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FAKULTI KEJURUTERAAN
Faculty of Engineering

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enginitium

The official bulletin of the Research Office, Faculty of Engineering, Universiti Malaya

IN THIS ISSUE

MESSAGE FROM THE DEAN

As Dean of the Faculty of Engineering at Universiti Malaya, I am honored to present Volume 2 of Enginitium, our research bulletin that spotlights exceptional engineering innovations within our faculty. This edition focuses on one of humanity's most pressing challenges: food security. Our faculty members are pioneering interdisciplinary solutions that address this critical global issue. Through their diverse expertise, they are developing technologies for crop monitoring, yield optimization, and disease prevention. Their work extends to crucial areas such as water purification systems and enhanced food safety protocols. The research featured in this volume demonstrates how engineering excellence can transform food security challenges into opportunities for sustainable innovation. Each project represents our faculty's commitment to developing practical solutions that benefit society. I invite you to explore these groundbreaking initiatives that showcase engineering's vital role in securing our food future. Through Enginitium, we are proud to share these achievements and grateful for your continued support of our mission to drive meaningful change through innovation.

Professor Ir. Dr. Nik Nazri Nik Ghazali

In an era of rapid global population growth, ensuring food security has become one of humanity's most pressing challenges. From adverse weather conditions to pollution and diseases, multiple factors threaten our ability to maintain a stable food supply for future generations. Our faculty members are addressing these challenges through multifaceted research approaches, each contributing a crucial piece to the complex puzzle of global food security.

The relentless pace of industrial development and urbanization has unleashed new threats to our food supply, from heavy metals and microplastics to dangerous levels of nutrient contamination. Dr. Noorhayati Idros tackles this crucial aspect of food security through advanced biochemical sensors. Her work in monitoring heavy metal contamination in shrimp not only ensures food safety but also provides early warning systems for environmental contamination, strengthening our ability to protect the food supply chain.

CHAPTER ONE: BIOCHEMICAL SENSORS FOR HEAVY METAL MONITORING

Dr. Noorhayati Idros's research focuses on developing innovative biochemical sensors and addressing environmental contamination challenges. As a Research Associate at the Cavendish Laboratory, University of Cambridge, her work included developing advanced heavy metal sensors and utilizing Peruvian shrimp as bioindicators to assess water quality in Peruvian rivers.

Shrimp are highly effective bioindicators due to their ecological and biological relevance in Peru's diverse aquatic environments. The country's rivers and ecosystems, essential for biodiversity and local livelihoods, are often polluted by mining, agriculture, and urban activities, leading to heavy metal contamination. As bottom-dwelling organisms, shrimp are exposed to sediments where heavy metals accumulate, making them reliable indicators of environmental pollution. Additionally, shrimp are crucial to Peru's aquatic food web and serve as an important economic resource for local consumption and export. Monitoring heavy metals in shrimp helps ensure food safety, supports sustainable aquaculture, and mitigates health risks.

Mercury contamination in Peru's rivers, exacerbated by mining and industrial activities, poses significant environmental and health challenges. Mercury can transform into methylmercury, a highly toxic compound that accumulates in aquatic ecosystems. To address this, Dr. Idros developed a mercury sensor and used Andean River Shrimp (*Cryphiops caementarius*) as a bioindicator species to assess environmental quality in the Rio Cañete drainage basin. The sensor employed a highly selective and sensitive two-step method, integrating a mercury-regulated oligonucleotide configuration switch with mercury-modulated fluorescence resonance energy transfer (FRET), activated by silver ions. This approach achieved a detection limit of 100 pM, outperforming conventional DNAzyme-based sensors and exceeding WHO and USEPA safety standards, with a broad detection range from 100 pM to 0.1 mM.

Shrimp tissue samples, including the tail, hepatopancreas, and exoskeleton, were extracted and tested for heavy metal traces. DNA barcoding confirmed the species as *Cryphiops caementarius*, which is distributed from Peru's Taymi River to Chile's Maipo River. The study revealed that *camarones*—Spanish for shrimp—do not significantly bioaccumulate heavy metals. This is largely attributed to the fast-flowing nature of Andean rivers, where heavy metals are diluted and less available for absorption. The rapid water flow effectively flushes metals downstream, reducing the shrimp's exposure to contaminated sediments and water.

These findings align with results from the mercury sensor, confirming the safety of the camarones for consumption. While shrimp possess mechanisms that limit heavy metal accumulation, such as efficient excretion systems and shorter lifespans, their ability to avoid contamination can vary depending on species, habitat, and pollution levels. In highly contaminated environments, shrimp may still accumulate dangerous levels of heavy metals, posing risks to both the ecosystem and human health if consumed.

Dr. Noorhayati and her Peruvian student excitedly catching *camarones*—Spanish for shrimp.



Dr. Noorhayati Idros with Peruvian counterparts in the UNAB laboratory, alongside the Cambridge and Peruvian teams during fieldwork in the Andean mountains, and with her team collecting water samples during a boat expedition in Peru.

In conclusion, Dr. Idros's work highlights the value of using shrimp as bioindicators to monitor pollution in remote and sensitive ecosystems like the Andean Mountain rivers. This approach allows for the identification of pollution hotspots, tracking contamination sources, and evaluating environmental policy effectiveness. It offers a cost-effective and ecologically relevant method for assessing environmental quality in a region rich in aquatic biodiversity.

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With wild fish stocks declining, aquaculture has emerged as a vital solution for global food security. Prof. Poo Balan's microbubble technology directly supports this sector by optimizing dissolved oxygen levels in aquaculture systems. This advancement not only prevents fish mortality but also promotes healthy growth, making aquaculture more efficient and sustainable as a food production method.

