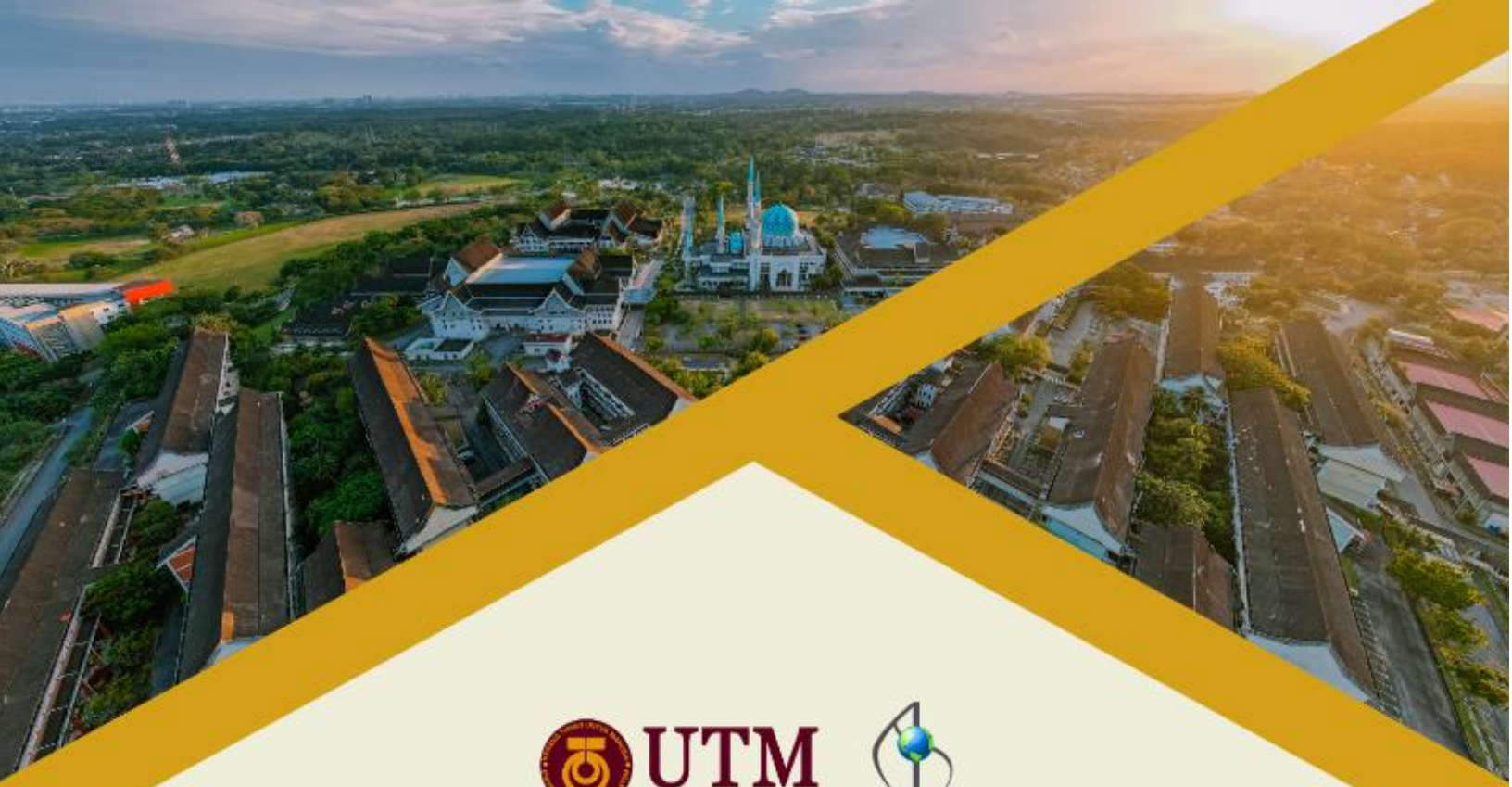

UTM
UNIVERSITI TEKNOLOGI MALAYSIA

ICoST 2025

5TH INTERNATIONAL CONFERENCE ON SEPARATION TECHNOLOGY

ICoST 2025

"Exploring Frontiers in Separation and Purification Technologies"

27 - 28 September 2025
The Everly Hotel Putrajaya

https://www.utm.my/icost clear@utm.com

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Foreword

Prof. Dr. Rosli Md Illias

Deputy Vice Chancellor of Universiti Teknologi Malaysia (Research & Innovation)

By the grace of Allah S.W.T., it is our great honour to host the 5th International Conference on Separation Technology 2025 (ICoST 2025). This landmark event marks a significant milestone in advancing separation technology, made possible through the visionary leadership of the Centre of Lipids Engineering and Applied Research (CLEAR) in bringing together the global scientific community.

Under the theme “Exploring Frontiers in Separation and Purification Technologies”, this conference arrives at a pivotal moment in scientific and industrial development. As we confront pressing global challenges, ICoST 2025 serves as both a hub for innovation in separation technologies and a vital collaborative platform that bridges academia and industry to propel sustainable technological solutions forward.

The transformative potential of advanced separation technologies is evident in several critical areas which are enabling the transition to carbon-neutral industrial processes, revolutionising resource recovery through circular economies, and accelerating progress toward the United Nations Sustainable Development Goals (SDGs).

To our esteemed participants, this conference represents not just knowledge exchange but an opportunity to:

- Pioneer next-generation solutions with real-world applicability,
- Forge strategic partnerships that transcend geographical boundaries
- Catalyse Malaysia’s leadership in sustainable technology innovation

We especially highlight the importance of industry-academia synergy for technology commercialisation, interdisciplinary problem-solving approaches, and global research networks that amplify scientific impact. May the exchange of ideas here inspire innovative paradigms that redefine our technological capabilities while addressing the world’s most pressing sustainability challenges.

Foreword

Assoc. Prof. Ts. ChM. Dr. Nik Ahmad Nizam Nik Malek

Acting Director of Ibnu Sina Institute for Scientific and Industrial Research (ISI-SIR)

It is a great honour for the Ibnu Sina Institute for Scientific and Industrial Research (ISI-SIR) to welcome all esteemed speakers and participants to the 5th International Conference on Separation Technology 2025 (ICoST 2025). This distinguished gathering brings together brilliant scientists, innovative engineers, dedicated researchers, and industry leaders from around the world.

The conference theme, "Exploring Frontiers in Separation and Purification Technologies", aligns closely with ISI-SIR's mission to:

- Drive innovation in advanced separation and purification processes
- Develop sustainable and efficient technologies for resource recovery and waste minimization
- Support evidence-based practices that enhance industrial separation performance
- Foster technologies that contribute to cleaner production and environmental protection
- Strengthen collaborations that translate scientific breakthroughs into practical separation solutions

Sincere appreciation is extended to the Organising Committee for their dedication in curating this exceptional platform for knowledge sharing and collaboration. The presentations and discussions throughout this conference are expected to stimulate innovative ideas and foster partnerships that deliver meaningful societal impact.

May this event inspire fresh approaches to separation technologies and strengthen connections that advance science and technology for the betterment of communities worldwide. Wishing everyone a productive and intellectually rewarding conference.

Foreword

Assoc. Prof. Ir. Dr. Muhammad Abbas Ahmad Zaini

Director of Centre of Lipids Engineering and Applied Research (CLEAR)

On behalf of the Centre for Lipids Engineering & Applied Research (CLEAR), Universiti Teknologi Malaysia (UTM), Johor Bahru, it is with great pride that we host the 5th International Conference on Separation Technology 2025 (ICoST 2025). We warmly welcome esteemed researchers, distinguished academics, and industry leaders from across the globe to this prestigious gathering of minds. Your participation elevates the significance of this conference as a cornerstone event in separation technology.

ICoST 2025 stands as a premier platform for researchers, scientists, and engineers to engage in meaningful discussions on cutting-edge advancements in separation technology and its interdisciplinary applications. As we convene under this year's theme "Exploring Frontiers in Separation and Purification Technologies", the conference will serve as a premier platform for interdisciplinary collaboration, addressing contemporary challenges through innovative research and technological advancements.

We anticipate that the robust exchange of ideas during this conference will not only generate novel scientific insights but also forge enduring professional networks. These interactions are vital for driving sustainable progress and shaping the future trajectory of separation technologies.

We extend our deepest appreciation to the Organising Committee, sponsors, and all contributors whose dedication has made this prestigious event possible. To all participants, we wish you a productive and rewarding conference experience, filled with fruitful exchanges and lasting connections.

Thank you, and welcome to ICoST 2025!

Foreword

Dr. Aishah Rosli

Conference Chair of 5th International Conference on Separation Technology 2025

It is my distinct privilege, on behalf of the organising committee, to warmly welcome all participants to the 5th International Conference on Separation Technology 2025 (ICoST 2025). This prestigious gathering unites leading researchers, scholars, scientists, engineers, and technologists from academia and industry to exchange cutting-edge knowledge and pioneering research in separation technologies.

This year's conference showcases an exceptional programme featuring advancements across key disciplines, including advanced separation technology, biotechnology, advanced material engineering, environmental engineering, nanotechnology in separation, artificial intelligence (AI) and machine learning (ML) in optimization of separation processes, challenges and opportunities in commercialising novel separation technologies.

We extend our deepest gratitude to Universiti Teknologi Malaysia for hosting this event, and particularly to Prof. Dr. Rosli Md Illias, Deputy Vice Chancellor of UTM (Research & Innovation), for graciously officiating the opening ceremony. His steadfast support has been instrumental to our success.

Special recognition is due to the ICoST 2025 Organising Committee, whose tireless dedication has transformed this vision into reality. May this conference catalyse meaningful collaborations and inspire transformative innovations in our field.

May our participation spark novel ideas, foster lasting partnerships, and advance the frontiers of separation technologies.

UTM
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ABOUT
UNIVERSITI TEKNOLOGI MALAYSIA

Universiti Teknologi Malaysia (UTM), established as a technical school in 1904 and later becoming a full-fledged university in 1972, has been a key contributor to the nation's technical and professional workforce, supporting local industries, government agencies, and multinational companies. UTM operates from two campuses: the Kuala Lumpur Campus and the main campus in Johor Bahru, strategically located within the Iskandar Malaysia region, a dynamic economic corridor in southern Peninsular Malaysia. Guided by its vision to be a world-class Entrepreneurial Research University, UTM strives to be a centre of academic and technological excellence. Its mission is to lead in human capital development and innovative technologies that contribute to national wealth creation. Today, UTM is recognised as Malaysia's premier institution in engineering, science, and technology, ranked among the world's top 100 universities in these fields.

Aligned with national aspirations for a knowledge-based, innovation-driven economy, UTM embraces the "New Academia" model. This approach goes beyond traditional paradigms, promoting knowledge advancement across disciplines and beyond boundaries through practicality, meaningful engagement, smart partnerships, and relevant exposure. The concept seeks to integrate higher education more effectively with socio-economic development, supported by good governance, sustainable funding, and entrepreneurial spirit.

Innovation forms the core of UTM's values, permeating teaching and learning, research, publications, management, staff and student development, consultancy, professional services, and social responsibility. This culture of innovation is driven by strong teamwork, shared values, and a clear sense of purpose. Since attaining research university status, UTM has emphasised being a graduate-focused institution, expanding innovative postgraduate programmes and flexible PhD pathways such as PhD by Publication, Industry-based Doctorates, Fast Track PhDs, and Double/Dual Doctorates. These initiatives not only offer greater study flexibility but also enhance research productivity, publications, citations, technological development, and contributions to a value-driven economy.

Through strategic organisational transformation, UTM continues to build a vibrant knowledge culture and intellectual ecosystem that fosters creativity, innovation, and entrepreneurship. This aligns with the Ministry of Higher Education's vision to position Malaysia as a global education hub renowned for high-quality standards, cutting-edge research, and multi-disciplinary excellence.

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ABOUT
CENTRE OF LIPIDS ENGINEERING AND APPLIED RESEARCH

Centre of Lipids Engineering and Applied Research (CLEAR) was established in 1987 to advance research in process development, engineering, technology, and product innovation. Over time, the centre has broadened its scope to focus on advanced separation processes, chemical engineering applications, as well as biomass- and biomaterial-based product development.

Since its establishment, CLEAR has actively provided research and consultancy services to various industries, contributing to innovation and technological advancement. As part of an academic institution, CLEAR is committed to upholding excellence through pioneering research and innovation that supports national growth and development. Its vision is to become a world-class research centre in green and advanced separation technologies, aligned with national and regional aspirations. To realise this vision, CLEAR actively engages in academic supervision, industrial collaboration, and Research, Development, Commercialisation, and Innovation (R&D&C&I) activities at both national and international levels.

The CLEAR Experts team is led by Director Assoc. Prof. Ir. Ts. Dr. Muhammad Abbas Ahmad Zaini, supported by Ms. Noor Sabariah Mahat. The team includes distinguished Principal Research Fellows, namely Prof. Dr. Siti Hamidah Mohd Setapar, Assoc. Prof. Ts. Dr. Liza Md Salleh, Assoc. Prof. Ir. Dr. Mazura Jusoh and Dr. Aishah Rosli, who represent the core expertise of the group. They are complemented by a network of Associate Research Fellows, bringing diverse knowledge and specialised skills across multiple disciplines.

With the combined strength of strong leadership, core experts, and Associate Research Fellows from institutions such as Universiti Teknologi Malaysia, Universiti Teknologi MARA, Universiti Malaysia Perlis, Universiti Malaysia Sabah, and the Higher Colleges of Technology in the United Arab Emirates, CLEAR is dedicated to providing professional consultation, impactful research, and innovative solutions. The team is committed to collaboration and delivering reliable expertise to serve the needs of industry, academia, and the wider community.

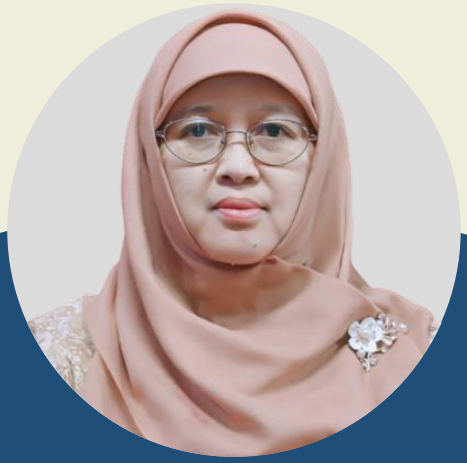
Plenary Speaker

Prof. Datuk Ir. Ts. Dr.

