MONASH University

MALAYSIA

SYNC

Say Yes N' Collaborate

DEMOLITION WASTE ain't really a waste.

Giving UGLY FOOD a second lease of life.

Biofuels and phytonutrients from things we call "TRASH".

waste to wealth

What is the biggest takeaway from postgraduate journey?

HEAR WHAT THEY SAY...

How is life after PhD?

ISSUE 9, AUGUST 2022

Letter from the Editor

Welcome back our faithful readers and those who are new to SYNC, the official research newsletter of our School of Engineering. We are proud to present the theme "Waste to Wealth" in this 9th issue. What a common topic, you may wonder. It is a common topic indeed. However, the fundamental problem of waste management and valorization still persists worldwide despite advancements of research and develoment in the field of materials, process technology, process optimization, smart systems, artificial intelligence (AI), and many more.

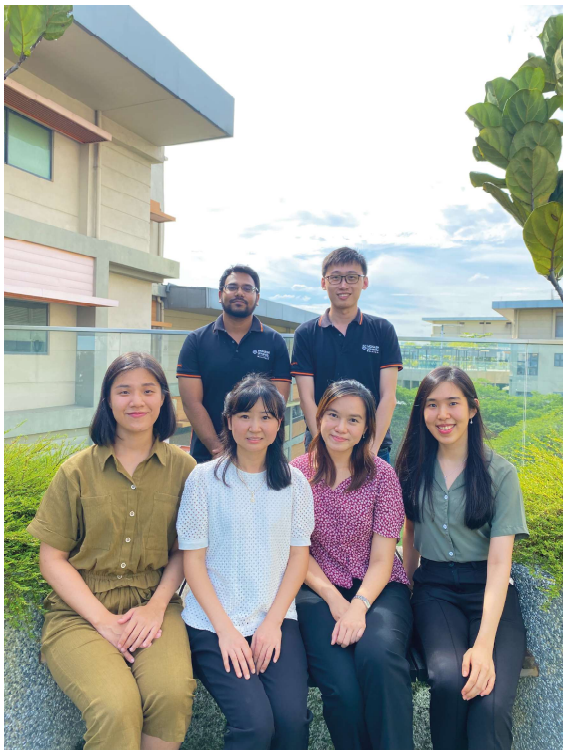
This issue features the work of A/P Raman and Dr. Raghunandhan on the valorization of demolition waste and oil palm shells in the construction industry, as well as interesting research works related to waste valorization from A/P Edward Ooi, Dr. Arshad Salema, and Dr. Song Cher Pin. We also dedicated a section to share the stories of our alumni after graduating from PhD. So, to our graduate research students (GRSs), make sure not to miss this section out! Do not forget to check our Break Zone too. The first 3 to submit the correct answer will be awarded RM20 Grab vouchers!

Join us or send us feedback!

Lastly, the SYNC Editorial Team would like to sincerely thank all contributors for their time and support to make this issue possible. We hope the readers enjoy reading this issue and gain various insights. Do send us your feedback and suggestions through the google form for our continuous improvement. If you would like to collaborate with us or be part of the team, do let us know via our email.

Let us SYNC—Say Yes 'N' Collaborate.
Thank you.

Dora Lawrencia
Editor



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Contents

Insights from
the Director of Research Excellence

It is an honour for me to be contributing to the SYNC newsletter again in a different capacity after a hiatus. I had a delightful experience in the two years (2019–2021) spent working with the editorial team and I am very pleased to see sustainability and growth of the team. Here, I wish for many more editions of the SYNC newsletter to come!

Previous issues of SYNC have vastly featured revolutionary work that would improve processes and industries. In the journey of revolutionising processes and industries, wastes are often generated in different forms. Those that are immediately harmful to the environment can be easily identified and dealt with in the process. However, wastes that are not potent do not get immediate attention and cause environmental issues with accumulation or process intensification. A good example of emerging pollutants is microplastics among many others.

Improper waste management will lead to issues such as soil, water and air pollution which will disrupt the food production cycle, water and eventually energy security. Engineers play an important role in waste management as engineers are at the heart of process design, identifying possible wastes that will be generated, and proposing innovative solutions to waste management. In this issue, SYNC will cover waste utilisation, where innovative solutions are put in place to valorize waste into useful products. Valorization of waste is now being given higher priority in the solutions being put forward for waste management. This is because the useful products could potentially improve the economic sustainability of processes with reduced environmental burden.

The topic on waste valorization will definitely continue to receive attention, until solutions are available for all types of wastes generated from anthropogenic activities. I hope that the topics covered in this issue will create awareness on waste management and how engineers of different disciplines could work together to develop revolutionary solutions with minimal impact to the environment!

A/P Poh Phaik Eong
Director of Research Excellence

Valorization of Waste Materials for Concreting and Structural Engineering Applications

A/P Sudharshan N. Raman

(Civil Engineering)

- Dora Lawrencia

The construction industry is often associated with negative connotations as it is heavily reliant on natural resources and is energy-intensive. Construction contributes to a significant amount of CO_2 emission due to heavy extraction of natural resources, high consumption of energy, as well as CO_2 emitted due to the hydration process of cement during concrete production. With around 70–80% of the construction materials made from concrete, researchers are looking for alternative greener base materials, such as by-products or wastes from other industries or within the construction industry itself. These can be reused, recycled, or upcycled for producing new construction materials.