CHAPTER TWO: INNOVATIVE MICRO-BUBBLE GENERATOR FOR ENHANCED OXYGENATION IN AQUACULTURE

In aquaculture, feeding is essential, but aeration plays an equally critical role in ensuring the success and sustainability of farming operations. Aeration is vital for maintaining optimal levels of dissolved oxygen (DO) in water, which is crucial for the health and growth of aquatic organisms. Insufficient oxygen levels can lead to stress, disease, and even mortality among aquatic species, making the efficient management of oxygen a top priority.

At Universiti Malaya, we are dedicated to addressing the challenges faced by the aquaculture industry. Our team of researchers has been consistently working on innovative methods to enhance the dissolved oxygen content in aquaculture systems. By combining both fundamental research and practical applications, we aim to provide scientifically sound, environmentally sustainable, and economically viable solutions. Through ongoing research and development, we are committed to improving aquaculture farming practices, fostering healthier aquatic environments, and ensuring the long-term success of the industry.

micro-bubbles in water

Building on our in-depth understanding of bubble formation dynamics, a state-of-the-art micro-bubble generator has been developed and rigorously tested at Universiti Malaya. This innovative device uses locally available components, including pumps, valves, and air separators, to produce highly efficient micro-bubbles.

The generator is capable of producing micro-bubbles with diameters as small as 200 micrometers or less. These tiny bubbles dramatically increase the surface area available for gas exchange, significantly improving the dissolved oxygen content in water. The enhanced oxygenation helps create optimal growth conditions for aquatic organisms, promotes healthier ecosystems, and reduces stress in farmed species.

This breakthrough provides a practical, cost-effective solution for aquaculture operations, offering an efficient method to improve water quality while utilizing locally accessible materials. Through this development, Universiti Malaya continues to contribute to the advancement of sustainable aquaculture practices.

Micro-bubble generator

For more information, including relevant publications, research grants, and patents, please visit https://umexpert.um.edu.my/poo_ganesan.

proof-of-concept and case studies

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Complementing the aquaculture developments, Dr. Suriani and Dr. Tuan Zaharinie address bacterial infections in tilapia farming. Their development of biopolymer-wrapped bacteriophages offers a sustainable alternative to antibiotics, protecting this valuable food source while preserving environmental health and preventing antimicrobial resistance in our food chain.

CHAPTER THREE: INNOVATIVE BIOPOLYMER CAPSULES: A BREAK-THROUGH IN SUSTAINABLE TILAPIA FARMING

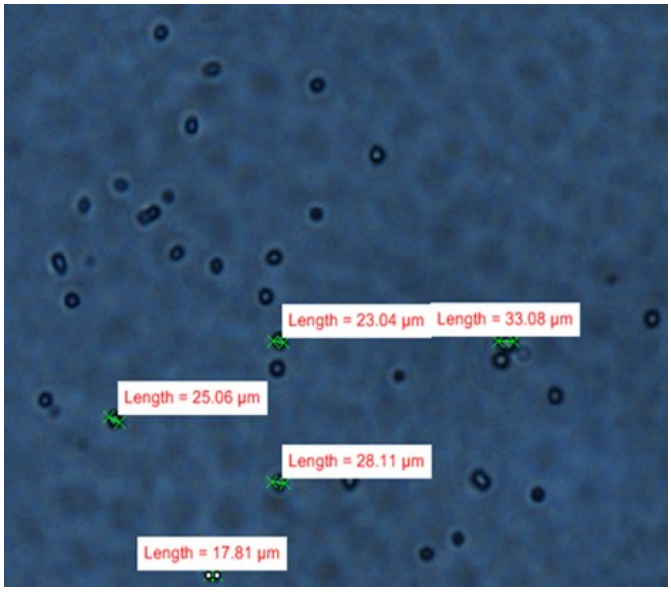
In the quest for sustainable aquaculture, researchers at the University of Malaya have embarked on an exciting project to develop biopolymer capsules for tilapia farming. This innovative approach aims to tackle the persistent problem of bacterial infections in fish, which can devastate aquaculture operations. By leveraging the natural power of bacteriophages (viruses that infect bacteria), the team is pioneering a method to protect fish health and improve farming sustainability.

Tilapia, a popular fish in aquaculture, often falls prey to bacterial infections, leading to significant economic losses for farmers. Traditional methods, such as antibiotics, are becoming less effective due to the rise of antibiotic-resistant bacteria. This situation calls for alternative solutions that are both effective and environmentally friendly.

The research team, led by Dr. Tang Swee Seong (Institute of Biological Sciences), Dr. Suriani Ibrahim & Dr Tuan Zaharinie Tuan Zahari (Department of Mechanical Engineering), and Dr. Norhafiza Mohd Arshad (Centre of Research in Biotechnology for Agriculture), has developed a novel biopolymer capsule loaded with bacteriophages. These capsules are designed using a layer-by-layer technique, which ensures the phages are effectively encapsulated and released in a controlled manner. This method not only targets the harmful bacteria but also minimizes the impact on the surrounding environment.

The process begins with the isolation and identification of bacteriophages that specifically target the bacteria causing infections in tilapia. Using biopolymers, the phages are then encapsulated in macrocapsules. This process involves controlling the concentration of the polymer, temperature, and pH to ensure optimal encapsulation. Once introduced into the fish farming environment, the capsules release the phages gradually. These phages then infect and kill the harmful bacteria, protecting the fish from disease.

