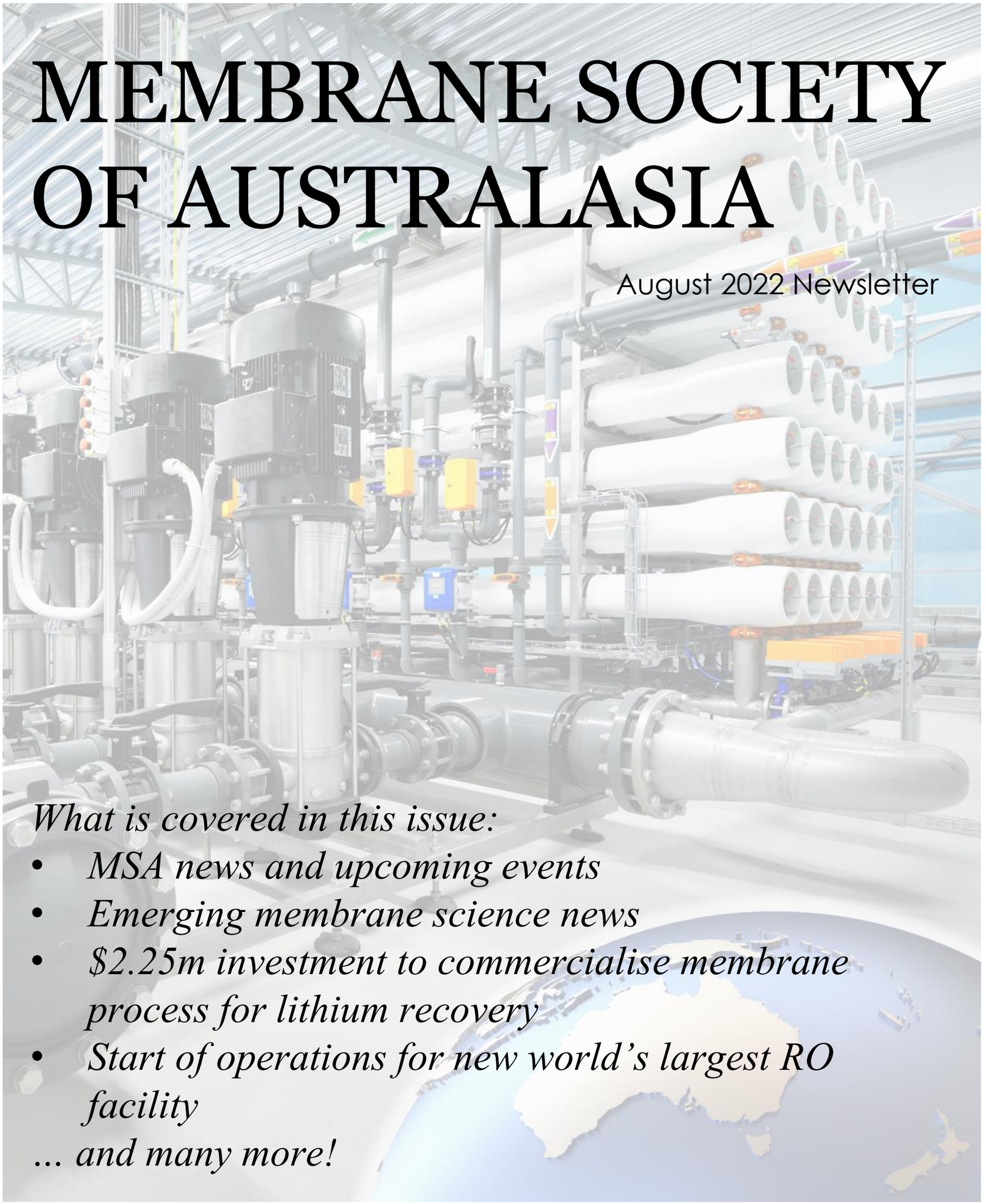
MEMBRANE SOCIETY OF AUSTRALASIA

August 2022 Newsletter



What is covered in this issue:

- *MSA news and upcoming events*
- *Emerging membrane science news*
- *$2.25m investment to commercialise membrane process for lithium recovery*
- *Start of operations for new world's largest RO facility*

... and many more!

Building a membrane community in Australasia.

