MONASH University

MONASH
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FOCUS

TEACHING AND RESEARCH NEWS FROM THE
DEPARTMENT OF CHEMICAL ENGINEERING

Chemical Engineering Focus Newsletter

focus

TEACHING AND RESEARCH NEWS FROM THE DEPARTMENT OF CHEMICAL ENGINEERING

HIGHLIGHTS IN THIS ISSUE

WELCOME FROM THE HEAD OF DEPARTMENT

How can we best represent our wonderful Chemical Engineering program at Monash? Is a picture worth 10,000 words? We are looking for your vision of how to represent the program on websites, department brochures, and the next issue of Focus! How do YOU see Chemical Engineering? We look forward to your submissions.

We are in the middle of a very exciting part of the academic year – fourth year design! This year the students are designing liquid natural gas (LNG) regasification plants with explicit consideration of how to best utilize the resulting cold energy. Andrew Hoadley is providing expert direction to the course and he and John Westover are taking the lead in providing technical consultation as requested by the groups. The whole department then pitches in to provide additional group mentorship and assist in the oral and written project assessments. Chemical engineering design @ Monash is a fantastic team effort by the students and staff. One of last year's teams was awarded the Victorian Pratt Prize earlier this year and the National prize will be awarded at Chemeca 2018 for their efforts. Andrew's passion for environmentally responsible and sustainable engineering as applied to real-world plants really shines through in this year's project. It has been wonderful watching the groups grapple with the technical and economic challenges associated with a major sustainable engineering challenge.

This issue of Focus also features many other major initiatives from the department in the sustainable engineering field. Exciting new work on recycling of plastic, rubber, and electronic waste is featured from Prof. Bhattacharya's research. A new, sustainable, non-fossil fuel approach to synthesis gas (CO and H_2) is reported from Dr Tanksale's collaboration with the IITB-Monash academy. The use of proteins to enhance energy efficient separations in Dr He's lab is highlighted. Finally, in a wonderful collaboration between CSIRO, the University of Texas at Austin, and Monash Chemical Engineering, a metal organic framework containing membrane was developed that shows great promise for efficient ion separation and therefore water desalination. And all of this dynamic and exciting work is just a part of the exciting research story in the department. Shu Gong was awarded the 2017 Mollie Homan Doctoral metal for the best thesis completed in the Faculty of Engineering. His work on soft skin-like wearable sensors promises to substantially change health care monitoring. Read on in this issue of Focus for even more exciting news.

Finally, it is the end of an era with the retirement of Department Manager Jill Crisfield. Jill was a tireless champion for the department who carefully looked after us so we could focus on the teaching and learning of engineering and the creation of the innovative research described in the issue. We have all benefited immensely from over decade of her hard work. Since the last issue of Focus, we also added four new staff. Tracy Groves as Departmental Manager, Gus Austin as Contract Technical Officer, Laura McManus as PA to head of department, and Anthony De Girolamo as Research Technical Officer. They are great new additions to strong team of professional staff that makes the department a wonderful environment to work on making this world a better place.

Professor Banaszak Holl

FINDING SOLUTIONS TO AUSTRALIA'S WASTE

The challenge of waste management is nothing new, however recent events, including ABC's *War on Waste* series, the embargo from China on waste imports, and the ban on single use plastic bags, has brought the topic into sharper focus around the country.

There is never a 'quick fix' to these complex problems; the solution will depend upon multiple factors including behavioural change, government policy and innovative technologies. It is the latter of these upon which Professor Sankar Bhattacharya is focussing his attention.

Professor Bhattacharya and his group within the Department is exploring the processing of waste tyres, waste plastics, electronic wastes and waste optical fibres for energy (oil and energetic gas) and metal recovery, and with some promising results. Their work also involves industry-funded projects on wood waste and municipal solid waste.

Plastic waste

Now that China has stopped importing Australia's recycled waste, Australia needs to find its own solutions to the waste challenge. Professor Bhattacharya believes Monash can take a leading role in solving the problem.

Professor Bhattacharya has built a prototype processing plant on campus that turns plastic and waste tyres into diesel fuel.

"The majority of the plastics we use in our daily life – different grades of polyethylene, polypropylene, polystyrene and even polyvinyl chloride to some extent - can be processed into liquid fuel," he says.

That's what China was doing with the plastic recyclables it bought from us, he explains. "They are now realising that their domestic production of waste products is so large that they cannot process any more by bringing in waste plastics from other countries."

The Chinese embargo means that the waste we used to send to China will now end up in landfill. Once in landfall, plastic, for example grocery bags, could take anywhere from 500-1000 years to degrade. Australians produce over 43 million tonnes of solid waste a year. In 2015-16, Victoria collected nearly 600,000 tonnes of recyclables of which nine per cent was plastic containers.

Turning plastic back into fuel may not seem environmentally friendly, however as the 'raw material' of plastic bags is the remains in the bottom-most fraction after producing jet fuel and transportation fuel, the conversion of bags back to fuel closes this cycle.

There are drawbacks with the process. The high-temperature catalytic process operates at temperatures around 400 degrees Celsius, and this requires energy input. Sorting and cleaning the waste gobbles water. The gaseous emissions produced as a by-product include carbon dioxide.

But this isn't as awful as it sounds, says Professor Bhattacharya. "Some of the really combustible gases that will be produced during the processing of the waste plastics are effectively recycled back to sustain the process."

Professor Bhattacharya, who came to Monash after a long career commissioning coal-fired power plants and gasification plants, is determined to translate this technology into one or more full-scale processing plants that can start taking recyclables ASAP. And to do this, he is starting close to home.

He has entered into discussions with three councils that border the university to scale up his laboratory processing facility into a plant that can handle real-world waste streams. His team has collected statistics on the volume of waste generated by the councils. "It's definitely possible to build three 10-tonne per day or one 30-tonne per day plant in the land which is owned by any one of the three councils," he says.

He and his team have built a business case to obtain venture capital funding. "We did a preliminary techno-economic analysis, including the capital costs of such a plant, all the control systems that will be necessary to run it, the manpower for three shifts on a day in day out basis, the purchase of the feedstock supply," he says. "Within 2-5 years, depending on the initial price of the plant that will be built, it will have a net positive value

Tyre waste

In addition to recycling plastics, the developed technology can also be tweaked to process waste tyres into fuel. Tyres are a huge waste issue in Australia. In 2015-2016, 56.3 million equivalent passenger unit (EPU) of end-of-life-tyres ended up in waste stream compared to 51 and 48 million

EPUs in years 2013-2014 and 2009-2010. Tyre recycling also increased up to 10 % in 2015-2016 as compared to 5% in 2013-2014.

However, the latest data suggest that 60-65 % of all tyre waste generated went to landfills. About 15 million EPUs are exported for reuse and energy recovery, typically in cement kilns. However, there is no tyre energy recovery unit reported in Australia.

Professor Bhattacharya believes we have the opportunity here to showcase our capacity and expertise in the processing of waste tyres as well as waste plastics and believes it can be easily scaled up.

“If everything falls into place, we start the work and within one year we have a plant built here, subject of course to EPA approval, land availability and all those kinds of things – but really, it can be done that quickly.”

Electrical and electronic waste

Due to the rapid pace of innovation in technology, electronic devices are replaced at an accelerating rate. This frequent replacement and low re-usage rate results in an increased quantity of electronic waste generation resulting in a serious environmental concern, not just in waste but also pressure on our natural resources.

In 2014, the world generated approximately 41.8 million tonnes of e-waste, with the amount of e-waste expected to reach nearly 50 million tonnes in 2018 (Cui, H., & Anderson, C., 2016). Waste electronic and electrical equipment contains metals embedded in to plastics and toxic adhesives. These precious metals are valuable resources which otherwise end up in landfill and contaminate water and soil through leaching over time. Hence, it is essential to establish an environmentally friendly and economically feasible way to efficiently recover these metals.

The printed circuit board (PCB) is the essential part of the electronics due to its considerably large metal content such as copper (10-30%) as well as other metals like Ni, Zn, Fe, Pb, Ag, Au, and Al. PCBs are now recognized as the secondary resource for the recovery of base metals like Cu and precious metals like Au and Ag. However, the recycling of PCBs is limited due to the heterogeneous nature of the material. Therefore, adequate management of waste PCBs is important for resource recovery as well as preventing their leaching in to the soil and water bodies.