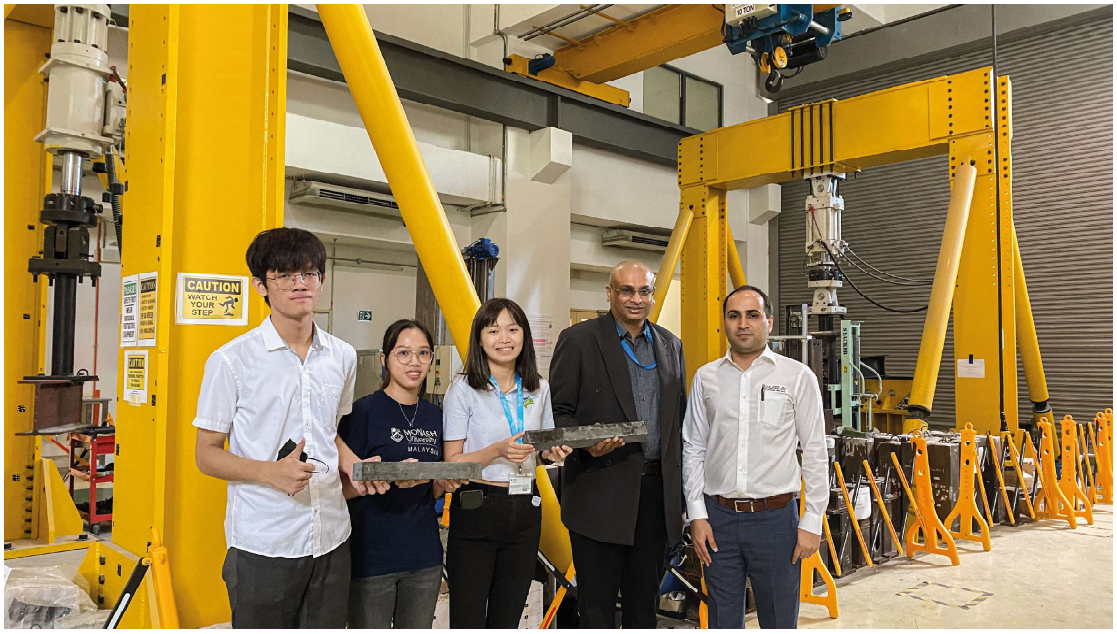
To contact A/P Raman, visit

A/P Sudharshan N. Raman and his research group are looking into the valorisation of construction and demolition wastes, as well as other by-product materials, for concreting and structural engineering applications. Many South and Southeast Asian nations, including Malaysia, gained their independence between the 1940s and 1960s and faced rapid population growth between 1970 and 2000. Within this period, there was a rapid increase in construction activities. With concrete being the primary material used and most of the structures designed for a 50-year service life, many of these structures would reach the limit of their service life in the next 5–20 years. Hence, these buildings can potentially be demolished to make way for new construction, leaving aggregates that can be extracted and processed using appropriate technologies.

Despite extensive research on recycling aggregates from construction and demolition waste, putting the research ideas into practice is challenging. As the extracted aggregates are no longer in their original form, their properties need to be examined for optimal performance of the new concrete mixture in order to meet the requirements of standards and structural design codes. A/P Raman's group focuses on filling these research gaps to ensure that the recycled aggregates are applicable in real life.

Aside from recycling aggregates from demolition wastes, A/P Raman and his group are also looking into valorising coal bottom ash (CBA), which makes up 15–20% of the by-products in a coal-fired power plant. As compared to fly ash, which is more commonly used due to them being the main by-product of coal-fired power plants, research on CBA as an alternative aggregate or cement composite has not been well established. When cement is mixed with water, the hydration mechanism produces several products, such as calcium-silicate-hydrate (C-S-H) and calcium hydroxide. C-S-H contributes to the structural strength and durability, but calcium hydroxide does not. Calcium hydroxide, on the other hand, can react with supplementary cementitious materials, such as fly ash, slag, and silica fume, to form more C-S-H as strength contributing materials. Hence, the research group is examining the properties of CBA and how it can contribute to the hydration process for desired cement properties.

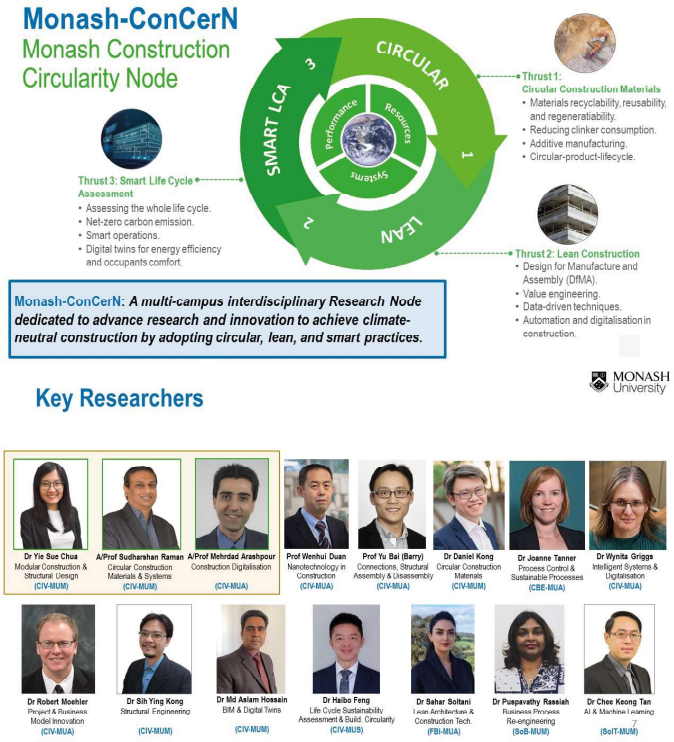
A/P Raman and his group member with representative from EC Precast Sdn Bhd



A/P Raman with his research group and representative from Dura Technology Sdn Bhd

In addition to this, A/P Raman's group is also collaborating with Dura Technology Sdn Bhd which specialises in ultra-high performance concrete (UHPC) production. Unlike regular concrete which has a compressive strength of about 25–40 MPa, UHPC has a remarkable compressive strength of more than 150 MPa, rendering them mainly used in bridge structures. This collaboration is pivotal and fundamental for the advancement of UHPC in widespread structural applications (generally for axially loaded structural members such as columns). Furthermore, this research is expected to contribute to structural design code guidelines for structures that may be constructed as axially loaded UHPC members. In the long term, UHPC can reduce the overall cost and contribute to sustainability as its high compressive strength allows lesser material usage, resulting in a leaner construction.

