to Function

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This paper develops a novel framework for scale-invariant general fractional calculus based on transmutation relations. By incorporating transmutation structures, the proposed framework extends traditional scale-invariant fractional operators to a more general class—namely, scale-invariant general fractional operators with respect to a function. These operators naturally capture key features of complex systems, including scaling behavior, non-locality, and memory effects. The approach generalizes classical fractional calculus by introducing scaling (dilation) differential operators, and establishes important properties such as semi-group behavior and scale-invariance. Theoretical developments are supported by discussions on boundedness and operator properties, positioning this work as a significant contribution to the advancement of generalized fractional calculus. These findings hold promising potential for applications in physics, engineering, and complex dynamical systems, where scale-invariance is a fundamental characteristic.
A single-page abstract in the prescribed template must be submitted online through the Google Form. Authors will be notified of abstract acceptance.

Keywords: Fractional Calculus, Scale-Invariant Operators, Mellin Convolution, Transmutation Relations, Scale-Invariant General Fractional Operators with Respect to Functions

Abstract ID: RSMPMATH01

An Accelerated Expansion of the Universe using ΛCDM Model

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Observations indicate that the expansion of the Universe is currently accelerating. The ΛCDM model is the standard cosmological model that explains this accelerated expansion by introducing a cosmological constant Λ, which represents dark energy. In this work, we study the accelerated expansion of the Universe using the ΛCDM framework based on the FLRW model. The presence of Λ leads to a negative deceleration parameter at late times. Observational results from Type Ia supernovae, the Cosmic Microwave Background and Baryon Acoustic Oscillations strongly support this model. Although the ΛCDM model agrees well with observations, the physical nature of dark energy remains an open problem.

Keywords: Accelerated Expansion; Dark Energy; FLRW model.

PHARMACEUTICAL SCIENCES

Sardar Patel University
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Abstract ID: RSMOPHARMA01

Preliminary Phytochemical Screening and Quality Evaluation of *Helicteres isora Linn* Fruit.

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The expanding use of herbal medicines emphasizes the need for systematic standardization and quality evaluation of medicinal plants to ensure their safety, effectiveness, and reproducibility, particularly for species that are widely used in traditional medicine but insufficiently characterized scientifically. *Helicteres isora Linn* fruit is reported to be useful in the treatment of snake bite, diarrhoea, malnutrition, colorectal cancer, inflammatory disorders, convulsive conditions, and diabetes; however, limited comparative information on extraction efficiency and physicochemical quality parameters may restrict its reliable pharmaceutical application and large-scale formulation development. To address this gap, the present study aimed to compare the percentage yield obtained from different extraction methods, conduct preliminary phytochemical screening, and evaluate key physicochemical parameters, including ash values, for the quality assessment of *Helicteres isora Linn* fruit. Dried and powdered fruit material was extracted using maceration and percolation with solvents of increasing polarity, namely chloroform, methanol, and water. Among the methods studied, the aqueous extract obtained by maceration produced the highest yield of 98% on a dry weight basis, indicating superior extraction efficiency due to enhanced solvent penetration and mass transfer compared with percolation. Physicochemical evaluation included determination of total ash, acid-insoluble ash, and water-soluble ash to assess inorganic residue, siliceous contamination, and water-soluble mineral content, and the total ash value was found to be 7%, which lies within acceptable Ayurvedic pharmacopoeia limits, suggesting low contamination and good quality of the raw material. Preliminary phytochemical screening confirmed the presence of carbohydrates, glycosides, fats and oils, alkaloids, triterpenoids, saponins, flavonoids, tannins, and phenolic compounds. Overall, the findings provide a scientific basis for selecting an appropriate extraction technique and establish essential quality control parameters that support the standardization and future formulation development of *Helicteres isora Linn* fruit.

Keywords: *Helicteres isora*, extraction yield, maceration, percolation, ash value.

RSMPPHARMA01

Nanogels: A Promising Nanocarrier System for Advanced Drug Delivery

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Conventional drug delivery systems often suffer from limitations such as poor solubility, low bioavailability, rapid drug degradation and lack of site specificity, which ultimately reduce therapeutic efficacy and patient compliance. These challenges have driven the need for advanced carrier systems capable of controlled and targeted drug delivery. Nanogels, three-dimensional cross-linked polymeric networks in the nanometer range, have emerged as promising nanocarriers due to their high water content, tunable physicochemical properties and excellent biocompatibility. The objective of this review is to critically evaluate the design, preparation methods, characterization parameters and pharmaceutical applications of nanogel-based drug delivery systems. A comprehensive literature survey was conducted using published research articles, reviews and reports focusing on nanogel composition, synthesis techniques such as emulsion polymerization, inverse mini emulsion and self-assembly, and their performance in drug loading and release. The reviewed studies demonstrate that nanogels exhibit high drug encapsulation efficiency, controlled and stimuli-responsive drug release, enhanced permeability and retention, and improved stability of both hydrophilic and hydrophobic drugs. Nanogels have shown significant potential in various applications including targeted delivery of anticancer agents, topical and transdermal formulations, protein and gene delivery, and treatment of inflammatory and infectious diseases. The findings highlight that nanogels can effectively overcome several drawbacks associated with conventional dosage forms and other nanocarriers. In conclusion, nanogels represent a versatile and efficient platform for advanced drug delivery, offering substantial contributions to the development of safer and more effective therapeutic systems and holding strong promise for future clinical translation.

Keywords: Nanogels; Nanocarriers; Drug delivery; Controlled release; Targeted therapy.

PHYSICS

Sardar Patel University
Vallabh Vidyanagar, Anand, Gujarat

Abstract ID: RSMOPHY01

A Novel Solid Acid Nanocomposite of NaH_2PO_4-$NdPO_4$: Creation and Extensive Analysis for Energy Storage

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The present study addresses the synthesis of pure and nanocomposite of NaH_2PO_4:$NdPO_4$ with weight ratio of 90:10 (A1 nanocomposite sample) was comprehensive investigated. The pure and nanocomposite prepared by chemical route. The structural, elemental composition, functional groups, porosity, surface morphology, thermal analysis and proton conductivity were rigorously analyzed using a variety of techniques including X-ray Diffraction, X-ray Spectroscopy, Fourier Transform Infrared Spectrometer, Brunauer Emmett Teller, Field Emission Scanning electron microscopy, Energy Dispersive Spectroscopy, Thermogravimetric analysis, Differential Thermal analysis and ionic conductivity by LCR meter of A1 nanocomposite sample. Moreover, the XPS corroborates the XRD findings, with the variations in binding energy explained by bonding states. The deconvoluted C1s spectrum resulting from hydrocarbons showed peaks at 284.6eV and 285.0 eV. At 982.44eV and 1005.52eV, there are two types of spin-orbits, representing the Nd $^3d_{3/2}$ and Nd $^3d_{5/2}$ constituents. The obtained results showed that Nd exists in the Nd^{3+} oxidation state. FESEM-EDS analysis indicated the presence of atomic percentage that provides the number of an element, reflects the relative weight of an element in the synthesized pure SDP, pure $NdPO_4$, and solid acid (A1) nanocomposite electrolyte. TGA-DTA analysis clearly illustrated the dehydration of SDP. In which, TGA curves indicated significant weight reductions surpassing those of pure SDP at 270°C and $NdPO_4$ at 300°C, and revealed the temporary characteristics of SDP, $NdPO_4$, and has a prominent endothermic peak for pure SDP at 275 °C. In this work the best conductivity found to be at 6.16×10^{-3} Scm^{-1} at 310°C. Additionally, this study showed that the pre-treatment temperature had a substantial impact on the proton conductivity of A1 nanocomposite sample, which had the highest value, because of $NdPO_4$. It has low precursor costs (SDP with $NdPO_4$) and easy of synthesis, is an excellent electrolyte for future energy storage applications.