At present, several techniques of recycling waste PCBs have been proposed including physical and mechanical separation technology, hydrometallurgical processing, pyrometallurgical method, electrodeposition, and microwave treatment. Among these recycling techniques, the combination of mechanical crushing and hydrometallurgical processing is still the most competitive and commonly used technology for waste PCBs recycling.

In a project led by Professor Bhattacharya, printed circuit boards from e-waste were processed for energy and metal recovery. The material is first shredded down to <3mm and further sieved to <1mm size fraction. The shredded PCB waste was characterised for its composition using thermogravimetric analysis (TGA) and inductively coupled plasma optical emission spectrometry .

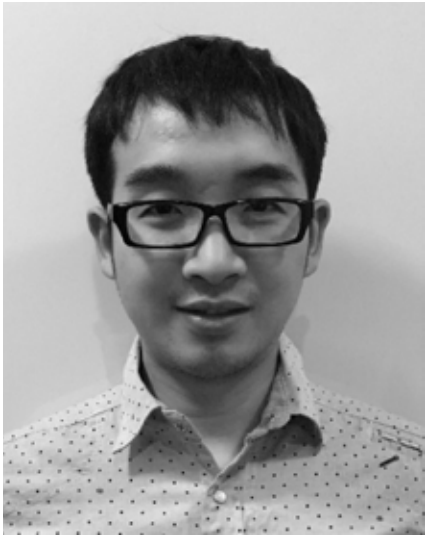
TGA analysis showed that the when PCB is pyrolysed the plastic components will be treated in the temperature range of 270-350 ^{o}C. The amount of plastics present in PCB is not more than 25%. The materials exhibit very high reactivity towards pyrolysis which provides an option for disintegrating the metals from the framework and extract the energy content.

Based on the results of TGA, PCB mixture was pyrolysed in a fixed bed reactor for the extraction of oils from it. Following this, the high value metals from the oil-free metal mix could be separated in mild acids with excellent results and with low emission footprint. The current work is focussing on separating the individual metals and the scaling up the overall work with industry support.

Source: Article based on a story originally published in Monash Lens

WATCH - Turning Plastic into Petrol: The Future of Recycling in Australia

SHU GONG RECEIVES MOLLIE HOLMAN DOCTORAL MEDAL FOR BEST THESIS



Dr Shu Gong has won the 2017 Mollie Holman Doctoral Medal for the best thesis completed in the Faculty of Engineering. This is a remarkable achievement and reflects both the quality of the thesis and the research. This medal is amongst the highest academic honours bestowed by Monash University and is named in honour of Professor Mollie Holman and was offered for the first time in 1998. Professor Holman has made a long and distinguished contribution to Monash and has been a vigorous champion of postgraduate education.

Dr Gong's research focused on developing soft skin-like wearable sensors (Wenlong Cheng, main supervisor). You can catch up on the research reading Dr Gong's recent review (Toward Soft Skin-Like Wearable and Implantable Energy Devices in Advanced Energy Materials 2017, 7, 1700648.)

Shu Gong received his B.S. from Central South University, China, in 2011, and his PhD from Monash University in 2017. At Monash University, his research interests include the development of soft electronics based on nanomaterials.

The development of ultra-compliant power sources is crucial for their seamless integration with next-generation skin-like wearable and implantable biomedical systems for long-term health monitoring. Toward this goal, stretchable energy storage and conversion devices (ESCDs), including supercapacitors, lithium-ion batteries (LIBs), solar cells, and generators are now attracting intensive worldwide research efforts. The purpose of the review is to discuss the latest achievements in the development of such stretchable energy devices in the context of biomedical applications. The first part of the review examines viable strategies and methodologies of fabricating stretchable energy storage and conversion devices. The authors then focus on descriptions of various types of soft energy devices from a materials point of view. Furthermore, they discuss the challenges and opportunities in the design of truly conformal soft energy systems, including various key parameters, such as energy density, stability, and scalability.

Current wearable and/or implantable electronic devices are 'energy-hungry', which calls for urgent solutions for seamlessly integrating energy devices with biological systems to power such kinds of devices, ideally for the lifetime of the living organisms. In contrast to dominant research efforts in worldwide, big energy sectors with the goal of improving energy density and/or power density, little attention has been paid to wearable or implantable energy research, until recently. In the context of wearable or implantable energy systems, the challenges are soft/hard materials interfaces between typically rigid active materials and soft biological skins/tissues, durability in biological environments, integrateability with other components such as sensors and wireless circuits, etc. Unlike conventional materials-focused energy research, wearable/implantable energy research often requires multidisciplinary collaborations among scientists, engineers, IT, and clinicians.

Dr Gong is now a Research Fellow in the Department of Chemical Engineering working in Professor Wenlong Cheng's research team.

WE WELCOME OUR NEW DEPARTMENT MANAGER TRACY GROVES

Tracy Groves is our Department Manager. She joins the Department from the University of Melbourne, were she was the Business Manager within Melbourne Institute: Applied Economics & Social Research.

Tracy has worked at a senior professional level at Latrobe University, RMIT University and Federation University in similar leadership positions and she has effortlessly straddled the daily management of both her team and the administrative needs of the large teaching departments and research institutes.

Tracy possesses excellent leadership skills and demonstrates a visionary sight for the benefits of the university. She is able to lead, direct and develop her team's capabilities. Tracy is also a strong supporter of the continuous improvement culture. Tracy is customer focused and has outstanding organisational skills.

When she is not at work she enjoys being outside and loves to run, cycle and spend time with her family. She has recently obtained her motorcycle licence so is enjoying the open road with her husband and is planning an overseas motorbike tour next year. Please contact her via email at tracy.groves@monash.edu.

FAREWELL FROM OUR MANAGER JILL CRISFIELD

Having reached the ripe old age of 65 in early June, I am taking retirement from 29 June. Having been in the department for 13.5 years, I have seen many changes, including five heads of department, together with major changes with the introduction of the finance hubs. Over this time, our staff and HDR numbers have grown significantly which has had an impact on space for offices, labs and desk. We somehow managed to keep up with the demand and there are very few areas that haven't been renovated or upgraded (and some twice).

Having entered the workforce a few months short of 50 years ago, two major changes have occurred. The first is in technology – from manual typewriters to the internet. I remember being very excited when a photocopier was first introduced at my workplace – it took about 2 minutes to get one very wet, grey and fuzzy reproduction, but we thought it was magic!! Corrections on typed documents had to be done with a rubber pencil, tippex papers or whiteout fluid, with bits of paper between each layer of carbon paper to stop smudging. And if one word was changed in a document, the whole thing had to be retyped. For bulk publications, we used a roneo machine. This involved a waxed paper being inserted into the typewriter (hopefully electric, not manual) and away you went. Any errors had to be corrected with a waxy fluid to patch up the hole. Then you put the sheet onto a big roller in the roneo machine, and cranked the handle. Out came as many copies as you wanted – all in purple ink! In about 1992 I was working in the Faculty of Economics and went to an information session about something called 'email' – I came out thinking this would never catch on! So it was probably a good thing I stuck to accounting and finance, and not IT.

The second major change is to do with the education and career opportunities for females. In my era (in Perth) the majority of girls left school after completing their Junior Certificate – this was generally in the year you turned 15. If you passed, you went into office work and if you failed you either went into hairdressing or worked as a shop assistant. Very few girls went onto higher education and the career options then were teaching or nursing. Over this period, I also saw the introduction of equal pay for equal work (in the 1970's). As strange as it may seem to you young people, in my day there were pay rates for males and separate pay rates for females, even though they were doing the same work, eg teaching, bank clerks, bar staff etc.

After working for 15 years across the banking, mining, accounting and manufacturing sectors, I took time off to have our three children and took the opportunity to complete my secondary education to Year 12 level, and then went on to do a full-time university degree here at Monash. At that time, the Bachelor of Commerce hadn't been introduced, so I had to do a Bachelor of Economics, with a major in accounting and finance. I was offered some casual work in the faculty and then took over from my honours co-ordinator when she went on maternity leave. From there I went to the Mathematics Department for one year as the Resources Manager, and then to the Faculty of Science as the Faculty Finance Manager for five 5 years, then off to La Trobe University as the Faculty Finance Manager in Health Sciences for 5 years, before coming back to Monash and the department of Chemical Engineering in December 2004.

What won't I miss? The 22 speed humps I have to go over to reach the carpark from the entrance, the alarm going off at 6.15am each work day, the 'wait' music when I phone HR or eSolutions, the solid line of traffic heading up Wellington Road which means a 45 minute trip home to do 10 Ks.