Ahmad Fauzi Ismail

(Universiti Teknologi Malaysia)

AHMAD FAUZI ISMAIL is the Founder and First Director of Advanced Membrane Technology Research Centre (AMTEC). His research interest is in the development of polymeric, inorganic and novel mixed matrix membranes for water desalination, wastewater treatment, gas separation processes, membrane for palm oil refining, photocatalytic membrane for removal of emerging contaminants, development of haemodialysis membrane and polymer electrolyte membrane for fuel cell applications. Professor Datuk Fauzi obtained a PhD. in Chemical Engineering in 1997 from University of Strathclyde and MSc. and BSc. from Universiti Teknologi Malaysia in 1992 and 1989 respectively. He is a Fellow of The Academy of Sciences Malaysia, Chairman of the ASM Southern Region Chapter since 2016, President of Malaysia Membrane Society (MyMembrane) since 2018, Chartered Engineer in the UK (CEng) and a Fellow of the Institution of Chemical Engineers (FIChemE). Professor Datuk Fauzi also served as the Editorial Board Members of Journal of Membrane Water Treatment, Chief Editor Journal of Applied Membrane Science & Technology, Editor Board Member of Separation and Purification Technology, Jurnal Teknologi, Journal of Membrane Science and Research, Journal of Membrane and Separation Technology, Advisory Board Members of Desalination Journal and the Advisory Editorial Board member of Journal of Chemical Technology and Biotechnology. He involved extensively in R&D&C for national and multinational companies related to membrane-based processes for industrial application and currently owns two spin off companies.



Keynote Speaker 1

Prof. Dr. Eng. Ir.
Reni Desmiarti
(Universitas Bung Hatta)

RENI DESMIARTI is now the Dean of Faculty of Industrial Technology Universitas Bung Hatta, Indonesia. She received her bachelor's degree from the Chemical Engineering Department of Sriwijaya University in 1998, Master of Engineering from Bandung Institute of Technology in 2001 and Doctor of Engineering from Gifu University Japan in 2009. She received a Professor in Chemical Engineering, especially for Water and Wastewater Treatment in 2018. She is currently a lecturer at the Chemical Engineering Department since 2009. She received Post Doctoral Program at Gifu University from Ministry of Higher Education, Science and Technology Indonesia in 2011 and the JASSO Fellowship Program Japan in 2016. She is also actively receiving Research Grant funds from PT. Pertamina, Ministry of Higher Education, Science and Technology Indonesia, Gifu University Japan and cooperation with various agencies for research and community service activities. The results of her research and community services have been published through Patents, National and International Journals, and presented at International Seminars. She is currently also active as an environmental consultant especially for design of water and wastewater treatment plant.

Keynote Speaker 2

Assoc. Prof. Dr.

Lin Qingsong

(National University of Singapore)

LIN QINGSONG is the Director of the Protein and Proteomics Centre in the NUS Department of Biological Science. He has over 25 years of experience in proteomics and mass spectrometry-based research and published over 150 peer-reviewed papers to date. Since he joined the National University of Singapore (NUS) in 2002, he has been key personnel establishing the proteomics platform technologies in the Protein and Proteomics Centre, which provides corefacility support to the local research community. He applied proteomics technologies to address various questions in the biological and biomedical fields. To highlight a few, his team has utilized quantitative chemical proteomics approaches to identify protein targets of artemisinin, revealing its potent parasite killing effect through promiscuously targeting multiple essential biological pathways (Nat Commun. 2015). His team also developed a novel non-radioactive method for quantification of autophagic protein degradation (Nat Protoc. 2017). He was one of the Lead PIs establishing the SingMass consortium in 2019, which is the Singapore National Laboratory for Mass Spectrometry, providing one-stop service to Singapore research community and industry. He is a co-PI of a Singapore Food Story grant focusing on allergen identification of alternative foods. His team has recently developed a protein extraction method that can effectively extract proteins from various food matrices for allergen identification.

Invited Speaker 1

Assoc. Prof. Ir Dr.

Mazura Jusoh

(Universiti Teknologi Malaysia)

MAZURA JUSOH is an academic staff in Faculty of Chemical and Energy Engineering (FCEE), Universiti Teknologi Malaysia who is now the Head of Advanced Material and Separation Technologies Research Group (AMSET), Research Fellow at Centre of Lipids Engineering and Applied Research (CLEAR) and Head of Separation Panel for Department of Chemical Engineering. She graduated from University of Bradford, England in 1999 and PhD in Chemical Engineering from UTM in 2010. She has been with UTM since 1999. Assoc. Prof. Ir. Dr. Mazura has a strong background in chemical engineering separation technologies, more specifically in freeze concentration which deals with crystallisation of pure ice from a solution for water removal purpose. She has published more than 150 academic manuscripts and 2 books and has a H-index of 22. She was the first in Malaysia to research on Freeze Concentration and to establish its local applications, coming up with various novel ice-crystalliser designs for fruit juice concentration, water purification and treatment of dangerously vaporous wastewaters. She has filed two patents, has one patent granted and four copyrights. Collectively, she has been the project leader and research member for 40 research grants, amounting to more than RM3.5 million since 2004. She has been appointed as Editorial Board member for five journals, and she has also won numerous awards in national and international conferences and research exhibitions. In UTM, Dr. Mazura is also well known as English language and communication coach, as well as a certified proof-reader. She has attended numerous conferences globally and received five Best Paper or Best Presenter Awards and also invited as keynote speaker in international conferences.

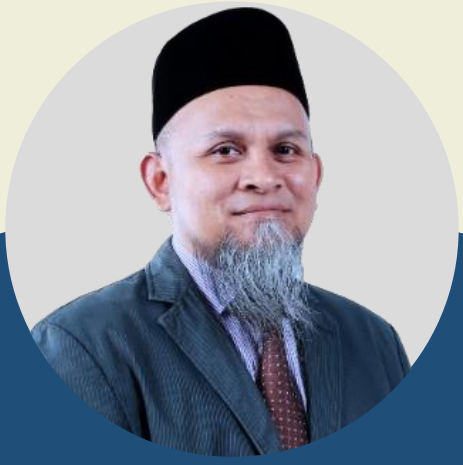
Invited Speaker 2

Ts.

Nurul Amirah Hanim Umar

(PETRONAS Technical Services Sdn Bhd)

NURUL AMIRAH HANIM UMAR is a Technical Professional from PETRONAS Group Technical Solutions (GTS) with 13 years of experience in the Oil & Gas industry. A graduate of Universiti Teknologi PETRONAS, she has developed strong expertise in process engineering, covering both greenfield and brownfield processes in refineries, gas processing facilities, upstream processing facilities, specialty chemicals, as well as decarbonization technologies including Carbon Capture, Utilization and Storage (CCUS). She has been actively involved in all stages of project execution from conceptual studies, detailed feasibility studies, FEED, and EPCC. In addition, she has also supported plant troubleshooting and operational improvements, delivering solutions that enhance efficiency, cost competitiveness, reliability, and sustainability. As a certified Professional Technologist (Ts.), Nurul is committed to advancing engineering excellence through technical leadership, value optimization, and innovative approaches in complex operating environments. In addition to her professional role, she contributes back to the community and industry by serving as an adjunct lecturer, invited speaker, and career talk panelist, sharing knowledge and experience with young engineers. She has also supervised student research projects and internships, helping to bridge academic learning with real-world industry applications. Her professional journey reflects a strong balance of technical depth, leadership, and societal impact, positioning her as an engineer dedicated not only to industrial excellence and operational reliability but also to shaping future talents and supporting the energy transition.



Invited Speaker 3

Assoc. Prof. Ts. Dr.

Shahrul Ismail

(Universiti Malaysia Terengganu)

SHAHRUL ISMAIL is currently serving at the Faculty of Ocean Engineering Technology, Universiti Malaysia Terengganu (UMT), where he leads the Bioprocess & Energy Nexus Group. He obtained his first degree from Universiti Sains Malaysia (USM), an M.Eng. from Universiti Teknologi Malaysia (UTM), and a Ph.D. from Wageningen University, The Netherlands, followed by a post-doctorate at TU Delft specializing in anaerobic process technology and environmental biotechnology. His research focuses on green technology, anaerobic digestion, composting, wastewater treatment, and biogas production from organic wastes, with additional expertise in advanced nitrogen removal using ANAMMOX processes. To date, he has secured more than RM 2.5 million in research grants, serving as principal investigator in 10 major projects and co-researcher in over 20 others, while also supervising five Ph.D. and seven master's students. With more than 40 indexed publications and high citations, his contributions have significantly advanced sustainable waste management technologies, particularly in palm oil mill effluent treatment and methane reforming studies. Dr. Shahrul maintains strong international collaborations with Wageningen University, TU Delft, King Abdul Aziz University, and Prince of Songkla University, and his innovative research has been recognized through multiple gold and silver medals at international competitions.

Invited Speaker 4

Ts.

Dhanaraj Turunawarasu

(Pace CCS)

DHANARAJ TURUNAWARASU is a Chartered Chemical Engineer, certified by IChemE and a Professional Technologist certified by MBOT. He currently serves as a Carbon Capture and Storage (CCS) Specialist at Pace CCS while pursuing a part-time PhD in Novel Carbon Capture Technology at Swinburne University. Dhanaraj has a strong passion for research and development and was key in the creation of a novel process technology that recovers condensate from flare gas to reduce CO2 emissions and enhance offshore oil production during his tenure as Senior R&D/Process Engineer and Technology Inventor at NGLTech. He also developed a new process scheme/patent utilizing MEG (anti-freeze/hydrate inhibition agent). This innovation earned a New Technology Award at the OTC Asia 2018 conference and received high commendation for the Oil & Gas Award at the 2018 IChemE Global Awards in London. While working at PETRONAS, Dhanaraj had the opportunity to work internationally, including on Sudan Facilities Modifications and various global projects. Notably, he led flow assurance studies in Mauritania, resulting in RM1 million/day savings by addressing hydrate blockage issues and worked on asphaltene issues in Turkmenistan. Dhanaraj has published ten international papers across diverse fields such as phase behavior, carbon capture, process technology, flow assurance, waste management, and environmental protection. In 2016 and 2018, he was nominated and recognized by IChemE as one of the top four finalists for the Young Chemical Engineer in Industry Award in Malaysia. His career consistently demonstrates that with the good attitude and right nurturing, chemical engineers have limitless potential.

ORGANISING COMMITTEE

5TH INTERNATIONAL CONFERENCE ON SEPARATION TECHNOLOGY 2025	
Honorary Advisor	Prof. Dr. Rosli Md Illias
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Vice Conference Chair	Assoc. Prof Dr. Chua Lee Suan
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Logistic Unit	Dr. Muhammad Syafiq Hazwan Ruslan **(Head of Unit)** Dr. Noor Fauziyah Ishak Dr. Ahmad Syahmi Zaini Ms. Noor Sabariah Mahat

TENTATIVE OF ICoST 2025

DAY 1 (27TH SEPTEMBER 2025)	
Time	**Events**
0800 - 0825	Participant's Arrival and Registration
0825 - 0930	Arrival of VIPs (Irama Hall)
	National Anthem "*Negaraku*"
	Du'a Recitation
	Welcoming Speech by Conference Chair of ICoST 2025, Dr. Aishah Rosli
	Opening Address and Officiation by Prof. Dr. Shamsul Sahibuddin, Performing the Function of Head of UTM Campus (Kuala Lumpur Branch)
	Video Montage Presentation of ICoST 2025
	Presentation of Token of Appreciation for Sponsors and Officiator
	Photo Session
	Booth Visit
0930 - 0945	Tea Break
0945 - 1030	**Plenary Speaker 1 (Irama Hall)** Prof. Datuk Ir. Ts. Dr. Ahmad Fauzi Ismail, Universiti Teknologi Malaysia (UTM), Malaysia Title: Multifunctional Nanocomposite Membranes for Enhanced Separation: Innovations and Application Moderator: Assoc. Prof. Ir. Dr. Mazura Jusoh
1030 - 1105	**Keynote Speaker 1 (Irama Hall)** Prof. Dr. Eng. Ir. Reni Desmiarti, Universitas Bung Hatta, Indonesia Title: Integration of Electrocoagulation and Membrane Bioreactor for Enhanced Industrial Wastewater Treatment Moderator: Dr. Mohd Asmadi Mohammed Yussuf

1105 - 1140	**Keynote Speaker 2 (Irama Hall)** Assoc. Prof. Dr. Lin Qingsong, National University of Singapore (NUS), Singapore Title: Beyond The Matrix: Efficient Protein Extraction for Allergy Risk Evaluation of Complex Foods Moderator: Assoc. Prof. Dr. Chua Lee Suan
1140 - 1200	Presentation of Token of Appreciation for Plenary and Keynote Speakers
1200 - 1430	Lunch (Fuze Restaurant, Ground Floor)

PARALLEL PRESENTATION SESSION 1			
Time	**Irama 5**	**Irama 6**	**Irama 7**
	Chair: Dr. Nur Syazwani Mohd Ali **Co-Chair: Dr. Norela Jusoh**	**Chair: Dr. Nur Hidayah Zainan** **Co-Chair: Mr. Hafizuddin Sutimin**	**Chair: Dr. Zuhaili Idham** **Co-Chair: Dr. Muhammad Akmal Abdul Aziz**
1430 - 1445	**Invited speaker 1** Name: Assoc. Prof. Ir. Dr. Mazura Jusoh Association: Universiti Teknologi Malaysia Title: Parametric Study of Glucose Concentration Process Using Double Tube Freeze Concentrator	**Invited speaker 2** Name: Ts. Nurul Amirah Hanim Umar Association: PETRONAS Technical Services Sdn Bhd Title: Feasibility Study of Cryogenic RPB Innovation for Acid Gas Removal in LNG Processing - Design Perspective	