Keywords: NaH_2PO_4:$NdPO_4$ Solid Acid Nanocomposite, Comprehensive Characterizations, Conductivity, Porosity and Fuel cells.

Abstract ID: RSMOPHY02

Bifunctional $MoSe_2$ Crystals for High-performance Photodetection and Photocatalytic Wastewater Treatment

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Photodetectors play a vital role in modern technologies by converting incident light into measurable electrical signals, enabling applications in imaging, optical communication, and environmental sensing. Simultaneously, the growing concern of water pollution—particularly from textile-derived dyes—demands efficient and sustainable treatment strategies. Layered Transition Metal Dichalcogenides (TMDCs) have emerged as powerful candidates owing to their exceptional electronic and optical behaviour. In this work, $MoSe_2$ single crystals were synthesized via a simple Direct Vapor Transport (DVT) technique and thoroughly characterized using PXRD, FESEM–EDAX, UV–Visible spectroscopy, and Raman spectroscopy. The bifunctional capability of $MoSe_2$ was explored through its photodetector performance and photocatalytic dye degradation activity. The device demonstrates stable visible-light photoresponse with a responsivity of 1.34 mA/W and fast rise/decay times of 122/107 ms, confirming efficient carrier dynamics. Notably, photocatalysis was performed using a **unique catalyst-coated glass substrate**, enabling effortless handling, reuse, and significantly enhanced degradation efficiency. Using this innovative setup, 10 ppm methylene blue solution was degraded by 82.36% under visible light (20 W LED), with further evaluation across different pH conditions. Overall, this study highlights $MoSe_2$ as a highly effective bifunctional material, simultaneously advancing optoelectronic sensing and sustainable environmental remediation.

Keywords: 2D Materials, TMDC, DVT, Crystal, Photodetector, Visible light driven Photocatalysis

Abstract ID: RSMOPHY03

Biomechanical Response of Red Blood Cells to Osmotic Pressure Variations

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Red blood cells (RBCs) undergo pronounced morphological changes when exposed to different osmotic environments, arising from variations in membrane tension, cell volume, and mechanical constraints. Understanding these shape transformations is fundamental to RBC biophysics and to the progression of many blood-related disorders. In this work, we model RBC shape remodeling by explicitly incorporating the osmotic pressure contribution ($\Delta P\ V$) into the total membrane free energy, alongside in-plane elasticity, bending rigidity, surface-area conservation, and volume constraints. This formulation provides a direct and physically consistent framework for quantifying how osmotic pressure gradients regulate RBC morphology. By systematically varying ΔP, we investigate its role in driving transitions between distinct RBC configurations. In contrast to earlier theoretical approaches that primarily attribute shape changes to area-difference elasticity (ΔA), our results demonstrate that osmotic pressure alone is sufficient to generate a wide range of experimentally observed RBC morphologies. This highlights ΔP as an independent and powerful control parameter in membrane remodeling. Furthermore, coupling osmotic pressure with other mechanical energy terms reveals the remarkable adaptability of RBCs under both physiological and pathological conditions, offering new insight into the physical principles governing cellular shape regulation.

Keywords: RBC morphology, Osmotic Pressure, Biophysics

Abstract ID: RSMOPHY04

Low-cost hyperspectral computational imaging spectrometer

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Hyperspectral imaging(HSI) in the visible range enables the user to get detailed insight in surface and spectral properties of materials, extending its use in multiple domains. Available conventional hyperspectral cameras in the market have high system cost and complex optical architecture bulking the system, often trading spectral resolution for compactness. Hence to address this, a low-cost hyperspectral computational imaging spectrometer is developed utilizing commercially available transmission diffraction grating and a Sony IMX335 CMOS USB camera. The optical setup of this system uses the transmission diffraction gratings positioned together normally, right in front of the camera to capture the first order spectrum of the illuminated object at the centre of field of view(FOV). System calibration is performed using various lasers within the 400-700nm range for illuminating the object (a uniformly perfect reflecting tile) positioned at the centre of FOV and images are recorded simultaneously. Due to wavelength-dependent angular dispersion introduced by the diffraction grating, the captured spectra appear to be laterally shifted replicas of the object image, enabling pixel-wise hyperspectral reconstruction through image registration and wavelength calibration while preserving the spatial and spectral properties simultaneously. After calibration, the spectral data is reconstructed using image-registration-based Shift-and-Stack and CTIS-inspired multi-view reconstruction approaches. Experimental results demonstrating a spectral sampling resolution of around ~10nm over the visible range, achieved using a light-weight optical setup without reliance on high-cost optical components.

Keywords: Computational Imaging, CTIS, hyperspectral, inverse imaging problem, low-cost spectrometer

Abstract ID: RSMOPHY05

Photodetection Performance of Rhenium Diselenide Single Crystals

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Transition Metal Dichalcogenides (TMDCs) are highly versatile materials with applications in optoelectronics, photonics, sensing, and energy technologies. Their unique two-dimensional structure imparts exceptional properties such as tunable band gaps, high carrier mobility, strong light absorption, and efficient exciton generation, making them ideal for advanced applications[1,2]. Among TMDCs, Rhenium Diselenide ($ReSe_2$) stands out as a relatively underexplored material with unique characteristics, including a direct band gap, optical biaxiality, and pronounced in-plane anisotropy[3,4]. In this study, $ReSe_2$ single crystals were synthesized using the Direct Vapor Transport (DVT) technique, and their properties were thoroughly characterized using techniques such as Powder X-ray Diffraction, Scanning Electron Microscopy, Energy Dispersive X-ray Spectroscopy (EDAX), Raman Spectroscopy, and UV-Visible Spectroscopy. Leveraging these properties, a high-performance anisotropic self-biased photodetector was developed. The photodetector's performance was evaluated under varying conditions, including different white light intensities, bias voltages, and wavelengths across the visible and infrared spectrum. The study also explored the anisotropic behaviour resulting from $ReSe_2$'s layered structure, with a focus on in-plane and out-of-plane electrical contacts. The findings underscore $ReSe_2$'s potential as a promising candidate for advanced electrical and optoelectronic applications, paving the way for future innovations in TMDC-based technologies.

Keywords: TMDC materials (2D materials), $ReSe_2$, Direct Vapor Transport (DVT), Basic characterizations, Photodetector

Abstract ID: RSMOPHY06

Electrophoretic Deposition of WS2 Thin Films from Exfoliated Nanosheets for Self-Powered Photoelectrochemical Photodetector Application

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Two-dimensional transition metal dichalcogenides (TMDs) have emerged as versatile materials for next-generation optoelectronic and energy devices due to their layer-dependent band structure, strong light–matter interaction, and stability in aqueous environments. Among semiconducting TMDs, atomically thin WS_2 nanosheets (NSs) offer significant opportunities for nanoelectronics and optoelectronic applications owing to their superior optoelectrical and structural properties, including high absorption coefficient, tunable bandgap, high on/off ratio, and absence of dangling bonds. In this work, bulk WS_2 crystalline powder was synthesized and systematically characterized using X-ray diffraction (XRD), scanning electron microscopy (SEM) with energy-dispersive X-ray analysis (EDAX), and diffuse reflectance spectroscopy (DRS), confirming its layered crystalline phase and optical bandgap. Liquid-phase exfoliation was employed to obtain WS_2 nanosheets, which were subsequently deposited as thin films on fluorine-doped tin oxide (FTO) substrates via electrophoretic deposition. Structural and optical characterizations, including XRD, SEM, UV–Vis absorption spectroscopy, transmission electron microscopy (TEM), and selected area electron diffraction (SAED), confirmed the nanosheet morphology and crystalline nature of the deposited films. Photoelectrochemical (PEC) measurements were performed under self-powered conditions (0 V bias) in a 0.1 M Na_2SO_4 electrolyte using LED illumination of different wavelengths and tunable intensities ranging from 20 to 100 mW/cm². The WS_2 nanosheet films exhibited wavelength-dependent photoresponse and stable switching behaviour. The calculated responsivity and detectivity values demonstrate the potential of WS_2 nanosheet films as efficient self-powered photodetectors and photoelectrodes for solar energy conversion applications.

