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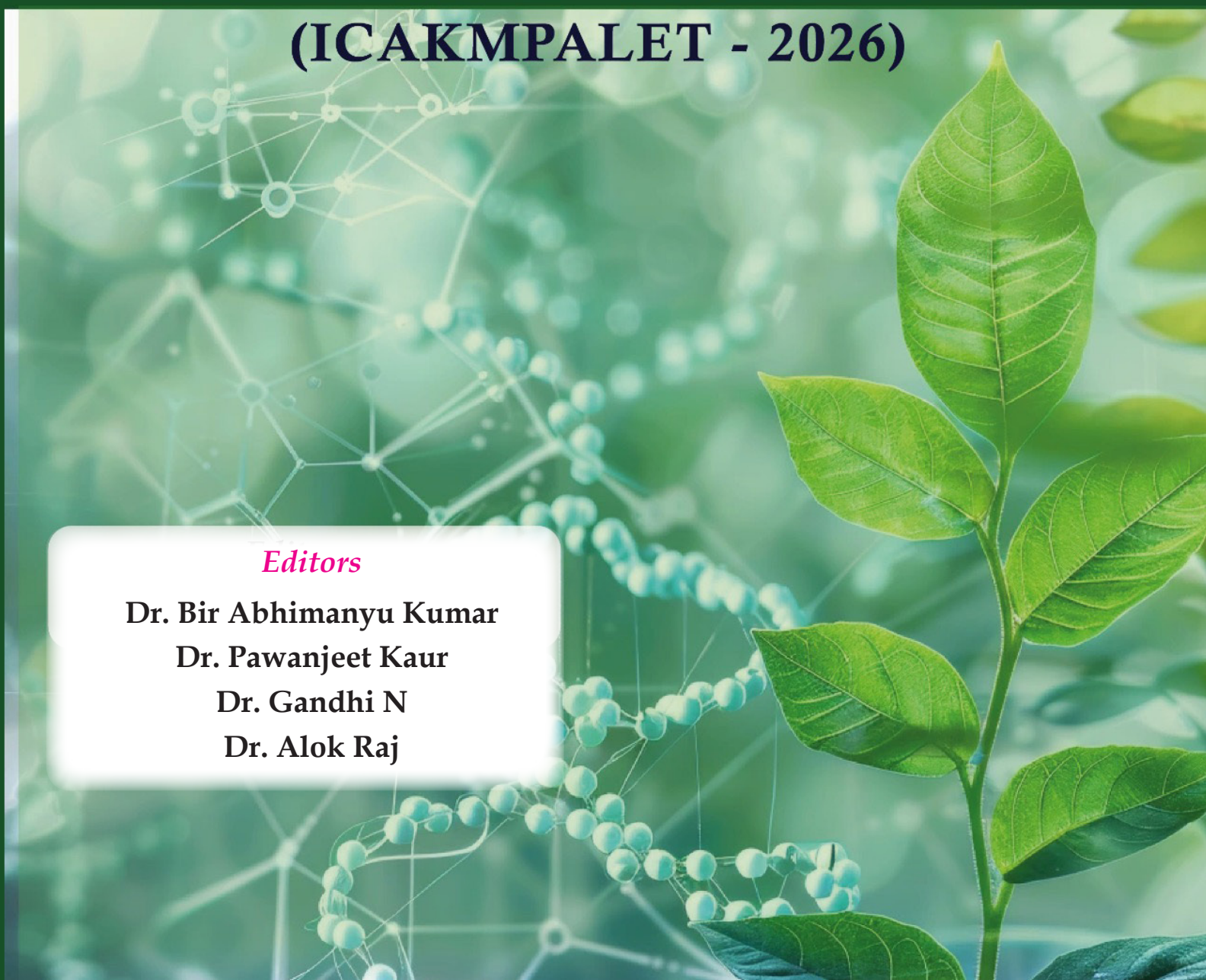
4th INTERNATIONAL CONFERENCE

On

Advancing Knowledge from Multidisciplinary Perspectives in Agricultural, Life Sciences, Engineering & Technology – 2026

(ICAKMPALET - 2026)



Editors

Dr. Bir Abhimanyu Kumar

Dr. Pawanjeet Kaur

Dr. Gandhi N

Dr. Alok Raj

A Conference Proceedings of

4th International Conference on Cimate Advancing Knowledge From Multi-Disciplinary Perspectives in Agricultural, Life Sciences, Engineering & Technology - 2026

(ICAKMPALET - 2026)

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SIDVI FOUNDATION

Hyderabad- 500084, Telangana

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Title: A Conference Proceedings of 4th International Conference on Cimate Advancing Knowledge From Multi-Disciplinary Perspectives in Agricultural, Life Sciences, Engineering & Technology - 2026

Editors in Chief: Dr. Rania Lampou, Dr. Aruna Kumari Nakkella

Editors: Dr. Bir Abhimanyu Kumar, Dr. Pawanjeet Kaur, Dr Gandhi N, Dr Alok Raj

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Message from the Chief Guest

February 9, 2026

It was a great honour and privilege for me to serve as the Chief Guest at the *International Conference on Advancing Knowledge from Multidisciplinary Perspectives in Agricultural, Life Sciences, Engineering and Technology (ICAKMPALET–2026)* organized by the SIDVI Foundation under the aegis of the SIDVI Society for Research and Development (SSRD). I convey my sincere appreciation to the organizers, speakers, researchers, academicians, industry professionals, and students whose enthusiastic participation contributed to the success of this international academic event.

The conference successfully brought together scholars from diverse disciplines to deliberate on contemporary challenges and emerging opportunities in science, technology, agriculture, environment, and management. The multidisciplinary nature of the event encouraged constructive dialogue, innovative thinking, and meaningful collaborations among participants from different academic and professional backgrounds.

The papers included in this conference proceedings reflect the depth, diversity, and relevance of the research presented during the conference. They address important themes such as sustainable development, emerging technologies, environmental management, agricultural innovations, artificial intelligence, and interdisciplinary approaches to societal challenges. Collectively, these contributions demonstrate how integrated research efforts can generate practical solutions to real-world problems.

The proceedings showcase innovative methodologies, fresh perspectives, and application-oriented studies that have the potential to influence future research, policy decisions, and technological advancements. Such scholarly contributions are essential for building resilient, sustainable, and knowledge-driven societies.

The success of this conference was a testament to the dedication and vision of the SIDVI Foundation in promoting research excellence and international academic collaboration. By providing a platform for interdisciplinary exchange, the conference fostered intellectual growth, professional networking, and the sharing of best practices across domains.