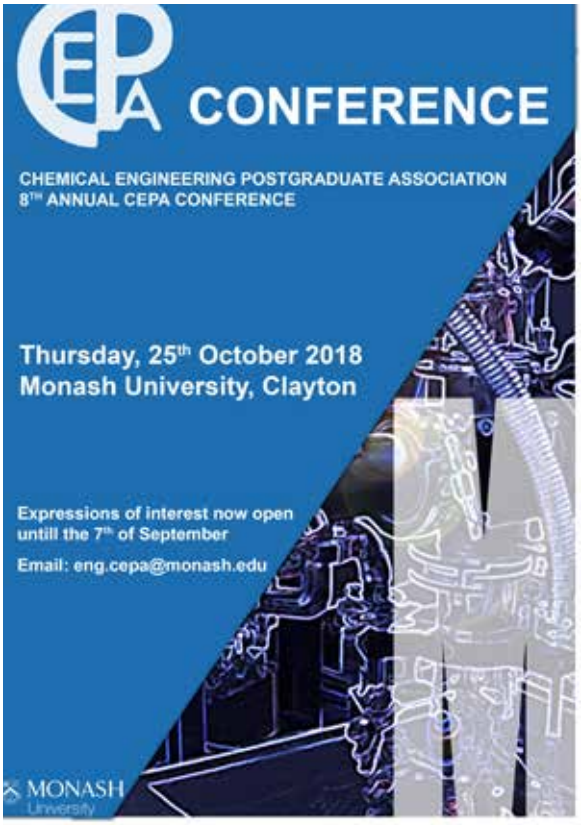
What will I miss? I will miss the challenges that come along on a regular basis, the companionship of my colleagues (staff and students), the stimulation of keeping everything hanging together, the international lunches, Christmas parties, and the fortnightly salary going into my bank account.
I plan to keep playing table tennis on Tuesdays and Thursdays at lunchtimes over in the Sports and Rec building with Andrew Hoadley, Yoshi Yazaki and our student Daniel. If you ever feel the need for a good laugh, come and watch us.
My replacement, Tracy Groves, will no doubt do a great job in taking over my position and I hope that she has as much enjoyment, fun and satisfaction in this role as I have had.
I wish all our staff and students the best that life can offer. Take advantage of every opportunity that comes your way and relish every moment. One day you will be like me, and think (#@!*#@) – am I really THAT old??

CATALYTIC CONVERSION OF MICROALGAE INTO SYNGAS USING MILLISECOND STEAM GASIFICATION

The food vs fuel debate has restricted the conversion of the first- and second-generation energy feedstocks into fuel. This is why microalgae have gained the significant attention in the recent literature as a potential renewable energy feedstock. However, efforts towards harnessing the stored energy were mostly focused on microalgal lipid conversion. This resulted in the poor overall carbon conversion efficiency. Various thermochemical methods have emerged to convert the whole cell; however, no direct solution was reported. Gasification is limited by tar accumulation and needs high temperatures (1000°C – 1200°C) to generate tar free syngas. Whereas, hydrothermal liquefaction is limited by harsh operating conditions (pressure 280 bar and >374°C).

In this research Pratik Gholkar (IITB-Monash PhD) and academic supervisor Dr Akshat Tanksale have reported a new single step and tar free catalytic process to convert microalgae into hydrogen- or methane-rich syngas using steam gasification. The composition of the gas phase can be tuned to increase, the selectivity towards either hydrogen or methane, depending on the catalyst and the reaction temperature.

Hydrogen rich syngas (65 per cent (v/v)) was obtained by using Rh-Ni/alumina catalyst at 650°C. Whereas, methane rich syngas (16 per cent (v/v)) was observed in the presence of Pd-Ni-Cu/alumina catalyst at 600°C. The carbon selectivity in the gas phase was reported to be more than 90 per cent for both the processes. To the best of our knowledge this is the highest reported literature methane and hydrogen composition with high carbon selectivity for a single step tar free gasification conversion process. Two provisional patents on this process have been filed in India through the IITB-Monash Research Academy.



CEPA CONFERENCE 2018

The CEPA conference is the largest postgraduate event of the year and is highly endorsed by the department. All postgraduates are invited and strongly encouraged to present an oral or poster presentation on their research to date.

Whether you want to rehearse a presentation for an upcoming conference, improve your communication skills or just want to learn more about the specific projects happening in the department, this event is not to be missed!

Expression of interest forms to register for this event **(CLICK HERE OR - https://docs.google.com/forms/d/1XinN99yln5o-lr7libFXLm3klSu5gNGjq_lQKrurzZc/formrestricted)**

STUDYING CUSTOM MADE PROTEINS IN PARTNERSHIP WITH ANSTO

Ms Gina Pacheco Arredondo's interest in proteins and their ability to separate molecules in an energy efficient process has brought her to Monash and the ARC Hub for Energy Efficient Separation to undertake her PhD.

Gina is supervised by Dr He and is supported by scholarships from Monash University and Mexico.

Gina's research, in partnership with ANSTO, involves the use of engineered proteins to separate molecules of interest for ANSTO.

"The main objective is to use these engineered proteins to make separation processes energy efficient and in only a few steps (1 or 2) - we want to make separation an environmental friendly process", Gina explains.

"I find proteins quite interesting and malleable. They are widely used and therefore studied; this helps us understand how to manipulate them to enhance their functions and even to create new ones", she says.

"The application of "custom made" proteins to separate molecules as an energy efficient process is what interested me most of this topic. In the long term, this project will make an impact in many Australian lives", she says.

Gina holds a bachelor's degree in Food Chemistry and a Master's degree in Biochemical Sciences in biotechnology from the Faculty of Chemistry, Universidad Nacional Autonoma de Mexico (UNAM).

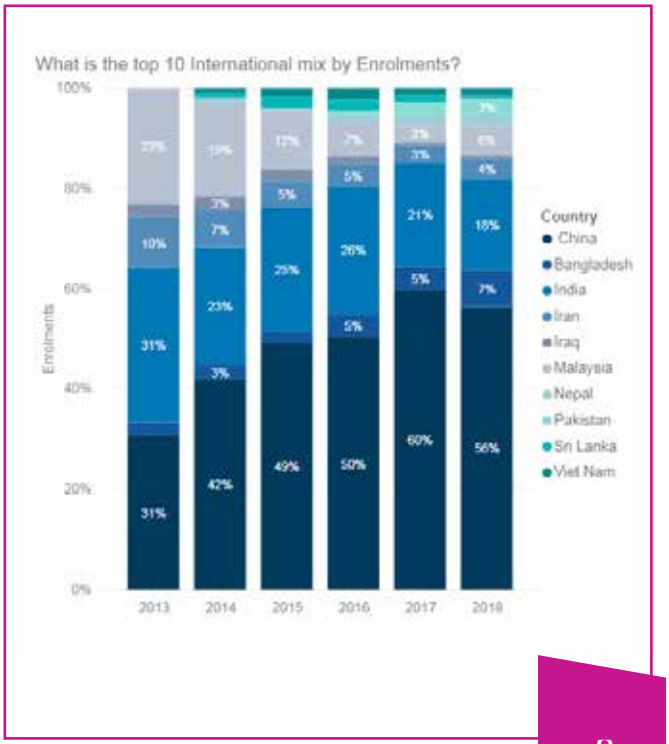
Her broader research interests include design, bacterial expression and purification of engineered proteins for bio-separation, waste treatment and development of new protein-based purification techniques for pharmaceutical purposes.

Asked why she came to Monash University from Mexico to continue her postgraduate studies, Gina cites the great partnerships, both domestic and international, the freedom to propose and develop new research ideas, the cultural diversity, and a wonderful supervisor.

AUSTRALIA LIKELY TO SURPASS UK TO BECOME SECOND LARGEST HOST FOR INTERNATIONAL STUDENTS

According to a study by UK's Centre for Global Higher Education, between 2011 and 2015, international students going to the UK increased by 2.6%, while Australia increased by 12%. In summary, the report concludes that Australia has now gone well past the UK in its numbers of international students from outside Europe, and this will be confirmed when the UNESCO data for 2016, 2017 and then 2018 become available. In terms of total international student numbers in tertiary education, Australia may have surpassed the UK in 2018, and if not will almost certainly do so in 2019 (Centre for Global Higher Education, 19 July 2018, (**click here for full report - http://www.researchcghe.org/perch/resources/publications/the-uk-in-the-global-student-market.pdf**).

Chemical Engineering at Monash has long attracted international students to its academic programs and support structures (scholarships, mentoring, student clubs etc). In 2018, 56% of our international students came from China, with India making up the second largest group of International students.