Keywords: Transition Metal Dichalcogenides (TMDs), WS_2 nanosheets, Liquid-phase exfoliation, Electrophoretic deposition, Self-powered photodetector, Photoelectrochemical (PEC) device

Abstract ID: RSMOPHY07

Pressure-induced structural phase transition in $FeGa_3$ accompanied by metallization.

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$FeGa_3$ intermetallic transitions from low pressure tetragonal phase (*P*42/*mnm, SG*-136, *LP*) to a new high-pressure phase (*P*42/*mmc, SG*-131, *HP*), with an onset at 14–16 GPa, and a pronounced ~17% volume collapse. *LP* phase coexists in progressively decreasing population with *HP* phase. XRD results suggest that a full conversion to the *HP* phase occurs just beyond ~35 GPa. The semiconducting gap in the *$FeGa_3$* originates from Fe(3*d*)/Ga(4*p*) hybridization. Pressures of 15–20 GPa initiate a disruption of this semiconducting tetragonal *LP* structure and the emergence of *HP* metallic phase follows. The onset of metallic behavior occurs in the range 16–20GPa, concurrent with the initiation of the *LP→HP* structural transition. This high-density metal reverts to the original *LP* crystalline structure upon decompression from ~35 GPa to ambient conditions. To enable this back transformation, some form of "memory" of the original lattice network, e.g., Fe-Fe dimers is supposed to be retained in the LP→HP structural transformation to a denser metallic state.

Keywords: Structural transformation; Semiconducting gap; Metallic behavior; Lattice network;

Abstract ID: RSMOPHY08

Enhanced optical and magnetic properties of CuO nanostructures- An investigation of effect of Mn doping

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1-D nanostructures have demonstrated remarkable advantages over 0-D quantum dots due to their relatively high aspect ratio and larger surface area which allow easy charge transport, sufficient space to accommodate the stress relaxation and anisotropy based physical and mechanical properties [1]. The present work reports the wet chemical synthesis of Mn doped CuO nanostructures [$Cu_{1-x}Mn_xO$, x= 0.01 (CMN1), 0.03 (CMN3)]. XRD analyses of these samples exhibit CuO to be present with monoclinic crystal structure in all the samples. The increase doping of Mn up to 3 % resulted a regular increase into the unit cell volume, without exhibiting the presence of Mn or any of its oxides. XPS measurement of CMN3 indicated Mn is present in 2^+ oxidation state only. The FESEM and TEM studies of these samples demonstrated the formation of nanosheets like morphology consisting of nanoneedles with sharp tip at the end and its transforms into nanoneedles at higher concentration of Mn. The observed change in morphology from nanosheets to nanoneedles by doping of Mn is understood by the creation of the point defects as was evidence by optical fluorescence and Raman measurements in which red shifted bands were observed. The presence of defects in doped samples was further analysed by increased lifetime at lower energy and increased magnetic behaviour associated with an increase in the magnetization value. This magnetic behaviour is explained by the overlapping of polarons based on bound magnetic polarons (BMP) model [2]. A corelation between the observed optical and magnetic properties have been analysed and discussed.

Keywords: Nanostructures, XRD, FESEM, Magnetization, BMP

Abstract ID: RSMPPHY01

Lensless Fourier Holography for Dual Sample via Angular Multiplexing

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Digital holography is a well-established quantitative phase imaging technique in which the full complex optical field of an object is retrieved by recording the interference between an object wave and a reference wave on a digital imaging sensor. However, the amount of information that can be recovered from a single hologram is fundamentally limited by the finite sensor size and pixel pitch. Holographic multiplexing addresses this limitation by exploiting different degrees of freedom of the optical field to encode information from multiple object waves onto a single sensor within a single acquisition. In this work, we present a novel configuration for multiplexed lensless Fourier holography that enables simultaneous recording and reconstruction of Fourier holograms from multiple distinct samples. A transmission grating is used to split an incident collimated beam into two object waves corresponding to the ±1st diffraction orders and a reference wave corresponding to the 0th order. Mirrors redirect the object beams toward the sensor such that they propagate at distinct angles with respect to the reference wave. A lens of focal length 35 mm is placed in the reference arm to generate a Fourier plane at its focal plane, where the objects are positioned, resulting in the formation of a Fourier hologram at the sensor. The information corresponding to each object is retrieved by applying a Fourier transform to the recorded multiplexed hologram. The results demonstrate the fidelity of the proposed configuration, showing reliable separation and reconstruction of multiple object fields from a single multiplexed hologram.

Keywords: Digital Holography; Multiplexing; Fourier Holography; Dual Sample.

Abstract ID: RSMPPHY02

STUDY OF TEMPERATURE EFFECTS ON FLUIDS USING LASER SPECKLE CONTRAST IMAGING

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Laser Speckle Contrast Imaging (LSCI) is a simple and non-contact optical technique that is commonly used to study motion by analyzing speckle patterns. Earlier studies mainly focus on measuring flow velocity in moving fluids. However, the effect of temperature on speckle behavior in stationary fluids has not been studied in detail. In this work, we study how heating affects a stationary scattering fluid and how temperature changes influence speckle contrast and decorrelation time. In the experiment, a stationary sugar solution is heated using an electrical heating element, and the temperature is measured with a thermocouple. Speckle images are recorded at different temperatures using a He–Ne laser and a CMOS camera. Spatial speckle contrast is calculated from the recorded images for different regions of interest. From the contrast values, the decorrelation time is also estimated to understand the change in fluid dynamics with temperature. The results show that the speckle contrast decreases as the temperature increases due to increased Brownian motion in the fluid. Heating also changes the refractive index of the fluid and reduces its viscosity, which further enhances particle motion and leads to faster speckle decorrelation. Similar trends are observed for different regions of the sample, confirming the consistency of the results. This study shows that LSCI is sensitive not only to externally driven flow but also to temperature-induced motion in stationary fluids. The findings provide useful insight for future work on temperature-dependent fluid analysis and viscosity estimation using LSCI.

Keywords: Laser Speckle Contrast Imaging, stationary fluid, temperature effect, spatial contrast, decorrelation time.

Abstract ID: RSMPPHY03

Design Freedom in Numerical Aperture Control Using Metalenses

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High-numerical-aperture optical devices are essential for applications in microscopy, optical data storage, and advanced imaging. However, conventional refractive lenses face fundamental limitations in achieving high numerical aperture, requiring bulky, curved geometries that introduce optical aberrations and pose fabrication challenges and higher manufacturing costs. To overcome these limitations, Metasurfaces-planar arrays of sub-wavelength nanostructures – have been introduced as a more efficient alternative, which offer a transformative approach by enabling precise wavefront manipulation and better control of phase, amplitude, and polarization of the incident light in ultra-compact form factor. This capability enables efficient, lightweight lens designs with significantly reduced aberrations and greater design flexibility than conventional lenses. In this work, we present a comprehensive numerical investigation of different meta-structure configurations for high-focusing applications with increased numerical aperture. FDTD simulations were employed to design and simulate three metalenses with numerical apertures of 0.1, 0.5, and 0.9. The focusing performance of each metalens was evaluated using the full width at half maximum (FWHM) and compared with the diffraction-limited FWHM. The focusing efficiency was also analysed for each case to showcase the metalens's focusing control. Our results demonstrate that metasurface-based lenses can be efficiently engineered to achieve diverse NA specifications with substantially simplified geometries. These findings highlight the considerable potential of metasurfaces for realizing compact, high-performance focusing lenses with advantages in aberration correction, form factor, and manufacturing scalability.