Talapia diseases outbreak at Termerloh River



Biopolymer Microcapsule

This method reduces the reliance on antibiotics, promoting a more sustainable approach to aquaculture. The targeted action of bacteriophages ensures that only harmful bacteria are eliminated, preserving the beneficial microorganisms in the environment. The biopolymer capsules are designed to be safe for both the fish and the environment, addressing concerns from farmers and regulatory bodies.

The successful implementation of this technology could revolutionize the tilapia farming industry in Malaysia and beyond. By providing a sustainable and effective solution to bacterial infections, this project has the potential to enhance fish health, improve farm productivity, and reduce environmental impact. The research team is also exploring the broader application of this technology in other aquaculture systems, aiming to extend its benefits globally.

Research Team with Fish Farmers

The development of biopolymer capsules for bacteriophage therapy represents a significant advancement in sustainable aquaculture. This innovative approach not only addresses the pressing issue of bacterial infections in tilapia but also sets the stage for future breakthroughs in the field. As the research progresses, it holds promise for transforming aquaculture practices and ensuring a healthier, more sustainable future for fish farming.

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Underpinning all aspects of food security is access to clean water. Prof. Adeline's research on Downflow Hanging Sponge technology strengthens this foundation by providing efficient water treatment solutions. Her team's work in removing ammonia and organic pollutants supports not just aquaculture, but the entire food production chain, from irrigation to food processing.

CHAPTER FOUR: DOWNFLOW HANGING SPONGE REACTOR FOR WATER TREATMENT

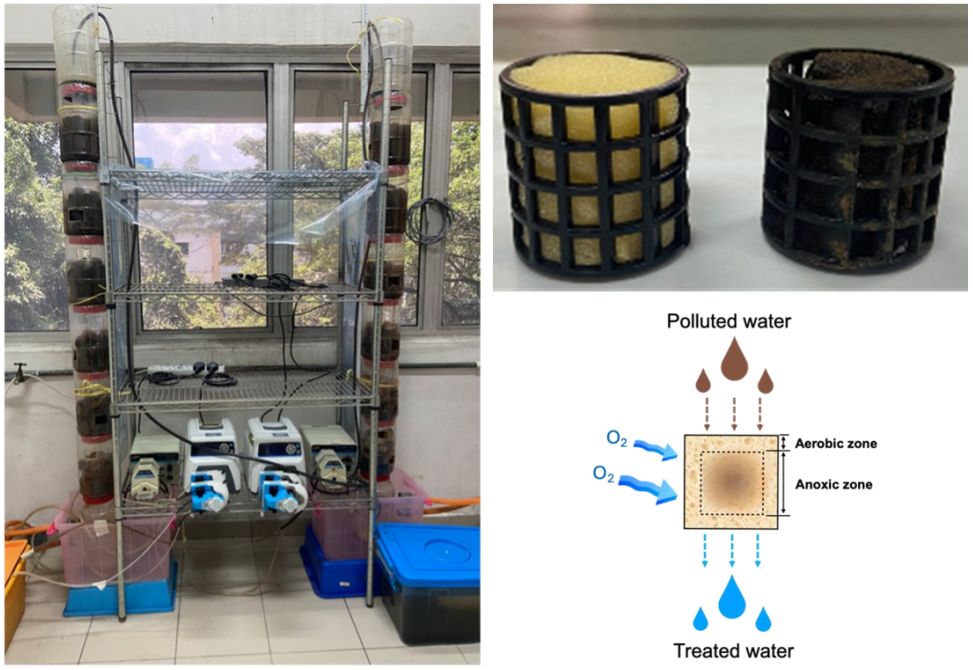
The journey of the Downflow Hanging Sponge (DHS) reactor system in Malaysia began as a response to the recurring water supply disruptions in Selangor. These disruptions highlighted the urgent need for a reliable and cost-effective solution to treat polluted raw water and provide clean, sustainable water for affected communities.

Motivated by this critical challenge, Prof. Ir. Dr. Adeline's research team at the Sustainable Process Engineering Center (SPEC), Department of Chemical Engineering, UM, collaborated with Prof. Kazuaki Syutsubo from the National Institute for Environmental Studies (NIES), Japan. Together, they explored the potential of DHS technology to efficiently remove ammonia and organic pollutants, even at high flow rates, while keeping energy use minimal. This breakthrough marked the first time DHS technology, which has been widely used for wastewater treatment, was adapted for polluted raw water treatment.

The DHS reactor's simplicity and energy efficiency make it ideal for water treatment. The reactor operates by allowing water to flow downward through the sponge bed. These sponges provide a surface for microorganisms to grow, forming a biofilm that breaks down pollutants like ammonia as the water passes through. This process effectively cleans the water, making it safer for use.

This innovative system has achieved significant recognition, winning three international exhibition awards for its contribution to water treatment. It has also led to impactful academic outputs, including two Q1 journal publications, and produced a graduated PhD student.

Access to clean water is critical for food security, as it is essential for irrigation, livestock, and food processing. By ensuring a reliable supply of clean water, the DHS reactor contributes to sustainable agriculture and the resilience of food systems in affected areas. Moving forward, the researchers plan to enhance the system's capabilities and bring it closer to real-world applications, ensuring a reliable and sustainable water supply for Malaysia.



DHS reactor using polyurethane sponge as media for microorganism growth (left: clean sponge; right: biomass-enriched sponge) and its working principle.

Prof. Kazuaki Syutsubo, a research collaborator from the National Institute for Environmental Studies, Japan, during his visit to the Bioprocess Laboratory at the Department of Chemical Engineering, Universiti Malaya. Pictured (left to right) are Prof. Kazuaki Syutsubo, Dr. Loi Jia Xing, Prof. Ir. Dr. Adeline Chua Seak May, and Dr. Mohamad Fairus bin Rabuni, standing in front of the lab-scale DHS reactors.