Moving forward, A/P Raman has teamed up with several prominent Monash researchers from the Malaysia, Clayton and Suzhou Campuses to form the multi-campus interdisciplinary research node to promote circular practices in construction, the Monash Construction Circularity Node (Monash-ConCerN). This research node will primarily focus on three research thrusts: circular construction materials, lean construction, and smart life cycle assessment; and is jointly led by Dr. Chua Yie Sue (Monash University Malaysia), A/P Mehrdad Arashpour (Monash University Australia) and A/P Raman. With these in place, A/P Raman believes that, we are one-step forward to a more sustainable construction industry for the betterment of the society and environment.



Monash ConCerN research node and its key researchers

Rubberized Oil Palm Shell (ROPS) Eco-composites for Soil Stabilization

Dr. M.E. Raghunandan

(Civil Engineering)

- Yanru Wang

Road pavement's structure is typically made of multiple layers of processed and compacted materials, mostly soil, which aims to support vehicle loads and provide a smooth riding quality and experience. Depending on the nature of the project, it is important to improve the subgrade strength, control the volume change of soil layers, and waterproofing through the practice of soil stabilization. Conventional geosynthetics are widely used for soil stabilization due to their proven and improved performance in soil reinforcement. However, it can be expensive and likely to cause relatively high carbon emissions.

On the other hand, eco-composites such as processed biomass and solid wastes have the potential as a low-carbon alternative to be used in the construction industry. Oil palm shell (OPS) is one of the by-products of the palm oil extraction process. The application of OPS in the construction field could achieve zero carbon emission in its overall life cycle. However, the raw OPS in moist soil can degrade quickly due to its interaction with water and biodegradation. To overcome this issue, Dr. Raghunandan and his research team pioneered the investigation of rubberized oil palm shell (ROPS) for their application in soil stabilization. Their study contributes to reducing global carbon emissions and improving human living comfort, basically another initiative toward sustainable development and an environmentally friendly approach in Civil Engineering and Construction Industry.

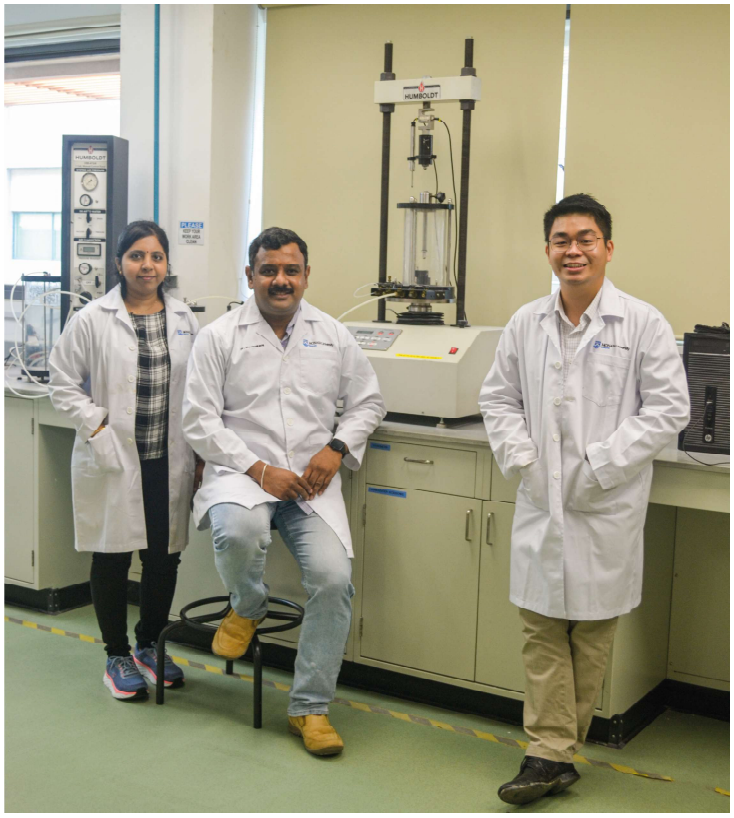
In this work, the OPS's surface is treated by coating a commercially available rubber sealant to restrict the interaction of OPS with water, thus reducing decomposition rates. The compaction characteristics of pure kaolin, kaolin-OPS, and kaolin-ROPS samples were then tested. Results showed that the kaolin-ROPS achieved better compaction characteristics compared to kaolin-OPS and pure kaolin. Moreover, the water absorption of kaolin-ROPS samples was reduced to a negligible amount of 1.5%, whereas that of kaolin-OPS was recorded as high as 31%. So far, this technique is still in the stage of lab studies, while some fundamental works have been published. Dr. Raghunandan and his team will continue to improve the ROPS properties by optimizing the surface treatment. He also believes that the use of synthetic rubber sealant can be replaced with natural rubber in the future. Meanwhile, he is looking for industry collaborators to test the eco-composite samples in the field and also explore the utilization of Malaysia rubber in the process.

Samples of OPS (left) and ROPS (right) used in the study on compaction characteristics of kaolin reinforced with raw and rubberized oil palm shell [1] by Dr. Raghunandan and his team.

Dr. Raghunandan mentioned that ROPS has broad applications in the future. Besides the application mentioned above, it could also be used to fill hollow walls—another alternative to lightweight concrete. The mat of the reinforced rubber composite can also be widely applied in the automobile industry, sports, and construction sectors. Dr. Raghunandan and his team analyzed the behavior of ROPS with various contents and shapes subjected to repeated compression loading via numerical and experimental methods. To this end, though lower strength was observed with ROPS layers compared to conventional geosynthetics for soil stabilization, this technique could be applied for temporary constructions or rural roads. Another limitation to this research is that the OPS is region-specific as only countries such as Malaysia, Indonesia, Thailand, and Nigeria, are rich in these raw materials, making these countries more feasible to apply the outcome of this research. Addressing this limitation by using other biomass types for eco-composites is another potential for research development.