Keywords: Numerical Aperture, Metasurfaces, Metalenses, FDTD.

Abstract ID: RSMPPHY04

Mass Spectroscopy of N Baryons

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N baryons are among the most important systems in the light baryon sector and are commonly used to study the internal dynamics of three-quark bound states. However, the mass ordering of their excited states is still not clearly established due to uncertainties and spread in the available experimental data. This situation motivates a detailed theoretical study of the mass spectroscopy of excited N baryons. In the present work, the mass spectroscopy of N baryons is studied within the framework of the non-relativistic quark model, where baryons are treated as systems of three constituent quarks interacting through an effective quark–quark potential. The mass calculations are performed by including the confinement interaction along with spin-dependent potential terms. The calculated masses of the 2S and 3S states corresponding to N(1440) and N(1710) are 1360 MeV and 1780 MeV, respectively. For the orbital excitations, the calculated masses of the 1P states corresponding to N(1520) and N(1535) are 1596.55 MeV and 1521.55 MeV, respectively. The present study shows that mass spectroscopy provides useful information about the structure of excited N baryons and that the non-relativistic quark model remains a simple and effective approach for describing their mass spectrum.

Keywords: N baryons, mass spectroscopy, non-relativistic quark model, excited states, light baryons

Abstract ID: RSMPPHY05

A Fluoride-Based Etching Method for 2D Vanadium Carbide MXene and Investigation of Its Structural, Morphological, and Elemental Properties.

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MXenes are two-dimensional transition metal carbides, nitrides, or carbonitrides with the general formula $M_{n+1}X_nT_x$ (n = 1–4), where M denotes an early transition metal, X indicates C/N/CN, and T_x represents surface termination groups such as –OH, –O, and –F. However, vanadium carbide MXene remains less studied within the MXene family. A two-dimensional vanadium carbide MXene was synthesized using a fluoride-based etching method, which is low-toxic and easy to perform under controlled parameters. The structural transformation was successfully confirmed using X-ray diffraction (XRD) analysis within the 2θ diffraction angle range of 5° to 80°. The morphological analysis, investigated by scanning electron microscopy (SEM), reveals a 2D layered structure. The elemental information observed by energy-dispersive X-ray analysis (EDAX) confirms the removal of Al and the presence of some impurities. The synthesis provides a direction to investigate the structural, morphological, and elemental characteristics of the synthesized sample. The systematic exploration of vanadium-based MXenes indicates their promising role in energy storage, sensing, and catalytic applications.

Keywords: MXene; Fluoride etching; in situ synthesis; characterization

Abstract ID: RSMPPHY06

Structural, Thermal, and Kinetic Analysis of $ZnSn(OH)_6$

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Zinc Hydroxy-stannate ("$ZnSn(OH)_6$") nanoparticles were synthesized by a straightforward co-precipitation method. The X-ray diffraction of the nanoparticles confirmed the phase and cubic crystallographic structure. The nanoparticles were studied for their thermal stability. The thermal stability was studied using thermogravimetry, differential thermogravimetry, and differential thermal analysis techniques. The non iso-conversional Kissinger method was employed to analyse the kinetics of single-step decomposition stated in the analyzed temperature range. The kinetic parameters, including activation energy, enthalpy change, entropy change, etc., were calculated. The "$ZnSn(OH)_6$" perovskite's phase stability, decomposition mechanism, and energy barrier are highlighted by the combination of structural and kinetic analyses, highlighting the material's potential for use as a thermally resilient functional material.

Keywords: Nanoparticles, Thermal Analysis, Kinetic Parameter.

Abstract ID: RSMPPHY07

Holographic Analysis of Red Blood Cells in Thalassemia

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Digital holography is an optical imaging technique that records both the amplitude and phase of light, enabling quantitative, three-dimensional analysis of biological samples. In this study, lateral shearing holography was used as a label-free quantitative phase-imaging method to investigate red blood cell abnormalities associated with thalassemia. The motivation for this work is to develop a non-invasive and objective approach to blood cell characterization that does not require chemical stains or complex preparation procedures. Blood samples from patients with thalassemia were analysed at the single-cell level, and high-resolution phase reconstructions were obtained to extract quantitative morphological parameters, including cell area and thickness variation. The results show differences in phase profiles and morphology between red blood cells from thalassemia-positive samples and healthy samples. This may be due to membrane distortion and structural irregularities characteristic of thalassemia. Digital holography provides reliable quantitative phase information and has strong potential to act as a complementary optical tool for red blood cell analysis.

Keywords: Holographical analysis, Red blood cells.

Abstract ID: RSMPPHY08

Physics-based CGMD network model for RBCs

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This work presents a systematic coarse-graining procedure to build a CGMD Spectrin network model of the red blood cell membrane that captures bending energy, in-plane shear and surface area and volume constraints. The physics-based network model of the RBC membrane keeps the important mechanical behaviour while using fewer particles. The network model matches experimental stretching tests, common shapes and is easy to scale, making it useful for simulations of blood flow and different conditions.

Keywords: Red blood cell; CGMD; Spectrin network model; Dissipative Particle Dynamics.

Abstract ID: RSMPPHY09

Label-Free Identification of Yeast Strains via Mach–Zehnder Digital Holographic Microscopy and Machine Learning

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Conventional brightfield microscopy provides limited contrast for transparent biological cells, making reliable differentiation of morphologically similar microorganisms difficult. Here, Mach–Zehnder digital holographic microscopy is employed to distinguish two visually identical *Saccharomyces* yeast strains (KT-D22 and ID) using quantitative phase imaging and machine learning. Digital holograms were numerically reconstructed to obtain phase difference maps, enabling automated segmentation of individual cells and extraction of optical thickness–based morphological features describing size, shape, volume, and thickness statistics. After statistical feature selection, multiple classifiers were trained, with Logistic Regression and Random Forest showing the best performance. The results demonstrate a robust label-free framework for automated discrimination of closely related yeast strains.

Keywords: Digital holographic microscopy, quantitative phase imaging, yeast strain classification, machine learning, label-free imaging.

Abstract ID: RSMPPHY10

Single Element Fourier Holographic Multiplexing Using All-Dielectric Metasurface

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Holography is a widely used quantitative phase-imaging technique for gathering full information about an object by recording not only its amplitude but also its phase. Due to the sensor's pixel size, the hologram information is encoded in only a small portion of the available spatial bandwidth. Multiplexing techniques exploit various degrees of freedom of light, such as wavelength, polarization, and interference angles, to capture more information on the same sensor area. Conventional multiplexing implementations, however, require various optical elements, such as gratings, mirrors, beam splitters, and lenses, which results in a complex, bulky, and alignment-sensitive optical system. Further, their complexity increases as the number of multiplex holograms is increased. Moreover, such challenges limit the integration of multiplex holography in compact systems. Metasurfaces are 2D subwavelength-engineered surfaces that allow for arbitrary control over the amplitude, phase, and polarization of light, which offers a compact alternative to bulky conventional optics. Here, a novel single-element metasurface approach is presented that multiplexes up to four holograms with distinct carrier frequencies and hologram fringe orientations in a single exposure. The single-element approach uses a single reference beam and four object beams. For the reference beam, a lens is placed at the bottom of the substrate so that its focus is formed at the top surface of the substrate. Four beam tilters are arranged around the reference beam, each having a different tilt orientation and tilt angle with respect to the reference, so that the orders are distributed across the full spatial bandwidth of the sensor and remain well separated. Finite-difference time-domain simulations demonstrate four pairs of spatially separated Fourier orders with minimal crosstalk. Thus, this approach greatly reduces system complexity, bulkiness, and alignment dependence, providing a compact alternative to conventional systems.