For more information, please contact Professor Ir. Dr. Adeline Chua Seak May, Sustainable Process Engineering Center (SPEC) at adeline@um.edu.my

Related Publications

Loi, J. X., Syutsubo, K., Rabuni, M. F., Takemura, Y., Masataka, A., &. Chua, A. S. M. (2024). Downflow sponge biofilm reactors for polluted raw water treatment: performance optimisation, kinetics, and microbial community. Chemosphere, 358, 142156.

Loi, J. X., Syutsubo, K., Rabuni, M. F., Takemura, Y., Masataka, A., &. Chua, A. S. M. (2024). Effect of long-term famine on nitrification performance and microbial dynamics in downflow hanging sponge reactor. Journal of Cleaner Production, 481, 144168.

Awards

Gold award, 34th International Invention, Innovation & Technology Exhibition 2024 (ITEX'23), Kuala Lumpur, Malaysia (Downflow Sponge Biofilm (DSB) Reactor Technology: Energy-saving and Cost-effective Innovation in Water and Wastewater Treatment).

Silver Award, 22nd Malaysia Technology Expo 2023 (MTE'23), Kuala Lumpur, Malaysia (Sponge-Based Biofilm Reactor (SBBR) Technology: Energy-saving and Cost-Effective Innovation in Water and Wastewater Treatment).

Platinum award, Innovation and Technology Exhibition, Universiti Malaya Research Carnival 2022, Kuala Lumpur, Malaysia (Downflow Hanging Sponge (DHS) Technology: Enhancing Energy and Financial Sustainability of Sewerage Industry).

Project Funding

High-rate Ammonia Removal In A Downflow Hanging Sponge (DHS) Reactor For Safe Water Supply: Kinetics And Microbiology (2020-2024) – FRGS Grant (FP094-2020) by MOHE, Malaysia

Microbial Characteristics In Raw Water Treatment System For Nitrogen Removal (2021-2026) – International Collaborative Grant by NIES, Japan

By:

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The final link in the food security chain lies in proper handling and hygiene. Dr. Goh's collaboration with Coway Malaysia explores how modern bidet technology can enhance sanitation standards among food handlers. This research addresses a critical yet often overlooked aspect of food safety, helping prevent illness outbreaks and reduce food waste throughout the supply chain.

CHAPTER FIVE: AUTOMATED BIDET SYSTEMS AS A PATH TO BETTER HYGIENE AND FOOD SECURITY

Have you ever felt “insecure” watching a food handler come out of a restroom and wonder if their hygiene practices might compromise the safety of your meal? This simple yet unsettling scenario highlights the critical connection between sanitation and food security. Poor hygiene can lead to foodborne illnesses, malnutrition, and economic losses, which are particularly significant in regions like Southeast Asia. Recognizing this, Universiti Malaya (UM), in partnership with Coway Malaysia, is conducting a pioneering study on automated bidet technology to explore how improved sanitation practices can strengthen public health and food security.

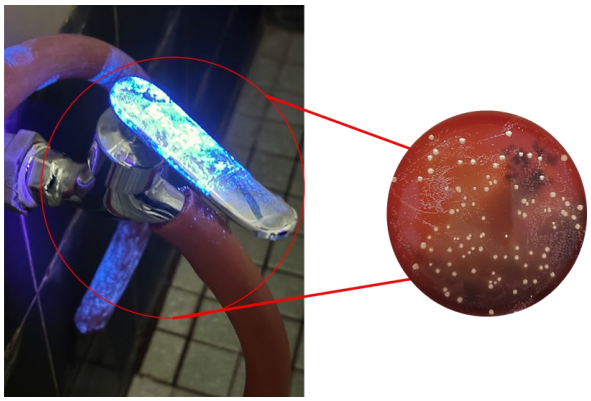
Globally, 2 billion people lack access to basic sanitation facilities, creating conditions for the spread of foodborne pathogens and diseases [1]. In Southeast Asia, 33 million people suffer annually from foodborne illnesses, causing substantial healthcare costs and reduced workforce productivity [2]. In Malaysia, the economic toll of inadequate sanitation is estimated at RM 5.4 billion annually, diverting resources from critical sectors like agriculture and food production [3]. Addressing these sanitation gaps is essential for building healthier communities and more food-secure societies.

At the heart of the UM-Coway collaboration is a study focused on automated bidet systems, which aim to reduce bacterial contamination, improve personal hygiene, and optimize water usage. The project, led by Dr. Goh Yingxin from the Department of Mechanical Engineering, represents an interdisciplinary effort involving the Department of Medical Microbiology. This partnership demonstrates how engineering innovation combined with medical expertise can address public health challenges with far-reaching impacts.

As part of the initiative, 20 bidet units were installed—16 at UM’s Faculty of Engineering and 4 at elderly care homes—providing a practical research platform while improving sanitation access for targeted populations. Vulnerable groups such as the elderly and individuals with special needs face higher risks of hygiene-related illnesses, which contribute to malnutrition and food insecurity. By enhancing hygiene practices, this project aims to reduce disease transmission and break the cycle of illness and malnutrition.

Improved sanitation also supports sustainable resource management. The automated bidet systems under study are designed to optimize water flow, ensuring efficient use of resources. In a region where water scarcity poses challenges for agriculture, innovations like these can help balance sanitation needs with the demands of food production. By reducing water waste, such technologies align with global efforts to promote sustainability and enhance food security.