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ElectraLith Secures $2.25 million Investment to Commercialise Membrane Process for Lithium Recovery

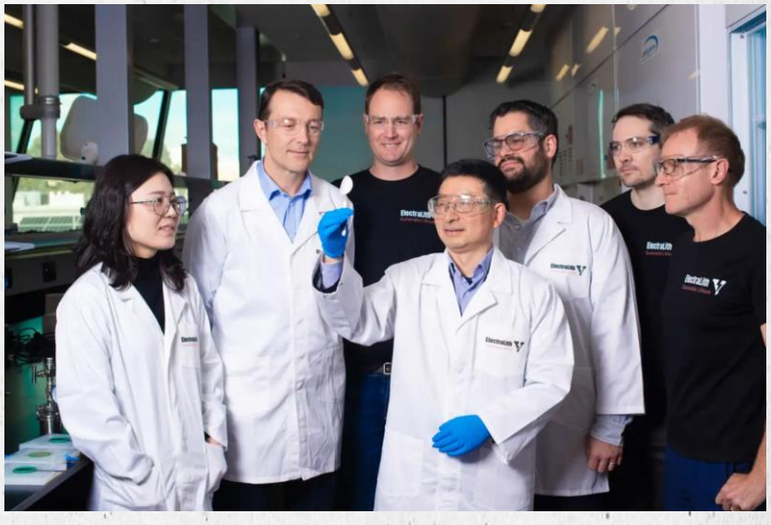
ElectraLith, a spin-off from Monash University, with the backing of Rio Tinto and leading university research commercialisation specialist IP Group Australia, along with the strong support from Monash Investment Holdings, has launched to commercialise breakthrough membrane technology for sustainable lithium production.

A total of $2.25 million will be contributed by the parties in seed funding to develop the electro-filtration membrane technology for lithium extraction and refining that possess the potential of reducing the lithium production cost by 40%. The seed investment contributed will be utilised to support the ongoing technology development carried out by a team of Monash University researchers, led by ElectraLith's founder and 2021 Eureka Prize finalist Professor Huanting Wang.

To meet the increasing green energy demand, it is forecasted that the growth in lithium supply will be around 800% or approximately 1 million tons per annum by 2050. ElectraLith's electrically-driven membrane filtration process has the potential to enable high purity lithium production with unmatched speed and yield. The technology is also expected to have the lowest energy requirement and environmental impact of all approaches to lithium refining and is compatible with renewable electricity.

ElectraLith could significantly shift the economics of lithium production from brine, ore and recycling sources, reducing costs substantially while dramatically lowering its environmental footprint. This breakthrough technology could make onshore lithium processing competitive by securing Australia's position in the growing battery industry and showcasing its advanced manufacturing capabilities.

ElectraLith
Sustainable Lithium



Source: Financial Review

MSA ECR Symposium 2022

The Membrane Society of Australasia Early Career Researcher Symposium (MSA ECR) provides a unique forum for PhD students, post-docs, and early career membrane scientists and engineers both within the region and overseas to present and exchange new research results and emerging ideas.

Membrane Separations to Unlock Resource Circularity

The transition towards a circular future of clean water, energy and manufacturing provides exciting opportunities for membrane technologies. This symposium aims to bring together young scientists and engineers working in the broad field of membrane separation to discuss their work. Topics will include, but not limited to, membrane materials and characterization, understanding of molecular scale transport phenomena, data-driven approaches to membrane processes, membrane modules and system design. The program features both oral and poster presentations given by the students and young researchers in attendance, as well as ample networking opportunities. In addition, distinguished guest mentors are invited from academia and industry who will participate in discussions and share their insights into the diverse career opportunities in this field.

Dates and Venue

3 December 2022

In-Person at the Learning & Teaching Building, **Monash University**, 19 Ancora Imparo Wy, Clayton VIC 3800

Registration only costs $50 for early bird, MSA members, students and retired membranologists! Lunch, morning / afternoon tea and drinks are included!

Get your tickets now at:

https://www.imstec2022.org/ecr-symposium

Sustainable Membranes for Crude Oil Fractionation

BY Mohadeseh Najafi

Crude oil fractionation is generally achieved through heat-based distillation, which is large-scale and energy-intensive and accounts for nearly 1% of global energy use – 1,100 TWh/y – according to the investigator. Industries have not been thriving in using membranes as alternatives to classical separation methods for hydrocarbon fractionation because they need membranes to meet stringent mechanical and thermal stability requirements to prevent rapid physical aging and deterioration.