Dr. Raghunandan highlighted that continued excessive utilization of natural resources to support the construction activities may not be sustainable. A recent news article estimates that about 40% of Earth's land is depleted [2]. Therefore, Dr. Raghunandan and his research team strongly believe that a safer alternative is crucial to ensure safe and sustainable development in construction practices and soil stabilization. Most of the research projects under his supervision predominantly focus on and contribute to the United Nations Sustainable Development Goals (SDGs), SDG 9 (Industry, Innovation, and Infrastructure), SDG 11 (Sustainable Cities and Communities), and SDG 12 (Responsible Consumption and Production) [3]. Dr. Raghunandan is available for discussion and potential collaboration with the industry, research labs, and universities towards achieving and contributing to sustainable development in the construction industry.

To contact Dr. Raghunandan, visit



Dr. Raghunandan with his research team

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COVID-19:
A Plastic Pandemic

- Janice Leong

The recent COVID-19 outbreak was not just a major public health concern, but inevitably an environmental one. Wastes produced during the pandemic are primarily clinical waste in the form of plastics originating from healthcare facilities, such as syringes, test kits, face masks, personal protective equipment, and plastic disposal bags. Before COVID-19 hit, our planet was en route to quadrupling its total plastic waste generation by 2050 [1]. Yet, the COVID-19 pandemic has exacerbated the already dire plastic pollution to unprecedented levels. In 2021, it was reported that approximately 400 tonnes—the weight of four blue whales—of pandemic-related clinical waste is produced every month in Malaysia [2]. Moreover, the rapid self-test kits are a rising plastic threat to the environment. The pandemic has also caused a significant shift in consumer behaviour to online shopping and is set to continue even though lockdowns have been eased. A recent study found that online shopping generates 4.8 times more packaging waste than shopping at bricks-and-mortar stores [3].

Clinical wastes (top) [8] and online shopping plastic wastes (bottom) [9] which ballooned during the COVID-19 pandemic.

But, how are we managing pandemic waste? Clinical wastes generated by the COVID-19 pandemic are largely discarded by incineration in Malaysia. The ashes are then disposed of at landfills [4]. This method of disposal emits pollutants that are detrimental to public health and the environment, yet it is recommended by the World Health Organization (WHO) for discarding infectious plastic waste [5]. The use of biodegradable plastic is one effective way as degradation of these materials has minimal negative consequences. Some examples of renewable feedstocks for bio-based plastics are cellulose, starch, bio-ethanols, and polyhydroxyalkanoate (PHA), to name a few [6]. For packaging wastes, companies like Amazon have embarked on a mission to create new energy-efficient technology that can break down various kinds of plastics and convert them into valuable materials that can be used to produce the same types of plastics or new plastics [7]. In case the materials are not recycled, their molecular structure will be designed to biodegrade in the environment [7]. Coming back to homeground, popular e-commerce companies like Shopee and Lazada are, unfortunately, not as proactive in their environmental sustainability efforts. Nevertheless, cutting back on plastic wastes and investing in biodegradable plastics should be low-hanging fruit for multi-million companies, yet we are compromising the environment for profit. Unless we treat plastic pollution just as seriously as the COVID-19 pandemic, it is only a matter of time until we are engulfed in plastics!

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Ugly Fruits and Vegetables:
A Second Lease of Life

- Janice Leong

Do you know that two in five fresh produce are thrown away right after they are harvested simply because they look "ugly" [1]? Yup, that's the reality of conventional farming these days as these fresh fruits and vegetables suffer from the same wrecked fate—they just don't look right. Consumer preference for aesthetically pleasing produce and mistrust of blemished crops have led to rejections of these suspicious-looking ones. Produce aesthetics are governed by their shape, colour, and size, and these standards are chiefly controlled by supermarkets to meet customer satisfaction and sales. Since they do not yield favourable returns, these misshapen fruits and vegetables are rejected by farmers and typically dumped as they are unsightly for sale. Crop rejection costs farmers 20% of their crop annually, and when these foods rot, they emit methane, a greenhouse gas [2].

Wonky fruits and vegetables [5]

Wonky or not, these fresh produce are still edible and provide similar nutritional content as aesthetically pleasing ones. At the consumer level, education is key for consumer behaviour—that ugly food does not pale in comparison to their aesthetic counterparts in terms of nutritional content, taste, and for that matter, appeal. In some countries, consumer education has been implemented by selling these abnormal-looking produce at slashed prices in supermarkets like Tesco in the UK [3] and WeFood in Denmark [4]. This drive would allow consumers to make their own purchasing decision on whether aesthetics matter. Not only that, consumers have more alternatives on how to spend their money.

Other than education, these rejected crops can have a second lease of life in myriad ways. Recently, a Malaysian lass with two other friends start-up their own business called The Unusual Greens, where they make ice-creams out of fruits that did not make it to the shelf [6]. In other news, a Malaysian duo started a project called Project F Series, where they make kombucha tea out of salvageable crops. Engineering-wise, we can also rescue these crops for energy valorization and production of biodegradable materials. A study published in Bioresource Technology journal produced biomethane as green energy from food waste via coupling of hydrothermal liquefaction and anaerobic digestion [7]. Moreover, since these crops are rich in cellulose, bio-based materials such as cellulose nanocrystals can be harnessed as filler materials in packaging materials for reinforcement effects [8]. Therefore, rather than letting these unattractive crops go to waste, why not valorize them for the betterment of our environment?

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Extraction of Phytonutrients from Agro and Food Waste

A/P Ooi Chien Wei

(Chemical Engineering)

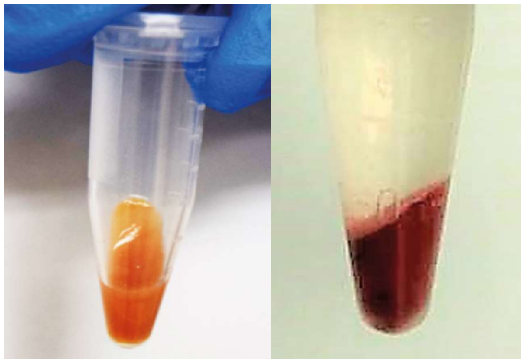
- Yanru Wang

A/P Ooi Chien Wei

To contact A/P Ooi, visit

Food waste and byproducts generated from food processing, production, and retail have increased steadily due to the huge consumption of food by the growing population worldwide. Conventional methods of waste management such as animal feed, landfilling, or compositing only partially utilise the food industry waste. Recovery of compounds from the food processing byproducts is attractive in terms of sustainability, profitability, and general improvement of human health. Hence, A/P Edward and his research team aim to valorize these byproducts of food processing into the valuable source of phytonutrients. The targeted waste sources range from the residues obtained from the processed food to the sludge palm oil generated from the palm oil processing. By adopting the water-induced hydrocolloidal complexation, they are the first team in the world demonstrating the potential of this green extraction method for recovery of carotenoids from waste sources derived from the pink guava decanter, tomato pomace, and carrot peel. The extracted lycopene and pectin have great potential in nutraceutical and pharmaceutical applications.