The broader implications of this research extend beyond hygiene. Poor sanitation contributes to diarrheal diseases that weaken immune systems and hinder nutrient absorption, particularly in children. In Southeast Asia, countries with limited access to sanitation facilities report stunting rates exceeding 20% among children under five, underscoring the long-term impact of inadequate hygiene on public health and economic productivity. Addressing these issues through innovations like automated bidet technology can create healthier populations capable of supporting resilient food systems.



Visual evidence of bacterial contamination on conventional toilet bidet handles under UV light (left), with magnified culture results (right) showing growth of gut bacteria. (Photo credit: MMBBacte 1, UM)

The UM-Coway partnership exemplifies how interdisciplinary collaboration and industry-academia partnerships can create impactful solutions. Through this collaboration, Coway's approach on advanced sanitation technology, such as automated bidets, not only tackles immediate public health concerns but also contributes to food security.

Improved sanitation reduces the prevalence of foodborne illnesses, strengthens workforce productivity, and frees up economic resources for agricultural investment, creating a ripple effect of benefits. In a world where access to clean sanitation is still a luxury for many, this project emphasizes that hygiene innovation is not just about personal well-being. It is a foundation for healthier communities, stronger economies, and a more food-secure future.

References:

[1] Food and Agriculture Organization. (2024). State of food security and nutrition 2024: Tracking financing for food security. FAO. Retrieved from https://openknowledge.fao.org/server/api/core/bitstreams/1c940464-8571-474b-b028-4ddcb385ac48/content

[2] United States Department of Agriculture. (n.d.). Food security insights. Economic Research Service. Retrieved from https://www.ers.usda.gov/webdocs/publications/84467/err-235.pdf

[3] World Health Organization. (2023). Economic impact of foodborne illness in Southeast Asia. PLOS One. Retrieved from https://pmc.ncbi.nlm.nih.gov/articles/PMC10208685/

Automated bidet installation and research agreement signing at Multicare Nursing Home (top left) and Amazing Grace Elderly Care Centre (bottom left), and automated bidet installed at Faculty of Engineering UM toilets (right)

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Together, these research initiatives form a comprehensive approach to strengthening global food security. From water treatment and aquaculture improvements to food safety monitoring and hygiene enhancement, each project addresses a critical component of the food system. This holistic strategy demonstrates how diverse engineering, and scientific approaches can collectively build a more resilient and sustainable food future for our growing population.

By: Dr. Cheah Mei Yee, CES

RECENT SUCCESS STORIES - AWARD

Lifetime Achievement Award - Prof. Ir. Dr. Fatimah Ibrahim

Professor Ir. Dr. Fatimah Ibrahim was honored with the prestigious Lifetime Achievement Award at the International Medical Device Exhibition & Conference (IMDEC 2024), held on 12th December 2024 at KLCC. The award recognized her outstanding contributions to the field of biomedical innovations, showcasing her dedication and expertise that have advanced healthcare technologies. The award was presented by YAB Dato' Seri Anwar bin Ibrahim, the Prime Minister of Malaysia, in recognition of Prof Ibrahim's significant impact on medical devices and healthcare advancements. Her pioneering work continues to inspire future generations in the biomedical engineering community.

By: Dr. Nurul Fauzani Jamaluddin, CIME

Ms. Sushmeeka Nair Prathaban Triumphs at INNOMed Pitching competition

At the INNOMed: Innovation Pitching Powered by PERANTIM 2024, held at the Kuala Lumpur Convention Center on December 10-11, 2024, Ms. Sushmeeka Nair Prathaban emerged victorious, winning two prestigious awards. The competition, designed for Malaysian university students and lecturers to showcase groundbreaking medical innovations, saw Ms. Sushmeeka clinch:

1. *Most Promising Innovation Award* in the *Medical Diagnostics & Monitoring* category
2. *Innovator Star* in the overall category and Best Pitcher

The awards were presented by YB Datuk Seri Haji Dr. Dzulkefly bin Ahmad, Minister of Health, Malaysia. Ms. Sushmeeka is a Master's student in the Biomedical Engineering Department, under the supervision of Prof. Ir. Dr. Fatimah Ibrahim. Her innovative contributions in the field of medical diagnostics were recognized for their potential to make a significant impact on healthcare solutions.

By: Dr. Nurul Fauzani Jamaluddin, CIME

RECENT SUCCESS STORIES - MOA

Universiti Malaya and Coway Malaysia Collaborate to Revolutionize Hygiene and Sanitation Solutions

On Thursday, 12 December 2024, Universiti Malaya (UM) and Coway Malaysia commemorated the signing of a Memorandum of Agreement (MoA) at the Faculty of Engineering, UM. This landmark event marks the launch of an innovative partnership that bridges academia and industry, focusing on advancing hygiene and sanitation technologies.

The partnership signifies a number of milestones: it is the first collaboration between Coway and the Faculty of Engineering, and Coway's first research grant awarded to UM Engineering. The project under this collaboration positions UM as a leader in interdisciplinary research and innovative solutions in hygiene and sanitation technology, reflecting the university's commitment to addressing real-world challenges.

The highlight of this partnership is a pioneering research project on automated bidet-equipped toilet technology, which investigates critical factors such as water flow patterns, user comfort, and bacterial contamination. The research is led by Dr. Goh Yingxin, Principal Investigator from the Department of Mechanical Engineering, in collaboration with the Department of Medical Microbiology, Faculty of Medicine. This collaboration is further enhanced by Coway's generous sponsorship of 20 advanced bidet units, which have been installed at the Faculty of Engineering. These installations not only upgrade campus sanitation facilities but also serve as a practical platform for conducting cutting-edge research.