Keywords: Metasurface, Fourier holography, multiplexing, ultra-compact, finite difference time domain

Abstract ID: RSMPPHY11

B_s^0 -> K X non-leptonic decays in covariant confined quark model.

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Nonleptonic weak decays are important probe to understand QCD dynamics as well as to study CP violation and indirect search of new physics beyond standard model. We study the rare charmless weak hadronic decay of B_s^0 meson using naive factorization approximation in covariant confined quark model that has built-in infrared confinement. We determine necessary form factors in complete kinematical range of momentum transfer. The form factors thus deduced are further used to compute branching fraction of the selective channels under study. We compare our results with latest precise measurements of LHCb as well as other available theoretical studies.

Keywords: covariant confined quark model; charmless weak hadronic decay; infrared confinement, factorization.

Abstract ID: RSMPPHY12

Composition-Dependent Phonon Dispersion and Elastic Properties of Ternary Cu–Zr–Al/Ag Metallic Glasses

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A comprehensive molecular dynamics investigation into the collective vibrational behaviors and elastic characteristics of ternary metallic glass systems, $Cu_{50}Zr_{50-x}Al/Ag_x$ (x = 5, 10, 15, 20, 25, 30 and 40) to explore how composition influences phonon dispersion and collective excitations. Our analysis utilizes mass–current correlation functions along with their associated spectral functions, which allowed us to derive longitudinal and transverse phonon dispersion relations. Additional structural and dynamic insights were gathered using the static structure factor $S(q)$, the velocity autocorrelation function (VACF), and the vibrational density of states (VDOS), which is obtained from the Fourier transform of the VACF. The elastic moduli were additionally assessed using the low-q limits of the phonon dispersion curves. Our findings demonstrate a dependence of collective excitations and elastic response on the composition of the alloy, emphasizing the impact of atomic mass differences and the local structural changes caused by the substitution of Al or Ag. By analysing the structure, dynamics, and elastic properties together, we gain an understanding of how chemical composition affects vibrational behaviour and mechanical stiffness in Cu-based ternary metallic glasses.

Keywords: Ternary Metallic Glasses, Vibrational Dynamics, Phonon Dispersion and Elastic moduli

Abstract ID: RSMPPHY13

Study of solute–solvent interaction in binary mixtures Using Time-Domain Reflectometry

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Dielectric relaxation studies were performed on binary mixtures of N, N-dimethylacetamide (DMA) and n-nonanol at eleven different concentrations over a frequency range of 10 MHz to 30 GHz using the time-domain reflectometry (TDR) technique at 293.15K temperature. The mixtures exhibit a principle dispersion of the Cole-Davidson relaxation type at microwave frequencies. The dielectric parameters, namely the static dielectric permittivity (ε_0) and relaxation time (τ), were evaluated using Fourier transform analysis combined with a least-squares fitting method. The experimental results reveal a non-linear dependence of both dielectric permittivity and relaxation time on the mole fraction of DMA, indicating structural reorganization arising from intermolecular interactions between DMA and n-Nonanol. In addition, the excess permittivity (ε_0^E), excess inverse relaxation time $(1/\tau)^E$, Kirkwood correlation factors (g_{eff} and g_f), and the Bruggeman factor (f_B) were evaluated to investigate the nature and strength of solute–solvent interactions.

Keywords: Binary mixtures; N, N-dimethylacetamide; time-domain reflectometry.

Abstract ID: RSMPPHY14

Shape Identification Technique Based on Speckle Correlation and Phase Measuring Deflectometry

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Laser speckle correlation is a powerful, non-contact optical technique that utilizes the statistical nature of speckle patterns generated when coherent light interacts with optically rough or diffusive surfaces. Any variation in optical or physical parameters leads to measurable changes in the speckle field, which can be quantitatively analyzed using digital correlation algorithms. Usually, the speckle field is generated by illuminating a diffusive surface using a coherent light source such as lasers. This makes such laser speckle systems bulky and optically complex. In this work, a unified speckle correlation–based framework is presented for the measurement of optical rotation, physical parameters, and three-dimensional (3D) shape construction by using a simulated speckle pattern projected from a mobile phone screen onto the sample and using a commercially available webcam to image the deviation observed in the projected speckle field due to the sample. The work demonstrates 3D shape reconstruction by spatially mapping speckle displacement and decorrelation across the recorded speckle field. Depth-dependent surface information is retrieved by analyzing correlation variations over multiple spatial locations, enabling qualitative and quantitative reconstruction of object geometry without complex interferometric arrangements.

Keywords: Speckle correlation; shape identification

Abstract ID: RSMPPHY15

Concentration Dependent Dielectric Study of Binary Mixtures of Halobenzene with Alcohol

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In the present study, static dielectric constant (ε_0) and optical dielectric constant ($\varepsilon_\infty = n^2$) of binary mixtures of Chlorobenzene (CB) with n-Butanol (n-BuOH) over the entire concentration range (0.0, 0.1, …. 1.0) by mole fractions are measured at fix frequency 2 MHz using precision LCR meter and Abbe's refractometer (λ = 589 nm) respectively at 303.15 K temperatures. The excess static dielectric constant $(\varepsilon_0)^E$, optical dielectric constant $(\varepsilon_\infty)^E$, linear correlation parameter (g_{rr}), mutual linear correlation parameter (g_{ab}), excess Helmholtz free energy functions (DF) and excess molar polarization (DP), Bruggeman parameter (f_B) were evaluated. The variations of these parameters with composition indicate the presence of molecular interaction between the participating components in mixtures. The static dielectric constant values of binary liquid mixtures were predicted using several mixing models and compared with experimentally measured (ε_0) values in terms of average percentage deviation (APD).

Keywords: Static dielectric constant; Bruggeman parameter; mixing models; Winkelmann and Quitzsch theory.

Abstract ID: RSMPPHY16

Effective Field Theory Based Study of Charm Baryons

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We study the weak decay properties of charmed Omega baryons within an effective field theory framework. Starting from the weak effective Hamiltonian, heavy quark effective theory is employed to organize the relevant operator structures governing charm-quark transitions. The required hadronic matrix elements are evaluated using the Covariant Confined Quark Model, which provides a fully relativistic and confinement-consistent description of baryon structure. In the present work, we focus on the calculation of strong coupling constants characterizing the internal dynamics of charmed Omega baryons. These strong couplings serve as essential non-perturbative inputs for the systematic determination of weak transition form factors and future phenomenological studies of exclusive weak decays.

Keywords: charmed baryons; Covariant confined quark model; Weak decay.

Abstract ID: RSMPPHY17

Structural and Optical Characterization of $ReSe_2$ Crystal with Insights into Photodetection Behavior

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Rhenium diselenide ($ReSe_2$), a layered transition metal dichalcogenide (TMDC), is of interest for optoelectronic devices due to its semiconducting band gap and visible-light absorption. In this study, bulk $ReSe_2$ single crystals were synthesized and characterized to explore their potential in photodetection. X-ray diffraction (XRD) confirmed the triclinic crystalline structure with good crystallinity, while scanning electron microscopy (SEM) revealed layered platelet-like morphology. Energy-dispersive X-ray analysis (EDAX) verified the stoichiometric composition of Re and Se across the surface. Optical characterization through UV–Vis spectroscopy indicated a clear absorption edge, corresponding to a direct band gap of ~1.6 eV, suitable for visible-light detection. The preliminary device fabrication using $ReSe_2$ crystals demonstrated stable photoresponse under illumination, highlighting the material's capability as an efficient channel for next-generation photodetectors. This work underscores the strong correlation between crystal structure, optical properties, and device behavior of $ReSe_2$, paving the way for its further performance enhancement through controlled doping strategies and material modifications.