Compared with conventional methods, the water-induced complexation method is simpler, green, and economical. It relies on water as a non-toxic solvent to induce the formation of the hydrocolloidal system, which requires fewer operating steps and without organic solvent involved. Unlike the conventional extraction methods that demand the drying of wet waste prior to extraction, the water-induced hydrocolloidal complexation could directly process the feedstock in wet form and this advantageous feature could avoid contamination and degradation of the carotenoids in the feedstock. More importantly, the water-induced complexation method could be adopted in any bioresources containing carotenoid and pectin intrinsically. A recently reported techno-economic assessment has revealed the good scalability and economic viability of the developed extraction process.



Carotenoid-pectin complexes

A/P Edward mentioned that one of the current challenges of utilising water-induced complexation methods is the high consumption of water. Nonetheless, the challenge could be overcome by adopting water filtration systems and water recycling methods. He also foresees that the batch quality of agrowaste feedstock may affect the optimal extraction conditions. Therefore, he suggested that the composition of food waste used in each batch of extraction be identified and correlated to the optimal extraction scheme. For example, AI tools are a good way to interpret the interaction parameters and adjust the extraction condition in response to the quality of feedstock. To promote the utilisation of food waste as a source of phytochemical, he has contributed to the publication of research articles, book chapters (Food Waste Recovery), and the establishment of a new journal (Discover Food, as an associate editor).

Converting Biomass to Biofuels and Bioenergy using Microwave Pyrolysis

Dr. Arshad Adam Salema

(Mechanical Engineering)

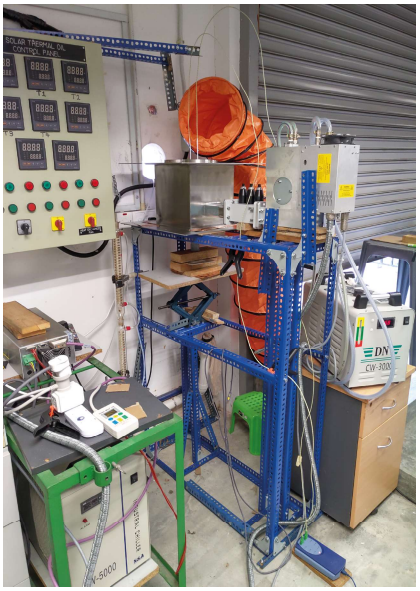
- Yanru Wang

Dr. Arshad Adam Salema

Biomass is a plant-based material used as feedstock to produce heat, electricity, or chemicals. Although, hitherto, the processing of biomass is complex (due to its chemical components and the presence of carbon, hydrogen, oxygen, and nitrogen), the immense benefits that can be reaped from it includes promising energy security and environmental protection. The use of biomass is no doubt an advantage for efficient waste management as well as its use as a heating fuel for various industrial applications. In 2017, the International Energy Agency (IEA) described bioenergy as the most important source for renewable energy. Hence, Dr. Arshad and his research team are focusing on converting various types of biomass, such as oil palm, wood-based, coconut shell, rice husk etc., to biochar, bio-oil and biogas via microwave pyrolysis. They are working on scaling up the reactor system to a kilogram scale.

To contact Dr. Arshad, visit

The pyrolysis process is employed to heat the biomass at a high temperature to produce biofuel. Conventionally, samples are in direct contact with the heating source, which enables heat transfer from the outer surface of the biomass to the core by conduction. This process is time-consuming, and furthermore leads to high heat loss. Therefore, Dr. Arshad's team is employing microwave radiation, which is a highly selective, rapid, volumetric, and non-contact heating approach. This undoubtedly saves time and improves product quality as compared to the conventional processing methods, owing to its unique heating characteristics. During microwave radiation, samples are heated up by absorbing energy from microwaves.



Microwave pyrolysis system

The conversion of biomass into fuel by employing microwave technology at larger-scale is still not available; however, some efforts are made to scale-up the microwave biomass processing to pilot-scale. Challenges for applying this technology on a large scale are reactor design, batch vs continuous temperature measurement and microwave absorber or catalyst. Recently, Dr. Arshad and his team have published a classical review paper titled “Technical challenges in scaling up the microwave technology for biomass processing” [1] in Renewable and Sustainable Energy Reviews journal.

Dr. Arshad and his team are working on solving some of these critical challenges including the temperature measurement during microwave heating through experiments and numerical simulation methods. Although some of the important problems need to be addressed, he believes that microwave-assisted biomass pyrolysis is a promising technique to be scaled up at a commercial level in the future.

Source:
[1] I. Siddique, A. Salema, E. Antunes and R. Vinu, "Technical challenges in scaling up the microwave technology for biomass processing", Renewable and Sustainable Energy Reviews, vol. 153, p. 111767, 2022. Available: 10.1016/j.rser.2021.111767.