Community-Centric Research Approach

The scope of the project extends beyond the university, addressing the hygiene needs of vulnerable groups in the wider community. The study includes collaboration with two nursing homes, focusing on the unique needs of special needs and elderly patients. By incorporating these groups into the research, the project demonstrates its commitment to improving sanitation and hygiene awareness while promoting public health and well-being.

Voices from UM and Coway

During the ceremony, Prof. Ir. Dr. Nik Nazri Nik Ghazali, Dean of the Faculty of Engineering, emphasized the significance of the collaboration:

> "This partnership bridges academia and industry, combining theoretical expertise with practical applications to create impactful solutions. It also underscores our commitment to improving hygiene and sanitation, both on campus and in the broader community."

Mr. Ian Lee Sangkyun, Head of Centre, Technology Support Centre at Coway, shared Coway's vision and excitement for the partnership:

> "At Coway, our mission is to provide 'The Best Life Solution' for everyone. Collaborating with a renowned institution like Universiti Malaya enables us to develop innovations that can make meaningful contributions to public health and hygiene. This is just the beginning of what we hope will be a long and impactful relationship."

A Milestone in Industry-Academia Collaboration

This partnership between UM and Coway represents a paradigm shift in hygiene and sanitation technology, setting a new benchmark for industry-academia collaborations. By combining UM's research expertise with Coway's industry expertise, the initiative addresses both academic and community needs, creating transformative outcomes with a focus on vulnerable populations and improving public health.

The collaboration was marked by a bidet handover and photo session, followed by a networking event that fostered meaningful discussions between stakeholders. Together, UM and Coway are paving the way for innovative advancements in hygiene and sanitation, reaffirming UM's position as a leading research university and Coway's dedication to improving the quality of life across Malaysia and beyond.

By: Dr. Goh Yingxin, Department of Mechanical Engineering

RECENT SUCCESS STORIES - RESEARCH GRANT

Congratulations to our Faculty Members

Credit to the Deputy Dean of Research Office, Faculty of Engineering, Universiti Malaya

PUBLICATION

Book

KUALA LUMPUR, 12 December 2024 – The Faculty of Engineering at Universiti Malaya (UM) is pleased to announce the release of **"Mechanical Engineering Insights: Highlights from Final Year Projects 2024."** This compilation features over 50 selected articles from the work of final year mechanical engineering students.

The publication is divided into three themes: manufacturing, which explores advancements in manufacturing processes; mechanical, which covers developments in mechanical systems; and materials, which highlights research on new materials and their applications.

This collection reflects the efforts and dedication of UM's students and showcases the high standards of education and research at the Faculty of Engineering. Each article provides insights into the students' projects and their contributions to the field of mechanical engineering.

The full book is available online and can be accessed through the Faculty of Engineering's Research Office Website.

By: Dr. Mohd. Fadzil Jamaludin, AMMP Centre

ISBN No: e ISBN 978-967-2182-45-0

CONFERENCE UPDATES

International Conference on Smart and Advanced Manufacturing 2024 Concludes Successfully in Kuala Lumpur

The International Conference on Smart and Advanced Manufacturing 2024 (ICSAM'24), organized by the Centre of Advanced Manufacturing and Material Processing (AMMP Centre) was successfully held on 27-28 November 2024. The two-day event, hosted at Aloft KL Sentral and Faculty of Engineering, Universiti Malaya, brought together experts, researchers, and professionals from around the world to discuss the latest advancements in smart and advanced manufacturing. Participants included members of the Asian Universities Alliance (AUA) from Singapore, Malaysia, Uzbekistan, China, Sri Lanka, Thailand and Indonesia, as well as researchers from the UK, Japan, Nigeria and South Korea.

The conference featured keynote addresses and technical presentations on topics such as artificial intelligence, industrial data science, AR/VR systems, advanced manufacturing, material processing, and medical device innovation. Keynote speakers shared their extensive knowledge and experience, providing valuable insights into various aspects of the manufacturing sector.

The plenary speaker, YBhg. Dato' Ts. V Valluvan A/L Veloo provided insights into Malaysia's strategies and policies for transforming the manufacturing sector. The second keynote from the National University of Singapore, Prof. Emeritus Andrew Nee Yeh Ching, highlighted sustainable practices and remanufacturing. The keynote speaker on the second day, Mr. Naguib Mohd Nor, CEO of AMRACE, emphasized the role of innovation and technology in shaping the future of manufacturing.

The hybrid format of ICSAM 2024 allowed both in-person and online participation, making the event accessible to a broader audience. The conference also provided ample opportunities for networking and collaboration. All submitted and reviewed articles would be published, with exceptional contributions considered for inclusion in the Lecture Notes in Mechanical Engineering (LNME), a Scopus -indexed publication. Participants appreciated the well-organized event, and the valuable insights gained.