Suzana Nunes and her team at King Abdullah University of Science and Technology have recently developed attractive membranes for the energy-efficient fractionation of crude oil by wisely selecting the polymer structure and a versatile strategy for membranes fabrication. Its exciting result was published under the title "Polytriazole membranes with ultrathin tunable selective layer for crude oil fractionation" in the Science journal this year.

Source: OIL SANDS MAGAZINE

Dr. Suzana Nunes (left), KAUST professor of chemical and environmental science and engineering, and Dr. Stefan Chisca (right), KAUST research scientist, examine a container of the polymer used to manufacture membranes in the Nanostructured Polymeric Membrane Laboratory, KAUST. *Source: KAUST / M. Weche*

The Future From Nunes's Eyes

As mentioned in KAUTS News, Nunes has been working on polytriazole membranes over twenty years. "The goal and the dream are to have large regional petrochemical companies use membrane technology as a substitute for part of their thermally driven separation processes," Nunes said.

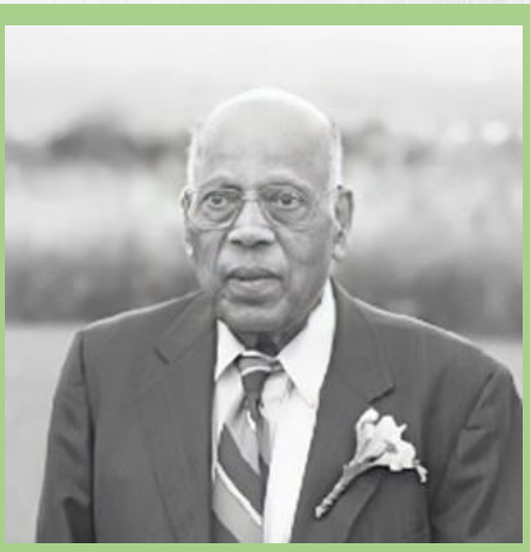
"It is the reason why we are doing it. It is the motivation." This is the first step in a long story," she said. On the horizon, Nunes also sees membrane technology as a viable solution to assist current efforts in minimizing carbon dioxide emissions by addressing the problem at the start of the industrial value chain. " If new plants in Saudi Arabia can incorporate novel and more sustainable membrane-based separation processes at the onset, it will significantly contribute to the circular carbon economy." (Source: KAUST)

Remembering Dr. Srinivasa Sourirajan

Dr. Sourirajan, best known as the father of reverse osmosis, passed away at the age of 98 in last February in Ottawa, Canada.

Dr. Sourirajan was born in southern India in 1923, and received his doctorate in chemistry in post-colonial India. His research brought him to the United States, Yale University, in the mid 1950s for another doctorate in chemical engineering. In 1956, he moved to UCLA as a research scientist and made great contributions in mainly three areas, including geophysics, catalysis, and perhaps most significantly, the invention of cellulose acetate membranes for reverse osmosis together with Sidney Loeb, a chemical engineer in California.

Dr Sourirajan and his family moved to Ottawa, Canada, in 1961, and he worked at the National Research Council (NRC) for 25 years. His research on reverse osmosis attracted top scientists from all over the world and inspired world leading companies like Dupont for the commercial and industrial applications. After his retirement from the NRC in 1986, he founded the Industrial Membrane Research Institute (IMRI) in the Department of Chemical Engineering at the University of Ottawa to educate the next generation of scientists. In 1994, he was awarded an Honorary Doctorate Degree by the University of Ottawa, and in 2016, he was inducted into the American Membrane Technology Association's Hall of Fame. He was also lauded by the Canadian Chemical Engineering Conference as one of the top-achieving chemical engineers of the 20th century.



Srinivasa Sourirajan
(October 16, 1923 – February 20, 2022)

While organic chemists focused on making synthetic membranes for two centuries he developed the non-solvent induced phase separation (NIPS) process, which is still the most popular method for fabrication of integrally-skinned asymmetric membranes of all types. The so-synthesized membrane is then used as a barrier for separation processes such as desalination.