Converting Low Value Byproducts to High Value Products using Enzymes

Dr. Song Cher Pin

(Chemical Engineering)

- Dora Lawrencia

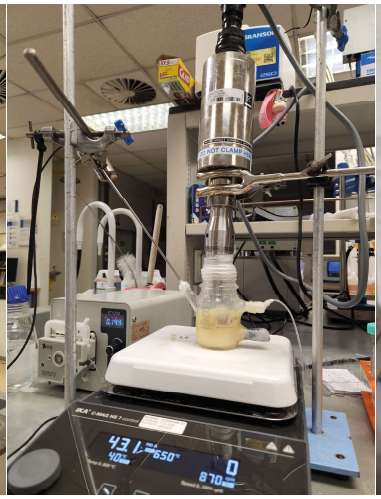
Dr. Song and Prof. Chan with their research team

To contact Dr. Song, visit

As palm oil production continues to rise, addressing the increasing amount of low-value palm oil by-products becomes a significant challenge. Palm oil byproducts include palm oil mill effluent, sludge palm oil, palm fatty acid distillate, palm pressed fiber oil, etc. Currently, there are not many applications for these by-products, resulting in waste management issues. Dr. Song and his research team focus on using biocatalyst to convert these waste oils into higher-value products such as biofuel. This way, they are solving waste management issues while simultaneously producing renewable energy. In addition, they developed a methanol-free enzymatic process to concentrate high-value phytonutrients such as carotenoids, tocotrienols, and tocopherols in the lipids before recovering them through separation processes.

The biocatalysis route, which uses enzymes, is more environmentally friendly than the conventional route, which uses chemical catalysts. Biocatalysis produces less waste while offering high conversion. Nonetheless, the use of enzymes is still not well accepted in the industry due to the high cost of enzymes and a longer reaction time up to 12 hours compared to 2–3 hours using the conventional route. Hence, his research team is currently working on optimizing the process to shorten the time while minimizing the enzyme concentration to reduce the cost. As enzymes are expensive, they are also looking into the recyclability of the enzymes to make the process more economical.

One of the future directions for the research team is to convert these waste oils into biojet fuel, which has a higher market value. To do this, they need to culture a different enzyme that can convert lipids into alkanes. According to Dr. Song, everyone has a different agenda for their research. While valorization of waste oils for higher-value products is also studied in other institutions, his team's research agenda is to make it commercially viable by including life cycle analysis, techno-economic analysis, and the overall circular economy rather than concept proofing. He hopes that his team can contribute to the industry.



Enzymatic biodiesel production from various feedstocks

Separation of biodiesel and glycerol

Let's Ask Our Alumni!

How is Life after PhD?

- Dora Lawrencia and Janice Leong

Dr. Emmanuel Endene

PhD in Geo-environmental Engineering (2021)
Currently an environmental engineer at WBG

Dr. Emmanuel Endene completed his master's degree in Geological Engineering from the Kwame Nkrumah University of Science and Technology, Kumasi, Ghana in 2015 and thereafter worked as a Geotechnical Engineer. He later joined Monash University Malaysia in 2017 to pursue his PhD studies under the supervision of Dr. Vivi Anggraini and Dr. M.E. Raghunandan.

He completed his PhD in 2021 with a specialization in Geo-environmental Engineering. His research focused on developing an innovative and smart landfill liner material to capture the generated carbon dioxide from municipal solid waste landfills, while utilizing the captured carbon dioxide for its strength and hydraulic conductivity improvement.

Despite being challenged at times, his PhD journey was truly fun filled. During his PhD, he traveled to a couple of countries, including Italy, Australia, UAE, and USA. As a recipient of Graduate Research Excellence award, he went to the University of British Columbia, Canada (the host university for his research) for 6 months. Furthermore, in the last year of his PhD, he took a 6-month intermission as he was selected to participate in the World Bank Group (WBG) African Fellowship Program. He thoroughly enjoyed the experience as there was a blend of industrial aspect, research, and policy making. Due to the COVID-19 pandemic and travel restriction, he had to complete his PhD from overseas.

Stemming from the great experience he obtained from the WBG, he decided to apply for a position at the WBG, and he is currently based in Washington DC, working as an Environmental Engineer for the East African Region. He is involved in about 12–15 projects spanning from infrastructure/construction projects, mining projects, waste management projects, health projects, digital projects, education projects, agricultural projects, etc.

"Have an idea of what you want to do after your PhD. These initial visualizations will help you prepare better and push you to streamline towards relevant opportunities. We also need to have a mentality of pushing, proactiveness and support for each other. Force yourself to make that step to reach out to people, create networks, and see what other people are doing. Do not be shy to reach out to others, when people see the effort you are putting in, they will come in to support and help you. Above all, enjoy your time as a PhD student and make good relations with your supervisors and mates because you will never experience it again," he said.

Dr. Sangeetaprivya P. Siva

Dr. Sangeeta obtained her PhD in Chemical Engineering in 2021. Her research was on the modelling of pickering emulsion droplet sizes stabilised by cellulose nanocrystals during ultrasound emulsification. The second year of her PhD candidature was particularly difficult for her, but she managed to pull herself together by demonstrating her effort and ability to work independently as a researcher to achieve her PhD objectives.

PhD in Chemical Engineering (2021)
Currently a researcher at KLK Oleo

Dr. Sangeeta is currently working as a researcher in KLK Oleo, which specializes in producing specialty oleochemicals. Her day-to-day job is to test the applicability of these specialty oleochemicals for certain homecare products such as soaps. She is also studying how to make soap bars and shampoos. Fundamentally, her job is related to her PhD research, nevertheless it is still a new area for her to learn. When asked about what employers seek for in job applications, she said: "Find out what you can market—the skills you acquired throughout your PhD—for your future career". It was Dr. Sangeeta's fundamental colloidal knowledge that attracted her employers.

Being a social butterfly herself, Dr. Sangeeta loves meeting new people. "Networking is a vital element of your PhD. Networking puts your name out there and gives you an advantage not just for jobs but also for expanding your knowledge by learning from people of different backgrounds,", she said. She advises current GRSs to take advantage of the opportunity to attend workshops, seminars, conferences, mingling events, and meet students from various faculties now that the pandemic restrictions have been lifted. These will broaden your horizons and expose you to new ideas. This is also why she loves coming to campus and working at the postgraduate office as she felt more motivated and productive there.

"Just enjoy your journey. The 3–4 years of research will fly by before you know it. Make a lot of friends. Don't worry about your milestones, because by hook or by crook, you will go through it!", she said.