1445 - 1500	**ID-08** Name: Ms. Afiqa Nabihah Ahmad Zaini Association: Universiti Teknologi Malaysia Title: Investigation of the Effect of Additives on Texture of *Amorphophallus Sp.* Noodles	**ID-25** Name: Mr. Nofri Naldi Association: Universitas Bung Hatta Title: Electrocoagulation Process of Palm Oil Mill Effluent: Effect of Applied Voltage on Removal of Organic Content	**ID-38** Name: Mr. Mohammad Lokman bin Hilmi Association: Universiti Teknologi Malaysia Title: Kinetic Modelling of Supercritical CO_2 Extraction from Swietenia macrophylla Seeds Extracts Using the Single Sphere Model
1500 - 1515	**ID-09** Name: Dr. Norul Fatiha Mohamed Noah Association: Universiti Teknologi Malaysia Title: Application of Response Surface Methodology in Optimizing Thiourea Leaching for Metal Extraction from E-Waste	**ID-22** Name: Dr. Maulana Rosadi Association: Universitas Borobudur Title: A Novel Ozonation-High-Speed Electrocoagulation Hybrid System for the Removal of Manganese and Fluoride from Electroplating Wastewater	**ID-42** Name: Mr. Sayed Ibrahim Wafa Sayed Ismat Association: Universiti Teknologi Malaysia Title: Optimization of Amygdalin Extraction from Prunus Armeniaca Kernels for Antioxidant and Anti-Inflammatory Potentials

1515 - 1530	**ID-16** Name: Assoc. Prof. Dr. Wan Mohd Afiq Wan Mohd Khalik Association: Universiti Malaysia Terengganu Title: Amine-Functionalized Fe_3O_4@SiO_2 as Magnetic Dispersive Adsorbents for the Pre-concentration of Selective Serotonin Reuptake Inhibitor Antidepressants from Aqueous Solutions: Analytical Performance, Sorption Modeling, and Greenness Assessment	**ID-24** Name: Ir. Dr. Erda Desfitri Association: Universitas Bung Hatta Title: Biogas Production Potential from Animal Farm Waste: A Preliminary Study at Sirukam Dairy Farm, Indonesia	**ID-64** Name: Ms. Hui Ying Teh Association: Universiti Teknologi PETRONAS Title: Microalgae-Mediated Biological Synthesis of Silver Nanoparticles: Optimization and Morphological Characterization
1530 - 1545	Tea Break		

PARALLEL PRESENTATION SESSION 2			
	Chair: Assoc. Prof. Ir. Dr. Mazura Jusoh **Co-Chair: Ms. Afiqa Nabihah Ahmad Zaini**	**Chair: Dr. Noor Fauziyah Ishak** **Co-Chair: Dr. Norul Fatiha Mohamed Noah**	**Chair: Dr. Shuhada Atika Idrus Saidi** **Co-Chair: Mr. How Chee Yang**
1545 - 1600	**ID-51** Name: Dr. Norela Jusoh Association: Universiti Teknologi Malaysia Title: Characterization of Palm Oil Sterilizer Condensate and Phenolic Compounds Recovery Using Synergistic Extractive Extraction	**ID-44** Name: Ms. Nurul Aishah Abdul Rahim Association: Universiti Malaysia Sarawak Title: Zinc Chloride Recovery for Synthesis of Porous Adsorbent from Lipid Condensate for Dye Removal	**ID-65** Name: Ms. Eizleisya Binti Eizwar Association: Universiti Teknologi MARA Title: Quantitative Analysis of Cellulose, Hemicellulose and Lignin Content in Treated Semantan Bamboo Fiber Using TAPPI and Wise Methods
1600 -1615	**ID-62** Name: Ms. Fadzlin Qistina Fauzan Association: Universiti Teknologi Malaysia Title: Removal of Cadmium from Aqueous Solution through Synergistic Liquid-Liquid Extraction (LLE)	**ID-46** Name: Dr. Aishah Rosli Association: Universiti Teknologi Malaysia Title: Simulation-Based Comparative Study of CO_2 Absorption Techniques for Biogas Purification Using Aspen HYSYS and Aspen Plus	**ID-49** Name: Ms. Nur Hazwani Dalili Mohamad Association: Universiti Teknologi MARA Title: Sc–CO_2 Dried Biodegradable Alginate/Zirconia Aerogels: Synthesis, And Characterization

1615 - 1630	**ID-53** Name: Dr. Zuhaili Idham Association: Universiti Teknologi Malaysia Title: Influence of Temperature, Flow Rate, and Extraction Time on Subcritical Water Extraction of Eugenol and Hydroxychavicol from Piper Betel Leaves: A Comparative Study with Soxhlet Extraction	**ID-57** Name: Ms. Tengku Zarith Hazlin Tengku Zainal Abidin Association: Universiti Teknologi Malaysia Title: Subcritical Water Extraction of Protein from *Trichanthera Gigantea*: Optimization Using Response Surface Methodology	**ID-27** Name: Dr. Nor Akmar Mohd Yahya Association: Sunway University Title: CBD-Grown MoS_2 thin films on Plastic Optical Fiber for NH_3 Sensing: Fabrication and Performance
1630 - 1645	**ID-67** Name: Dr. Nurizzati Mohd Daud Association: Universiti Teknologi Malaysia Title: Green Valorization of Palm Oil Solid Condensate using Supercritical CO_2-Ethanol Extraction for Anti Inflammatory Potentials	**ID-58** Name: Ms. Nurul Aishah Abdul Rahim Association: Universiti Malaysia Sarawak Title: Optimization of *Mimosa Pudica Linn* Extraction at Varied Feed to Solvent Ratios and Solvent Concentrations Using Response Surface Methodology	**ID-40** Name: Mr. Hajhamad Osman Yousif Osman Association: University of Wollongong Title: Topology Optimization and Structural Analysis of an Octocopter Drone Frame Designed in SolidWorks
1700	End of Day 1		

POSTER PRESENTATION	
Time	**Events**
	Chair 1: Assoc. Prof. Dr. Chua Lee Suan **Chair 2: Dr. Mohd Asmadi Mohammed Yussuf**
1430 - 1445	**ID-76** Name: Dr. Chen Wenqian Association: National University of Singapore Title: Heterogenous Protein Crystallization with Mesoporous Silica
1445 - 1500	**ID-52** Name: Dr. Ramita Abdul Rahim Association: Universiti Teknologi MARA Title: Motivations to Engage in IT Sustainability and Circular Economy: An Extension of Self-Determination Theory
1500 - 1515	**ID-69** Name: Mr. Vikram Singh Association: CSIR-Indian Institute of Petroleum Dehradun, India Title: Process for Separation of Petrochemicals (BTX) from Naphtha Feed Stock
1515 - 1530	**ID-36** Name: Ms. Tarangini Rawat Association: Vikrant University, Gwalior India Title: Phytochemical Profile and Antimicrobial Potential of *Angelica glauca* Root Oil from the Indian Himalayas
1530 - 1545	Tea Break

DAY 2 (28TH SEPTEMBER 2025)			
PARALLEL PRESENTATION SESSION 3			
Time	**Irama 5**	**Irama 6**	**Irama 7**
0830 - 0900	Registration		
	Chair: Dr. Nur Izyan Wan Azelee **Co-Chair: Ms. Nurul Aishah Abdul Rahim**	**Chair: Dr. Izzat Naim Shamsul Kahar** **Co-Chair: Ms. Fadzlin Qistina Fauzan**	**Chair: Dr. Noor Azwani Mohd Rasidek** **Co-Chair: Ms. Tengku Zarith Hazlin Tengku Zainal Abidin**
0900 - 0915	**ID-50** Name: Mr. Hafizuddin Sutimin Association: Universiti Teknologi Malaysia Title: Influence of Feed Temperature on Progressive Freeze Concentration of Magnesium Sulphate Solutions	**ID-71** Name: Ms. Chelly Kong Yi Ting Association: Universiti Teknologi PETRONAS Title: Development of a Higher Order Numerical Wave Tank for Internal Waves	**ID-59** Name: Mr. Rafi Jusar Wishnuwardana Association: Universiti Teknologi PETRONAS Title: Prediction of Solvent Component and Composition for Absorption-Based Acid Gas Removal Unit using Optuna-LightGBM and K-means
0915 - 0930	**ID-68** Name: Ms. Intan Khazaimah binti Kushairi Association: Universiti Teknologi PETRONAS Title: Modified Electrospinning of PAN/Lignin Nanoyarns for Enhanced Alignment and Rapid Stabilization	**ID-18** Name: Ms. Yen Yan Ng Association: Universiti Teknologi Malaysia Title: Pectin-Functionalized Iron Oxide Nanoparticles for Enhanced Removal of Cationic Dyes: Influence of Pectin Methoxylation on Surface Charge and Adsorption Efficiency	**ID-75** Name: Ms. Nur Syamielia Sofi Association: Universiti Teknologi MARA Title: Optimization of Stable Water–Oil Emulsified Samples for Hydrate–Wax Interaction Studies

0930 - 0945			**ID-72** Name: Assoc. Prof. Dr. Jimoh K. Adewole Association: National University of Science & Technology Oman Title: Computer-Aided Molecular Design and Fabrication of Advanced Membrane Materials: An insight into the Application in Nitrogen/Methane Gas Separation
1000	Tea break		

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VIRTUAL PRESENTATION		
Time	**Breakout Room 1**	**Breakout Room 2**
0830 - 0900	Registration	
0900 - 0915	**Invited speaker 4** Name: Ts. Dhanaraj Turunawarasu Association: Pace CCS Title: Multi-solution Heat Exchanger Network Synthesis for Energy-efficient Cryogenic CO2 Capture in Pre-combustion and Oxy-fuel Combustion Applications	

v

	Chair: Assoc. Prof. Ir. Dr. Muhammad Abbas Ahmad Zaini **Co-Chair: Mr. Hilmi Abdul Rahman**	**Chair: Dr. Ahmad Syahmi Zaini** **Co-Chair: Dr. Nurul Adilah Manshor**
0915 - 0930	**ID-20** Name: Ir. Dr. Suffiyana Akhbar Association: Universiti Teknologi MARA Title: Polyethylene Glycol (PEG) Water-Soluble Binder Effects on Ceramic Guide Pins Characteristics Performance and Fabrication	**ID-48** Name: Ms. Siti Norasimah Hamid Association: Universiti Teknologi Malaysia Title: Fractional Flow Reserve of Non-Newtonian Blood Flow in Stenosed Bifurcated Artery
0930 - 0945	**ID-31** Name: Dr. Rozaini Abdullah Association: Universiti Malaysia Perlis Title: Screening and Integration of Watermelon Rind Extract (WMRE) for Functional Chitosan Thin Films	**ID-63** Name: Mr. Muhamad Afif Naqiudien Aladin Association: Universiti Malaysia Sabah Title: Applications of Machine Learning in Modelling and Optimization of Breakthrough Curve Analysis: A Focus on Artificial Neural Network and Their Comparison
0945 - 1000	**ID-13** Name: Dr. Shafirah Samsuri Association: Universiti Teknologi PETRONAS Title: Effect of Temperature and Time on the Conversion of Defatted Microalgae Biomass into Bio-Oil through Hydrothermal Liquefaction	**ID-32** Name: Dr. Noor Amirah Abdul Halim Association: Universiti Malaysia Perlis Title: Parametric Evaluation of Subcritical Water Extraction of Oleoresin from Syzygium Aromaticum via Factorial Design Approach

1000 - 1015	**ID-41** Name: Dr. Najiahtul Syafiqah Ismail Association: Universiti Teknologi Mara Title: Efficient Detection of Mobile Banking Trojans on Android Using Gaussian Naïve Ba	**ID-23** Name: Mr. Mohammed Awwal Suleiman Association: Universiti Teknologi Malaysia Title: Biochar from Pyrolysis of One-Step Phosphoric Acid Activated Pomegranate Peel Powder for Adsorptive Removal of Tetracycline in Aqueous Solution: Synthesis, Adsorption and Mechanism
1015 - 1030	**ID-17** Name: Mr. Mohamad Razlan Md Radzi Association: Universiti Teknologi PETRONAS Title: Eco-Friendly Activation of Palm Kernel Shell Carbon using Calcium Chloride from Cockle Shells	
1030	Tea Break	

CLOSING CEREMONY	
Time	**Events**
1000 - 1100	Tea break
1100 - 1200	Closing Ceremony (Irama Hall) Closing Speech from Director of CLEAR 2025 Awards 1. Best Session Presenter Award 2. Best Oral Presenter Award 3. Best Poster Presenter Award Closing Montage UTM Anthem "*Keunggulan Terbilang*"
1200 - 1400	Lunch
1400	End of Day 2

ABSTRACTS

PLENARY SPEAKER

PLENARY SPEAKER 1

Multifunctional Nanocomposite Membranes for Enhanced Separation: Innovations and Application

Ahmad Fauzi Ismail [a] and Pei Sean Goh

Advanced Membrane Technology Research Centre, Faculty of Chemical and Energy Engineering, Universiti Teknologi Malaysia, 81310 Johor Bahru, Malaysia

[a] Corresponding author: *afauzi@utm.my*

Abstract

Nanocomposite membrane represents a significant advancement and transformative solutions in membrane technology, offering enhanced performances in gas separation and wastewater treatment through the strategic incorporation of functional materials, including nano-scaled materials. By leveraging the unique chemical and structural properties of these functional materials, nanocomposite membranes exhibit significantly improved selectivity, permeability, and mechanical robustness. The presence of functional materials enables precise tuning of membrane microstructure and interfacial compatibility. This plenary talk provides an overview of recent advancements in nanocomposite membrane fabrication techniques, characterization, and performance evaluation. The advancements driven by innovative approaches to nanomaterial incorporation, including in situ growth, surface functionalization, and interfacial engineering, are discussed. Key case studies will be discussed, highlighting the role of various classes of functional materials such as metal-organic frameworks (MOFs) and graphene-based materials in tailoring membrane transport behavior for targeted separation applications. By integrating fundamental research with industrial relevance, this talk summarizes the transformative potentials of nanocomposite membranes and outlines the key challenges and opportunities.