Keywords: TMDC; Crystal; $ReSe_2$; Characterization; Photodetector

Abstract ID: RSMPPHY18

Growth of $SbSnS_3$ single crystal by Bridgman technique and exploration of its photodetection capabilities and thermoelectric performance

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Looking at the literature survey, it seems to be the first report on growth of Antimony Tin Trisulphide ($SbSnS_3$) crystal with 5.8 cm length and 1.0 cm diameter by vertical Bridgman technique. The validation of the orthorhombic crystal structure of $SbSnS_3$ is verified through outcomes from powder X-ray diffraction pattern. The stoichiometry of the grown crystal is corroborated via energy dispersive X-ray analysis, while FEG-SEM reveals a well-defined layered surface morphology. The Raman spectra depicted prominent peak at 313.89 cm^{-1} corresponding to A_{1g} vibrational mode. Optical reflectance spectroscopy substantiated that $SbSnS_3$ crystal possesses a direct bandgap of 1.54 eV, rendering it a suitable candidate for potential solar cell applications. Thermoelectric transport measurements carried out over the temperature range of 300 K to 573.15 K show a consistently positive Seebeck coefficient, confirming the p-type semiconducting nature of the crystal. A temperature dependent reduction in thermal conductivity is observed, leading to a modest thermoelectric performance with a maximum figure of merit (ZT) of 0.91×10^{-4} at 573.15 K, which is higher than that reported for Sb_2S_3 crystal. Furthermore, the room temperature I-V characteristics under both polychromatic and monochromatic illumination (532 and 650 nm) reveal a strong photoresponse, the photodetector shows a high responsivity of 306.46 μA/W and a detectivity of 86.88×10^6 Jones at an applied bias of 20 V, highlighting the excellent photosensitive performance of the $SbSnS_3$ crystal.

Keywords: $SbSnS_3$, crystal, Vertical Bridgman technique, Thermoelectric, I-V characteristics.

Abstract ID: RSMPPHY19

Structural, Optical, and Photocatalytic Properties of Hydrothermally Synthesised WO_3–CNT Nanocomposites

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Tungsten trioxide (WO_3) nanoparticles are an important metal oxide semiconductor that has attracted considerable attention due to its promising structural and optical properties; however, further modification is required to enhance its Photocatalytic performance. In the present study, WO_3–carbon nanotube (CNT) nanocomposites were successfully synthesised with CNT concentrations of 1%, 3%, and 5% using a hydrothermal method. Sodium tungstate dihydrate ($Na_2WO_4 \cdot 2H_2O$) was employed as the tungsten precursor, while CNTs were dispersed in distilled water to ensure uniform distribution within the reaction medium. Hydrochloric acid (HCl) was used as the precipitating agent, and oxalic acid ($(COOH)_2 \cdot 2H_2O$) served as the capping agent. The resulting solution was filtered, washed three times with methanol and distilled water to remove residual impurities, then oven-dried and ground into a fine powder. The dried samples were calcined at 600 °C in a furnace to obtain crystalline WO_3–CNT nanocomposites. Structural characterisation of the synthesised nanocomposites with varying CNT loadings was performed using powder X-ray diffraction and Raman spectroscopy, confirming the formation of crystalline WO_3 and the successful incorporation of CNTs. The optical properties of the nanocomposites were investigated using UV–Vis Reflectance spectroscopy. The elemental composition and purity of the synthesised samples were analysed using energy-dispersive X-ray spectroscopy. This study provides valuable insight into the role of CNT content in WO_3 as we add CNT degradation Increases for Methylene Blue (MB dye) under a UV light source.

Keywords: Tungsten trioxide; Carbon nanotubes; Nanocomposites; Hydrothermal Synthesis; Photocatalytic performance.

Abstract ID: RSMPPHY20

Total scattering cross sections calculations for Electron impact on CF_2 radical

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Total scattering cross sections for electron impact on CF_2 in the gas phase are presented from 0.1 eV to 2000 eV. Computation of such e - CF_2 cross sections over such a wide range of energy is reported for the first time employing two distinct formalisms. From 0.1 eV to the ionization threshold of the target we employed the ab-initio R-matrix method, while at higher energies we used the Spherical Complex Optical Potential (SCOP) method. At the crossing point, the two theories match one another quite well and hence prove that they are consistent with one another. A quantum chemistry code is utilized to generate the target properties which are in good agreement with earlier reported data. The calculations show a peak at 0.81 eV using the Static Exchange Polarization (SEP) model and at 1.86 eV using a Static Exchange (SE) model which is a reflection of the formation of a Π_u shape resonance state. These values are close to theoretical calculations by Rozum et al. [J. Phys. Chem. Ref. data, 35, 267 (2006)] with a peak at 0.89 eV for SEP model and 1.91 eV for SE model. Lee et al. [Phys. Rev. A, 74, 052716 (2006)] have also reported a peak at 1.65 eV. The total cross sections presented here are in good agreement with other experimental and theoretical calculations. These results show that the techniques employed here can be used to predict cross sections for other targets for which data is scarce or not available. This methodology maybe integrated into online databases such as the Virtual Atomic and Molecular Data Centre (VAMDC) to provide cross section data required by many desperate users.

Keywords: R-matrix method; ab-initio calculations; Spherical Complex Optical Potential; Total cross sections, CF_2.

Abstract ID: RSMPPHY21

Flexible Self-Powered Photoelectrochemical Photodetector Based on $AgBiS_2$ Nanoflakes for High-Performance Broadband Photoresponse

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Metal chalcogenide–based semiconductors have recently attracted significant attention for next-generation optoelectronic devices owing to their exceptional electronic and optical properties. These materials are cost-effective, compositionally versatile, and exhibit a direct bandgap, strong light–matter interaction, and pronounced quantum confinement effects. Photoelectrochemical photodetector (PEC-PD) research primarily focuses on achieving high sensitivity and intrinsic self-powered operation through the engineering of efficient photoelectrode materials and optimized charge-transfer interfaces. In this work, silver bismuth disulfide ($AgBiS_2$) crystals were successfully grown using the direct vapor transport (DVT) method. Subsequently, $AgBiS_2$ nanoflakes were prepared via liquid-phase exfoliation (LPE) and deposited as thin films onto indium tin oxide (ITO)-coated polyethylene terephthalate (PET) substrates using electrophoretic deposition. The structural, morphological, and optical properties of the exfoliated nanoflakes were systematically characterized, confirming the successful formation of high-quality $AgBiS_2$ nanostructures. The photoresponse performance of the $AgBiS_2$ film-based PEC photodetector was evaluated under illumination with different wavelengths. Under a 405 nm light source, the device exhibited a maximum responsivity of 55.34 $\mu A\ W^{-1}$ and a detectivity of 1.036×10^8 Jones in self-powered mode, measured using a Keithley 2400 Source Measure Unit (SMU). These results demonstrate the excellent potential of $AgBiS_2$ nanoflakes for applications in PEC-based photodetection and flexible optoelectronic devices.