MONASH University

AUSTRALIA-CHINA JOINT RESEARCH CENTRE IN FUTURE DAIRY MANUFACTURING

CHEESE SYMPOSIUM

THE 2ND SYMPOSIUM IN FUTURE DAIRY MANUFACTURING

17 – 19 OCTOBER 2018 | BEIJING, CHINA

A symposium of lead thinking by INRA France, COFCO NHRI, Monash University, Soochow University and the University of Queensland.

With dairy industry guests from Arla, Mengniu, Fonterra, Sodiaal and many more. With government guests from the Australian Embassy, Austrade, Victorian Trade Commissioner, and Chinese government counterparts.

EVENT BRIEF

The 2nd Joint Symposium, with the focus on the latest research and development in cheese, will be hosted by our industry partner, China National Cereals, Oils and Foodstuffs Corporation (COFCO). The co-organisers include Soochow University in China, Mengniu Dairy, INRA – Europe's top agricultural research institute in France, and Monash University in Australia.

The two-day event will be based at COFCO NHRI (Nutrition and Health Research Institute), the research centre of COFCO. The event includes a technical symposium, showcasing advanced capabilities and innovative dairy technologies for industry to utilise and co-develop into high-value, high-tech applications. The technical talks will be delivered by cheese experts from INRA and other countries. The symposium also includes a "Cheese Exhibition" and a "Wine Tasting" session as well as an exclusive tour of COFCO NHRI. Following the symposium, the attendees are invited to visit Mengniu Dairy, one of the top dairy companies in China and in the top ten globally, at their largest manufacturing site and R&D centre in Hohhot or to the yoghurt manufacturing site in Beijing.

FEATURED TOPICS AND SPEAKERS

- Building cheese texture and taste separately with design-on-demand
- Development of an anti-inflammatory cheese
- Consumer preference, market and R&D trends for cheese products in China
- Opportunities and challenges of the Chinese cheese industry
- Traditional Chinese fermented food and innovation trends for cheese products in China
- Designing cheese product to target the Chinese consumer
- Influence of starter cultures in the digestion of cheese

SYMPOSIUM AGENDA

17 OCT, WEDNESDAY 2018

COFCO NHRI tour

Registration

Welcome Reception

18 OCT, THURSDAY 2018

Technical symposium with exhibition booth and posters

Government panel discussion and industry panel discussion

Cheese Exhibition and Wine Tasting

Conference Dinner

19 OCT, FRIDAY 2018

Site visit to Mengniu Dairy (optional)

Option 1: Beijing Tongzhou Yoghurt Site

Option 2: Hohhot Mengniu R&D Centre and Mengniu's largest manufacturing site

REGISTRATION

Please register via this link by 19 October 2018.

FOR ANY ENQUIRIES, PLEASE CONTACT

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BEGA, NUTRITION INNOVATION TURN TO MONASH TO HELP CREATE NEW POWDERED PRODUCTS

Professor Cordelia Selomulya, photo by Elke Meitzel

Major dairy industry players such as Bega and Saputo have joined forces with Monash University to utilise new drying technologies to extend the life and improve the quality of powdered dairy products.

The Melbourne-based university has created a "smart drying program", in which major manufacturers can work with Monash to test how a product would dry and how long it would last under various conditions at a small scale prior to investing in and rolling out the new product or process at a commercial level.

"We have been developing dairy products for over 100 years, advancements in technology and investing in new ideas ensures that our products and processes are always improving," Bega group research and innovation manager Karren Bathurst said.

"We have a state-of-the-art facility but are always looking at new and emerging technologies that will improve our processes. Our investment in research and development allows us to support universities to build capability within Australia, and we are currently supporting Monash with a study on milk drying. "

In the five years to July 2016, dairy exports from Australia to China increased by 46 per cent, according to Dairy Australia. In the past year demand from China has slowed, suggesting that the market is maturing and causing analysts to suggest manufacturers target other south-east Asian markets.

Spray drying has been commonly used by the sector for decades to make popular products such as powdered infant formula, but Monash's use of a small-scale drying machine, X-ray diffraction and infra-red technology allows it to not only significantly cut the cost of trialling the spray drying of new products, but also to monitor fundamental changes in the properties of the powdered products during storage, caused by things such as heat or moisture.

Monash has also developed modelling algorithms to let it test how the materials in a powder will react in different conditions.

Professor Cordelia Selomulya, who has led the project at Monash, said a more targeted approach to spray drying helped manufacturers produce higher-quality powders, as well as leading to energy savings.

"We're the only university in Australia doing this, but we have international partners in China, the US and France. Research is always collaborative," she said.

"When working with a completely new formulation which has never existed in a powder form, we can use our single-dropper dryer to see if you can dry the material, what happens when it's dry and what conditions need to be applied."

The industry partnerships have also extended outside of the dairy industry, with other companies and organisations such as Treasury Wine Estates, Simplot, the CSIRO and Meat and Livestock Australia also working with Monash.

Treasury Wine Estates is experimenting with a grape-derived antioxidant, while Singaporean-based business Nutrition Innovation has supported a graduate research industry partnership position at Monash in exchange for access to the university's resources to help develop a powdered protein, which is sweet (thanks to sugar cane juice), and can be added to foods and drinks.

Nutrition Innovation chief executive Matthew Godfrey said protein was usually bitter in taste, so food manufacturers were forced to also add sugar to their products, but its powdered protein had less sugar and was rich in antioxidants.

"There hasn't been a product like this before and it's on the cutting edge of food innovation," he said.

Source: Financial Review, 23 June 2018, Yoland Redrup

Professor Cordelia Selomulya is the incoming president of the Nutraceutical & Functional Foods Division of The Institute Of Food Technologists.

The division said in their statement that Cordelia will bring an excellent perspective and vast experience to the division.

‘NEVER UNDERESTIMATE YOUR VALUE AND YOUR WORTH’

I didn’t grow up saying I would like to be a chemical engineer. I didn’t even know that profession existed. I wanted to be an environmental engineer, but that wasn’t available for international students at UNSW when I applied. In the third year, I did a summer research project with a young female senior lecturer. We published a paper, and she took me to a great conference in New Zealand. I thought, “It’s not so bad doing research, if you get to do fun things like this.”

In 1998, the year I started my PhD, there was a riot in Jakarta, my hometown. My parents were here for my graduation. On the one hand, we were happy because I was graduating, and at the top of my class, but on the other hand they were trying to get my older sister out of the country. For them education was a big priority but also a big sacrifice, because it was not cheap to send children overseas to university.

Hardly anyone will have a smooth sailing PhD. Either you have enough results, or you feel that this is so depressing you just want to quit. For me, in combination with all the things that were happening back home, the second year was tough. I was doing a very fundamental study of particle aggregation, and the engineer who was building a very specialized rig for me suddenly just disappeared. He took off to Antarctica on a research project without telling us, without finishing the rig. We had to change the project very quickly, and I had to build another rig.

I tell my PhD students that you have to be flexible, because things will not happen as you planned. You have to be able to navigate that. You have to be a bit open-minded about it and not too stressed.

As females we are often afraid to ask because we don’t feel that we are good enough. Most men don’t have that problem. I’ve sat through many recruitment and promotion processes, and seen male candidates who are successful -- before they even come they’re asking for all sorts of stuff. I didn’t ask for anything when I first came here. I was just so grateful to get the job! I wish I had been a better negotiator. Never underestimate your value and your worth.

Professor Cordelia Selomuyla

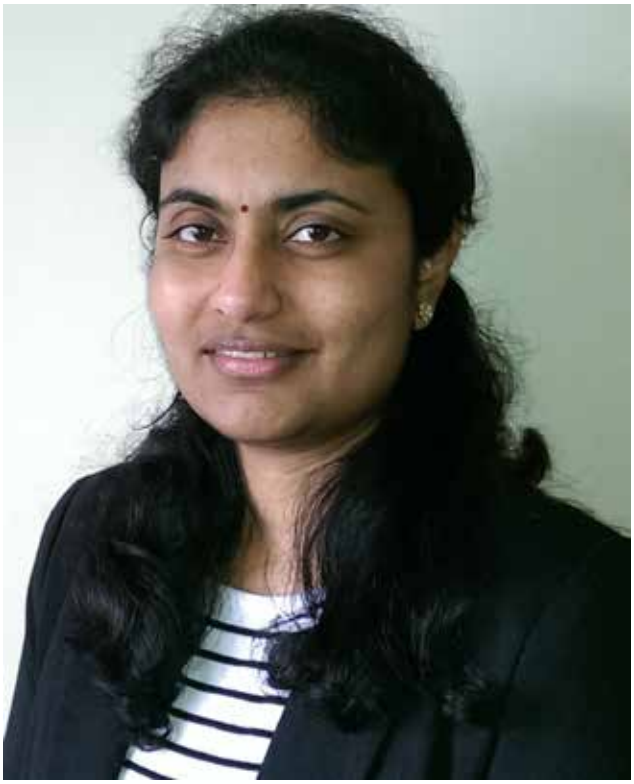
WATCH VIDEO: Why we need women in STEM I Dean of Engineering

CHEMICAL ENGINEERING IMPROVES IN QS 2018 SUBJECT RANKINGS

Monash Engineering is delighted with the results of the QS World University Ranking By Subject 2018 which saw Chemical Engineering improve significantly.