ABSTRACTS

KEYNOTE SPEAKERS

KEYNOTE SPEAKER 1

Integration of Electrocoagulation and Membrane Bioreactor for Enhanced Industrial Wastewater Treatment

Reni Desmiarti[1, a)], Maulana Yusup Rosadi[2], Ariadi Hazmi[3], Nofrizon Rahman[4]

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Abstract

Industries produce harmful wastewater, and its treatment is challenging due to high pollutant load, complex composition, and potential environmental impact. Conventional treatment technologies often fall short in meeting stringent discharge standards, particularly when dealing with heavy metals, dyes, recalcitrant organics, and high chemical oxygen demand (COD). In recent years, integrated treatment systems have gained popularity for their ability to efficiently reduce high concentrations of pollutants. One promising approach is the integration of electrocoagulation (EC) with a membrane bioreactor (MBR), forming a hybrid system capable of enhanced pollutant removal, reduced sludge generation, and improved overall efficiency. EC can destabilize and remove suspended solids, colloids, and heavy metals through in situ generation of coagulation, while the MBR ensures biological degradation of organic matter and fine particle retention through membrane separation. When combined, EC acts as a pretreatment step that reduces membrane fouling and organic/inorganic load on the MBR, thereby extending membrane life and improving operational stability. The integrated EC-MBR technology shows significant potential for sustainable industrial wastewater treatment, offering high removal efficiencies for COD, BOD, turbidity, color, and toxic metals, while aligning with circular economy and zero-liquid-discharge strategies. Further research into reactor design, automation, and life cycle assessment is essential to accelerate its industrial application.

KEYNOTE SPEAKER 2

Beyond the Matrix: Efficient Protein Extraction for Allergy Risk Evaluation of Complex Foods

Lin Qingsong [a)]

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Abstract

The rise of alternative proteins, ranging from plant-based to fungal and cultured meat, presents a promising path toward sustainable food systems. However, these complex and heavily processed food matrices pose significant challenges for food safety assessment, particularly in detecting potential allergens. In this keynote, I will present our development of a highly efficient and reproducible protein extraction method that enables accurate allergen quantification across diverse alternative protein sources. By integrating optimized SDS-based extraction with heat treatment and advanced mass spectrometry, our approach significantly improves protein solubilization, identification, and reproducibility. I will discuss the implications of extraction efficiency on allergen detectability and demonstrate how this workflow enhances the resolution of proteomics-based allergen profiling. The method's transferability across laboratories also underscores its practical relevance for regulatory agencies and the food industry. This work represents a critical step toward robust food allergy risk assessment in next-generation protein innovation.

ABSTRACTS

INVITED SPEAKERS

INVITED SPEAKER 1

Parametric Study of Glucose Concentration Process Using Double Tube Freeze Concentrator

Mazura Jusoh [a)]

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Abstract. Glucose concentration is a critical step in various industrial and laboratory processes, including food and beverage production, pharmaceutical formulation, and biofuel production. The double tube freeze concentrator (DTFC) is a newly designed technology for concentrating dilute glucose solutions due to its efficiency and scalability. However, the optimization of operating parameters for glucose concentration in a DTFC remains a challenge, as it requires a comprehensive understanding of the complex interplay between process variables. This study aimed to optimize the operating parameters for glucose concentration using a DTFC through a systematic experimental and numerical investigation. The key operating parameters considered in this research include the initial glucose concentration, circulation flow rate, coolant temperature, and circulation time. Experimental trials were conducted using a lab-scale DTFC setup, where glucose solutions were processed under different operating conditions. The resulting glucose concentration and recovery were measured to evaluate the impact of each parameter on the process performance. Furthermore, the developed experimental and numerical framework can serve as a basis for further research and optimization of other freeze concentration systems for diverse applications beyond glucose concentration.

INVITED SPEAKER 2

Feasibility Study of Cryogenic RPB Innovation for Acid Gas Removal in LNG Processing-Design Perspective

Amiza Surmi[1], Norazliza Md Tahir[2], Nurul Amirah Hanim Umar[2, a)], Nur Baizurah M Zamry[2], Radin Suhaib Salihuddin[1]

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Abstract. The global demand for gas production is rising rapidly due to economic growth, with the Asia Pacific region among the highest contributors. To meet this demand, innovative technology like the Rotating Packed Bed (RPB) operated at cryogenic conditions is being explored and studied for application focusing on acid gas removal in Liquefied Natural Gas (LNG) processing on floater topside. This study delves on 30% CO2 gas field with high H2S and ethane composition via cryogenic technologies with comparable separation capability as conventional amine-based technologies. The main methodology involves detailed process simulations and benchmarking with conventional commercial floater design as a basis for technology scale-up. Amongst key challenges regarding cryogenic RPB design on a floater are non-conventional acid gas removal process, plot space constraint, energy intensity, and technology scale-up. This study also highlights the potential improvement of cryogenic RPB design in optimized refrigeration schemes and careful evaluation of heavy hydrocarbon recovery. Overall, the successful implementation of cryogenic RPB design optimization for acid gas removal is crucial to unlock monetization of high CO2 gas field(s).

INVITED SPEAKER 3

Transforming Palm Oil Bioresources: Advancing the Bio-Circular Economy through Nutrient Recovery and High-Value Bioproduct

Shahrul Ismail[a)]

Bioprocess and Energy Nexus Group (BioNexG), Universiti Malaysia Terengganu (UMT), 21030 Kuala Nerus, Terengganu, Malaysia

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Abstract. The palm oil industry is one of Malaysia's most economically significant sectors, contributing over RM 100 billion to the national GDP annually. However, it also generates vast quantities of underutilized waste, particularly palm oil mill effluent (POME) estimated at 53 million tonnes per year and solid biomass such as empty fruit bunches (EFB). POME contains high levels of chemical oxygen demand (COD: 44,000–65,000 mg/L) and total nitrogen (TN: 200–800 mg/L), making it an environmental pollutant if untreated. Traditional treatment methods fail to recover nutrients and often lead to methane emissions, contributing to greenhouse gas accumulation. Bio-circular economy approach for palm oil waste management, emphasizing waste valorization and industrial symbiosis. Central to this strategy is the utilization of pre-treated POME as a nutrient medium for cultivating high-value microalgae in closed-system photobioreactors (PBRs). In UMT-led pilot trials, microalgae species such as Chlorella vulgaris and Nannochloropsis sp. achieved biomass productivities of up to 1.5 g/L/day in POME-based media, with lipid content exceeding 30% dry weight, suitable for aquafeed and bioenergy applications. In addition, nutrient recovery from POME led to a >75% reduction in TN and TP (total phosphorus), supporting sustainable discharge standards and water quality improvements. Anaerobic co-digestion with microalgae biomass also demonstrated potential for biogas yields of 400–500 mL CH_4/g VS, promoting a zero-waste energy loop. The presentation will highlight data from current UMT research and joint industry-academic pilot projects with selected palm oil mills in Terengganu. Economic modelling indicates that integrating PBR systems for microalgae production using POME can reduce feed costs by up to 30%, while creating new revenue streams from algae-based bioproducts

INVITED SPEAKER 4

Multi-solution Heat Exchanger Network Synthesis for Energy-efficient Cryogenic CO_2 Capture in Pre-combustion and Oxy-fuel Combustion Applications

Dhanaraj Turunawarasu[a)]

Swinburne University

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Abstract. Energy efficiency is crucial for reducing global emissions, with the energy sector responsible for three-quarters of emissions. The International Energy Agency (IEA) emphasises the role of energy efficiency, projecting it to contribute over 40% of necessary emission reductions by 2040. Cryogenic CO2 capture methods, particularly designed for carbon capture in pre-combustion and oxy-fuel combustion may play a significant role in reducing emissions in the near future. However, the increased operational costs and indirect emissions due to high utility consumption by cryogenic CO2 capture systems remain as critical challenges. Thus, further improvements in energy efficiency are vital to enhance the viability of cryogenic CO2 capture technologies. This study focuses on synthesizing an energy-efficient cryogenic CO2 capture process by exploring heat recovery opportunities through pinch analysis. P-HENS, an open-source graph-theoretical-inspired tool, is used to construct feasible heat exchanger networks (HEN). Multiple near-optimal HEN are generated and benchmarked to select the optimal HEN for the proposed.

ABSTRACTS

PARTICIPANTS

ICOST 2025: ID-08

Investigation of the Effect of Additives on Texture of Amorphophallus Sp. Noodles

Afiqa Nabihah Ahmad Zaini[1], Mazura Jusoh[1, 2, a)], Zaki Yamani Zakaria[1], Yanti Maslina Mohd Jusoh[1], Mohamad Sukri Mohamad Yusof[1], Dayang Norulfairuz Abang Zaidel[3], Norzita Ngadi[1], How Chee Yang[1]

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Abstract. Konjac noodles, derived from Amorphophallus muelleri flour (AMF), are a promising functional food due to their high dietary fiber content and health benefits, including cholesterol regulation and glucose control. However, their acceptance is limited by poor textural characteristics such as excessive chewiness and weak structural integrity. This study investigates the effects of two specific additives, which are calcium hydroxide and psyllium husk, on the textural properties of noodles produced from Amorphophallus muelleri flour (AMF), focusing on firmness, springiness, and toughness. The konjac noodle was prepared using the ratio of konjac flour: water (1:10) and two different additives which are 0.01%, 0.02%, 0.03% calcium hydroxide and 0.1%, 0.2%, 0.3% of psyllium husk (w/w). Texture Profile Analysis (TPA) revealed that calcium hydroxide significantly enhanced firmness, while psyllium husk improved springiness and overall chewiness. The findings revealed that the addition of calcium hydroxide significantly increased noodle firmness and gel stability, while psyllium husk enhanced the springiness and chewiness of the final product. The combined application of both additives produced a synergistic effect, offering improved texture closer to conventional wheat-based noodles while retaining the health benefits associated with konjac. These results suggest that additive optimization can play a crucial role in the development of konjac-based functional foods with superior sensory and structural qualities.

ICOST 2025: ID-09

Application of Response Surface Methodology in Optimizing Thiourea Leaching for Metal Extraction from E-Waste

Norul Fatiha Mohamed Noah[1], Norasikin Othman[1,2, a)], Izzat Naim Shamsul Kahar[1,2], Sazmin Sufi Suliman[1], Shuhada Atika Idrus-Saidi[1, 2, b)], Aishah Rosli[1,2]

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Abstract. Electronic waste (e-waste) is an escalating environmental concern that poses significant risks to human health and ecosystems. Despite its hazardous nature, e-waste is rich in valuable metals, particularly gold (Au), which has a high economic value and is experiencing a rising market price trend. Consequently, Au recovery from e-waste is crucial for long-term environmental sustainability as well as economic feasibility. This work describes a less harmful thiourea leachate method for removing gold from used printed circuit boards (PCBs). The study looks at a number of variables, such as the concentration of thiourea, the concentration of acid, and oxidizing agents, that affect how effective the leaching process is. To improve Au recovery, Box-Behnken design and Response Surface Methodology (RSM) are used to optimize these parameters. The maximum predicted Au extraction performance was found to be 2.81ppm, achieved at specific conditions of 57.971 mL H_2O_2, 0.502M thiourea, and 1.006M H_2SO_4. The observed extraction value closely matched this prediction at 2.87ppm, indicating a deviation of less than 5%. The results highlight thiourea as the most significant variable influences Au recovery, with the interaction between thiourea and H_2SO_4 playing a critical role in the leaching process. Also, the separation factors (β) indicate that Au can be efficiently separated from other metals, particularly copper and aluminium, with high separation factors of 31.10 and 18.59, respectively. This work contributes to the development of sustainable practices for e-waste management and underscores the potential of thiourea in the metallurgical recovery of precious metals from electronic waste.

ICOST 2025: ID-16

Amine-Functionalized Fe_3O_4@SiO_2 as Magnetic Dispersive Adsorbents for the Pre-concentration of Selective Serotonin Reuptake Inhibitor Antidepressants from Aqueous Solutions: Analytical Performance, Sorption Modeling, and Greenness Assessment

Khirtana Raveendran[1], Loh Saw Hong[1], and Wan Mohd Afiq Wan Mohd Khalik[1, 2, a)]

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Abstract. This study successfully synthesized, characterized, and applied a magnetic amine-functionalized adsorbent material, modified with an alkaline activator, for the pre-concentration of five selective serotonin reuptake inhibitor (SSRI) antidepressant drugs in water. A range of techniques, including X-ray diffraction (XRD), scanning electron microscopy (SEM), vibrating sample magnetometry (VSM), specific surface area analysis, and Fourier transform infrared spectroscopy (FTIR), were employed to investigate the physical and chemical properties of the synthesized material. Response surface methodology, specifically the 27-run Plackett–Burman and the 24-run Central Composite design, was utilized to explore synergistic factors influencing the magnetic dispersive micro-solid phase extraction method. The optimal conditions for pre-concentrating the target analytes as suggested by model as follows: a sample volume of 15 mL, water temperature of 22 °C, sorbent weight of 0.5 g, effervescent precursor amount of 1 g, solution pH of 11.0, contact time of 7 minutes, and desorption solvent volume of 250 µL. Under these conditions, a high recovery of 90% was achieved, with a desirability value of 0.90. Quantification of the analytes was performed using HPLC-DAD. The method demonstrated low limits of detection (LOD) and quantification (LOQ), ranging from 0.01 to 0.08 µg/mL and 0.03 to 0.28 ng/mL, respectively. Extraction recoveries ranged from 79% to 95%, while intra- and inter-day precision showed low variability, (RSDs) below 10%. Regeneration studies revealed recovery losses of less than 10% after four cycles of use. The Freundlich isotherm model (R^2 >0.990) and the pseudo-second-order kinetic model (R^2 >0.980) provided the best fit to the experimental data. Furthermore, the magnetic dispersive micro-solid phase extraction method achieving an AGREEnness score of 0.70, a Blue Applicability Grade Index of 67.5 and a Sample Preparation Metric Sustainability score of 7.37, respectively.