I congratulate the organizing committee for the successful conduct of the conference and the timely publication of these proceedings. I also commend all authors whose valuable research work forms an important part of this publication. I am confident that the ideas and findings presented here will inspire further research, innovation, and collaboration in the years ahead.

With my best wishes for continued academic excellence and impactful research.

Chief Guest
ICAKMPALET–2026
International Conference
SIDVI Foundation

Dr. Rania Lampou
STEM Instructor & Researcher, Global Academician
Ministry of Education, Religious Affairs and Sports, Greece

Conference Note for Proceedings

On the occasion of **International Environmental Education Day** which is observed annually on 26th January, SIDVI Foundation organised 4th International Conference on Advancing Knowledge from Multidisciplinary Perspectives in Agricultural, Life sciences, Engineering & Technology – 2026 (ICAKMPALET – 2026) & International Award Ceremony (PRATISHTA – 2026) on 26th- 27th January 2026 (Online mode).

The occasion is very important as this day is dedicated to raising global awareness about various environmental issues like environmental pollution, global warming, deforestation, biodiversity degradation, etc and promoting the integration of sustainability into educational systems worldwide. By emphasizing the interdependence between humans and the natural world, the observance encourages individuals to identify local and global ecological issues and develop the skills necessary to address them.

True to the spirit of International Environmental Education Day, the International Conference organised by SIDVI Foundation provided an excellent academic opportunity to young reseachers, scientists and teachers to present their research work and findings covering multidisciplinary areas.

The academic presentations highlighted the importance and significance of various current issues such as Arsenic contamination in groundwater, recent advances for management of Diabetes Mellitus, use of Nanoparticles in defence, importance of millets in our diet, agriculture issues, nature friendly Polymers, health impacts of air pollution, use of robotics, water management practices, issues and challenges of plastic pollution, etc. The International Conference also provided a great opportunity to address these issues and challenges through innovative research and development initiatives in the area of environment, agriculture, health care, engineering, green technology & challenges and opportunity of using Artificial Intelligence (AI).

During the International Conference People making significant contribution in the field of teaching, research and innovation were awarded suitably by the SIDVI Foundation.

Dr. Bir Abhimanyu Kumar
Associate Professor
NCERT

KEYNOTE

Advancing Sustainability in the Digital Age

In an era marked by rapid digital transformation and mounting environmental challenges, it is crucial that we reimagine sustainability through the lens of innovation. The international conference provided an ideal platform to explore this intersection, bringing together diverse minds committed to reshaping the future.

My keynote address, "Advancing Sustainability in the Digital Age," focused on how emerging technologies—such as AI, IoT, data analytics, and smart systems—can be harnessed to build sustainable solutions across sectors. From smart cities and digital agriculture to green chemistry and circular economy models, the talk highlighted how interdisciplinary applications of digital tools are already transforming the way we monitor, mitigate, and manage ecological impact.

This conference exemplified the power of collaboration across disciplines—chemistry, engineering, computer science, environmental studies, and more—to address shared global concerns. Our collective insights reaffirmed that sustainability is not a standalone goal but a shared responsibility that thrives on knowledge exchange, inclusive dialogue, and real-world application.

We must continue to empower the next generation of scientists and innovators through skill-based, experiential, and problem-solving education. It is through such global gatherings that we not only exchange ideas but also inspire action toward a greener, more equitable, and technologically resilient future.

I extend my sincere thanks to SIDVI FOUNDATION and Dr. Aruna Kumari ma'am for the opportunity to participate as a Keynote Speaker and Conference Chairperson in this impactful event. It was a privilege to contribute to a dialogue that merges science with sustainability for the betterment of humanity.

Dr. Pawanjeet Kaur
Assistant Professor – Chemistry
Symbiosis Skills and Professional University, Pune, India.

Global and National Opportunities in Pulse Production and Trade in India

Vikas Kumar

ICAR – Indian Agricultural Statistics Research Institute, New Delhi

A.L. Yadav

ICAR-Indian Agricultural Research Institute, New Delhi

Sudhir K Rawat

KVK Aligarh, UP

Chandan Singh

Vikrant University, Gwalior, 5-KVK Jamui, Bihar

RN Patel

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Introduction: Pulses are edible seeds of leguminous plants and a rich source of plant protein (20–25% by weight), vitamins, and minerals, making them vital for global nutrition security. India's diet relies heavily on pulses as the major source of protein, especially in vegetarian populations. India is a central player in global pulse production, consumption, and trade.

Global Pulse Production and Trade Landscape: Globally, pulses were cultivated on about 97 million hectares, yielding 96 million tonnes (2022 figures). Asia accounts for >44% of global pulse production, while developing countries contribute nearly 75% of global output.

International Trade: 20% of global pulse production enters international trade. Top global exporters include Canada (26.6%), Myanmar (11.2%), Australia (10.3%), and Russia (9.4%). Global pulse exports reached USD 12.5 billion in 2022, up from USD 9.77 billion in 2020, reflecting rising demand. India and China are among the largest pulse importers, accounting for ~15–17% each of global import quantity, with India leading by value.

Opportunities in Global Trade: Rising health consciousness and plant-based diets worldwide are boosting international demand for pulses. Trade liberalization and multilateral agreements (e.g., WTO, bilateral FTAs) provide market access opportunities, especially for high-quality pulse varieties (chickpeas, lentils, peas).

India's Pulse Production Dynamics: Domestic Production Trends: India is the largest producer of pulses in the world, producing 25–28 million tonnes annually. All-India production increased from 163.23 lakh tonnes to 244.93 lakh tonnes, indicating long-term growth.

Crop Composition: Major pulse crops and approximate production share is as Chickpeas (gram) 38–41%, Peas 21%, Tur (pigeon pea)14–16%, Urad (black gram) and Moong (green gram) 8–12% each and for Lentils (masoor) 6% .

Area and Yield Challenges: Despite high production, India's average yield (0.74 t/ha) remains below the global average (0.99 t/ha), indicating room for productivity improvement.

India's Pulse Consumption, Imports & Exports:

Consumption Trends: India is the largest consumer of pulses, accounting for ≈27% of global consumption. Per capita pulse availability is highly influenced by production, imports, and domestic demand shifts.

Import Dependency: Despite large domestic output, India remains a net importer due to supply-demand gaps for specific pulses. For year 2024–25, India made the imports of 7.34 MMT. The leading importers were Australia as 1.885 MMT, Myanmar 1.05 MMT, Russia 0.718 MMT and Tanzania, Brazil, Sudan, Malawi – other significant suppliers.