Chemical Engineering rose by four places to equal 24th in the world.

“We are delighted by the recognition of the students’ and staff’s hard work and excellence in both fundamental and translational chemical engineering by the most recent QS rankings,” said Head of Chemical Engineering Professor Mark Banaszak Holl. “It’s very exciting for the department to be counted amongst the world’s top 25 universities for the subject.”



BHUVANA SHANBHAG SHORTLISTED FOR THE RISING STARS WOMEN IN ENGINEERING WORKSHOP

Department Postdoctoral Fellow Dr Bhuvana Shanbhag has been shortlisted for the Asian Deans’ Forum 2018 – The Rising Stars Women in Engineering Workshop on 4-7 October 2018. The committee will provide her funding for airfare and provide accommodation to attend the workshop.

The rising stars workshop is a platform to advance the career of women in engineering, research and academia and to develop leadership skills. The three-day program is filled with mentoring sessions and presentations.

“ I'm really excited about this opportunity. As an early career researcher, I have so much to learn in terms of advancing my research interests and how to shape my academic career. This workshop will give me that platform to help me shape my skills for life in academia”, Dr Shanbhag said.

Dr Shanbhag will have the opportunity to meet the Deans of several engineering institutions who will share their journey in academia.

Furthermore, all participants of the workshop will deliver a 90 second elevator pitch of their research and present a poster.

“I expect this workshop to be filled with plethora of information, advice and mentorship from seniors in the field. Years of experience would be packed into this exciting workshop”, she said.

Dr Shanbhag currently works in Dr Lizhong He’s team. Her research is part of an industry partnership project to develop low-cost process for separation of bioactive molecules, in the ARC-Hub for Energy Efficient Separation.

She competed her PhD in chemical engineering at Monash in 2017 under Dr Lizhong He and Associate Professor Victoria Haritos, involving the self-assembly of enzymes as advanced biocatalysts.

More information about the workshop can be found **HERE (https://risingstarsasia2018.ust.hk/index.php)**

POSTGRADUATE OPPORTUNITIES

PhD

Monash Engineering operates at the forefront of engineering research. All specialised fields of research are at world standard or above and the most recent Excellence in Research for Australia assessment has rated our research results well above world standard. With access to world-class laboratories, workshops and facilities and with highly specialised equipment and software, a PhD in Engineering offers you a stimulating, supportive and professional environment in which to explore engineering challenges and develop solutions for the future.

A PhD in Engineering takes the form of the Monash Doctoral Program – a PhD for the 21st century. The program consists of extensive, independent research of a topic formulated in consultation with academic staff. A minimum of two academic supervisors will support you throughout your study. As part of the program you will also complete a series of professional development activities or coursework units that provide you with the skills required to make an impact in academia, industry, government or the wider community. Your study will result in a research thesis or alternative approved output, which makes a valuable contribution to the current body of knowledge on your chosen topic.

Our research explores a wide range of chemical engineering disciplines, including chemical reactor engineering, coal conversion processes and particle technology. And our researchers are leading the way. Not only are we the number one chemical engineering faculty in Australia – we're among the very best in the world.

Our expertise

Our research here at the Department of Chemical Engineering at Monash is organised into six key areas.
http://www.monash.edu/engineering/departments/chemical/research/department-research-expertise

Why join Monash?
Monash University is ranked as the best university in Australia for engineering and technology by the Times Higher Education, 2016-2017.

What's more, Monash itself is in the top 1 per cent of world universities according to the Times Higher Education World University Rankings 2016-2017, and a member of the prestigious Group of Eight Universities here in Australia.

A full-time funded scholarship is available from outstanding candidates for PhD study in Chemical Engineering.

Chemical Engineering Higher Degree by Research enquiries.
Email us at: chemeng-hdr.enquiries@monash.edu

Masters

Master of Advanced Engineering Coursework (Chemical Engineering) enquiries
https://www.monash.edu/engineering/masters
Email us at: chemeng-pgcoursework.enquiries@monash.edu

SMUCE - SOCIETY OF MONASH UNIVERSITY CHEMICAL ENGINEERS

2018 is drawing to a close, and the committee of SMUCE will soon be changing. We can fondly look back on all the wonderful events we have held this semester.

In Semester 1, we ran some of our biggest Thursday Industry Seminars, with Carlton United Breweries more than filling the Lawson Room with over 60 students to learn about graduate and vacation opportunities. In Semester 1, we had the change from Trivia Night to the annual SMUCE Ball. It was a fantastic night, themed the Roaring 20's. We were also fortunate enough to have our Head of Department, Professor Banaszak Holl, give a formal address to open the night.

Semester 2 kicked off with a bang, having both Open Day and Trivia Night. Not to mention, we have a new official website, www.smuce.org, where we have all our upcoming events and opportunities we have been informed about.

Monash Open Day is one of the most important events, not only for us, but for the new cohort of chemical engineers who will be attending Monash University. On August 5th this year, we donned our orange engineering shirts and beanies and spoke to high school students about all the wonders and potentials that Chemical Engineering has to offer. This year we joined with Monash Engineering Student Society (MESS) to provide people on open day a delicious breakfast or lunch of BBQ sausages, bacon and eggs.

We can't wait for more exciting events throughout the year and the upcoming election of the 2019 Committee later in the semester.

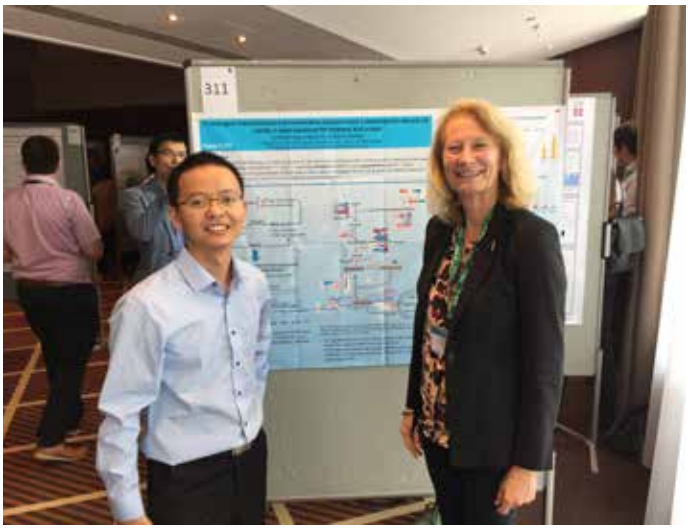
From left to right: Anthea Martin, Katelyn Evans, Dean Elizabeth Croft and Laksara Andra Hennadige.

SOCIETY OF MONASH UNIVERSITY CHEMICAL ENGINEERS

Linking students with industry
CONTACT smuce@monashclubs.org
to organise your opportunity to connect with the Chemical Engineering students at Monash University

Like us in Facebook www.facebook.com/SocietyOf-MonashUniversityChemicalEngineers/)

HUADONG PENG WINS THE TRAVEL GRANT AND POSTER RUNNER-UP AWARD



Congratulations to PhD student Huadong Peng who won both a Travel Grant and Poster Runner-up Award from the International Metabolic Engineering Society (IMES), at the Metabolic Engineering 12 conference held in Munich, Germany in June 2018.

The Metabolic Engineering Conference is organised by IMES every two years as a world-leading conference to share premium developments and achievements in the field. The theme of this year's conference was Systems Metabolic Engineering for Superior Bio-production. There were more than 500 attendees with around 400 posters, and only 13 poster winners in total.

Huadong Peng, a final year PhD student supervised by Associate Professor Victoria Haritos and Dr Lizhong He in the Department of Chemical Engineering at Monash University, presented his latest research on the production and storage of high-value cyclopropane fatty acid in metabolic engineered yeast by poster. Huadong was also selected to present this work as a 'rapid-fire' oral presentation during the conference.