Keywords: Metal Chalcogenide; PEC-PD; Nanoflakes; Thin Film

Abstract ID: RSMPPHY22

Hematology Analysis using Lateral Shearing Digital Holographic Microscope

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Recently, optical imaging techniques as a system are becoming more popular for disease diagnosis due to their non-invasive and stain-free nature. Digital holographic microscopy (DHM) techniques have been employed to study the morphology and mechanical properties of RBCs to facilitate disease diagnosis. It has been shown using a Lateral Shearing Interferometer (LSI) that the membranes of healthy red blood cells (RBCs) and sickle cell disease RBCs may fluctuate at different frequencies which can be beneficial for cell identification. The LSI is a common-path self-referencing DHM which is temporally more stable than two-beam configurations. It also requires less components that fulfill our need for cost-effective, compact, and field-portable device, suitable for measurement of nanometer level thickness fluctuations of red blood cells. A laser light passing through the sample kept on a translational stage followed by a microscope objective. A fused silica glass plate kept at an angle 45° to create 2 laterally sheared versions of object wavefront from the front and back surface of the plate. The interference pattern thus created is captured on a CCD. Holograms of object and area on glass slide not containing any object part are recorded and phase profiles extracted by subtracting one from another. Samples of Sickle-cell disease patients as well as those of healthy volunteers were collected. Thin blood smears from these samples were prepared and holographic images as well as videos of 20s collected for each sample. Physical and Mechanical Parameters extracted from the images and videos respectively are fed to machine learning algorithms. The algorithm then classifies them into Sickle-positive and Sickle-negative cells and cluster based on the differences in parameters.

Keywords: red blood cells; Digital Holographic Microscope; hologram, machine learning; classification

Abstract ID: RSMPPHY23

Direct Vapor Transport (DVT) Grown Indium Selenide (InSe) and its Liquid-Phase Exfoliation for High-quality 2D-Nanoflakes

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Layered metal chalcogenides[1] have garnered considerable interest owing to their distinctive structural, electronic [2], and optical [3] properties, rendering them ideal candidates for a diverse array of electronic and optoelectronic applications. In this study, we present the synthesis of nanoflakes derived from Indium Selenide (InSe), a layered metal chalcogenide, utilizing a controlled synthesis method achieved through Direct Vapor Transport of stoichiometric amounts of Indium (99.9% pure) and Selenium (99.99% pure) powders in a dual zone high-temperature furnace equipped with PID control. The resulting InSe ingot is characterized in terms of its structural, optical, and morphological properties. The preparation of nanoflakes was conducted using the Ultrasound-Assisted Liquid Phase Exfoliation technique in an N-Methyl-2-Pyrrolidone (NMP) medium, subjected to bath sonication for a duration of 15-16 hours. The resultant solution was then centrifuged, and the collected supernatant was thoroughly analyzed for structural and morphological characterization employing X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Particle Size Analysis via Dynamic Light Scattering (DLS), and Transmission Electron Microscopy (TEM). The optical properties were examined using UV-VIS spectroscopy, which confirmed the existence of size-dependent quantum confinement effects. The findings indicate that the synthesized nanoflakes display tunable electronic and optical properties, positioning them as promising materials for next-generation device applications.

Keywords: Direct Vapor Transport (DVT) method; Ultrasound-Assisted Liquid Phase Exfoliation; 2D-InSe Nanoflakes; Structural & Optical Characterizations.

Abstract ID: RSMPPHY24

Investigations on Structural, Microstructural and Electrical Properties of CuO:TiO_2 Nanocomposites

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In the present study, CuO:TiO_2 nanocomposites were successfully synthesized using sol-gel method. For Structural study, X-ray diffraction (XRD) measurements were carried out, which confirms that CuO nanoparticles have a monoclinic crystal structure and TiO_2 nanoparticles have a tetragonal crystal structure. Crystallite size varies from 44.98 nm to 29.64 nm and strain increases from 0.00162 to 0.00327 with TiO_2 wt%. Energy dispersive spectroscopy (EDX) suggest that the there is no extra contamination present in the all five samples. The morphological and optical studies of pure and nanocomposite samples were characterized using FESEM, FTIR and PL spectra. Dielectric investigations were carried out in the frequency range of 1 kHz–2 MHz using the cole-cole relaxation and UDR model. Frequency-dependent electrical conductivity has been understood on the basis of Jonscher's universal power law, and it follows the CBH conduction mechanism, with the maximum barrier height (Wm) calculated. The ac conductivity was found to increase from CT0 to CT100. The electrical characteristics are carefully examined in relation to defects, disorder, oxygen vacancies.

Keywords: Sol–gel method; Impedance Spectroscopy; Electrical Conductivity; PL, FTIR.

Abstract ID: RSMPPHY25

Photoelectrochemical Type Photodetector Based on $TiSe_2$ Thin Films Prepared by Scalable Physical Vapour Deposition

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Transition metal dichalcogenides (TMDCs) offer unique structural and optical properties that make them promising for optoelectronic applications[1,2]. In this work, titanium diselenide ($TiSe_2$) thin films were deposited using a thermal evaporation technique and subsequently characterized by X-ray diffraction (XRD) and Raman spectroscopy, confirming the formation of pure phase $TiSe_2$ with good crystallinity[3,4]. The films were then integrated into a photoelectrochemical (PEC)-type photodetector architecture, which exhibited excellent performance including high sensitivity, fast response–recovery times, and stable operation under illumination. The enhanced photoresponse arises from efficient carrier generation and separation enabled by the layered structure and strong light absorption of $TiSe_2$. These findings demonstrate that thermally evaporated $TiSe_2$ thin films provide a scalable and cost-effective route for fabricating high-performance PEC photodetectors, underscoring their potential in next-generation optoelectronic and sensing technologies.

Keywords: $TiSe_2$; PEC type Photodetector; Optoelectronic device; Physical Vapour deposition.

Abstract ID: RSMPPHY26

Synhtesis, Characterization and Application of Niobium Pentoxide (Nb_2O_5) Nanoparticles as a Photocatalyst

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This study investigates the synthesis, characterization and photocatalytic application of niobium pentoxide (Nb_2O_5) nanoparticles (NP's). The nanoparticles were synthesized using the Hydrothermal method, followed by calcination at 700°C to achieve the orthorhombic phase structure.Comprehensive characterizations were performed to study the structural, optical properties of synthesized Nb_2O_5 NP's. X-ray diffraction (XRD) analysis confirmed the orthorhombic phase, while UV-visible spectroscopy was utilized to determine the optical bandgap using Tauc's plot, yielding a direct bandgap of 3.38 eV. HRTEM analysis was done to verfity average particle size of the prepared NP's. Furthermore, EDAX analysis was employed to identify elemental composition of the NP's. The photocatalytic efficiency of the synthesized Nb_2O_5 nanoparticles was evaluated by studying the degradation of Rhodamine B (RhB) dye under UV light in a photocatalytic reactor at different catalyst dosages. The results demonstrated an 70%+ degradation of RhB dye for all different alternating conditions after 5 hours of UV exposure, highlighting the material's potential as an effective photocatalyst for organic pollutant remediation.

Keywords: Niobium Pentoxide, Hydrothermal method, Photocatalysis, Photocatalytic Reactor, RhodamineB Dye.

STATISTICS

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Abstract ID: RSMOSTAT01

Adaptive Extended EWMA Control Chart for Monitoring Normal and Non-Normal Processes

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Exponentially weighted moving average (EWMA) control charts are widely used in statistical process control due to their effectiveness in detecting small and moderate shifts in process parameters. Numerous modifications of the EWMA chart have been proposed to improve detection performance; however, many existing approaches rely on fixed smoothing parameters or adaptive mechanisms that do not fully exploit extended chart structures. These limitations can reduce detection efficiency, particularly when monitoring processes characterized by non-normal behaviour. In this study, an adaptive extended EWMA control chart is proposed that integrates an extended EWMA formulation with a data-driven adaptive smoothing mechanism. The proposed chart dynamically adjusts its smoothing parameter based on real-time information while incorporating both current and previous observations to enhance sensitivity. Control limits are obtained through Monte Carlo simulation to achieve a specified in-control average run length. The performance of the proposed chart is evaluated through extensive simulation experiments under normal, exponential, gamma, and Student's *t* distributions. The results demonstrate that the proposed adaptive extended EWMA chart provides improved detection performance compared to conventional adaptive EWMA schemes and exhibits competitive behaviour relative to extended EWMA structures, particularly under skewed and heavy-tailed process distributions. These findings suggest that the proposed chart offers a robust and flexible tool for process monitoring in practical applications involving non-normal data.