AMMP Centre and Universiti Malaya extend their heartfelt thanks to the sponsors: the Asian Universities Alliance (AUA), the Royal Academy of Engineering UK, and The Japan Foundation. Their support was crucial to the conference's success, enabling knowledge exchange and fostering collaboration among participants from diverse backgrounds. More photos at the official webpage : https://umevent.um.edu.my/icsam2024

By: Dr. Mohd. Fadzil Jamaludin, AMMP Centre

16th Malaysian Universities Transport Research Forum Conference

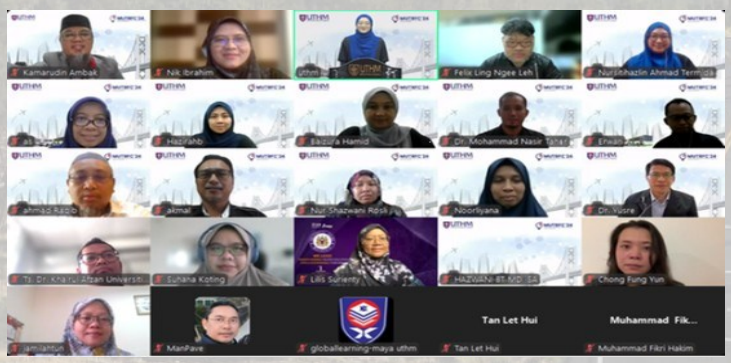
The 16th MUTRFC has been successfully organized by Smart Driving Research Center (SDRC), UTHM, in collaboration with Spatial Technology For Civil Engineering (STFORCE), Transportation Science Society of Malaysia (TSSM), Centre for Transportation Research, Universiti Malaya and Universitas Mercu Buana, Indonesia. There were 2 keynote speakers:

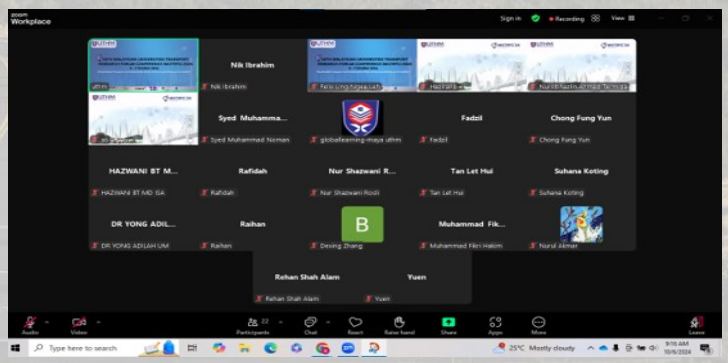
(1) Mr. Fadzil Abd Hamid (Perbadanan Pengangkutan Awam Johor - PAJ).

(2) Assoc. Prof. Ts. Dr. Mohamad Yusri Aman (UTHM)

A total of 25 papers was presented during the 2 days event. Participants were from Universiti Malaya (UM), Universiti Tun Hussein Onn Malaysia (UTHM), Tidar University Mangelang Indonesia, Universiti Teknologi Mara (UiTM), Universiti Sains Malaysia (USM), Universitas Mercu Buana Indonesia, Sunway College, Universiti Teknologi Malaysia (UTM) and ATUR Traffic Consultant Sdn Bhd.

The Malaysian Universities Transport Research Forum Conference (MUTRFC) was first organized in 2002 by the Transportation Science Society of Malaysia (TSSM). This conference serves as a platform for sharing and discussing transportation issues and challenges for the benefit of the participants, who are mainly undergraduate and post-graduate students in the various transportation disciplines. Nevertheless, participation in this conference is open to everyone involved in transportation from the academia, government agencies and industry.





Our main target is to nurture young researchers from the academic institutions to become experts in transportation related fields, through sharing of research findings, ideas, and knowledge with and getting feedbacks from others from amongst academics, transport practitioners and professionals, both from Malaysia and abroad.

By: Nik Ibtishamiah Hj. Ibrahim, CTR

Pioneering Discussions on Climate Resilience and Water Security through SEAWE-14

The most recent in a biennial series, the 14th South East Asia Water Environment Symposium (SEAWE-14) was held for the first time in Malaysia from December 3-5 , 2024, at Wyndham Grand Bangsar Kuala Lumpur. The symposium was co-chaired by Prof. Ir. Dr. Adeline Chua Seak May, Head of Sustainable Process Engineering Center (SPEC), Faculty of Engineering, Universiti Malaya (UM) and Prof. Dr. Futoshi Kurisu, Research Center for Water Environment Technology (RECWET), The University of Tokyo (UT).

Focused on critical issues surrounding water environments and sustainability, the symposium attracted over 150 delegates from 13 countries. Areas from fundamental research to cutting-edge water technologies were addressed in technical sessions consisting of 119 oral presentations. Key themes included sustainable water treatment and resource utilization, water quality management, and the abatement of emerging contaminants. Besides technical sessions, the symposium featured three keynote speeches and two technical visits.

YBhg. Dato' Seri Ir. Dr. Zaini Ujang, Secretary General of the Ministry of Higher Education (MOHE), Malaysia, officiated SEAWE-14 and delivered a keynote on the vital role of non-state actors in equitable water management. Prof. Dr. Satoshi Takizawa from The University of Tokyo discussed the balance between societal development and environmental pressures in Asia, while Ir. Khor Bee Chin from Indah Water Konsortium Sdn. Bhd. (IWK) shared strategies for sustainable wastewater management.

The delegates enjoyed technical visits to the IWK Pantai 2 Regional Sewage Treatment Plant and Green Street Farm (GSF). At IWK Pantai 2, they learned about sustainable sewage treatment integrating biogas generation, while GSF showcased urban farming practices using aquaculture wastewater in line with circular economy principles.

SEAWE-14 was a success, providing valuable networking opportunities that facilitated reconnections and established new collaborations among researchers, industry professionals, and policymakers. The symposium also sparked potential collaborations and fostered regional partnerships, paving the way for innovative solutions to environmental challenges.

By: Prof. Ir. Dr. Adeline Chua Seak May and Dr. Loi Jia Xing, SPEC

MEET OUR RESEARCHER

Dr. Noorhayati Idros

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Dr. Noorhayati Idros is a Senior Lecturer in the Department of Electrical Engineering at Universiti Malaya, specializing in the development of nanophotonics-based biochemical sensors for water quality and environmental monitoring. Her professional journey began as an engineer at Intel Microelectronics Sdn. Bhd., Malaysia after earning her undergraduate degree in Electrical and Electronics Engineering from Universiti Tenaga Nasional, Malaysia. She furthered her education with a Master's degree in Nanoelectronics from The University of Manchester, United Kingdom, and later obtained a PhD in Engineering from the University of Cambridge, United Kingdom.