ICOST 2025: ID-51

Phenolic Compounds Recovery from Palm Oil Sterilizer Condensate Using Synergistic Extraction

Norela Jusoh[1,2], Norasikin Othman[1,2, a)], Shuhada A. Idrus-Saidi[1,2, b)], Muhammad Abbas Ahmad Zaini[1,2], Izzat Naim Shamsul Kahar[1], Norul Fatiha Mohamed Noah[1]

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[b)] *shuhada.atika@utm.my*

Abstract. Palm oil sterilizer condensate (POSC) has been identified as a potential source of bioactive phenolic compounds (PCs), which are rich in antioxidant properties. In this study, an extractive extraction approach was employed to recover PCs from POSC using a green synergistic formulation. The POSC was initially characterized to determine its total phenolic contents (TPC), ionic composition, and pH. The effects of key parameters including extractant concentration, agitation speed, and treat ratio on the extraction PCs were evaluated. Additionally, the optimal condition for recovering PCs from the loaded organic phase was investigated by varying stripping agent concentration. The result revealed that POSC contains a high concentration of TPC, approximately 4200 mg GAE/L. An extraction efficiency exceeding 93% was achieved using a synergistic mixture of 0.3/0.0024 M Aliquat 336/D2EHPA, an agitation speed of 240 rpm, and a treat ratio of 0.4. Furthermore, almost 99% of the extracted PCs were successfully recovered using 1/0.12 M NaOH/Na_2CO_3. These findings highlight the potential of POSC as a low-cost secondary source for PCs recovery and contribute to the valorization of palm oil mill waste through sustainable resource utilization.

ICOST 2025: ID-62

Removal of Cadmium from Simulated Wastewater Through Synergistic Reactive Extraction

Fadzlin Qistina Fauzan[1], Izzat Naim Shamsul Kahar[1], Norisya Balqis Mohd Amin[1], Norasikin Othman[1,2], Shuhada A. Idrus-Saidi[1,2, a)]

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Abstract. Cadmium (Cd) contamination in water poses serious environmental risks due to its high toxicity, making effective removal strategies essential. Among various methods, reactive extraction has emerged as a promising and greener approach for Cd removal from wastewater. The use of a single extractant has shown potential in Cd removal from wastewater. However, its efficiency remains limited, highlighting the need for improved formulations. In this study, the effects of extractant type, concentration, and synergistic combinations were investigated to determine the most effective system for Cd extraction. The results revealed that the synergistic pairing of phosphinothioic acid (Cyanex 302) as the base extractant, with tributyl phosphate (TBP) as a synergist, using palm oil as diluent, achieved high efficiency. At the optimized conditions of 0.03 M Cyanex 302 and 0.001 M TBP, Cd extraction reached 99.47%. Stoichiometric analysis conducted indicated that 0.5 mole of Cyanex 302 interacted with one mole of Cd during complex formation, confirming the extraction mechanism. For Cd stripping, 0.15 M H_2SO_4 exhibited the highest stripping efficiency, with 96.73% Cd successfully stripped from the organic phase. Stoichiometric analysis revealed that 1.5 moles of H_2SO_4 are required to complex with one mole of Cd, validating the stripping mechanism.

ICOST 2025: ID-53

Influence of Temperature, Flow Rate, and Extraction Time on Subcritical Water Extraction of Eugenol and Hydroxychavicol from Piper Betel Leaves: A Comparative Study with Soxhlet Extraction

Zuhaili Idham[1, a)], Mohd Sharizan Md Sarip[2], Noor Azwani Mohd Rasidek[1], Siti Alyani Mat[1], Aishah Rosli[1], Nik Zetti Amani Nik Faudzi[1]

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Abstract. Piper betel leaves are rich in phenolic compounds such as eugenol and hydroxychavicol, which possess notable antioxidant and antimicrobial properties. This study evaluated the influence of temperature (120 °C and 180 °C), flow rate (1, 3, and 5 mL/min), and extraction time (10, 20, and 30 minutes) on the extraction of these compounds using subcritical water extraction (SWE), and compared the results to Soxhlet extraction using ethanol at varying concentrations (25–100%). The SWE results showed that eugenol yield increased from 0.52% at 120 °C to 0.83% at 180 °C, while hydroxychavicol increased from 2.53% to 4.77%, indicating strong temperature dependence. Flow rate significantly influenced hydroxychavicol, with the highest yield (13.75%) at 3 mL/min, whereas eugenol increased steadily with higher flow rates. Extended extraction time (20–30 minutes) enhanced yields for both compounds, with maximum hydroxychavicol (5.17%) and eugenol (0.74%) observed at 30 minutes. In contrast, Soxhlet extraction required longer time (6 hours) and yielded lower amounts: eugenol ranged from 0.03–0.23%, and hydroxychavicol from 0.48–2.28%, with the best result at 75% ethanol. The study demonstrates that SWE is a faster, solvent-free, and more efficient method for extracting high-value phenolics from Piper betel compared to conventional extraction, highlighting its promise for sustainable phytochemical recovery.

ICOST 2025: ID-67

Green Valorization of Palm Oil Solid Condensate using Supercritical CO_2-Ethanol Extraction for Anti-Inflammatory Potentials

Noor Azwani Mohd Rasidek[1, a)], Liza Md Salleh[1, b)], Nurizzati Mohd Daud[3], Noor Sabariah Mahat[1], Zuhaili Idham[2], Mohammad Lokman Hilmi[1], Muhammad Abbas Ahmad Zaini[1]

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Abstract. Palm oil sterilization condensate (POSteC), a milling by-product, is rich in bioactive compounds with therapeutic potential. This study valorized its solid fraction (POSC) using supercritical fluid extraction (SFE) with CO_2–ethanol across 40–80 °C and 10–30 MPa. Extraction yield, β-carotene, α-tocopherol, total phenolic content (TPC), total flavonoid content (TFC), and antioxidant activity (AA) were assessed, alongside LC-MS/MS profiling of anti-inflammatory constituents. TPC increased with harsher conditions, peaking at 52.214 mg/g GAE DW (80 °C, 30 MPa), whereas TFC was highest under mild conditions (155.384 mg/g QE DW at 40 °C, 10 MPa) due to thermal sensitivity. AA remained consistently high (>95%), indicating preserved radical-scavenging potential. Key bioactives, including pseudobrucine, fawcettiine, and eclalbasaponin V, were linked to NF-κB and COX pathway modulation. Overall, mid SFE conditions (60 °C, 20 MPa) provided the most balanced phytochemical profile. These findings demonstrate SFE as a green strategy to convert POSC into antioxidant and anti-inflammatory-rich extracts for nutraceutical, cosmetic, and pharmaceutical applications.

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Influence of Feed Temperature on Progressive Freeze Concentration of Magnesium Sulphate Solutions

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Abstract. Progressive freeze concentration (PFC) is a separation technique that manipulates cryogenisation technology to concentrate or purify liquid solutions. It offers strong potential for sustainable water purification. However, the influence of feed temperature on PFC performance remains underexplored. Therefore, this study aims to investigate the influence of room temperature feed (RF) and pre-chilled feed (CF) on the PFC process using magnesium sulphate solutions. The study focused on separation metrics, kinetics, and energy demand using a vertical finned crystallizer under controlled cycle duration (50 minutes), circulation flow rate (2100 mg/min), and cooling temperature (-10 °C). The findings of this study were analyzed using multivariate analysis. It revealed no significant overall effect on combined performance metrics ($p = 0.580$) for either feed condition. Furthermore, a deeper analysis of each metric showed that feed temperature did not significantly affect solute recovery ($p = 0.726$), partition constant ($p = 0.741$), or process kinetics ($p = 0.161$–0.483), indicating the stability of PFC selective crystallization despite different feed temperatures such as RF and CF. Although the difference was not statistically significant ($p = 0.379$), higher recovery efficiency was observed under RF conditions (72.69 ± 4.95%) compared to CF (69.40 ± 2.84%), suggesting that thermal boundary-layer thinning enhances solute rejection without compromising selectivity. Warmer feeds also yielded purer ice fractions, attributed to enhanced convective removal of rejected ions. In terms of energy demand, although CF samples consumed significantly less total energy ($p < 0.001$), they exhibited lower energy efficiency ($p = 0.001$), indicating a shift from sensible-heat removal to a reversible, convectively assisted freezing pathway. While pre-cooling reduces energy input, maintaining flow-driven boundary-layer dynamics is essential for optimizing both energy use and separation performance.

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Modified Electrospinning of PAN/Lignin Nanoyarns for Enhanced Alignment and Rapid Stabilization

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Abstract. PAN and PAN/lignin precursor fibers were fabricated using both conventional and modified electrospinning setups. The modified setup, designed to produce uniaxially aligned nanoyarns, applied in-situ tension and twisting to improve fiber alignment and reduce diameter. Twisted PAN fibers exhibited the best alignment and smallest diameter (~50 μm), while PAN mats showed broader distribution (~75 μm). PAN/lignin nanoyarns had a larger average diameter (~150 μm) but retained good orientation. All twisted fibers were subjected to stabilization by varying temperatures and heating rates to evaluate their structural and chemical changes. Characterization using Fourier-Transform Infrared Spectroscopy (FTIR), Thermogravimetric Analysis (TGA) and, X-ray Diffraction (XRD) were analyzed to study the effects of different stabilization parameters. FTIR analysis revealed that lignin enhanced cyclization and oxidation at higher temperatures, indicated by a reduction in C≡N and C–H, and increase in C=N groups. XRD analysis confirmed increased crystallinity at elevated temperatures, particularly in PAN/lignin fibers. FTIR, XRD and TGA results also confirm that at higher temperature and at 10 ˚C/min temperature rate has reduced the stabilization duration tremendously by 60% of time consumption without jeopardizing the crystallinity and structures formation during stabilization process. These results highlight the effectiveness of the modified electrospinning setup and the potential of PAN/lignin nanoyarns for the subsequent carbonization stages as a greener and sustainable carbon fiber precursors, by improving the orientation and reducing the stabilization duration.

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Electrocoagulation Process of Palm Oil Mill Effluent: Effect of Applied Voltage on Removal of Organic Content

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Abstract. Palm oil mill effluent (POME) has high organic content or extremely polluted waste water. Electrocoagulation is advanced alternative technology to treat POME. This study aims to investigate the effects of applied voltage and residence time on chemical oxygen demand (COD), biological oxygen demand (BOD), and total dissolved solid (TDS) removal. Aluminum electrodes were used and applied voltage was varied between 5, 7, and 9 volts. The sampling time was conducted at 30, 60, 90, and 120 minutes. The results showed that the removal of COD, BOD, and TDS increased with the increased of applied voltage. The optimum applied voltage at 9 volts and pH 7.7, achieving the highest removal efficiencies: 96.7% for COD, 98.8% for BOD, and 99.8% for TDS at 120 minutes of processing time. This research found that electrocoagulation process is very effective to treat highly polluted wastewater such as pam oil mill effluent.

ICOST 2025: ID-22

A Novel Ozonation-High-Speed Electrocoagulation Hybrid System for the Removal of Manganese and Fluoride from Electroplating Wastewater

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Abstract. Industries, like electroplating, discharge wastewater containing toxic pollutants such as manganese (Mn^{2+}) and fluoride (F^-), which pose significant environmental and public health concerns. A novel ozonation-high-speed electrocoagulation hybrid system has been developed to overcome the limitations of conventional stand-alone electrocoagulation (EC) in removing Mn^{2+} and F^-. The system combined a high-spiral-current EC reactor using aluminum and stainless-steel electrodes with an ozonation module that introduced ozone (O_3) to enhance oxidation and treatment efficiency. The satisfactory results were achieved at the experimental operating conditions: O_3 dose of 30 mg/L, O_3 generation rate of 4.2 mg/s, ozonation time of 30 min, current intensity of 900 A, and electrolysis time of 3 min. Under these conditions, the system achieved Mn^{2+} and F^- removal efficiencies of 91.4% and 58%, respectively, through oxidative precipitation, complexation, and coagulation-adsorption mechanisms. Kinetic and adsorption studies were performed to understand the degradation behavior of the pollutant during the hybrid process. The removal process followed pseudo-second-order kinetics (R^2 = 0.97), indicating chemisorption, and was well-fitted by the Langmuir isotherm (R^2 = 0.99), confirming monolayer adsorption on homogeneous active sites. The mass transfer characteristics and energy consumption were analyzed and compared with stand-alone EC and other reported hybrid systems. Results demonstrated superior performance with reduced energy cost and faster treatment time, making it a promising solution for real-time industrial wastewater treatment.

ICOST 2025: ID-24

Biogas Production Potential from Animal Farm Waste: A Preliminary Study at Sirukam Dairy Farm, Indonesia

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Abstract. The generation of animal waste from dairy farming activities presents both an environmental challenge and an opportunity for renewable energy production. This study aims to analyze the biogas production potential from livestock waste generated at Sirukam Dairy Farm, West Sumatra. The research involved estimating the volume of waste, analyzing its carbon-to-nitrogen (C/N) ratio, and calculating the theoretical yield of biogas based on volatile solids (VS). The results show that with approximately 100 cows producing an average of 20 kg of manure per day, the farm generates 2,000 kg of manure daily. Laboratory analysis indicates a C/N ratio of 25:1, ideal for anaerobic digestion. Theoretical biogas production is estimated at 0.35 m^3/kg volatile solids (VS), resulting in a potential daily output of 350–400 m^3 of biogas. This energy can be utilized for cooking, lighting, and heating processes within the farm, promoting sustainability and reducing environmental impact.

ICOST 2025: ID-44

Zinc Chloride Recovery for Synthesis of Porous Adsorbent from Lipid Condensate for Dye Removal

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Abstract. Zinc chloride ($ZnCl_2$) is one of the most frequently used chemical activators for the synthesis of porous adsorbents. However, $ZnCl_2$ activator is constrained by the corrosive nature of zinc ions (Zn^+) and accumulation of chemical waste, posing a significant environmental concern. To address these issues, the potential of recycling the $ZnCl_2$ recovered from washing filtrate is explored as a resource utilization strategy. Lipid condensate, a by-product from sterilization process in palm oil mill is proposed as a precursor for activation using the recovered $ZnCl_2$ washing filtrate. Preliminary insights suggest that the absorption performance of the absorbent produced with recovered $ZnCl_2$ may exhibit a comparable result to that prepared using fresh $ZnCl_2$. Nevertheless, further reuse of the activator beyond the first-cycle of recovered $ZnCl_2$ may results in a significant decline of adsorption performance. This commentary highlights a practical approach for $ZnCl_2$ recovery aimed at reducing environmental burden while maximizing the utilization efficiency of $ZnCl_2$.