Import Composition (2024–25): The major import in pulse are Peas at 2.166 MMT, Desi chickpeas 1.506 MMT, Pigeon peas 1.223 MMT, Lentils 1.219 MMT etc

Export Performance: India also exports pulses, though at much lower volumes than imports. India exported 793,291 MT of pulses valued at USD 854.89 million in FY 2024–25. Export destinations include Bangladesh, China, UAE, USA, and Sri Lanka. India's calendar year 2025 export (Jan–Nov) reached 876 KMT, a significant rise over 2024.

Opportunities in Pulse Sector: The opportunities in pulse sector are mentioned below.

a) Government Initiatives: Central and state governments in Indian have taken several initiatives for enhancement of pulse production.
   - Mission for Aatmanirbharta in Pulses with an □11,440 crore budget aims to achieve 350 lakh tonnes of production by 2030–31, enhancing self-sufficiency.
   - MSP and Procurement:
   - Enhanced Minimum Support Prices (MSPs) have encouraged cultivation, especially of chickpeas and tur.

b) State Success Stories:
   - Gujarat doubled pulse production in 6 years (2019–20 to 2024–25), with area expanding from 9 to 14.39 lakh hectares and productivity rising from 1,173 to 1,495 kg/ha.

c) Trade and Export Opportunities
   - Global Market Access: Rising protein demand, plant-based diets, and nutritional awareness have increased global pulse consumption. The demand exists for value-added pulse products (split dals, processed goods) in Middle East, Africa, and Southeast Asia.
   - Trade Agreements: Participation in global food trade fairs (e.g., Gulfood 2026) and CEPA agreements (e.g., with UAE) can expand export markets.
   - Niche Product Exports: Specialty pulses (organic, heirloom varieties) have growing demand in Europe and North America.

Challenges and Mitigation: India's pulse yields are below global averages, constraining competitiveness. Despite production growth, dependence on imports remains high for peas, lentils, and pigeon peas. Storage, market linkages, and value chain inefficiencies inhibit export growth.

Key Mitigation Areas: Development of high-yielding, climate-resilient pulse varieties. Market Infrastructure may be created as Cold storage, processing units, and export facilitation centers. The policy Supports Stable MSP regimes, export incentives, and tariff rationalization should be enhanced.

Conclusion: India stands at a strategic juncture in the global pulse economy—as the largest producer, consumer, and a major importer. Rapidly evolving global demand for protein-rich foods and expanding trade networks present significant export and investment opportunities. Strengthening domestic production efficiency and value chain capabilities can transform India from a net importer to a major global pulse exporter, benefiting farmers and trade partners alike.

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MEETING LINK https://us06web.zoom.us/j/85709668419?pwd=CLfMGiBv1j8wqYGhYeypFbbbsP1yza.1			
Session Name with Date 26/1/2026	**Time**	**Resource Person**	**Topic**
INAUGURATION	5.30 PM	Lightening the lamp	By Honorable Guests
		Prayer Song	Team SIDVI
		Welcoming the Guests	Organizing Team
		Chief Guests	Prof A Srinivasa Rao, Senior S&T Scientist at AYR Studios, Bethesda, MD 20817 USA Sri. Sahithi Shree Prakash Rao Kollaram Former Cyber Security Chief, U.S. Department of Defense, Richmond, VA, USA Dr Dickson Adom Educational Innovations in Science and Technology Kwame Nkrumah University of Science and Technology, Ghana Dr. Rania Lampou STEM Instructor & Researcher, Greek Ministry of Education, Religious Affairs and Sports, Greece Mr Nagababu Abbaraju President, SSRD, SIDVI Foundation
		Special Invitees and Distinguished Guests, Speakers	Dr. Vikas Kumar Senior Scientist (Agricultural Economics), ICAR-Indian Agricultural Statistics Research Institute (IASRI), Pusa, New Delhi.

x

			Dr Bir Abhimanyu Kumar **Associate Professor (Environmental Education) DEE, National Institute of Education, NCERT, New Delhi** **Dr. Pawanjeet Kaur** **Assistant Professor (Chemistry)** **School of Mechatronics Engineering, Symbiosis Skills and Professional University, Pune, Maharashtra, India** **Dr Gandhi N** **Department of Marine Biology, Vikrama Simhapuri University, SPSR Nellore, Andhra Pradesh, India** **Dr. Kaustubh Kumar Shukla** **Associate Professor,** **Dept of Computer Science & Engineering,** **Dronacharya Group of Institutions, Greater Noida, Uttar Pradesh, India**
		Guests of Honor	**Dr D. Jayarajan** **Professor, Program of Medical Lab Technology Faculty of Paramedical Sciences, Assam Downtown University Gauwhathi, Assam** **Dr. N. Baratha Jyoti** **Assistant Professor, Dept of Zoology, Maris Stella College (A), Vijayawada** **Dr Alok Raj** **Assistant Professor, Department of Chemical Engineering, Rashtrakavi Ramadhari Singh Dinkar College of Engineering, Bihar Engineering University, Patna, Bihar, India**
		Publishing Partner	**SIDVI PUBLICATION HOUSE & IJSEAM**
		Releasing the Conference Proceedings	**By Distinguished Guests**

	5.45 PM - 6.00 PM	**Announcement of SIDVI's Distinguished Award** **SENIOR SCIENTIST AWARD** **Prof. (Dr.) Purnima Nag** Professor, Department of Chemistry, Jaipur National University, Jaipur, Rajasthan, India. **EXCELLENCE IN RESEARCH AND DEVELOPMENT AWARD** **Dr. Pawanjeet Kaur** Assistant Professor (Chemistry), School of Mechatronics Engineering, Symbiosis Skills and Professional University, Pune, Maharashtra, India **Dr Gandhi N** Department of Marine Biology, Vikrama Simhapuri University, SPSR Nellore, Andhra Pradesh, India **Dr Alok Raj** Assistant Professor, Department of Chemical Engineering, Rashtrakavi Ramadhari Singh Dinkar College of Engineering, Bihar Engineering University, Patna, Bihar, India	
	6.00PM – 6.30PM	**Addressing the gathering With Special Talk**	**Dr. Rania Lampou** STEM Instructor & Researcher, Greek Ministry of Education, Religious Affairs and Sports, Greece
TECHNICAL SESSION - 1			
	6.30PM – 8.30PM	**Chairperson** **Co-Chairperson**	**Dr. Vikas Kumar** Senior Scientist (Agricultural Economics), ICAR-Indian Agricultural Statistics Research Institute (IASRI), Pusa, New Delhi. **Dr Gandhi N** Department of Marine Biology, Vikrama Simhapuri University, SPSR Nellore, Andhra Pradesh, India
	6.30PM – 6.40PM	**ICKAMPALET202601P001** **Arsenic Contamination of Water: Assessment, Impact, and Mitigation**	. **Akash D. and Pawanjeet Kaur*** Symbiosis Skills and Professional University, Pune, India - 412101
	6.40PM – 6.50PM	**ICKAMPALET202601P002** **Recent Advances in Heterocyclic Frameworks as Bioactive Strategy for management of Diabetes Mellitus**	**Karan Bhalla[a,b] , Shilpi Bhalla[a] ,** [a]Chemistry Department, NIILM University, Kaithal, Haryana, India [b]Guru Nanak Dev Engineering College, Ludhiana, Punjab, India
	6.50PM – 7.00PM	**ICKAMPALET202601P003** **Re-thinking Green Chemistry Metrics: Beyond E-Factor towards a Holistic Sustainability Index**	**Aaditi D. Deshmukh[1] and P. R. Mahalle[2*]** 1.P.G. Department of Chemistry, Late B.S. Arts, Prof. N.G. Science and A.G. Commerce College, Sakharkherda, Tq. Sindkhed Raja, Dist. Buldhana, Maharashtra, India. 2. Assistant Professor and Head, Department of Chemistry, Late B.S. Arts, Prof. N.G. Science and A.G. Commerce College, Sakharkherda, Tq. Sindkhed Raja, Dist. Buldhana, Maharashtra, India.