The success for Huadong at ME12 builds on excellent progress during his PhD which has included 3 papers published as first author; 3 in advanced draft ready for submission as first or second author and a further 2 first author, in preparation) and he has presented his research orally at 3 conferences (plus a 'rapid fire' poster presentation) and by poster at another 4 occasions. He has won many travel and poster awards. Huadong is due to submit his thesis at the end of August 2018 and we wish him all the best.

CHINA–MONASH LINKS STRENGTHENED WITH NEW RESEARCH COLLABORATIONS

A delegation from Jiangsu Province in China visited Monash last week to establish research collaborations between the University and Jiangsu Industrial Technology Research Institute (JITRI).

The delegation, led by Professor Liu Qing, President of JITRI, included 20 research and development (R&D) leaders from JITRI specialised research institutes in Jiangsu. Monash President and Vice-Chancellor Professor Margaret Gardner AO, Provost and Senior Vice-President Professor Marc Parlange, Pro Vice-Chancellor and President (Suzhou) Professor Aibing Yu and other Monash leaders met the delegation last Wednesday.

The two parties discussed Monash–JITRI collaboration on the eve of the inaugural Monash-JITRI joint symposium on 16-17 August to explore opportunities and research areas of mutual interest for future collaboration.

Of the 34 presentations at the symposium, 23 were delivered by Monash senior representatives, including deans or associate deans, HoDs, directors of ARC research hubs/centres and project leaders.

The delegation also visited some of the University's leading research platforms, including the CAVE2 facility, Monash Centre for Electron Microscopy and the Woodside Innovation Centre.

JITRI was established in December 2013 in Jiangsu Province, a sister region with Victoria. Its aim is to close the gap between science and technology, and assist industries, small or large, in utilising the latest technology to enhance their competitiveness.

Monash and JITRI signed an initial CNY20 million (A$4 million) agreement in 2015 that resulted in the development and implementation of nine collaborative projects.

A second agreement with the same value was last year signed to support further projects. Monash-JITRI joint PhD training has now become part of the collaboration.

As previously, the JITRI funds are available to Monash researchers in collaboration with JITRI researchers, with detailed information provided at the website.

A SWEET GRIP

Mr Fernando Toledo Hernandez is half way through his PhD and the sweet task of improving the production of an Australian confectionery company.

Fernando chose Monash as part of his professional pathway as the university provides the perfect opportunity to interact with local industry through its GRIP (Graduate Research Industry Partnerships) program.

“Once I finished my masters at Monash, I discovered GRIP projects which really caught my attention due to the partnership with the industry. I see this project as a win-win-win relationship (yes, 3 wins); as a collaboration of three partners, Monash University, the industry and myself”, Fernando says

Fernando hopes to return to the food manufacturing sector, applying his experience , knowledge and skills learned during the PhD.

About GRIP

Graduate Research Industry Partnerships (GRIPs) respond to the rising demand for researchers with interdisciplinary capabilities and the readiness to apply their expertise to solving real-world problems in industry.

Graduate research students in a GRIP are honed to become thought leaders for industry through a unique industry-driven interdisciplinary training program, internship opportunities, mentoring and scholarships.

GRIPs bring together graduate researchers (PhD students) and academic leaders from various fields with external partners to explore an issue of global significance.

LEARN MORE ABOUT GRIP (https://www.monash.edu/graduate-research/partnerships/grip)

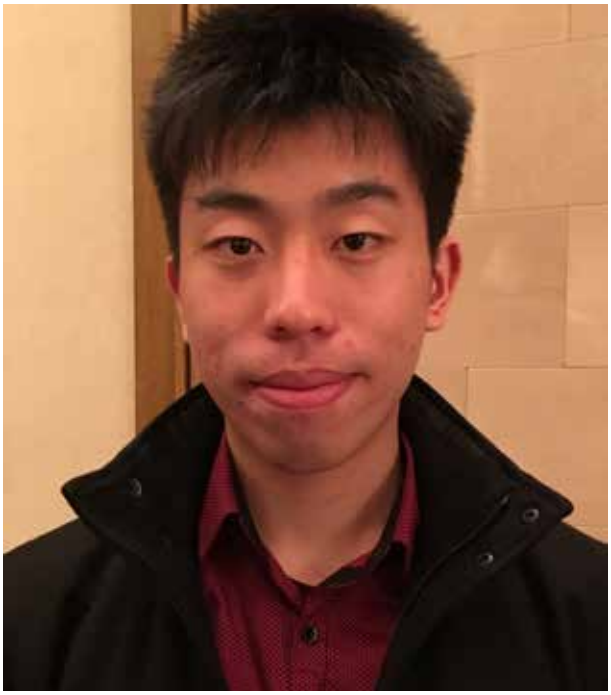
2017 DESIGN PROJECT WINS NATIONAL AWARD

The 2017 Design Project examined the production of Mono-ethylene Glycol, which is a very important chemical, especially for the production of polyester plastics such as PET.

In a first, last year both the Sunway and Clayton students worked on the same topic and with a very similar project brief. The Clayton class was formed into 16 groups with locations around Australia, New Zealand and Southeast Asia. Groups were allowed a free choice of any of the less-proven technologies, but were allocated to either the Dow or Shell technologies. Half of the class selected Dow and the other half selected the Shell Process. The students were particularly challenged by the need to use different thermodynamic property methods to model different sections of the process using Aspen Plus. A highlight was the opportunity to visit the Dow Chemicals Propylene Glycol Plant in Altona and to meet the plant chemical engineers and maintenance personnel.

The team have won the State of Victoria Pratt Prize and the National prize. The national prize will be presented at Chemeca2018 in New Zealand. The Department is sponsoring some of the students to fly to New Zealand to attend the conference and accept the award.

SUMMER RESEARCH PROGRAM



Before starting the fifth year of his Bachelor of Biomedical Science/Bachelor of Engineering, Monash University student Alex Lin undertook a Summer Research Program project as a way to explore the possibilities of bioprinting. Although he was majoring in Chemical Engineering, Alex saw the SRP as an exciting opportunity to study something new.

"Bioprinting has great potential in the field of regenerative medicine, in particular for organ transplantation," he said. "This was a large reason why my project was conducted on bioprinting, because of the many benefits it could lead to in the future."

The Summer Research Program of 2018 - 2019 will offer similar opportunities for eligible students completing their third year or higher of an Engineering or Science degree. With 63 projects to choose from, participants benefit from experiencing hands-on engineering research under full academic supervision, while connecting with industry partners for better career opportunities.

For example, a project converting waste tyres into fuels, supervised by Professor Sankar Bhattarcharya, will result in publishable work in peer-reviewed journals. An environmental engineering project monitoring water quality in the Yarra River will offer the opportunity to develop direct industry connections with Melbourne Water, the EPA and Yarra Ranges Council. A food manufacturing project will offer training in analytical testing and equipment use in Monash University's food laboratories and centre.

Students can also attend a series of sessions teaching research skills and gain an introduction to the engineering research community. Throughout the program, students also have the opportunity to present their research to their peers and academics, including oral presentations and a poster conference.

A twelve-week program running from November to February, the Summer Research Program is open to anyone enrolled as an undergraduate or graduate (coursework) student with an Australian university with a weighted average mark of 80 or higher. Students also receive a $400 per week scholarship throughout the duration of the program, and those travelling to Monash University from outside metropolitan Melbourne will be reimbursed for travel to Melbourne and additional living costs.

Reflecting on his experience in the Summer Research Program, Alex said: "It has been a very eye-opening and informative experience into the field of bioprinting and the possibilities that this has for the future." Alex enjoyed the process throughout and appreciated learning new skills that he could apply to his studies and future work.

Alex graduated in June 2018 and has accepted a graduate position at The Wood Group commencing in February 2019 as a Graduate Process Engineer. Alex credits the Summer Research Program with helping him to learn and hone skills important to job searching, including research, communication, report writing and laboratory skills.