Keywords: Statistical Process Control, EWMA Control Chart, Adaptive Control Chart, Extended EWMA, Non-Normal Distributions

Abstract ID: RSMOSTAT02

Statistical Foundation for Multivariate Control Chart Pattern Recognition

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Multivariate Control Chart Pattern Recognition (MCCPR) is an important technique used to detect shifts and unusual patterns in complex industrial systems that involve multiple interrelated variables. While most existing MCCPR approaches rely on computational or machine learning methods, they often lack a statistical explanation of their underlying behavior. This study establishes a theoretical foundation by deriving the statistical distribution of the MCCPR monitoring statistic. The analysis demonstrates that this statistic follows a noncentral chi-square distribution, where the non-centrality parameter reflects both the degree of correlation among process variables and the magnitude of process shifts. Based on this result, analytical expressions are developed for major performance indicators, including false alarm probability, detection power, Average Run Length (ARL) and misclassification probability. Simulation studies validate that the theoretical predictions align closely with empirical outcomes. This research strengthens MCCPR with a rigorous statistical basis, transforming it from an empirical approach into a transparent and interpretable tool for monitoring multivariate processes and ensuring quality control.

Keywords: Multivariate Control Chart Pattern Recognition, Non-central chi-square, Misclassification Probability, Average Run Length, Statistical Quality Monitoring.

Abstract ID: RSMOSTAT03

Sustainable Inventory Model with Trade Credit Policy and Carbon Emission Cost under Exponential Lead Time Demand

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Sustainable inventory management has become a key focus area for modern supply chains as organizations face increasing pressure to balance economic performance with environmental responsibility. One major challenge in this direction is the reduction of carbon emissions, which arise from activities such as production, transportation and warehousing. At the same time, trade credit has emerged as an essential financial policy through which suppliers allow buyers to delay payment for a specified credit period. Another critical factor affecting inventory cost is uncertainty in lead-time demand. Variability in order processing, transportation delays and market fluctuations make lead time unpredictable. Modelling lead-time demand using an exponential probability distribution provides a realistic approach for minimizing stockout risk and determining an appropriate reorder level. This research develops a new sustainable inventory model by combining carbon emission cost, trade credit policy and exponential lead time demand. The objective is to determine the optimal order quantity, reorder level, their corresponding total cost and to analyse how changing parameters influence the overall system, thereby suggesting good managerial practices that lower total cost while balancing financial and environmental considerations.

Keywords: Inventory model, lead time demand, exponential distribution, trade credit, carbon emissions.

Abstract ID: RSMOSTAT04

Hybrid structural segmentation with Bayesian regime inference using the Cubic Inverted Kumaraswamy Model

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We propose a **hybrid Bayesian change-point detection (CPD) framework** based on the Cubic Inverted Kumaraswamy (CIKw) distribution, a flexible four-parameter model capable of capturing skewness, heavy tails, bimodality, and non-monotone hazard rates. Structural changes are first identified using the Pruned Exact Linear Time (PELT) algorithm, after which segment-specific CIKw parameters are estimated within a Bayesian framework. Conditional on the estimated change points, posterior inference for each segment is carried out using Hamiltonian Monte Carlo with the No-U-Turn Sampler (NUTS). Finite-sample performance is evaluated through simulation studies using bias, root mean squared error (RMSE), mean absolute error (MAE), and convergence diagnostics, while change-point estimation accuracy is assessed via Hausdorff distance. Model adequacy and comparative performance are examined using Bayesian information criteria, including DIC, WAIC, and leave-one-out cross-validation (LOO). Simulation results demonstrate accurate recovery of distributional parameters and reliable detection of structural changes. Applications to the Indian Gini index economic data illustrate the practical effectiveness and flexibility of the proposed hybrid CIKw-based CPD methodology.

Keywords: Change point detection; Hybrid Bayesian Modeling, PELT algorithm; Time series segmentation

Abstract ID: RSMOSTAT05

Comparative Analysis of Measurement Error Correction Techniques in Generalized Linear Models: A Performance-Based Simulation Study

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Measurement error in explanatory variables is a common problem in real data analysis and can seriously affect the accuracy of regression results if it is ignored. Such errors often arise due to inaccurate measurement tools, reporting mistakes, or the use of proxy variables. When measurement error is present, standard regression methods may produce biased estimates, leading to incorrect conclusions. The main objective of this study is to compare different measurement error correction techniques and to identify a method that performs well across a wide range of regression models. The techniques considered in this study include the instrumental variable method, regression calibration, and the simulation–extrapolation approach. A simulation-based framework is used, where regression models with response variables following binomial, Poisson, exponential, gamma, and negative binomial distributions are examined. Data are generated under an additive measurement error structure, and model parameters are estimated using each correction technique. The estimated regression coefficients are then compared with the true parameter values used to generate the data. The results show that ignoring measurement error leads to large bias in parameter estimates for all models considered. While the instrumental variable and simulation–extrapolation methods reduce bias in some cases, their performance is not consistent across different distributions. Regression calibration performs well in all settings and provides estimates that are closest to the true parameter values. These findings highlight the importance of correcting for measurement error in generalized linear models and show that regression calibration is a simple, stable, and reliable method for handling measurement error across different exponential family regression models.

Keywords: Measurement Error, Regression Calibration, Instrumental Variable, Simulation–Extrapolation, Generalized Linear Models.

About the Sardar Patel University

The great visionary and architect of modern India, Sardar Vallabhbhai Patel, was the source of the genesis of the Sardar Patel University (SPU) in the year of 1955. Started as a rural University for the upliftment of the rural populace. It has emerged as a reputed seat of learning and has created its own niche in the fields of academics and research. The University is NAAC accredited with an 'A' grade for the duration 2023 2028. The University campus is spread across the area of around 87 acres and has state of the art infrastructural facilities for teaching-learning and research. The university offers 46 PG, 4 UG and 31 doctoral programs through its 27 postgraduate departments, a constituent college and 148 affiliated colleges. More than 4000 students enrol for the study at the university every year. More than 400 PhD students are engaged in research work in the university. Researchers of the university annually publish more than 300 research articles in reputed journals. The university is committed to foster in dynamic ecosystem that supports research and innovation. The university has been granted Rs.3 Crores under the Student Start Up and Innovation Policy (SSIP) 2.0 of the Government of Gujarat. A section-8 company Sardar Patel Startup & Entrepreneurship Council (SPSEC) has been established to promote startups and entrepreneurship among the students and faculties of the university. SPU has some unique features. It has an agro Economic Research Centre (for the states of Gujarat, Rajasthan, Dadra & Nagar Haveli) and a Cost of Cultivation Scheme for Gujarat established by the Ministry of Agriculture, Govt. of India. The university also runs a Community Science Centre funded by GUJCOST, Govt. of Gujarat. SPU has its own Community Radio Station. A Centre for Indian Knowledge System (IKS) has been established recently. Also, SPU was nominated for the International Green University Award 2024 by the Green Mentors Institution, affiliated with ECOSOC of the United Nations. Furthermore, the university has launched a significant event, "Sardar Saga" commemorating the 150th anniversary of Bharat Ratna Shri Sardar Vallabhbhai Patel through a series of creative and vibrant programs throughout the year dedicated to his legacy.