	7.00PM – 7.10PM	**ICKAMPALET202601P004** **Nanoparticals and Their Applications in Defence Technology**	**Aryan Potdar and Pawanjeet Kaur*** Symbiosis Skills and Professional University, Pune, India
	7.10PM – 7.20PM	**ICKAMPALET202601P005** **A Mathematical Approach to Energy Efficiency in Modern Industrial Systems Using Indian Knowledge System Principles**	**Chanchal B. Deshmukh[1] and C. S. Khodre[2]** 1P.G. Department of Mathematics, Late B.S. Arts, Prof. N.G. Science and A.G. Commerce College, Sakharkherda, Tq. Sindkhed Raja, Dist. Buldhana, Maharashtra, India. 2Assistant Professor and Head, Department of Mathematics, Late B.S. Arts, Prof. N.G. Science and A.G. Commerce College, Sakharkherda, Tq. Sindkhed Raja, Dist. Buldhana, Maharashtra, India
	7.20PM- 7.40PM	**Key Note address** **Dr. Vikas Kumar** Senior Scientist (Agricultural Economics), ICAR-Indian Agricultural Statistics Research Institute (IASRI), Pusa, New Delhi.	
AWARD CEREMONY 7.45 PM – 8.00 PM			
BEST FACULTY FOR TEACHING INNOVATIONS AWARD **Prof.G.Mary Sunanda** HoD, Education, Dr.Braou.Hyd T.S **BEST TEACHER AWARD** **Dr. Mohammad Mansoor** Professor, Dept of Pharmacology, Devaki Amma Memorial College of Pharmacy Chelembra, Pulliparamba, Mallapuram (Dist), Kerala **Dr Santosh Kumar Sahoo** VIT Bhopal University, School of Computing Science and Engineering, Madhya Pradesh **Dr Harshmit Kaur Saluja** Assistant Professor, MBA Department, Institute of Engineering and Technology, Lucknow, Uttar Pradesh, India			
TECHNICAL SESSION - 2			
	8.00PM – 8.10PM	**ICKAMPALET202601P006** **Biodegradable Plastics: Chemistry of Nature-Friendly Polymers**	**Jihan Kandhari and Pawanjeet Kaur*** Symbiosis Skills and Professional University, Pune, Maharashtra, India- 412101
	8.10PM – 8.20PM	**ICKAMPALET202601P007** **Household Air Pollution in India: Implications for Public Health**	**Sivaprasad and Pawanjeet Kaur*** Symbiosis Skills and Professional University, Pune, Maharashtra, India- 412101
	8.20PM – 8.30PM	**ICKAMPALET202601P008** **Carbon Nanotubes in Manufacturing: Applications and Opportunities**	**Aiswarya V. and Pawanjeet Kaur*** School of Mechatronics Engineering, Symbiosis Skills and Professional University, Pune, Maharashtra, India- 412101
		Any other points with the permission of Hon'ble Jury	

	9.00PM	**Closing remarks of Day 1**	
	DAY 2 **27-1-2026**		
	6.00PM	**INVITING THE GUESTS**	
	6.10PM – 6.30PM	**Keynote speech** **Dr. Pawanjeet Kaur** Assistant Professor (Chemistry) School of Mechatronics Engineering, Symbiosis Skills and Professional University, Pune, Maharashtra, India Title: **AI Literacy for STEM Professionals: Tools for Teaching and Research**	
	TECHNICAL SESSION - 3		
	6.30PM – 8.20PM	**Chairperson** **Co-Chairperson**	**Dr. Pawanjeet Kaur** Assistant Professor (Chemistry) School of Mechatronics Engineering, Symbiosis Skills and Professional University, Pune, Maharashtra, India **Dr Alok Raj** Assistant Professor, Department of Chemical Engineering, Rashtrakavi Ramadhari Singh Dinkar College of Engineering, Bihar Engineering University, Patna, Bihar, India
	6.30PM- 6.40PM	**ICKAMPALET202601P009** **Robotics in Modern Manufacturing Industries**	**Atharva Wagh and Pawanjeet Kaur*** Symbiosis Skills and Professional University, Pune, India
	6.40PM- 6.50PM	**ICKAMPALET202601P010** **Digital Transformation, Bank Performance, and Risk: Evidence from a Global Panel Analysis**	**Naveen Sai Ommi** MBA Finance, K J Somiya School of Management, Mumbai, MH
	6.50PM- 7.20PM	**Keynote Speech** **Dr Gandhi N** Department of Marine Biology, Vikrama Simhapuri University, SPSR Nellore, Andhra Pradesh, India	
	TECHNICAL SESSION - 4		
	7.20PM – 7.30PM	**ICKAMPALET202601P011** **Toxin-Free Plastic Synthesis: Green Chemistry Revolution**	**Tripti Yadav and Pawanjeet Kaur*** Symbiosis Skills and Professional University, Pune, India - 412101
	7.30PM – 7.40PM	**ICKAMPALET202601P012** **The Impact of International Space Treaties on Contemporary Defense Architecture**	**Gia Mehta & Pawanjeet Kaur*** Symbiosis Skills and Professional University, Pune, Maharashtra, India- 412101
	7.40PM – 7.50PM	**ICKAMPALET202601P013** **Nano-Composites for Aerospace Applications**	**Hradya Sehgal and Pawanjeet Kaur*** Symbiosis Skills and Professional University, Pune, India – 412101