Dr. Sourirajan was an influential scientist who made a huge impact on our world. His discovery contributed to solving the world's social challenges including global access to drinkable water and food supply, innovation in healthcare and medicine as well as clean energy. He was nominated to the Nobel Prize in chemistry three times. His design of a desalination membrane that selectively separates dissolved solids under pressure while allowing water to pass through using cellulose acetate, made today's two-thirds of desalination plants being based on reverse osmosis worldwide.

ACWA Power and EWEC Announce Start of Operations for the First Phase of Al Taweelah IWP, the World's Largest Reverse Osmosis Water Desalination Facility

ACWA Power, a leading Saudi developer, investor and operator of power generation, desalinated water and green hydrogen plants worldwide, and the Emirates Water and Electricity Company, announced the commencement of operations for the first phase of Al Taweelah Independent Water Plant (IWP). Connected to the Abu Dhabi network in December 2021, Al Taweelah now provides 454,609 m^3 of desalinated water per day, and will eventually reach 909,200 m^3/day, making it the world's largest reverse osmosis (RO) facility.

The plant supports the industries and the community at Al Taweelah and the surrounding areas, and will additionally play a key role in catering to Abu Dhabi's peak water demand, which is expected to rise by Q1 in 2023. Al Taweelah IWP employs low carbon-intensive reverse osmosis (RO) technology and is partially powered by solar energy, which is expected to account for at least 30% of the project's electricity capacity within eight years, with a target of raising this figure to 55% by the end of the first quarter-life of the project.

ACWA Power is the lead developer and operator of the project and a 40% shareholder, with the remaining 60% contributed by the Government of Abu Dhabi through Abu Dhabi Power Corporation and Mubadala Development Company PJSC. Emirates Water & Electricity Company, a fully owned entity of the Government of Abu Dhabi and the water and power supplier of the region, is the sole offtaker of the project under a 30-year contract. The financial impact pertaining to the operation of the first phase of the project is expected from Q2 2022 financial results onwards.

Source: ACWA Power

Source: Savener

Industry Engagement

In this new industry engagement section, we strive to instigate collaborations between membrane researchers and industry experts. This edition features an interview with Dr. Mark Mullett from The Water and Carbon Group, who is also a MSA board member in charge of industry engagement. If you or your company would like to be featured in this section, please contact our Newsletter Coordinator and Editor or Associate Editor at amir.razmjou@ecu.edu.au / milton.chai@uq.edu.au.

Interview with Mark Mullett from The Water and Carbon Group

Dr. Mark Mullett

Q1. We are very keen to know more about you and how you first started working with membranes. Please tell us about yourself.

Mark: I started working with membranes from the early 2000s. There was an issue at Alcoa with one of the water streams and one of the two solutions that came forward was a membrane-based solution. This was an opportunity to engage with membrane experts and we spent nearly $1,000,000 over a couple of years in developing a process using membranes at Alcoa in Perth. After that, I joined Hatch as a consultant in 2008, and my role was technical lead for process separations globally looking at membrane applications in hydrometallurgy. In Hatch, I developed my expertise in nanofiltration by doing some pilot works. I also joined MSA at that time, where I started to get to know people who were involved in membranes that could do some test works for Hatch. I was at Hatch for almost nine years before I joined Veolia in 2016 as a corporate sponsor, where I did a lot of consulting work for RO. Just a week before this interview, I joined The Water and Carbon Group as the development manager for PFAS and mining.

Q2. Can you tell us what are the challenges that you are currently looking at in your company?

Mark: The Water and Carbon Group has developed a proprietary fractionation technology for PFAS that I am helping to put into practice. PFAS is a very complex problem as it has thousands of chemicals with long chain and short chain, different degrees of polarity and suitability, and different propensities to absorb to different things. The main issue with PFAS is that just about every technology only moves it from one place to another. We need to develop a cradle to grave solution so that we can completely mineralise it. At the moment, it is still being stored somewhere like in activated carbon or in resin. The regeneration process is also very complex, requiring methanol, which is quite hazardous to use. So, there's a lot of work to be done in PFAS.

There is potential for membranes to be involved in the PFAS removal. We have done a fairly big study recently where we have looked at different process trains for huge volumes, but low concentration, which involved a flowsheet membrane preconcentration. After preconcentration, we could then apply foam fractionation on the brine solution, which is a development process in itself. Although there are still some works to be done, the application of membrane is ideal because you can get a large volume of clean water through as permeate and you can take that volume down even further with foam fractionation. If you could do surface degradation of PFAS while you're concentrating, that would be an ideal scenario for sure.