ICOST 2025: ID-46

Simulation-Based Comparative Study of CO_2 Absorption Techniques for Biogas Purification Using Aspen HYSYS and Aspen Plus

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Abstract. Upgrading biogas by removing CO_2 is essential to increase its energy value and usability as a clean fuel. This study compares three CO_2 absorption techniques using simulation: chemical absorption with monoethanolamine (MEA), diethanolamine (DEA), methyl diethanolamine (MDEA) with piperazine (PZ), and physical absorption with water. The MEA, DEA, and MDEA/PZ systems were simulated using Aspen HYSYS, while water scrubbing was simulated using Aspen Plus. The simulations used standardized biogas composition and analyzed the effect of parameters such as solvent concentration, temperature, pressure, and liquid-to-gas (L/G) ratio. MEA showed a maximum removal efficiency of 99.28% at 35 mol% and 60°C. MDEA/PZ performed well under low-pressure conditions, with improved absorption due to PZ activation. Water scrubbing showed better CO_2 removal at higher pressures and L/G ratios but was less selective than amine solvents. The results highlight trade-offs between chemical and physical absorption: amine-based systems offer higher efficiency but may involve higher regeneration costs, while water scrubbing provides a more straightforward and cost-effective option. This study provides valuable insights for selecting efficient and sustainable biogas upgrading methods.

ICOST 2025: ID-57

Subcritical Water Extraction of Protein from *Trichanthera Gigantea*: Optimization Using Response Surface Methodology

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Abstract. Rising costs of conventional poultry feed ingredients like soybean and fish meals highlight the need for sustainable, local protein sources. *Trichanthera gigantea* (*T. gigantea*), with around 22% crude protein and a nutritionally rich amino acid profile, offers potential as a feed ingredient but faces challenges such as anti-nutritional factors and limited shelf life. This study investigates the use of Subcritical Water Extraction (SWE), an environmentally friendly and solvent-free technique that employs pressurized hot water to efficiently extract protein from *T. gigantea* leaves. SWE offers advantages such as enhanced extraction efficiency and reduced reliance on organic solvents, aligning with the principles of green technology. To optimize the extraction process, experiments were designed using Response Surface Methodology (RSM) with a Central Composite Design (CCD), evaluating the combined effects of key parameters including temperature (140–180 °C), extraction time (10–40 minutes), and flow rate (1–3 mL/min). The results identified optimal operating conditions for maximizing protein recovery while preserving protein integrity. The findings of this study establish a foundational approach for the scalable and efficient recovery of plant-based protein from *T. gigantea*, contributing to the diversification of sustainable poultry feed sources. This aligns with Malaysia's National Food Policy Action Plan 2021–2025, which emphasizes local feed production and food security through environmentally responsible innovation.

ICOST 2025: ID-58

Optimization of *Mimosa pudica* Linn Extraction at Varied Feed to Solvent Ratios and Solvent Concentrations using Response Surface Methodology

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Abstract. *Mimosa pudica* linn, a creeping plant with either annual or perennial flowering, is commonly known as Daun Semalu in Malaysia. This plant has gained worldwide recognition among researchers not only for its unique reaction upon touch, but also for its long-standing used in traditional medicine. In this study, Response Surface Methodology (RSM) was used to determine the ideal extraction conditions of the plant leaves by Soxhlet extraction. The study was conducted using ethanol as the solvent at three different concentrations (50%, 70% and 90%) with varied feed-to-solvent ratios (1:15, 1:17, 1:20). The highest extraction yield achieved is 18.61% at ratio of 1:20 with a solvent concentration of 90%. Further analyses using Fourier Transform Infrared Spectroscopy (FTIR) and Gas Chromatography-Mass Spectrometry (GC-MS) were also conducted to identify the bioactive compounds present in the extracts. FTIR results indicated the presence of various functional groups such as phenolics, alcohol, and alkene groups, suggesting the presence of bioactive compounds. GC-MS analysis identified several key compounds, including benzene, phytol, and phenol, 2,4-bis(1-methyl-1-phenylethyl)-, which are known for their therapeutic properties.

ICOST 2025: ID-71

Development of a higher order numerical wave tank for internal waves

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Abstract. Internal waves, particularly internal solitary waves (ISW), play a significant role in ocean dynamics and have substantial implications for offshore structures and underwater operations. The South China Sea is a region where ISW is frequently observed, posing challenges to offshore platforms, submarine navigation, and underwater infrastructure. However, accurate numerical modelling of ISW remains limited due to computational inefficiencies and a lack of publicly available simulation tools. This study presents the development of a higher-order numerical wave tank for simulating internal waves in a double-layer wave system under the rigid lid approximation. The model employs a Finite Difference Method (FDM) combined with a sigma-coordinate transformation, enabling computations to be performed on a fixed two-dimensional grid despite spatial variations in the velocity potential, ϕ. An arbitrary-order stencil was implemented, allowing the numerical accuracy to be tuned according to specific real-world problem requirements. The numerical model builds upon previous work that lacked an open-source implementation. The velocity potential was solved as an intermediate step to derive the two-dimensional velocity field. With the application of the known boundary conditions, the combined-layer numerical model demonstrated satisfactory performance when validated against established benchmark test cases, with results aligning well within the understandable error margins. To further contribute to future research, the model was structured as an open source for reuse within the research group. Future development will focus on adopting second-order wave theory, removing the rigid lid approximation, and extending the model to three-dimensional configurations. These improvements bridge the gap between numerical simulations and the real-world dynamics of internal waves.

ICOST 2025: ID-18

Pectin-Functionalized Iron Oxide Nanoparticles for Enhanced Removal of Cationic Dyes: Influence of Pectin Methoxylation on Surface Charge and Adsorption Efficiency

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Abstract. The discharge of industrial dye effluents, particularly those containing persistent cationic dyes such as methylene blue, poses a serious threat to aquatic ecosystems and public health due to their stability and resistance to conventional treatment methods. Among various emerging remediation strategies, iron oxide nanoparticles (IONPs) have attracted significant attention for their high surface area and strong adsorption capacity toward such dyes. However, their practical use is hindered by colloidal instability and agglomeration, which limit their dispersion and reduce adsorption efficiency. To address these limitations, this study aims to develop and evaluate a sustainable nanocomposite adsorbent by functionalizing IONPs with pectin, a biodegradable polysaccharide derived from agricultural waste. Specifically, the influence of pectin methoxylation, comparing high methoxyl pectin (HMP) and low methoxyl pectin (LMP) on the surface charge, colloidal stability and adsorption performance of the composite materials was systematically investigated. The influence of synthesis parameters particularly temperature, on the structural characteristics and dye adsorption capacity of the pectin-functionalized IONPs was explored. The IONPs were synthesized via a co-precipitation method and functionalized with HMP and LMP. The nanoparticles were characterized by zeta potential analysis and adsorption experiments using methylene blue as a model pollutant. Results demonstrate that pectin functionalization significantly enhances the surface charge and dispersion stability of the nanoparticles, with notable differences observed between HMP- and LMP-functionalized IONPs. These findings highlight the critical role of both synthesis conditions and pectin structure in tailoring nanoparticle properties and support the development of efficient, eco-friendly adsorbents for wastewater treatment applications.

ICOST 2025: ID-38

Kinetic Modelling of Supercritical CO_2 Extraction from Swietenia macrophylla Seeds Extracts Using the Single Sphere Model

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Abstract. Swietenia macrophylla, commonly known as "Tunjuk Langit," has been reported to exhibit antidiabetic properties, attributed to its high phytosterol content, with β-sitosterol comprising approximately 66% of the total sterols in the extract. In this study, supercritical carbon dioxide (SC-CO_2) was used to extract oil from S. macrophylla, and the mass transfer behaviour was modelled using the Single Sphere Model (SSM). Key parameters namely the diffusion coefficient (D_e) and external mass transfer coefficient (kf) were estimated based on experimental data. The D_e values ranged from 1.0104×10^{-13} to 17.912×10^{-13} m^2/s, while kf varied between $0.7115 \times 10^{-}6$ and 3.9919×10^{-6} m/s. Biot numbers consistently exceeded 500 across all parameters, confirming that internal diffusion governs the SC-CO_2 extraction process of S.macrophylla. These results highlight the importance of considering both internal diffusion and external film resistance when modelling extraction kinetics to achieve accurate process predictions.

ICOST 2025: ID-42

Optimization of Amygdalin Extraction from Prunus Armeniaca Kernels for Antioxidant and Anti-Inflammatory Potentials

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Abstract. Amygdalin is one of the compounds contributing to the major pharmacological properties of *Prunus armeniaca* (PA) kernels. Clinical trials have proved the anticancer activity of amygdalin, and its pharmacological activities such as antioxidant, anti-inflammatory, anti-tumor, anti-bacterial, anti-fibrotic, and many more. This study was to investigate the effect of extraction parameters such as temperature, solvent ratio, and particles size on ground *P. armeniaca* kernels powder to obtain a high extraction yield of amygdalin. Ultrasonic Assisted Extraction (UAE) was utilized to recover amygdalin from PA kernels. The operating variables, such as temperatures (27-60 °C), ethanol concentration (10-90%), and particle size (20-40 mesh), were varied using the technique of One-Factor-At-A-Time (OFAT) for optimization. The results found that the extraction temperature of 60 °C in 70% ethanol using mesh 40 (400 µm) of particle size exhibited the highest concentration of amygdalin, 326.92 ± 3.11 mg/g of extract powder. The lowest and the highest amygdalin content of samples were also compared for their antioxidant potential by correlating their radical scavenging ability (DPPH and ABTS) and reducing power (FRAP). The PA kernels extract with the highest amygdalin content showed higher anti-oxidant capacity in both DPPH and FRAP assays with the effective concentration at 137.92 ± 21.87 mg GAE/100g and 101.19 ± 0.14 mg GAE/100g, respectively. However, there was no significant difference for the ABTS results between the lowest and highest amygdalin content of *P. armeniaca* kernel extract. Albumin assay showed a significant anti-inflammatory action (32.48 ± 609.70 g DCFE/100g). As a conclusion, the optimization of UAE produced a higher content of amygdalin and enhanced better anti-oxidant and anti-inflammatory properties of PA kernels.

ICOST 2025: ID-64

Microalgae-Mediated Biological Synthesis of Silver Nanoparticles: Optimization and Morphological Characterization

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Abstract. Silver nanoparticles (AgNPs) are valued for their high surface-area-to-volume ratio and localized surface plasmon resonance (LSPR), making them vital in biomedical and water treatment applications. Green synthesis using bio-reducing agents, such as plant extracts, offer eco-friendly alternatives to conventional chemical methods. Among bio-reducing agents, microalgae such as *Chlorella vulgaris* stand out for their non-pathogenic nature, ease of cultivation, and viability for scalable and sustainable industrial use. In this study, *C. vulgaris* was employed as a bio-reducing agent to fabricate AgNPs from silver nitrate ($AgNO_3$) via photo-induced synthesis. The reaction rate was found to be highly dependent on the energy emitted by the illumination source. To optimize the synthesis process, the volumetric ratio of C. vulgaris-to-precursor solution was varied alongside the illumination wavelengths provided by different LED colors (white, blue, red, and green). Spectrophotometric analysis indicated that the optimal *C. vulgaris*-to-precursor ratio was 1:5, achieving a LSPR band peak increment of 0.407 a.u. within 35 minutes. Blue light was found to accelerate the reaction most effectively, reducing the optimal incubation time to 30 minutes and resulting in a higher LSPR band peak increment of 0.445 a.u. Particle size analysis using a Malvern Zetasizer further confirmed the enhanced synthesis under blue light, as evidenced by a narrower and more intense particle size distribution peak in the 39 - 47 nm range. FESEM revealed larger particle sizes due to aggregation from thermal effects during drying. However, upon re-suspension of the dried AgNPs in a solvent, smaller particles were recovered. HRTEM provided higher-resolution imaging, revealing individual AgNPs as small as ~16 nm. Overall, the results highlight the positive role of *C. vulgaris* in mediating AgNP production through a greener, more sustainable approach, while still achieving competitive particle sizes.

ICOST 2025: ID-65

Quantitative Analysis of Cellulose, Hemicellulose and Lignin Content in Extracted Semantan Bamboo Fiber Via TAPPI and Wise Methods

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Abstract. Bamboo is a renewable resource with high lignocellulosic content, making it a promising reinforcement material for many applications. The objective of this study is to extract lignocellulosic Semantan bamboo (*Gigantochloa scortechinii*) fiber and quantify the cellulose, hemicellulose, and lignin content in the extracted Semantan bamboo fiber using Technical Association of the Pulp and Paper Industry (TAPPI) and Wise methods. Standard chemical treatments, including sulfuric acid delignification (TAPPI T222), sodium chlorite for holocellulose isolation (Wise method), and sodium hydroxide for α-cellulose extraction (TAPPI T203), were employed. Hemicellulose content was determined by weight difference. The analysis result shows that the extracted Semantan bamboo fiber contains 18.53±3.45 wt% lignin, 71.51±1.87 wt% holocellulose, 36.87±1.69 wt% α-cellulose, and 34.64±3.46 wt% hemicellulose. The high content of holocellulose in extracted Semantan bamboo fiber shows potential as a reinforcing material for various applications, driving the value-added use of local biomass resources.

ICOST 2025: ID-49

Sc–CO_2 Dried Biodegradable Alginate/Zirconia Aerogels: Synthesis, And Characterization

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Abstract. This work presents the synthesis of new biodegradable alginate-zirconia (AG-ZR) hybrid aerogels as a potential thermal insulator material. The effect of the alginate-to-zirconia ratio on their physical and chemical characteristics is investigated. The 3 wt% and 5 wt% alginate concentrations, along with 0.05 wt% and 0.2 wt% zirconia concentrations, were synthesized through the solvent casting method, followed by supercritical carbon dioxide (Sc-CO2) drying to produce alginate/zirconia film aerogels. The physical and chemical properties were characterized by Fourier-transform infrared spectroscopy (FTIR), thermogravimetric analysis (TGA), and differential scanning calorimetry (DSC) analysis. Results showed that the chemical interaction between alginate and zirconia was identified by the characteristic Zr–O and –COO– stretching vibrations. Thermogravimetric analysis (TGA) indicated considerable thermal stability up to 350 °C, while differential scanning calorimetry (DSC) suggested that degradation commenced at approximately 270 °C. Mechanical testing revealed that the aerogel formulation composed of 5 wt% alginate and 0.2 wt% zirconia exhibited a notable tensile strength of approximately 1.8 MPa and improved flexibility, as indicated by elongation at break. The synthesized AG-ZR hybrid aerogels showed strong chemical crosslinking, excellent thermal stability, and superior mechanical strength, particularly in AG 5:ZR 0.2 formulation. These findings demonstrate the potential of the material as a lightweight, biodegradable, and thermally stable insulation solution for advanced engineering applications.