	7.50PM – 8.00PM	**ICKAMPALET202601P014** **Self-Cleaning Plastic Surfaces Using Nanotechnology**	**Harsharan Singh and Pawanjeet Kaur*** Symbiosis Skills and Professional University, Pune, Maharashtra, India- 412101
	8.00PM – 8.10PM	**ICKAMPALET202601P015** **Residue Analysis of Post-Blast Explosive Materials**	**Swara Sawant and Dr Pawanjeet Kaur*** Symbiosis Skills and Professional University, Pune, Maharashtra, India- 412101
	8.10PM – 8.20PM	**ICKAMPALET202601P016** **Development of Forensic Latent Fingerprints by MgONPs**	**P. Dinesh, B. Naveen, P. Nikhil Chand, Y. Tarun, B. Manoj Kumar, Ch. Venkatanadh, D. Rama Krishna, B. Aswini and K. Chandra Mohan*** Department of Chemistry, University College of Sciences, Acharya Nagarjuna University, N Nagar, Guntur, AP., India
	8.20PM – 8.30PM	**ICKAMPALET202601P017** **Carbon Nanos as sustainable smart-material/s: Towards adsorptive advance/s.**	**Dr. S.R. Pratap[1], Dr. N. Chandrasekhar[1], R. Thara[1]** [1]Shridevi Institute of Engineering & Technology, Tumkur-572106, Karnataka. India.
	8.30PM – 8.40PM	**ICKAMPALET202601P018** **Experimental and computational assessment of ganciclovir–fumaric acid cocrystals for improved solubility**	**Sravan Kumar[1], Shwetha JC[2], J. Roshni T[3], Karthick[1,2], Anand Solomon K[1]*** [1] Department of Chemistry, School of Engineering, Dayananda Sagar University, Harohalli, Bengaluru [2] Department of Physical and Chemical Science, Sri Sathya Sai University for Human Excellence, Navanihal, Kalaburagi, Karnataka, India [3] Department of Physics, School of Electrical and Electronics Engineering, SASTRA Deemed University, Thanjavur, 613 401
DISCUSSIONS			
ANY OTHER DISCUSSIONS WITH THE PERMISSION OF CHAIR AND CO CHAIR			
	8.30PM	**VOTE OF THANKS** **by** **Dr. N. Baratha Jyoti** Assistant Professor, Department of Zoology, Maris Stella College (A), Vijayawada, A.P	
	NATIONAL ANTHEM		

ICKAMPALET202601P001

Arsenic Contamination of Water: Assessment, Impact and Mitigation

Akash D

Symbiosis Skills and Professional University, Pune

Pawanjeet Kaur

Symbiosis Skills and Professional University, Pune

Abstract

The issue of water scarcity and groundwater contamination is emergent in the modern world, due to rapid industrialisation and urbanisation. The current resources of ground water are potentially hazardous as per regulatory standards due to excessive heavy metal contamination in the developing industrial areas. The traditional wastewater technologies are inefficient to provide the safe drinking water as these treatment plants are primarily removing the visible and micro-level impurities, but, the heavy metal contaminants such as arsenic (As) are hard to remove from the waste water. Regulatory authorities, WHO and ISI declared the permissible limits for arsenic in potable water is 10 parts per billion, but the treated water from current treatment plants is exceeding the limit, which eventually effects the public health due to chronic arsenic toxicity. Apart from that, arsenic pollution also disturbs the agricultural productivity, food security, and overall quality of life. This paper emphasizes the sources of arsenic contamination in water, examining the treatment methods employed for its removal, and analysing the significant technical, economic, and environmental challenges associated with this complex purification process.

Keywords: Arsenic Contamination; Groundwater Pollution; Chronic Arsenic Toxicity; Waterborne Exposure; Public Health; Environmental Toxicology; Water Quality; Risk Assessment.

ICKAMPALET202601P002

Recent Advances in Heterocyclic Frameworks as Bioactive Strategy for management of Diabetes Mellitus

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Abstract

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by persistent hyperglycemia and is increasing at an alarming rate worldwide. Despite the availability of several therapeutic agents, long-term management of DM remains challenging due to limited efficacy and undesirable side effects. Over the past two decades, heterocyclic compounds with diverse substituents have gained significant attention owing to their wide-ranging medicinal potential in the treatment of diabetes. Although certain phytochemical components play a crucial role in antidiabetic drug development, their clinical use is often associated with adverse effects, particularly gastrointestinal complications. Consequently, there is a growing demand for the development of novel, efficient, and safer antidiabetic agents with minimal side effects. Recent studies have focused on key heterocyclic scaffolds, including pyrimidines, chalcones, thiazolidinones, pyrroles, indoles, and their hybrid derivatives, which serve as fundamental structural frameworks in modern drug design. Many synthesized heterocyclic derivatives exhibit structural and functional similarities to natural alkaloids, contributing to their biological relevance. Molecular interaction studies reveal that amino acid residues such as Arg, Asp, Val, His, and Lys, present in the catalytic sites of diabetes-related metabolic enzymes, participate in significant electrostatic and hydrogen-bonding interactions with these ligands. Such interactions play a critical role in modulating enzyme activity and enhancing antidiabetic efficacy. This review compiles and critically analyzes reported synthetic strategies for diverse heterocyclic derivatives, highlighting their antidiabetic potential and structure–activity relationships. Furthermore, the study emphasizes the necessity of comprehensive evaluations, including toxicological profiling, thermodynamic stability, and kinetic parameter assessment, prior to advancing these compounds toward clinical trials. Overall, this work aims to provide valuable insights for researchers in designing and optimizing heterocyclic hybrids with promising therapeutic applications in diabetes management.

Keywords: Diabetes Mellitus, Heterocyclic Compounds, Antidiabetic Agents, Drug Design, Enzyme–Ligand Interaction, Structure–Activity Relationship.

ICKAMPALET202601P003

Re-thinking Green Chemistry Metrics: Beyond E-Factor towards a Holistic Sustainability Index

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Abstract

Sustainable chemical manufacturing requires assessment tools that go beyond traditional single-parameter metrics such as E-factor, Atom Economy, or Process Mass Intensity. This study proposes a Holistic Sustainability Index (HSI) to evaluate chemical processes comprehensively by integrating environmental impact, energy efficiency, toxicity, and resource utilization into a single framework. A case study comparing two representative processes, Process A and Process B, demonstrates the effectiveness of HSI in capturing multi-dimensional sustainability trade-offs. Results indicate that Process B achieves a significantly higher HSI score, reflecting superior performance across all parameters. The analysis highlights the limitations of conventional metrics, which may fail to detect critical sustainability weaknesses such as high energy consumption or hazardous reagent use. The proposed HSI offers a practical and scalable tool for process comparison, optimization, and decision-making, supporting the adoption of green chemistry principles and sustainable development goals in chemical manufacturing.