The other thing we would really like to explore more is electro-oxidation of PFAS, and we are trying to move that out of the laboratory and into viability.

Q3. How can membrane researchers in our community help or contribute in addressing these challenges?

Mark: In academia, there is the need to publish and there is the need to do fundamental research. Industry research can help you get more funding, but it is not necessarily suitable for publication because it's covered under trade secrets and the companies are buying the IP. I think that is a real tension that drives down the academic process. The industry also wants a problem addressed with a fee for service approach. I have had a lot of experience working with the universities to know that they want to continue expanding the program to take the opportunity to develop more knowledge in the area, but also to bring in post-doctoral researchers and develop PhD students. There are huge merits going both ways, but I am not sure if it has been bridged yet.

With industry, it is always a new project because the fundamentals, the chemistry and the interactions between the chemistry is always different. For example, if you are doing fundamental research using particular membranes developed yourself in a synthetic environment, then there is still a lot of work to do to make it applied. If we take PFAS removal in landfill leachate as an example, there are COD, colour, TOC, biological process, and high concentration of ammonia, which can all interfere and add ionic strength and osmotic pressure that can

eventually get very complex. In addition, mature and non-mature landfill leachate are totally different. Mature landfill leachate is very stable and the feed stream is very consistent, whereas an active landfill leachate can be changing by the hour or by the day or by the week. A big leap of faith has to be taken by the industry to want to try and develop one of the solutions, so keep in mind that the solution you propose has to be extremely robust.

Q4. Do you have any advice, especially for early career researchers on how to reach out to the industry and start building a relationship that would help in securing projects or collaborations?

Mark: The industry needs to step out of its shell to meet early career researchers and see what they're up to. Conferences are important, so the early career students or researchers need to be brave and find people out and say “Hi, I’m studying at [this university] and my research/major is on improving MBR, I’d love to have a coffee with you sometime”. You need to take those opportunities to network with industry people. Industry people are actually quite nice. Another thing is having presentations to industry as part of a seminar series, which we have spoken about in the MSA board, and allowing industry people to present at MSA functions, AGM, and monthly meetings, to help bridge some of the intents.

Q5. What do you think the future of membrane technology looks like in the next 10-20 years? Will there still be hot areas for development?

Mark: Material science, such as more robust materials to do nanofiltration-type separation, will still be important. But it also comes down to energy consumption and capital cost to do a specific separation which need to be addressed. Process optimisation, low energy or low carbon intensive membrane processes would be something that still has valuable research potential. Anything that reduces the energy associated with current membrane processes is going to gain attention.

I know there's a lot of work being done on membrane recycling. Having to landfill thousands of membranes every time there is a change is a real problem. There are still a lot of problems with the reuse and repurposing in terms of who owns the process guarantee if you take them out and put them somewhere else, and there's a middle man who does the transfer that needs to get paid and the economics don't stack up. If we can make membranes out of materials that are recyclable and start heading towards that, it will get a lot of interest as well.