Find out more about the Graduate Summer Research Program **HERE (https://www.monash.edu/engineering/current-students/graduate-research/summer-research-program-scholarships)**

Base on an original article published on https://www.monash.edu/engineering, 12 July 2018

TRAVEL AWARD FOR PHD STUDENT TO ATTEND DUBLIN CONFERENCE

PhD student Mahmud Kibria won a Travel Award from the Australia New Zealand section of the Combustion Institute to give an oral presentation at the 2018 International Symposium on Combustion held in August in Dublin. The selection of papers for oral presentations in this biennial international symposium is highly competitive with an acceptance rate under 40%. Mahmud's paper is entitled "Rational design of thermogravimetric experiments to determine intrinsic char gasification kinetics"; he is an ARC ITRH (BAMI) funded student supervised by Professor Sankar Bhattacharya

CHEMICAL ENGINEERING ANNOUNCES NEW RESEARCH THEMES

As defined by the American Institute of Chemical Engineers (AIChE), "chemical engineers take chemistry out of the laboratory and into the factory and the world around us". While this definition still applies, the applications change as the needs of society change.

In Australia, chemical engineering was firmly embedded in the early industries of the nation, namely agriculture (in particular sugar refinement and fertiliser) and the petrochemical industry.

But as Australia's industries evolve to meet the demands of contemporary society, including clean energy, water and food security, and health, the discipline also needs to evolve in order to provide creative solutions and technology.

We are therefore pleased to announce that the Department has added the following disciplines to its research focus: Biotechnology, food, modelling, nanomaterials, fuels and energy, membranes, and drugs.

CHEMICAL ENGINEERING IN PICTURES

WIN A $500.00 CASH PRIZE OR UP TO $1000.00 TOWARDS A PROFESSIONAL CONFERENCE RELATED TO YOUR DEGREE. YOU GET TO CHOOSE!

Help us represent the changing face of Chemical Engineering at Monash University

Modern society relies on the work of chemical, biochemical and process engineers - they help manage resources, protect the environment and control health and safety procedures, while developing the processes that make the products we desire or depend on. Chemical engineering is all about changing raw materials into useful products you use every day in a safe and cost effective way. For example petrol, plastics and synthetic fibres such as polyester and nylon, all come from oil. Chemical engineers understand how to alter the chemical, biochemical or physical state of a substance, to create everything from pharmaceuticals or perform research into new medical devices, develop innovations in food processing and packaging that help improve taste, appearance, and nutritional value while increasing safety, convenience, and shelf life. The opportunities for chemical engineers to participate in advancing the medical and health sciences fields are abundant. A career in chemical engineering can see you working from everything from face creams to fuels.

But how do we represent all of this information in a photo?

We need your help to graphically represent how Chemical Engineers develop and design chemical manufacturing processes. How Chemical Engineers apply the principles of chemistry, biology, physics, and math to solve problems that involve the production or use of chemicals, fuel, drugs, food, and many other products. How Chemical Engineers working in the medical field can work on pharmaceuticals or perform research into new medical devices and procedures. And that Chemical Engineers are involved Pharmaceutical research which involve creating synthetic analogues of natural products, such as insulin.

We are looking for images for use on the Chemical Engineering Web page and Brochures that best represent the department's present and future directions.

A single compelling image may prove to be a winner. We also think a good approach would be a composite image made from multiple photos. For those who don't find Photoshop easy this can be a challenge, so here you'll find a few suggestions for how to produce the composite image you need. The following are PDF documents describing how to create a composite in different applications:

- **Creating a Composite in Photoshop**
- **Creating a Composite in Picasa**
- **Creating a Composite in Google Photos**
- **Creating a Composite in Paint**

Competition is open to Monash University, Faculty of Engineering students (current enrolled and Alumni). The competition will end on the 30 October 2018

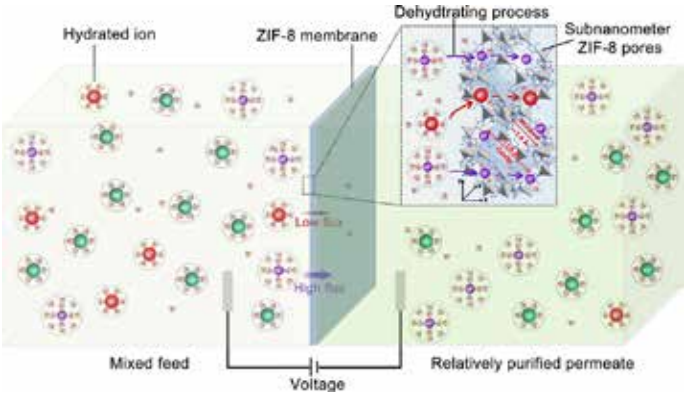
Send your Composite Photo to:

chemeng.hod.pa@monash.edu with the following information included. Composite photos must be your own creations and/or using Royalty Free Images

First Name:
Last Name:
Mobile:
Monash Student ID:
Email:

CHEMICAL ENGINEERING TEAM HELPS FIND AN EFFICIENT AND SUSTAINABLE WAY TO FILTER SALT AND METAL IONS FROM SEAWATER

With two billion people worldwide lacking access to clean and safe drinking water, joint research by Monash University, CSIRO and The University of Texas at Austin published today in Sciences Advances may offer a breakthrough new solution.



It all comes down to metal-organic frameworks (MOFs), an amazing next generation material that have the largest internal surface area of any known substance. The sponge like crystals can be used to capture, store and release chemical compounds. In this case, the salt and ions in sea water.

Dr Huacheng Zhang, Professor Huanting Wang and Associate Professor Zhe Liu and their team in Chemical Engineering, in collaboration with Dr Anita Hill of CSIRO and Professor Benny Freeman of the McKetta Department of Chemical Engineering at The University of Texas at Austin, have recently discovered that MOF membranes can mimic the filtering function, or 'ion selectivity', of organic cell membranes.

With further development, these membranes have significant potential to perform the dual functions of removing salts from seawater and separating metal ions in a highly efficient and cost effective manner, offering a revolutionary new technological approach for the water and mining industries.

Currently, reverse osmosis membranes are responsible for more than half of the world's desalination capacity, and the last stage of most water treatment processes, yet these membranes have room for improvement by a factor of 2 to 3 in energy consumption. They do not operate on the principles of dehydration of ions, or selective ion transport in biological channels, the subject of the 2003 Nobel Prize in Chemistry awarded to Roderick MacKinnon and Peter Agre, and therefore have significant limitations.

In the mining industry, membrane processes are being developed to reduce water pollution, as well as for recovering valuable metals. For example, lithium-ion batteries are now the most popular power source for mobile electronic devices, however at current rates of consumption, there is rising demand likely to require lithium production from non-traditional sources, such as recovery from salt water and waste process streams. If economically and technologically feasible, direct extraction and purification of lithium from such a complex liquid system would have profound economic impacts.

These innovations are now possible thanks to this new research. Professor Huanting Wang said, "We can use our findings to address the challenges of water desalination. Instead of relying on the current costly and energy intensive processes, this research opens up the potential for removing salt ions from water in a far more energy efficient and environmentally sustainable way."

"Also, this is just the start of the potential for this phenomenon. We'll continue researching how the lithium ion selectivity of these membranes can be further applied. Lithium ions are abundant in seawater, so this has implications for the mining industry who current use inefficient chemical treatments to extract lithium from rocks and brines. Global demand for lithium required for electronics and batteries is very high. These membranes offer the potential for a very effective way to extract lithium ions from seawater, a plentiful and easily accessible resource."

Building on the growing scientific understanding of MOFs, CSIRO's Dr Anita Hill said the research offers another potential real-world use for the next-generation material. "The prospect of using MOFs for sustainable water filtration is incredibly exciting from a public good perspective, while delivering a better way of extracting lithium ions to meet global demand could create new industries for Australia," Dr Hill said.

The University of Texas in Austin Professor Benny Freeman says, "Produced water from shale gas fields in Texas is rich in lithium. Advanced separation materials concepts, such as this, could potentially turn this waste stream into a resource recovery opportunity. I am very grateful to have had the opportunity to work with these distinguished colleagues from Monash and CSIRO via the Australian-American Fulbright Commission for the U.S. Fulbright Distinguished Chair in Science, Technology and Innovation sponsored by the Commonwealth Scientific and Industrial Research Organization (CSIRO)."

Congratulations to everyone on the team for this outstanding research offering such promising future benefits.

Original article published on https://www.monash.edu/engineering, 10 February 2018

JUNIOR ENGINEERS ENJOY THE YEAR 8 CHALLENGE

Monash Engineering welcomed 169 secondary school students to this year's Year 8 ChallENGe. Enjoying seven separate workshops across three days, the students had the chance to explore each engineering discipline through fun, interactive and challenging practical activities, while also gaining an early taste of life on a university campus.

Working together in groups, the students built bridge structures out of spaghetti; performed chemical experiments with soft drink, salt and balloons; generated wind power through household fans and simple turbines; constructed a working electrical gadget; commanded robots and quadcopters; created 3D game characters; and explored the materials that make the built world.