Keywords: Green Chemistry, Holistic Sustainability Index, Environmental Impact, Energy Efficiency, Toxicity, Resource Utilization.

ICKAMPALET202601P004

Nanoparticals and Their Applications in Defence Technology

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Abstract

Nanoparticles have emerged as a powerful tool in modern defence technology, offering innovative solutions to long-standing challenges in security and military operations. Due to their unique physicochemical properties like small size and adaptability, nanoparticles enable the development of advanced materials and systems with enhanced performance. In defence applications, they play a crucial role in areas such as lightweight yet strong armor materials, high-sensitivity sensors, stealth coatings, and improved energy storage devices. Nanoparticles are also used in chemical and biological detection systems, allowing faster and more accurate identification of potential threats. Additionally, their application in smart textiles and self-healing materials contributes to better protection and durability of military equipment. While the integration of nanotechnology in defence raises concerns related to cost, safety, and ethical considerations, ongoing research continues to expand its potential. This paper elaborates the insights about nanoparticles in transforming future military advancements by improving efficiency, protection, and strategic capability, along with the challenges in their adoption and the possible solutions.

Keywords: Nanoparticles, Defence Technology, Nanotechnology, Advanced Materials, Military Applications, Sensors.

ICKAMPALET202601P005

A Mathematical Approach to Energy Efficiency in Modern Industrial Systems Using Indian Knowledge System Principles

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Abstract

The integration of Indian Knowledge System (IKS) principles with modern industrial energy management offers a promising approach for enhancing efficiency and sustainability. Traditional IKS concepts, including Vastu Shastra, Ayurveda-inspired ergonomics, Vedic Mathematics, and Panchang-based temporal planning, provide structured methods for optimizing spatial layouts, operational cycles, and predictive energy flows. This paper develops mathematical models inspired by these principles and applies them to contemporary industrial systems, comparing the results with conventional optimization techniques. Simulation studies using MATLAB and Python demonstrate significant improvements in energy utilization, cost reduction, and process efficiency. The findings highlight the feasibility of implementing IKS-based strategies in modern factories, complementing AI and machine learning approaches for predictive and adaptive energy optimization. This study bridges ancient wisdom with contemporary technology, providing a structured framework for sustainable industrial development.

Keywords: Indian Knowledge System (IKS) ,Energy Efficiency, Industrial Optimization, Vastu Shastra, Vedic Mathematics, Predictive Energy Modeling, Sustainable Manufacturing.

ICKAMPALET202601P006

Biodegradable Plastics: Chemistry of Nature-Friendly Polymers

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Abstract

The plastic pollution became a major concern in today's era as the traditional plastics are persistent and causing harmful impacts on environment and public health. Biodegradable polymers have drawn interest as a more environmentally friendly solution to this issue as these polymers are typically made from renewable natural resources like cellulose, starch, polylactic acid, etc. These polymers are impulsively getting decomposed due to microbial activity under the appropriate circumstances. Biodegradable polymers possess the exclusive chemical and structural properties that the moisture, heat, and enzyme-sensitivity led the break-down of polymers into simple byproducts. By reducing dependence on fossil fuels and minimizing long-term environmental pollution, biodegradable plastics offer clear environmental benefits. They are already finding applications in packaging, agriculture, medicine, and disposable products. However, there are few challenges such as higher costs, limited strength, and controlled degradation conditions, which required further research and innovation to enhance productivity and adaptability for sustainable development.

Keywords: Biodegradable Plastics, Sustainable Polymers, Renewable Resources, Natural Polymer Degradation, Eco-Friendly Materials, Plastic Pollution, Green Chemistry.

ICKAMPALET202601P007

Household Air Pollution in India: Implications for Public Health

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Abstract

Indoor air pollution is a crucial but abandoned public health issue in India, especially in poor population. Around 70% population of India use solid fuels like firewood, cow dung cakes, coal, and biomass for cooking and space heating, that results in higher concentration levels of indoor air pollutants like particulate matter, carbon monoxide, nitrogen oxides, and volatile organic compounds. This causes severity of health disorders like serious respiratory infections and allergies, chronic obstreperous lung diseases, asthma, cardiovascular diseases, cancer, and even deaths, majorly in children, elderly people, and women. The maximum indoor air pollutants are released due to insufficient ventilation in households, overcrowding, and lack of awareness. This paper emphasizes the causes of indoor air pollution in Indian households, exposure routes, public health impacts, possible solutions to resolve this issue and challenges in the adaptation of these solutions. It also focuses on the proper usage of cleaner and future generation greener fuels to completely solve this issue at ground level.

Keywords: Indoor Air Pollution; Public Health; Respiratory Diseases; Solid Fuel Use; Particulate Matter; Green Fuels.

ICKAMPALET202601P008

Carbon Nanotubes in Manufacturing: Applications and Opportunities

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Abstract

The modern engineering methods have observed the limits of conventional materials such as steel and aluminium, whereas the alternating materials like carbon nanotubes are emerging as a promising alternative in manufacturing. Carbon nanotubes possess extraordinary physicochemical, mechanical, electrical, and thermal properties, which enable them for next-generation industrial applications. They are useful in high-strength aerospace components, fast-charging energy storage systems, electrically conductive 3D-printed parts, and lightweight composites for the automotive industry. Alongside their technical usage, these are emphasizing the environmental sustainability due to enhanced efficiency and emission reduction. Although they possess few challenges like large-scale production, higher manufacturing costs, uniform diffusion etc., which leads to future research opportunities in the next industrial revolution. This paper highlights the advancements of carbon nano-tubes in manufacturing industry, their synthesis at laboratory level, the challenges observed at the and industry level production along with the possible solutions.

Keywords: Carbon Nanotubes; Nanomaterials; Advanced Manufacturing; Mechanical Reinforcement; Lightweight Materials; Polymer Nanocomposites; Energy Storage; Industrial Challenges.

ICKAMPALET202601P009

Robotics in Modern Manufacturing Industries

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Abstract

In the era of Industry 5.0, Robotics is observed as an emergent part of manufacturing industries in terms of quick, accurate and smarter work. At present, all the production and manufacturing industries are depending on the robots and cobots for quality improvement, even and incessant production, and manpower shortage. Robots equipped with artificial intelligence and deep learning are adaptive in vulnerable environments and are capable of predictive analysis based on the data provided over the time. Although the entire dependency on robots observes few challenges like, cyber issues, data-security issues, higher process and maintenance expenditure, and every so often skilled labor loss. To deal with these challenges, industries must take preventive measures like skilling their workers, investing in cobots wherever applicable, data-security enhancement, feedback-based mechanisms and human surveillances. This paper highlights the importance of robotics in the competitive manufacturing field, their implementation at various levels, challenges in their adoption along with the future scope, which is required for the resilient smart manufacturing.