Her PhD research focuses on the development of biochemical sensors for detection of water contaminants 2,4,6-trinitrotoluene (TNT) explosive and heavy metals. This interdisciplinary research exploits aptamer/DNA and chemical materials, that are functionalized on colloidal photonic crystals (PCs) surface, with the integration of microfluidics paper-based devices (μPADs) for low-cost, easy-to-use, and portable applications. During PhD, Dr Idros examined numerous surface functionalization chemistry for receptor-target attachment on PCs surface in water. The surface functionalization technique coupling with sensitive optical transduction in use resulted a high dynamic range of five orders with limit of detection in picomolar and linearity on a logarithmic scale. Conventional methods for monitoring water contamination are often laborious and require highly skilled technicians to perform the measurements, making the quest for developing simpler and cost-effective techniques for rapid monitoring incessant.

Dr. Idros's work bridges innovative sensor technologies with critical applications in environmental monitoring and sustainability. Following her PhD, Dr. Noorhayati Idros served as a Research Associate at the Cavendish Laboratory, University of Cambridge. During this time, she developed biochemical sensors for detecting mercury in water and investigated the use of Peruvian shrimp as bioindicators to assess water quality in Peruvian rivers. Her responsibilities extended to training university staff and students in laboratory and field techniques, leading fieldwork demonstrations, and presenting research findings at international conferences. She also played a key role in facilitating staff and student exchange programs between the University of Cambridge and institutions in Peru. Dr. Idros's interdisciplinary research combines environmental physics and water analysis, fostering collaborations with international teams from the UK, USA, Peru, and China. Her work seamlessly integrates advanced sensor technologies with practical applications, making significant contributions to environmental monitoring, water quality assessment, and sustainability initiatives.

Selected Publications:

1) Hunter, M.; Perera, D.H.N.; Barnes, E.P.G.; Lepage, H.V.; Escobedo-Pacheco, E.; Idros, N.; Arvidsson-Shukur, D.; Newton, P.J.; de los Santos Valladares, L.; Byrne, P.A.; et al. Landscape-Scale Mining and Water Management in a Hyper-Arid Catchment: The Cuajone Mine, Moquegua, Southern Peru. Water 2024, 16, 769. https://doi.org/10.3390/w16050769

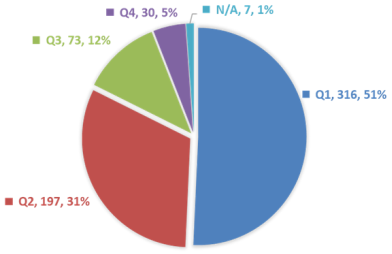
2) Idros, N.; Stott, K.; Allen, J.; Kamboj, V. S.; Corns, W. T.; Newton, P. J.; Verde-Luján, H.; Valladares, L. D.; Villanueva, C.; Jhoncon, J. H.; Chu, D.; & Barnes, C. H. W. Highly sensitive fluorescence-based mercury (II) DNA sensor enhanced by silver(I) activation. Measurement: Sensors, 2022, 20-21, 100368. https://doi.org/10.1016/j.measen.2022.100368

3) Idros, N.; Chu, D. Triple-Indicator-Based Multidimensional Colorimetric Sensing Platform for Heavy Metal Ion Detections. ACS Sensors, 2018, 3 (9), 1756–1764. https://doi.org/10.1021/ascsensors.8b00490

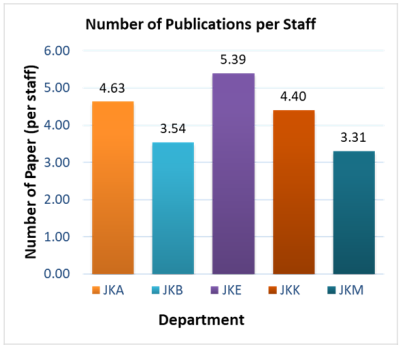
2024 RESEARCH MILESTONES

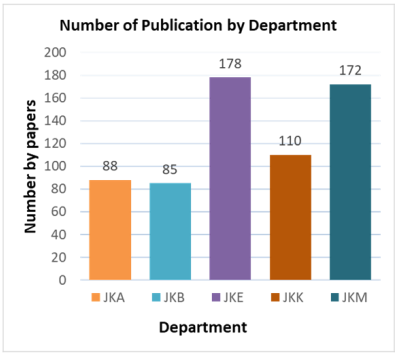
Faculty of Engineering 2024 Achievements

Publication (01 Jan—30 Nov 2024)



623 ISI Papers
Q1 and Q2 (82%)





New Research Grant Approved 2024

RM 17,696,892.49

R&D consultations (UMConsult) 2024

86

Patent filed 2024

2

Other IPR 2024

12

Credit to the Deputy Dean of Research Office, Faculty of Engineering, Universiti Malaya

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Enginitium is the quarterly bulletin published by the Research Office at the Faculty of Engineering, Universiti Malaya. Its mission is to celebrate the achievements of our faculty members, particularly focusing on their research initiatives and contributions to knowledge and society. This publication seeks to foster a vibrant culture of knowledge sharing and collaboration within our academic community. Through Enginitium, we aspire to inspire and inform, showcasing the impactful work being conducted at the Faculty of Engineering, Universiti Malaya.

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