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CBD-Grown MoS_2 thin films on Plastic Optical Fiber for NH_3 Sensing: Fabrication and Performance

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Abstract. This study presents the development of an optical ammonia (NH_3) gas sensor based on plastic optical fiber (POF) coated with molybdenum disulfide (MoS_2), synthesized via chemical bath deposition (CBD). The MoS_2 thin film was uniformly deposited along the unclad region of the fiber, allowing surface interaction with NH_3 molecules through nanoscale adsorption mechanisms. These interactions result in measurable changes in absorbance, enabling real-time detection of NH3. The morphological and optical properties of the MoS_2 coating were characterized using field emission scanning electron microscopy (FESEM), energy-dispersive X-ray spectroscopy (EDX), and UV-Vis spectroscopy. The sensor exhibited a sensitivity of 1.55/% NH_3 over a concentration range of 0.0625% to 1.00%, demonstrating reliable performance for low-level NH_3 detection. This work highlights the potential of nanomaterial-coated fiber optic sensors for environmental monitoring applications.

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Topology Optimization and Structural Analysis of an Octocopter Drone Frame Designed in SolidWorks

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Abstract. Unmanned Aerial Vehicles (UAVs), particularly multirotor drones, face critical design challenges in balancing weight reduction and structural integrity to enhance flight performance and payload capacity. This study focuses on optimizing the frame of a flat octocopter using topology optimization (TO) techniques to achieve a lightweight yet robust design. Polylactic Acid (PLA), a cost-effective and eco-friendly 3D-printing material, was selected for its suitability in prototyping. The methodology involved creating a 3D CAD model in SolidWorks, applying Finite Element Analysis (FEA) to simulate operational stresses, and employing the Solid Isotropic Material with Penalization (SIMP) method for topology optimization. Critical components, including arms, covers, and brackets, were iteratively redesigned by removing non-critical material while preserving structural strength. The optimized design reduced the total frame mass by 31.99%, from 1595.90 g to 1086.60 g, while maintaining stress levels and deformation well within PLA's allowable limits. Post-optimization FEA validated the structural integrity under thrust, payload, and boundary conditions, confirming the design's reliability for real-world applications. The results demonstrate that topology optimization is an effective tool for UAV design development by improving flight efficiency through weight reduction.

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Prediction of Solvent Component and Composition for Absorption-Based Acid Gas Removal Unit Using Optuna-LightGBM and K-means

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Abstract. Acid gas removal unit (AGRU) is a pivotal component of a natural gas processing plant. The primary purpose of acid gas removal is to reach the industrial pipeline standard of H2S below four ppm and CO2 below 2% per volume for pipeline quality. The most widely used technique is an absorption-based AGRU using amine as a solvent. MDEA is the most utilized solvent but has the drawback of absorbing CO2. The mixture of other amine and physical solvents is necessary to assist the absorption of CO2. However, the main problem of mixing solvents is parameter complexity. The machine learning method is utilized to find the most optimal solvent based on its operational parameters. LightGBM tuned with Optuna are used to classify the solvent component, followed by K-means to identify solvent composition. The algorithm is applied to six different solvent blends and two feed gas compositions, resulting in 37,786 data points. The LightGBM model tuned with Optuna performed excellently with accuracy of 0.98 and training time under 0.2 seconds. K-means showed the silhouette score averaging 0.5, showing that the data is not well clustered.

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Optimization of Stable Water–Oil Emulsified Samples for Hydrate–Wax Interaction Studies

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Abstract. Hydrate and wax plugging pose major challenges in petroleum production, leading to flow disruption, blockages, and safety risks. In oil-dominated systems, water and oil often form emulsions, where hydrates develop at the water–oil interface of dispersed droplets while wax precipitates in the continuous oil phase. These emulsions strongly influence hydrate–wax interactions, yet the role of emulsion characteristics remains underexplored. Achieving emulsion stability is important to ensure complete hydrate conversion and proper interaction with precipitated wax. However, optimum stability is difficult to evaluate, as multiple physical and chemical factors are interrelated. In this study, synthetic emulsions were prepared by dissolving octadecane (C18) in heptane and emulsifying with water using Span 85 and Tween 85. The objective was to obtain stable emulsions to ensure complete hydrate formation, while assessing the influence of surfactant concentration, surfactant type, wax ratio, and solvent type. Stability was evaluated using the bottle test, with viscosity and droplet size as supporting measures. Ten samples were prepared with varying formulations. Results showed wax content had the strongest impact: the 60:40 heptane:C18 sample maintained a stable emulsion for one hour, while the 80:20 ratio showed ~30% reduction. Higher wax content also increased viscosity (to 17.5 mPa·s), limiting droplet coalescence. Although interfacial tension suggested reduced stability, the findings confirmed that long-chain paraffinic components enhance stability even before wax precipitation. This study provides a basis for preparing stable emulsified oil–water systems, enabling more reliable hydrate–wax interaction research in flow assurance.

ICOST 2025: ID-72

Computer-Aided Molecular Design and Fabrication of Advanced Membrane Materials: An insight into the Application in Nitrogen/Methane Gas Separation

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Abstract. Membrane engineering has proven to be an excellent tool for achieving the goals of process intensification. One of these goals is the optimization of the driving forces/resistances in a chemical system at every scale within the spatial domain. This can be achieved by a purposeful introduction of reproducible structure using a combination of computer-aided molecular design and print assisted technique. Molecular models of two polymers MDA and ODA were developed using Avogadros software. The molecular model of the structure of polymer was then made into membrane using a print assisted fabrication method. Specifically, the printing was done by using a LaserJet printer to fabricate structured flat sheet composite membranes that were evaluated for N2/CH4 separation. Membrane characterization was done using XRD, and microscopy. The gas transport properties and the separation performance were evaluated using constant-pressure gas permeation test to measure the permeability and hydraulic resistance. Although the sheet of paper on which the two polymers were printed are the same, however, the hydraulic resistance was found to be different for each polymer as well as for each gas. For example, the hydraulic resistance to the flow of N2 and CH4 gases in MDA ranges from 38,560.78 to 95,697.10 kPa.s/m3 while that of ODA ranges from 28,132.33 to 88,124.16 kPa.s/m3. The selectivity of ODA for N2/CH4 is 2.34 and 3.10 for single layer and 7-layer membrane samples, respectively while it is 1.71 and 1.92 for single layer and 7-layer MDA membrane samples, respectively. In addition, the morphological analysis results showed that the printed membranes have well-structured morphology and evenly distributed voidage which can enhance their reproducibility and the predictability of their performance. Overall, the resulting properties of the fabricated membrane demonstrated its potentials for enhancing the intensification of a membrane system that is used in N2/CH4 separation.

ABSTRACTS

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(Virtual Presentation)

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Polyethylene Glycol (PEG) Water-Soluble Binder Effects on Ceramic Guide Pins Characteristics Performance and Fabrication

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Abstract. Polymer binder plays an important role in production of ceramic guide pin using a computer numerical control (CNC) process. An unsuitable binder may result in sample breakage and difficulties in shaping during the CNC process. This study investigates the potential of polyethylene glycol (PEG) as an alternative water-soluble binder instead of current binder of polyvinyl alcohol (PVA). The PEG binder content was varied at 10 wt% and 20 wt% in preparing of ceramic slurry using a ball milling process. The water content loss of blank sample and the percentage of broken blank sample during CNC machining process were calculated. Thus, the shrinkage factor and the density of sintered ceramic guide pin were also determined. This study found incorporation of PEG binder at 10 wt% decreased the water content loss from 1.27% to 0.77% and reduced the percentage of failure blank sample during CNC machining process from 33% to 13% compared to the current PVA binder. Meanwhile, the shrinkage factor of sintered ceramic guide pin is minimally affected despite slightly lower density. In conclusion, 10 wt% PEG binder demonstrates potential as a co-water-soluble binder to PVA binder in the production of ceramic guide pins, based on the findings of the characterization analysis.

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Screening and Integration of Watermelon Rind Extract (WMRE) for Functional Chitosan Thin Films

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Abstract. This study investigates the development and characterisation of chitosan-based thin films incorporating watermelon rind extract (WMRE), a valuable by-product from food waste. The primary goal was to leverage the cost-effectiveness and accessibility of watermelon rind to create sustainable film formulations with enhanced properties. Initially, a maceration technique was optimised for WMRE, comparing different extraction techniques to maximise total phenolic content (TPC) and 2,2-diphenyl-1-picrylhydrazyl (DPPH) scavenging activity. Optimal extraction, yielding the highest TPC (6.015 mg GAE/g) and DPPH activity (23.97%), was achieved using a hot plate stirrer under controlled conditions. A 2-level factorial design was subsequently employed to systematically assess how varying chitosan concentration (% w/v), plasticiser amount (% v/v), and WMRE concentration (% v/v) affected the resulting thin film properties. The respective responses were DPPH value and biodegradability rate. The lowest WMRE concentration exhibited an average biodegradability rate of 51.8%, with an average DPPH value of 45.37%. Fourier-transform infrared (FTIR) spectroscopy confirmed the successful incorporation of phenolic compounds from WMRE, evidenced by characteristic bands between 1405.86 cm-1 and 1407.85 cm-1. Notably, water vapour permeability (WVP) analysis revealed that the inclusion of WMRE reduces the film's permeability to water, indicating improved barrier properties. These findings highlight the potential of upcycled watermelon rind as a functional additive in chitosan-based thin film, offering a sustainable approach for various applications, particularly in packaging or other fields requiring moisture barrier characteristics.

ICOST 2025: ID-13

Effect of temperature and time on the conversion of defatted microalgae biomass into bio-oil through hydrothermal liquefaction

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Abstract. The growing demand for renewable energy has increased interest in bio-oil production from microalgae biomass using hydrothermal liquefaction (HTL). However, limited research has focused on the utilization of defatted microalgae biomass (DMB), the residual biomass remaining after lipid extraction. Therefore, this study investigated the effect of varying operating conditions on the conversion of DMB derived from Chlorella sp. into bio-oil via HTL. Experiments were conducted at reaction temperatures ranging from 210 - 270 °C and reaction times between 30 and 90 minutes. The resulting bio-oils contained a range of compounds, including aliphatic acids, amines, amides, pyrazine, pyridine, and phenolic compounds. The highest yields of desirable aliphatic acids were obtained at 250–260 °C and 45 minutes, indicating these as optimal conditions for maximizing fuel-relevant components. While higher temperatures and longer reaction times promoted the formation of nitrogenous and aromatic compounds, they also introduced instability in the product composition. Hence, this work highlights the importance of optimizing HTL parameters to enhance bio-oil recovery from DMB.

ICOST 2025: ID-41

Efficient Detection of Mobile Banking Trojans on Android Using Gaussian Naïve Bayes

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Abstract. The increasing reliance on mobile banking services has made Android smartphones a primary target for cybercriminals, particularly through banking Trojans. These malicious applications impersonate legitimate banking apps to steal sensitive information such as login credentials and authentication codes. In 2024, global banking Trojan attacks rose to 1.24 million with high infection rates reported in countries like Turkey (5.7%), Indonesia (2.7%) and India (2.4%). The growing sophistication and regional spread of such threats emphasize the need for efficient, real-time mobile security solutions. This study presents a lightweight malware detection model using the Gaussian Naïve Bayes (GNB) algorithm to identify banking Trojans based on static analysis of Android Package (APK) files. Features such as permissions, API usage and application metadata were extracted from a labeled dataset. The model was trained and validated using a 70:30 data split, achieving a classification accuracy of 95.83%. The GNB classifier's probabilistic framework and low computational overhead make it ideal for deployment in resource constrained mobile environments. The results highlight the potential of GNB as a practical and scalable solution for early-stage mobile malware detection. Future work will focus on extending the framework with dynamic analysis and ensemble methods to address evolving malware threats.

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Eco-Friendly Activation of Palm Kernel Shell Carbon using Calcium Chloride from Cockle Shells

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Abstract. The removal of heavy metals from wastewater is crucial to mitigate the adverse effects of contaminants such as lead (Pb) and cadmium (Cd) on human health and the environment. Traditionally, commercial activated carbon is used for this purpose. However, it is often expensive. To address this, a more sustainable approach was proposed by synthesizing activated carbon from palm kernel shells, an abundant agricultural waste product in Malaysia. This carbon was chemically activated using calcium chloride derived from waste cockle shells, promoting a green and cost-effective method. In the experiment, nine variations of activated carbon were synthesized based on three key parameters, heating temperature (500–700°C), heating duration (60–120 min), and calcium chloride concentration (0.25–1M). These parameters were optimized using a Taguchi L9 orthogonal array. After synthesis and washing, the yield of activated carbon was calculated, and the variant with the highest yield was selected for further testing. The selected activated carbon was evaluated for its ability to adsorb lead (Pb) from aqueous solutions, under varying adsorbent dosages, metal concentrations, and contact times. Adsorption performance was measured using atomic absorption spectrometry (AAS). Results indicated that carbon yield was significantly influenced by heating temperature and time, where excessive values led to increased ash formation rather than activated carbon. Higher metal removal efficiency was observed with increased adsorbent dosage, whereas higher initial metal concentrations resulted in a lower percentage of removal. Additionally, while longer contact times initially improved metal adsorption, the effect eventually plateaued.