Keywords: Robotics Adoption, Collaborative Robots (Cobots), Smart Manufacturing, Labor Shortages, Human–Robot Collaboration, Workforce Upskilling, Cybersecurity Challenges, Industrial Automation, Product Quality Improvement, Industry 5.0.

ICKAMPALET202601P010

Digital Transformation, Bank Performance, and Risk: Evidence from a Global Panel Analysis

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Abstract

This study examines the impact of digital transformation on bank performance and risk using a global panel dataset of commercial banks from both developed and emerging economies over a multi-year period. Employing fixed-effects, random-effects, and system Generalized Method of Moments (GMM) estimators, the analysis investigates the relationship between digitalization intensity and key outcome variables, including Return on Assets, Cost-to-Income Ratio, Capital Adequacy Ratio, and Non-Performing Loans. The models control for bank-specific characteristics such as size, capitalization, and liquidity, as well as macroeconomic conditions including GDP growth, inflation, and financial development. The empirical results demonstrate that greater digital adoption significantly enhances profitability and operational efficiency while reducing credit risk in the long run. However, the findings also indicate a short-term increase in operational and technology-related risks, reflecting adjustment and investment costs. Robustness checks confirm the stability of the results across alternative model specifications. The study contributes to the literature on digital finance by providing global-level empirical evidence on the performance and risk implications of digital transformation in the banking sector.

Keywords: Digital transformation; Global banking; Bank performance; Risk management; Panel data analysis; System GMM; Financial stability.

ICKAMPALET202601P011

Toxin-Free Plastic Synthesis: Green Chemistry Revolution

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Abstract

Plastic pollution becomes a global environmental issue as the dangerous plastic additives and microplastics are entering the food chain and affect the ecosystems. The traditional approaches for the manufacturing of plastics are generating plastic debris along with the air and water pollution during the manufacturing processes. It includes usage of toxic monomers, additives, and reagents, making the processes high energy consumption which adversely affect the environment. The green chemistry approaches on the other side, by using bio-based reactants and not-toxic catalysts, are producing toxin free, sustainable, and safer plastics by using the catalyst-based manufacturing. Many biodegradable plastics are naturally getting degraded, not leaving microplastic debris and capable of controlling molecular weight and stereochemistry. By using green solvents like water and super critical carbon dioxide, there will be lesser energy consumption and waste reduction. Green chemistry enhances the circular economy along with taking care of environmental and public health. This paper examines the green production of plastic, emphasizing biodegradability, recyclability, and challenges observed in circular economy integration along with the future research scope.

Keywords: Green Chemistry, Toxin-free Polymers, Biodegradable Polymers, Renewable Feedstocks, PLA, Biocatalytic Polymerization, Circular Economy, Microplastic Waste Reduction.

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The Impact of International Space Treaties on Contemporary Defense Architecture

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Abstract

International space treaties by different countries, provide the rules and regulations for space activities like satellite operations, space study, and the prevention of armaments in space, to ensure the peaceful and safer use of outer space. These treaties are crucial for maintaining the satellite communication and space-based surveillance in the global defence sector. The cold war era was fully dependent on the international space treaties as the national defence forces need to protect their space assets like satellites and to maintain space stability. While making the defence strategies, it is essential to maintain the national security and space investigation without violating international laws. This paper highlights the importance of international space treaties in the defence systems of nations, their challenges, the major treaties happened globally, their outcomes specifically to military and defence activities. It also deliberates the future opportunities to support space stability that influence the imminent defence strategies.

Keywords: International Space Treaties, Defence Technology, Military Satellites, Dual-Use Systems, Anti-Satellite Weapons, Space-based Surveillance.

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Nano-Composites for Aerospace Applications

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Abstract

The aerospace and defense sectors demand materials of ultra-lightweight properties with exceptional mechanical strength, thermal stability, and multifunctional performance. Conventional metallic alloys are carrying significant weight and undergoes corrosion, which make them inappropriate for the modern aerospace applications. In such conditions, nanocomposites, made of epoxy and thermoplastics-based polymer matrix, have gain attention due to their physicochemical properties. These composites have shown potential in lightweight aircraft panels, UAV airframes, missile casings, satellite structural components, and thermal shields for space missions due to their high-strength, low-mass, and multifunctionality. They are supporting future advancements in commercial aviation, defense technology, and space exploration. Although there are key challenges such as nanoparticle agglomeration, long-term durability under extreme temperatures, radiation exposure, and mechanical vibrations, which need further research. This paper investigates advanced polymer-based nano-composites reinforced with carbon nanotubes (CNTs), graphene nanoplatelets, and nano-clays as next-generation alternatives for aerospace and space-defense applications.

Keywords: Nano-composites, Aerospace materials, High-strength polymers, Lightweight materials, Nanofillers, Mechanical enhancement, Thermal stability, Advanced composites, Structural applications, Material innovation.

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Self-Cleaning Plastic Surfaces Using Nanotechnology

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Abstract

Self-cleaning plastic surfaces developed using nanotechnology, is an innovative approach to address surface contamination and maintenance issues. Surface modification at nano-level brings changes like super-hydrophobicity, photocatalytic activity, and antimicrobial behavior in plastic surfaces, which is required for evading the surface impurities. Nanomaterials consisting TiOx, silica-based nanoparticles, and silver and gold nanoparticles, are utilized to repel water, dust, microorganisms and decompose organic pollutants by photoactivity, without using external cleaning agents. The self-cleaning nano-coated plastics have extensive applications in medical implantation devices, electronics, automotive parts, and food packagings. Although there are few challenges like durability, production and sustaining cost, which require advanced research to produce sustainable self-cleaning plastic surfaces based on nanotechnology. This paper offers insights to environment friendly, hygienic, and low-maintenance nano-based self-cleaning surface films for modern applications, along with the possibility of industrial scale sustainable production.

Keywords: Nanotechnology, Self-cleaning surfaces, Plastic materials, Hydrophobic coatings, Photocatalytic nanoparticles.