Dr. Joseph Chan Chang Lun

PhD in Robotics and Mechatronics Engineering (2019)
Currently a postdoctoral researcher at Monash University Malaysia

Dr. Joseph Chan Chang Lun completed his PhD in Robotics and Mechatronics Engineering in 2019, in which he applied observers for reconstructing fault signals affecting singular systems (or as his supervisor used to call it: "finding faults in singles"). Initially, he was set on going into the industry, but during his industrial internship he realized that his passions were in a different direction. His interest in research was kindled during his final year project, where he enjoyed the research process and found that he could work very well with his supervisor.

Despite a good start, his PhD journey was challenging, partly due to the abstract nature of his work hampering discussions with others. Nevertheless, thanks to his supervisor and research group's guidance, he successfully completed his candidature and built a foundation for a fledgling research career.

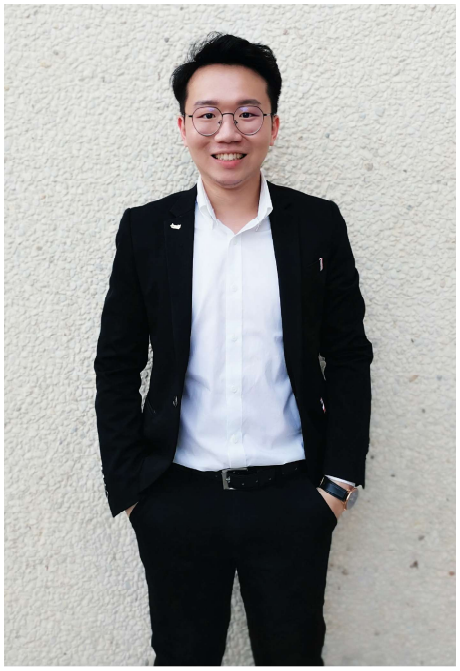
Dr. Joseph is currently working as a postdoctoral researcher at Monash University Malaysia. Prior to this, he was a Brain Korea PLUS (BK21+) Postdoctoral Fellowship Scholar with Jeonbuk National University, Jeonju, South Korea, where he was also a postdoctoral researcher from 2019–2021.

"After completing your PhD, you realize that even with your accrued experience and knowhow, there is much more to study beyond your previous scope. A postdoctoral position lets you use your experience and skills to continue investigations into your expertise, or even a different topic altogether. Being able to work and communicate with somebody from a different background are some of the most rewarding experiences in my research career."

There are several considerations when applying for a postdoctoral position, one of the most important being your publication track record as it reflects your ability as an independent scientist. Postdocs are also expected to be independent, have relevant skills, and be capable of producing results over shorter timeframes. Moreover, postdocs are usually hired to tackle certain niches of a larger research project, so each stint is typically short and temporary. Lastly, postdocs are expected to eventually build and manage their own research group and funding, and move on to more permanent positions.

His advice to current GRSs who are thinking about pursuing a postdoc is, "Do not be afraid to get out of your comfort zone. Learn as many things as possible, work with people from different backgrounds, and expand your horizons. But most importantly, do not sacrifice your physical and mental health—your work is important, but you are even more so!"

Dr. Wong See Kiat



PhD in Chemical Engineering (2022)
Currently a researcher at Hartalega

Dr. Wong completed his PhD in Chemical Engineering in early 2022. His research was on the synthesis of emulsion carriers for drug delivery. Although the initial few months were stressful, he later enjoyed carrying out his research with the addition of new friends who journeyed along with him, allowing him to share and exchange ideas.

Shortly after he completed his PhD, he began his career at Hartalega —one of the world's largest manufacturers of nitrile gloves—as part of the Research in Innovations team. Unlike the research and development department, which focuses on troubleshooting and doing research directly related to the production line, the Research in Innovations team develops new materials to produce specialty gloves (e.g., anti-bacterial, able to withstand high temperature, self-healing, etc.) and focuses on new manufacturing breakthrough.

Dr. Wong said, "When you start a research project in industry, it is like doing a PhD all over again, but within the span of 1 year". When asked about whether a masters or PhD helped in job applications, he said that it depends on the company and the job role. Some companies value working experience more than higher qualifications, on the other hand, some roles, such as the research department, masters or a PhD are valued. This is because the skills picked up during research, such as skimming through information, identifying suitable methods, and troubleshooting are highly transferable.

In addition, he added that the pool of job opportunities out there may not necessarily align with the research you did during your masters or PhD. One of his colleagues did a PhD in fuel cell engineering which is not relevant to the gloves industry. Yet, the company is seeking new ideas from diverse backgrounds for any possible discovery.

Lastly, his advice to current GRSs who are aiming to work in the industry is to build connections, talk to more people, and engage in more open discussions by attending seminars, workshops, and conferences from both the industry and academia.

Let's Ask Our GRSs!

What is the Biggest Takeaway from PhD Journey?

- Amelia

Life is a non-stop learning process. Be humble. Getting my PhD made me realise how much we do not know and how small we are in this vast world. But, don't put yourself down, you'll look back one day and see how far you've come!

Ng Wen Cai
4th Year, Chemical Engineering

I have learned to be more detailed and meticulous when doing my work. For example, in order to have a chance to publish in peer-reviewed journals, it is absolutely necessary to be thorough in every step of the process, such as literature review, running the experiments, and presenting the results. I believe that this developed soft skill will be very helpful in my future career and endeavours.

Ding Ze Yang
3rd Year, Robotics and Mechatronics Engineering

The greatest takeaway from my PhD is to step beyond of my comfort zone, I am amazed by the technical skills that I have acquired in the past 3 years.

Lee Chia Chun
3rd Year, Mechanical Engineering

Some important things that I've learned throughout my PhD journey is that it's vital to always prioritize "quality over quantity" in your research work eventhough publishing can boost more visibility of your work. Also, instead of rushing to complete more experiments as fast as you can, plan and focus on executing experiments effectively and meticulously.

Amardeep Singh Dhillon
3rd Year, Electrical and Computer Systems Engineering

The biggest takeaway from my PhD is scheduling my research activities, identifying a workspace for my working mindset, and feeling more productive. I am able to utilize appropriate resources, like talking to other graduate research assistants and lab mates, to get knowledge on the latest technologies to overcome the research problems. I encourage myself to engage in social events so that I may practice speaking in my free time.