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Fractional Flow Reserve of Non-Newtonian Blood Flow in a Stenosed Bifurcated Artery

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Abstract. Coronary artery stenosis significantly alters blood flow dynamics, often leading to myocardial ischemia and increased cardiovascular risk. To assess the functional severity of stenosis, this study investigates the relationship between fractional flow reserve and four distinct plaque formations in a bifurcated artery model. Simulations are conducted using COMSOL Multiphysics, where blood is modeled as a non-Newtonian fluid governed by a generalised power-law, and arterial walls are treated as rigid to reflect reduced compliance in diseased vessels. The analysis incorporates hybrid nanofluids and magnetohydrodynamic effects. Under hyperemic conditions, pressure gradients across stenosed regions are evaluated to compute fractional flow reserve values. Results indicate that geometrical complexity and plaque distribution significantly influence fractional flow reserve behavior. A simpler bifurcation maintains a higher fractional flow reserve and a more complex geometry showing reduced and irregular profiles. Magnetic fields tend to stabilize flow and slightly improve fractional flow reserve in constrained regions. While hybrid nanofluids enhance fractional flow reserves in less restricted geometries, but may reduce it in narrower vessels due to increased viscosity. These findings highlight the potential of integrating advanced fluid models and electromagnetic effects into computational frameworks for more precise and physiologically relevant cardiovascular diagnostics.

ICOST 2025: ID-63

Applications of Machine Learning in Modelling and Optimization of Breakthrough Curve Analysis: A Focus on Artificial Neural Network and Their Comparison

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Abstract. Complex processes like adsorption in fixed-bed columns can now be optimized thanks to the application of machine learning (ML) and deep learning (DL) in chemical engineering. One of the most important metrics for assessing adsorption performance in packed bed columns is breakthrough curve analysis. However, predicting breakthrough curve is not an easy task due to high complexity between the adsorbate and desorbent interactions. Different adsorption system requires different ML algorithm types with distinct configurations and hyperparameters. Hence, this article discusses the performance of various artificial neural networks (ANNs) architectures and hyperparameters in predicting breakthrough curves from various published literatures. We also evaluate ANNs configurations, optimization approaches, and performance metrics against traditional techniques and other machine learning algorithms, such as Random Forest, XGBoost, and Support Vector Machines. Our review demonstrates how ANNs may capture nonlinear correlations between breakthrough curve factors and adsorption performances. The comparison results highlight that ANNs enhance prediction accuracy and adaptability, establishing it as an essential instrument for dynamic process simulation and optimization. The findings encourage a wider use of machine learning in process engineering applications and advance data-driven modelling techniques in adsorption science.

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Parametric Evaluation of Subcritical Water Extraction of Oleoresin from Syzygium Aromaticum via Factorial Design Approach

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Abstract. The growing demand for natural products underscores the need for efficient and sustainable extraction methods for bioactive compounds. Oleoresin from Syzygium Aromaticum (S. aromaticum) is highly valued for its functional and therapeutic properties, with promising applications in the food and nutraceutical industries. In this study, subcritical water extraction (SWE) was employed to evaluate the effects of key process parameters on the yield of S. aromaticum oleoresin. A full factorial design (FFD) was used to systematically assess the influence of four variables: particle size, solvent-to-sample ratio, extraction temperature, and extraction time. The highest oleoresin yield of 53.9% was obtained under conditions of 0.5 mm particle size, 0.05 g/mL solvent-to-sample ratio, 120 °C extraction temperature, and 50 minutes extraction time. Statistical analysis revealed that particle size and solvent-to-sample ratio were the most significant factors, with a notable synergistic interaction between them. Both main and interaction effects were evaluated to provide mechanistic insights into the SWE process. The developed regression model exhibited excellent predictive capability, with an R^2 value of 0.99, confirming the robustness of the factorial design approach in modelling and understanding S. aromaticum oleoresin extraction via SWE.

ICOST 2025: ID-23

Biochar from pyrolysis of one-step phosphoric acid activated pomegranate peel powder for adsorptive removal of tetracycline in aqueous solution: Synthesis, adsorption and mechanism

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Abstract. In this study, a high surface area biochar was synthesized from pomegranate peel powder via one-step phosphoric acid activation and pyrolysis (at 600 oC for 1 hr), and evaluated for the adsorption of tetracycline (TC) from aqueous solution. Characterization using BET, FTIR, SEM, and XRD confirmed the development of mesoporous architecture and the presence of functional groups favorable for TC interaction. The biochar exhibited a high specific surface area of 1882 m^2/g, total pore volume of 1.668 cm^3/g, and average pore radius of 3.543 nm. Batch adsorption experiments were performed to assess the effects of pH, contact time, initial concentration, and temperature. The biochar achieved a maximum TC adsorption capacity of 430.6 mg/g. Equilibrium data were fitted to Langmuir, Freundlich, Redlich–Peterson, and Sips isotherm models, with the Langmuir model providing the best fit, indicating monolayer adsorption. Kinetic data fitted the pseudo-second-order model, suggesting chemisorption as the dominant mechanism. Thermodynamic parameters revealed the adsorption process to be spontaneous and endothermic. Mechanistic analysis revealed that TC removal was driven by electrostatic interactions, π–π electron donor–acceptor interactions, and hydrogen bonding. These results demonstrate the efficacy of phosphoric acid-activated pomegranate peel biochar as a low-cost, sustainable adsorbent for removing pharmaceutical contaminants from water.

ABSTRACTS

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(Poster Presentation)

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Heterogenous Protein Crystallization with Mesoporous Silica

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Abstract. Since protein crystallization has slow kinetics due to the inherent complex 3D configuration of protein, numerous heterogeneous nucleants have been developed to accelerate the process. Using high-protein-loading mesoporous silica such as SBA-15 as the nucleant and lysozyme as the model protein, the experimental results showed that nanocrystals of lysozyme appeared on the surface of the SBA-15 and the crystallization kinetics was significantly improved in comparison to the negative control. The proposed mechanism involves the adsorption of lysozyme model onto/into SBA-15, followed by the conversion of the adsorbed protein molecules into scattered crystalline regions that subsequently grow into nanocrystals, which promote the nucleation in the bulk solution.

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Motivations to Engage in It Sustainability and Circular Economy: An Extension of Self-Determination Theory

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Abstract. This study investigates the influence of Green Information Technology (Green IT) practices on the implementation of Circular Economy (CE) principles within Malaysian higher education institutions. The research aims to explore how sustainable IT strategies can facilitate resource optimization, reduce environmental impact, and support circular initiatives across academic institutions. Specifically, the study examines the mediating role of Green Human Resource Management (Green HRM) and the moderating effect of Organizational Culture (OC) in shaping this relationship. Using a quantitative research design, data were collected from administrative and academic staff at selected Malaysian universities. Structural Equation Modeling (SEM) was employed to analyze the relationships among the key variables. The findings suggest that Green IT practices significantly contribute to CE implementation. Moreover, Green HRM partially mediates this relationship, emphasizing the importance of green competencies, training, and performance management in achieving sustainability goals. Organizational culture was also found to moderate the strength of the Green IT–CE link, indicating that a culture supportive of environmental values enhances CE outcomes. This study contributes to the growing body of knowledge on sustainable practices in higher education and offers practical insights for university leaders seeking to integrate environmental strategies into institutional operations. The results underline the synergistic role of technology, human capital, and organizational values in advancing sustainability through the circular economy framework.

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Process for Separation of Petrochemicals (BTX) from Naphtha Feed Stock

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Abstract. In recent years, in petroleum refining industry is seeing a great shift from traditional fuels production to high-value petrochemicals production. This shift is driven by the growing demand of plastics, synthetic fibres and other chemicals used in various industries. Among various petrochemicals Benzene, Toluene and Xylenes (BTX) are most important aromatics because they are basic building blocks for many materials which are in great demand. Petroleum refineries produce many intermediate streams those are rich in BTX. Recovering these compounds from petroleum refinery streams provides a sustainable and cost-effective way to produce high-value chemicals. In the present study, a solvent extraction based separation process was developed and optimized for separation of petrochemicals (BTX) from naphtha feed stock. Petroleum derived naphtha from one of the Indian Refinery was used as a feed stock. The naphtha contains 30 wt.% aromatics and 680 ppm sulfur. Five different conventional solvents such as Di-methyl Formamide (DMF), n-Formyl Morpholine (NFM), n-Methyl Pyrrolidone (NMP) and Di-Methyl Sulfoxide (DMSO) were used as solvent for the aromatic separation in a single-stage batch extractor. The solvent extraction runs were performed under varied process conditions such as extraction temperatures (20, 25 and 30°C) and Solvent-to-Feed (S/F) ratios (0.5, 1.0, 2.0 and 3.0) and mixing time of 30 min. The aromatic recovery with solvents DMF, NFM, NMP, and DMSO was found to be 75.3, 50.2, 70.9, and 38.2 wt% respectively. Among all solvents, DMF showed the highest aromatic recovery as compared to NFM, NMP and DMSO solvents. Further, process conditions were optimized with DMF solvent and it was found that DMF showed highest aromatic recovery of 75.3wt% and 78.3wt% of sulfur removal at solvent extraction temperature of 25°C and at Solvent-to-Feed (S/F) ratio 2.0.

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Phytochemical Profile and Antimicrobial Potential of *Angelica glauca* Root Oil from the Indian Himalayas

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Abstract. The rising incidence of antibiotic resistance has highlighted the urgent need to investigate alternative, plant-derived therapies. This study looks at the essential oil derived from the roots of Angelica glauca, a threatened medicinal herb native to the Western Himalayas, with a focus on samples obtained in high-altitude regions of Uttarakhand, India. We used gas chromatography-mass spectrometry (GC-MS) to identify a distinct phytochemical profile dominated by monoterpenes and phthalides, including α-pinene, β-pinene, limonene, and ligustilide, which are known for their therapeutic importance. Antimicrobial testing revealed considerable inhibition against a variety of harmful bacteria, including Staphylococcus aureus, Escherichia coli, and Candida albicans. Notably, the essential oil had considerable efficacy against multidrug-resistant (MDR) bacteria, indicating its medicinal potential as a natural antimicrobial agent. This study is unique in that it correlates chemotypic variability with the plant's altitudinal environment. Chemometric investigation revealed additional altitude-driven differences in oil composition, providing a foundation for marker-based quality control and region-specific value. This study not only improves our pharmacognostic understanding of A. glauca, but it also promotes conservation through value-added use options. Our findings add to the growing body of evidence that Himalayan botanicals are viable candidates in the fight against antibiotic resistance, establishing Angelica glauca as a high-value species for phytopharmaceutical uses and sustainable bioprospecting.

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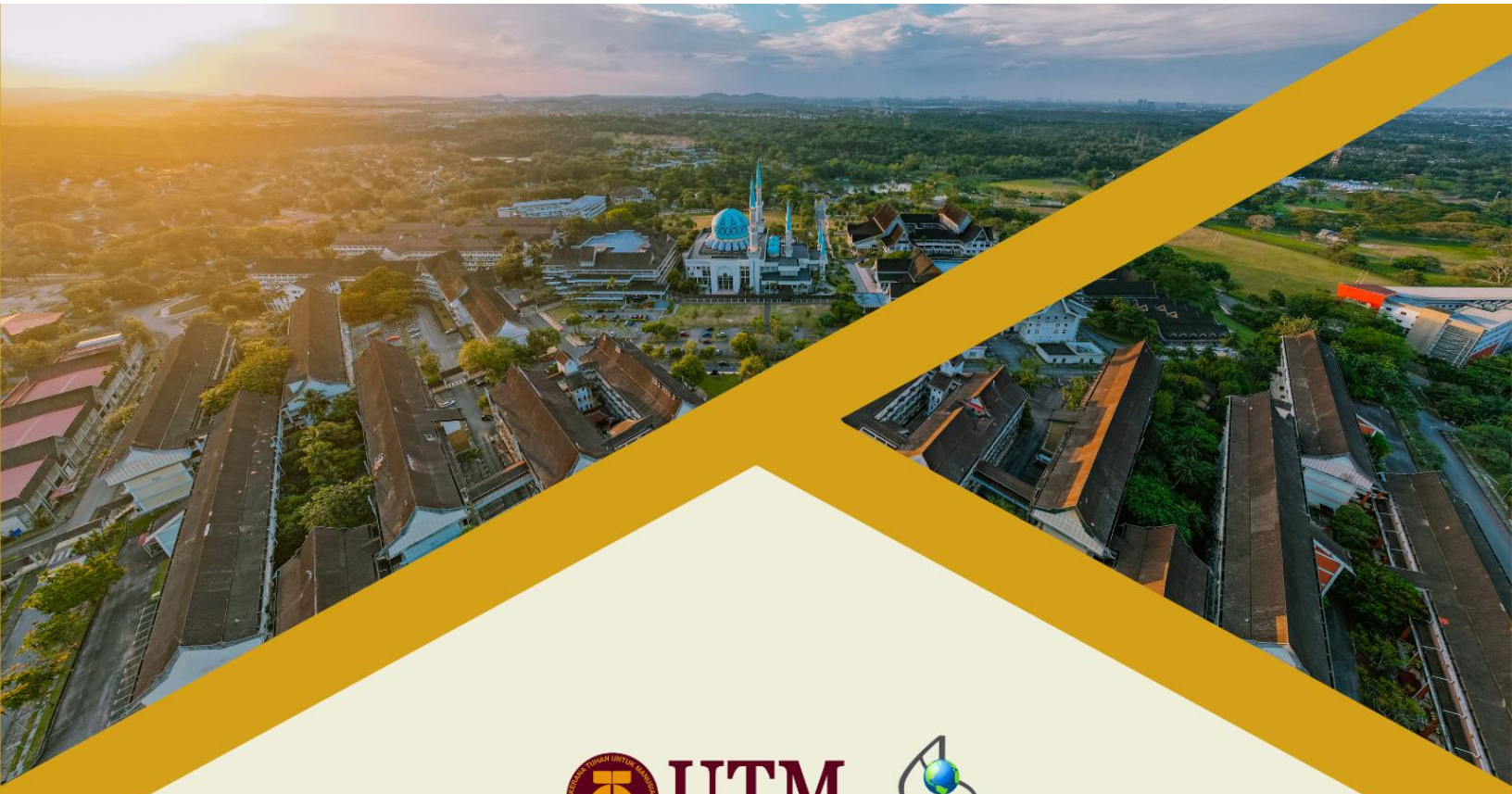

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