ICKAMPALET202601P015

Residue Analysis of Post-Blast Explosive Materials

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Abstract

Residue analysis of post-blast explosives materials found at crime scenes presents a critical challenge for investigators who need to analyse explosive events. The extreme temperature and pressure conditions at the scene destroy most physical evidence. Environmental factors lead to contamination of samples which results in debris scattering throughout the area after an explosion. Environmental contamination of evidence makes it difficult to determine which explosives were used because their origin remains unknown. Investigations become delayed when evidence remains unavailable because it decreases the odds of identifying suspect individuals. Forensic science uses post-blast residue analysis to solve this problem through its method of detecting and analysing explosive traces that remain after explosions. The analytical methods Gas Chromatography-Mass Spectrometry, Ion Chromatography and Scanning Electron Microscopy (SEM) enable scientists to detect TNT, RDX, PETN and ammonium nitrate explosives at trace levels. The methods enable investigators to recreate the explosion while connecting the explosives used to their potential origins. Post-blast residue analysis plays a vital role in current society because it addresses the dangers that terrorist attacks and bomb explosions and industrial accidents create for public safety and national security. The scientific method provides essential evidence which helps counter-terrorism efforts and enables accurate forensic work and scientific-backed justice processes. The tool functions as a critical resource which modern forensic investigations.

Keywords: Post-Blast Explosives, Environmental Contamination, Explosive Analytical Methods, Industrial Accidents, Counter-Terrorism, Forensic Accuracy.

ICKAMPALET202601P016

Development of Forensic Latent Fingerprints by MgONPs

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Abstract

Nanoparticles have gained significant importance due to their unique physical, chemical, and biological properties arising from their nanoscale dimensions. They are widely used in medicine, electronics, energy, and environmental protection. Magnesium oxide nanoparticles (MgONPs) are important due to their unique properties such as high surface area, strong adsorption capacity, thermal stability, and antibacterial activity features make MgONPs useful in diverse applications, including catalysis, wastewater treatment, antimicrobial coatings, sensors, flame retardants, and biomedical fields. Several biomolecules are present in the aqueous plant part extracts acting as reducing, stabilizing, and capping agents. Clitoria ternatea, commonly known as Butterfly pea, contains bioactive compounds such as anthocyanins, flavonoids, and phenolic acids. These compounds exhibit strong antioxidant, anti-inflammatory, antimicrobial, and neuroprotective activities. Simply, the butterfly pea flowers were subjected to maceration by immersed in 100 mL (10 % w/v) of dd water, allow it to boil (around 90 oC) in a water bath. Let it steep for 15-20 min. After that, the aqueous medium turning into a deep, ink-like blue. Filter and store the extract in a dark place. To this mixture, 20 mL C. ternatea with 10 mL 0.1M Mg(NO3)2.6H2O and 20 mL 0.1M NaOH dropwise and allow the mixture to stirring for 1-2 hrs for the particles to stabilize until pH about 10-12. Later, the colloidal suspension of Mg(OH)2 was subjected to centrifugation with 1000 rpm for 10 minutes. To this, light green colour solid layer was separated and heated up to 30 minutes at 70 oC. Finally, the MgONPs were obtained with 85 % yield. Further, the synthesized MgONPs were subjected to efficient Latent Finger Prints (LFP's) for forensics evidences in crime scene investigation.

Keywords: MgONP's, C. ternatea flower leaf extract, Latent Fingerprints (LFP's), Forensic Application.

ICKAMPALET202601P017

Carbon Nanos as Sustainable Smart-Material/S: Towards Adsorptive Advance/S.

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Abstract

Adsorption is a vital and natural physicochemical technique for the purification and separation in waste water management/s. Today, secondary waste generation is a universal concern. This concern can be overcome by the degradation of adsorbed sort/s. In consideration of the monetary approach, recyclability and regeneration of the spent adsorbent were considered as significant techniques. Quite a few studies were implemented for the restoration of the adsorbent without adsorption of active sites and recycled for adsorption. The present study highlights the principles of the diverse regeneration proposals to eliminate pollutants from the waste water over quite a few phases.

Keywords: Sustainable Smart- materials, Adsorption, Carbon nanos.

ICKAMPALET202601P018

Experimental and computational Assessment of Ganciclovir–Fumaric Acid Cocrystals for Improved Solubility

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Abstract

This study determines the structural, thermal, and electronic properties of a ganciclovir-fumaric acid (GCV-FA) cocrystal through a combination of Single-Crystal X-ray Diffraction (SCXRD), Differential Scanning Calorimetry (DSC), Fourier Transform Infrared Spectroscopy (FTIR), and Density Functional Theory (DFT) calculations. SCXRD analysis reveals a monoclinic crystal system with a well-organized hydrogen-bonded network, including key interactions such as N4-H6···O6 and O5-H4A···O4, leading to the formation of stable ring motifs and a corrugated layered structure. Thermal analysis by DSC shows a melting point of 208.5°C, indicative of good thermal stability. The comparison of experimental FTIR and simulated IR spectrum using density functional theory (DFT) confirms shifts in functional group vibrations, indicating the formation of new hydrogen bonds in the cocrystal. DFT calculations highlight the electronic properties, including a small HOMO-LUMO gap and high chemical softness, reflecting significant reactivity and adaptability. GCV-FA showed a significantly faster dissolution rate, reaching 100% release in 60 minutes, while GCV released only 56.79% at 90 minutes. This enhancement is attributed to fumaric acid improving solubility and bioavailability. These findings provide insight into the structural and electronic characteristics of the GCV-FA cocrystal, suggesting its potential for enhancing drug stability and bioavailability in pharmaceutical applications.

Keywords: cocrystal, Single-Crystal X-ray Diffraction, Density Functional Theory, Dissolution rate, HOMO-LUMO.

ICKAMPALET202601P019

Smart IOT- AIR Based Flower Harvester

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Abstract

Floriculture is one of the highly profitable venture in Agriculture. The major flower crops cultivated in Madurai District are Jasmine, Mullai and Pitchi. Agronomy of flowers involves tremendous input of nutrients and is labour intensive. The major drawback is harvesting of these flowers since they had to be completed daily to prevent shedding of mature flowers. In villages farmers start to work from 02.00 a.m during times of huge demand or festive time. This work proposes a Smart IoT and air based flower harvester / picker which can save the farmer in the above mentioned problems and save him from the clutches of debt. This Smart Air-Based Flower Picking System using sensors and airflow technology. The main aim of this system is to identify and pick fully matured flowers without damaging buds, leaves, or plants. A camera and light source are used to confirm the maturity stage of the flowers. By employing the basic simple image processing logic, the system identifies and confirms the maturity stage of the flower is fully bloomed or still a bud. Thus only mature flowers are selected for harvesting. Once detected, a low-pressure air suction mechanism is activated. The airflow gently detaches the flower from the plant by using the natural weakness of the flower stem. The picked flower is directly collected into a soft plastic or cloth bag. This method avoids physical contact, reduces damage, and maintains flower quality. The proposed system is low cost, easy to use, and suitable for village-level implementation. It reduces dependency on manual labor and helps farmers pick flowers on time. This project demonstrates how sensor technology and simple automation can solve real- world agricultural problems effectively.

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