Four friends from Gippsland - Caterina, Eliza, Ella and Flynn - attended the Year 8 ChallENGe thanks to a scholarship program offered to regional Victorian students. After successfully applying, the girls had their registration and Clayton-based accommodation covered by the university's Engineering and IT faculties.

Caterina, 13, said she enjoyed working with robots in the mechanical and aerospace engineering workshop the best. "I've never been to a university before," she said. "I wanted to find out what it was like; it's very different to school." Eliza, 13, who likes to work with chemicals in school science, enjoyed the chemical engineering workshop most. "We had to do a test with iodine and extract it from water," she said. "It was fun!" Ella, 13, came simply to try something new. "I really enjoyed the civil engineering workshop," she said. "Our spaghetti bridge was the lightest one and only carried 450g of weight, but it looked really good!" Flynn, 13, came to "check out how engineering works" and to cast an eye on the university her big brother hopes to join next year. "They've made everything fun," she said. "It's been really enjoyable."

Flynn's mother Jodie was the catalyst that brought Flynn and her three friends to the ChallENGe. "She was reluctant to come by herself, but we thought it was such a good opportunity, we put the word out and got three friends to come along with her," explained Jodie. "They had a lot of fun, were happy to go every morning, and reflected each night on what they'd been learning. It was so valuable for them to share the experience and learn from each other."

Jodie feels that her daughter has improved confidence thanks to the ChallENGe. "Flynn went with the perception that she wasn't going to be as good as her 'brainiac' friends, and questioned, 'Will I be smart enough?'" she said. "She's come away from the ChallENGe realising that she's got as much opportunity, and is capable as anyone else. She's found a 'can do' attitude. When we got home, it was great to watch her demonstrating the electrical circuit she made to her dad and older brother, it was something she could teach them that they can't do themselves. The best outcome for me as a parent is seeing her feeling confident and capable."

Michael Pattie, technology teacher from Sale College, brought another female scholarship student along to attend the ChallENGe. "It's great to give a student an opportunity out of their comfort zone and normal experience," he said. "We don't have a lot of girls going into technology and science in my area of rural Victoria, so it was great to be able to have one of our female students come along."

Michael also found the experience highly valuable as a teacher working in the technology space. "I run a small Technology Club at school twice a week at lunchtime, where we do things 3D printing, laser cutting and electronics," he said. "We've modified the curriculum quite a lot in technology though. This experience, in the university, has confirmed to me as a teacher that we're on a valid pathway."

Monash University Associate Professor of Resources Engineering Mohan Yellishetty was delighted with the outcome. "As the academic lead, the Year 8 ChallENGe has been a fulfilling and exciting opportunity for me over the past two years we've run the event," he said. "It was such a delight to see 40% girls enrolled into this 3-day activity filled with fun, challenge and excitement. Monash University is truly committed to fostering innovation and nurturing future talent to help create a workforce that supports Australia's future."

If you'd like to help change the conversation about STEM and encourage more young people to participate, It's not too early to get involved in next year's event. "We're calling upon industry and other like-minded organisations to come forward and sponsor our 2019 Year 8 Challenge!" Associate Professor Yellishetty said.

Original article published on https://www.monash.edu/engineering, 6 July 2018

THE IBMM-IEESEP2018

In January 2018, the Chemical Engineering Department was delighted to be a platinum sponsor of the 1st International Conference on Bioinspired Materials and Membranes (IBMM2018) and the 1st International Conference on Energy-efficient Separation (iEESEP2018).

The two conferences, organised by the ARC Research Hub for Energy-efficient Separation, hosted 157 participants and aimed to review and discuss the recent research progress and future direction of two vital research topics - bio-inspired materials and membranes.

Bio-inspired materials are the focus of an emerging research topic, which aims to develop high-performance functional materials by learning from nature. In the last a few years the applications of bio-inspired materials in membranes has markedly increased.

Within this context, the two conferences together provided the perfect opportunity to gather experts from both research fields - including academic and industry partners - to exchange innovative ideas and experience in developing advanced materials and membranes for energy-efficient separation.

Co-chairs Professor Huanting Wang and Professor Xiwang Zhang, along with their organising committee, created a scientific program designed to provide researchers tangible benefits and collaboration opportunities, thereby stimulating research in the development of new bio-inspired materials and membrane.

The conference committee welcomed five plenary speakers, 25 keynote speakers and 15 invited speakers. Plenary speakers included Professor Tony Fane (UNESCO Centre for Membrane Science and Technology at UNSW, Australia), Prof Lei Jiang (ICCAS, and Dean of School of Chemistry and Environment, Beijing University of Aeronautics and Astronautics, China and Department of Chemical Engineering, Monash University, Australia), Prof Liang-Yin Chu (School of Chemical Engineering, Sichuan University, China), Dr Anita Hill (Future Industries, CSIRO, Australia), and Prof Dongyuan Zhao, (Department of Chemistry, Laboratory of Advanced Materials and Collaborative Innovation Center of Chemistry for Energy Materials, Fudan University, China and Department of Chemical Engineering, Monash University, Australia).

The event also included a tour of Monash Campus and the Australian Synchrotron, as well as an Early Career Researcher Workshop.

The next IBMM will be held in Sichuan, China in 2020 .

Student awards:

An important element of the conferences was the opportunity for students to present their research in a supportive environment, which included mentors, future collaborators and leaders of their fields. Students were encouraged to present a poster or enter the 3MT competition, with awards given to the top three in each category. Recipients included:

3MT award:

1st - Van Huy Tran (University of Technology Sydney)
2nd - Wang Zhao (Monash University)
3rd - Yun Xia (Monash University)

Best poster award:

1st - James Maina (Deakin University)
2nd - Yuqi Wang (Monash University
3rd - Yun Lu (Monash University)

SHINE BRIGHTER - SUPERSTARS OF STEM

Science and Technology Australia's (STA) Superstars of STEM program aims to smash society's gender assumptions about engineers and scientists by increasing the public visibility of women in STEM. The program aims to create a critical mass of Australian female scientists and technologists - role models for young women and girls – and to work towards equal representation in the media of women and men working in all fields in STEM.

The 2019-2020 program is taking applications until 23 September. 60 places will be offered, of which 20 are scholarship (no fee) and 40 are fee paying ($2,500+GST). For the first time, the Faculty of Engineering is offering to pay the program fees for up to 5 alum who are offered places in the program. **FIND OUR MORE HERE (https://scienceandtechnology-australia.org.au/what-we-do/superstars-of-stem/)**

UPDATE FROM ARC RESEARCH HUB FOR ENERGY EFFICIENT SEPARATION

PUBLICATION HIGHLIGHTS

» Hub Deputy Director Professor Huanting Wang has published his insight into one of the most highly cited scientific journals, Nature Nanotechnology. His paper, titled *Nanoporous Membrane: Low-energy desalination, explains how a nanoporous fibrous carbon membrane has greater potential for lower energy desalination than the commercial PTFE membrane. Wang, H. Nanoporous Membrane: Low-energy desalination*, Nature Nanotechnology 13, 273–274 (2018)

» Our researchers have discovered an efficient and sustainable way to filter salt and metal ions from water. Dr Huacheng Zhang, Professor Huanting Wang (ARCEESEP CI) and Associate Professor Zhe Liu and their team have recently discovered that MOF membranes can mimic the filtering function, or 'ion selectivity', of organic cell membranes. Zhang, H et al. *Ultrafast selective transport of alkali metal ions in metal organic frameworks with subnanometer pores*. Science Advances 4, 2

SCIENTIFIC SEMINAR BY PROF WOJCIECH KUJAWSKI

During August, the hub was pleased to welcome Professor Wojciech Kujawski to give us a lecture on "Physicochemical Properties of Hydrophobized Ceramic Materials (Powders and Membranes)".

Prof Kujwaski is a Faculty Member at Faculty of Chemistry, and Head of the Chair of Physical Chemistry and Physical Chemistry of Polymers in Nicolaus Copernicus University, Torun, Poland. Prof Kujwaski has extensive experience in education, research, and cooperation with diverse external companies. His main research interest is focused on the fundamental research of membrane separation processes (e.g. pervaporation, membrane distillation, thermopervaporation, ultra- and nanofiltration), membranes in food processing, ionic liquids for task specific processes, ion-exchange membranes, bio-polymers, fossil and bio-fuels, as well as the modification and functionalization of polymeric and ceramic membranes.

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