Muhammad Tahir
3rd Year, Civil Engineering

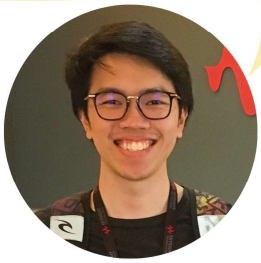
Failures and mistakes are almost always part of the process. The key is to be resilient, learn from them, and continue moving forward.

Sharon Gooi Ai Ping
3rd Year, Civil Engineering

Some of the things I've discovered during my PhD journey is that: It is absolutely normal to feel “stuck” with your research work at a certain time; be it with ideas, methodology, analysis, or having a "writer's block”—just take some time to unwind, learn and understand. It is also extremely important to self-motivate yourself in this journey—celebrate small achievements with your loved ones! Setting a proper timeline and following it diligently will make your journey smoother. Just do your best!

Charanjit Kaur Surjit Singh
4th Year, Chemical Engineering

1. Independence in learning about anything.
2. No one knows your work better than you do, so gotta be confident in your own work.
3. You can't rely on anyone but yourself. It is your PhD journey, not your supervisors, colleagues, family or friend's.
4. Learning to admit that you don't know something. People are willing to help if you show that you're willing to learn.



Ian Wong
3rd Year, Electrical and Computer Systems Engineering

I would say problem-solving skill. Since doing research is more like exploring something we don't know yet, "the ability to solve the unknown" is a skill I have cultivated the most throughout my PhD.

Chan Yon Sin
3rd Year, Mechanical Engineering

Physical Event is Back!

Town Hall Meeting

Recently, the School of Engineering held its first ever physical Town Hall meeting on 15th July 2022 with Engineering GRSs. The Town Hall meeting serves to inform GRSs on important updates and support that can be provided by the School and campus, as well as allow GRSs to voice out any concerns regarding their research work. The meeting went smoothly with good attendance, and the event was followed by lunch. It was a fruitful session indeed!

Engineering GRSs with Prof. Chai Siang Piao (Deputy Head of School), discipline GRS coordinators, and research management office members

A/P Wu Ta Yeong – Associate Head of School (Graduate Research)

Introducing
New Academics

Name: Dr. Low Liang Ee
Position/Department: Lecturer, Chemical Engineering Discipline, School of Engineering
Expertise: Nanomaterial synthesis, drug delivery, biomedical diagnosis and imaging, oil and fat science, oil and fat contaminants mitigation

Ongoing/Completed Projects:
- Development of stimuli-responsive iron oxide nanoassemblies for tumor diagnosis and therapy of tumors
- Microenvironment-targeted nanoassemblies for diagnosis and therapy against neurodegenerative diseases
- Smart oil and fat emulsion system for sustained release of natural product
- Nanomaterials as adsorbent for oil and fat contaminants mitigation

Contact: low.liangee@monash.edu
For more information, scan here

Name: Dr. Yeoh Chin Vern
Position/Department: Lecturer, Mechanical Engineering Discipline, School of Engineering
Expertise: Coputational fluid dynamics, lattice-Boltzmann methods, turbulence, thermo-fluids and heat transfer, nonlinear dynamics and chaos theory

Ongoing/Completed Projects:
- A mesoscale-based approach to the simulation and modelling of turbulent multiphase flows
- Employment of machine learning algorithms for effective selection and prediction of foundational parameters in the lattice-Boltzmann method
- Development of a comprehensive multiphysics model for increasingly accurate simulations of photobioreactors
- Direct numerical simulation, study, and quantification of fractal grid-generated turbulent flows

Contact: yeoh.chinvern@monash.edu
For more information, scan here

Congratulations to Our Winners!

ITEX 2022

The 33rd International Invention, Innovation & Technology (ITEX) 2022, Malaysia returned with the theme "Beyond Invention" on 26th and 27th May 2022 at KL Convention Center. Our School of Engineering researchers won a Silver Medal as highlighted below.

BuoyScout – A Mobile Autonomous Solution for Water Monitoring and Sampling
by Dr. Darwin Gouwanda, Lee Khai Hoe (GRS), A/P Poh Phaik Eong
The event was attended by Prof. Matthew Nicholson.

3MT 2022 (School of Engineering)

Three Minute Thesis (3MT) is an academic research communication competition which allows GRSs to present their PhD thesis within 3 minutes. Within our School of Engineering, Ling Ting Rang emerged as champion and Mohammed I.I. Al Khatib the first runner-up. A huge congratulations to the both of them! Champion Ling Ting Rang proceeded to compete with GRSs from other schools at the campus round at Monash University Malaysia.

Champion: Ling Ting Rang
Title: A Sense of Touch for Soft Robots

Runner-up: Mohammed I.I. Al Khatib
Title: Citizens Under the Rain 2.0

Spot Me at Monash

RM20 Grab vouchers are up for grabs!
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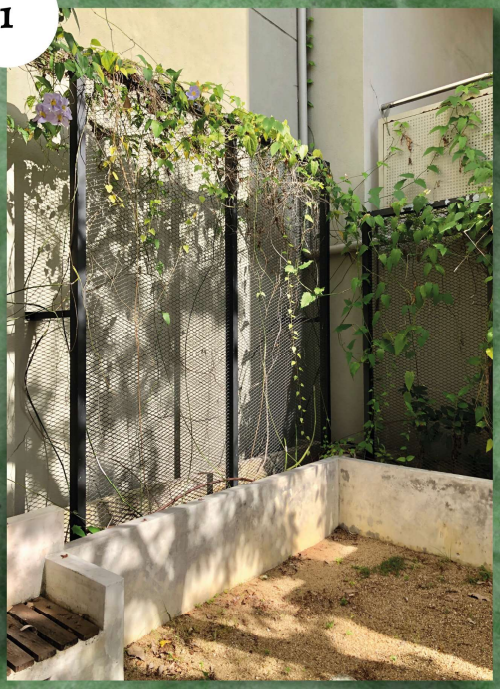

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