Membranes, the Key Ingredient of Lithium-Sulfur Batteries Supply Chain

By Javad Farahbakhsh

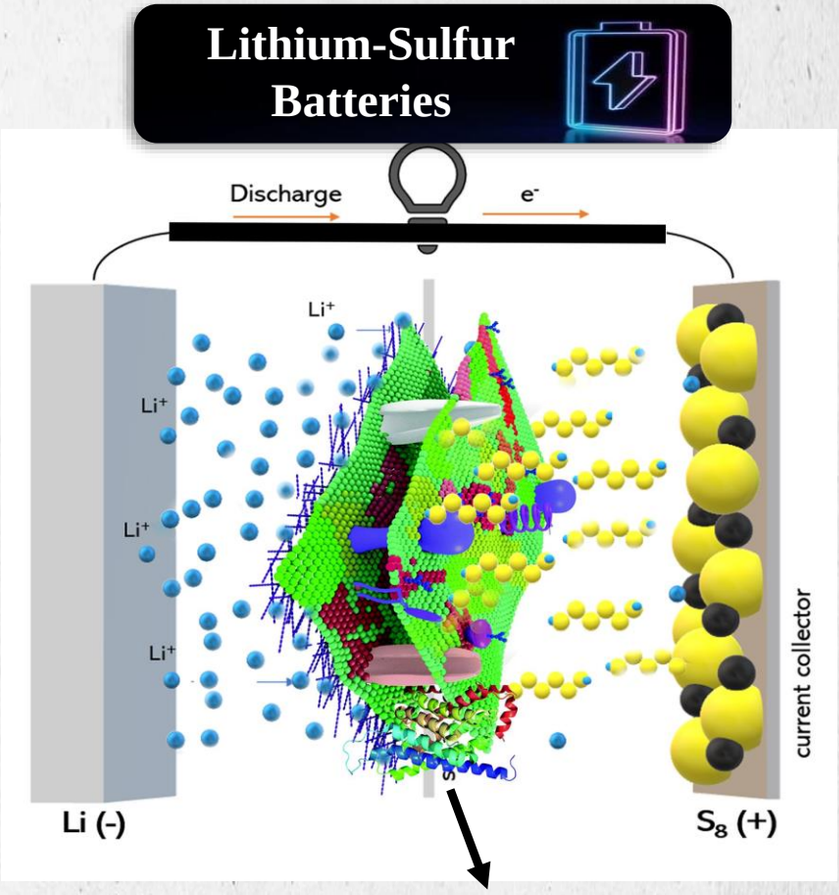
Lithium as the main material in batteries has shared 18% deposits in Australia. In fact, Australia has the ability to earn $213 billion of lithium exports and the lithium industry in the world. Hence, focusing on lithium-related products has significant financial benefits. Nowadays, lithium-sulfur batteries are getting considerable attention as alternative batteries that we will most likely use in electric cars or cellphones in near future. The main advantage of lithium-sulfur batteries is their high energy storage capacity while being cheaper and lighter compared to lithium-ion batteries.

So why not mass production

The main hold-up for the mass production of lithium-sulfur batteries is the chemical reaction that happens inside the battery and reduces its life span. In fact, the recharge cycle is very low (about 50 times) because of the active materials in the battery deposit over a short period of time, and polysulfide diffusion from cathode to anode. This reduces the power that the battery can deliver and can also end up making a short-circuit, potentially causing a flammable electrolyte to catch fire.

The ongoing research

Researchers are currently working on the development of the lithium-sulfur life cycle with the help of new materials and different processes. “It’s world-leading,” said professor Mattew Hill, deputy head of the university’s Department of Chemical and Biological Engineering. “A lot of our research has been about making the battery more stable and lasting longer, so this particular discovery is really exciting”. They have developed an interlayer that stops polysulfides to move from cathode to anode and therefore, increases the battery life cycle. Professor Nicholas A. Kotov, the University of Michigan who leads an international team working on biomimetic membranes believes that using a biomimetic membrane as an interlayer could be a game changer. Their results were promising showing that their developed bio-inspired membranes could block polysulfide transport increasing the recharge cycle and lifespan of these batteries(read more).



Biomimetic membrane

MSA Travel Support

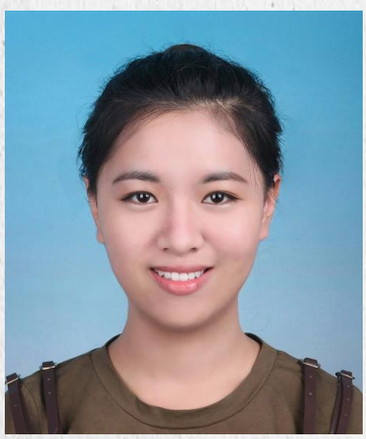
In order to assist MSA members (HDR students and early career researchers (ECRs)) in attending MSA affiliated symposiums and conferences, MSA will sponsor travel awards to support their conference registration costs or to partially cover their conference expenses. Subject to the approval of the MSA executives, MSA executive will directly pay the registration costs of the award recipients to the organising committee. The award winners will be announced during the conference closing ceremony and published in our newsletter post-conference.

(ECRs here are defined as researchers within 5 years post-PhD graduation)

Contact us

Dr Gayathri Naidu
Travel Award Coordinator
Senior Lecturer/ARC DECRA Fellow
University of Technology Sydney
E: gayathri.danasamy@uts.edu.au

In July this year, MSA has sponsored two MSA members to attend the 13th Conference of the Aseanian Membrane Society that was held in Singapore. Congratulations to the MSA travel awardees!



Mrs. Chen Wang received her MS degree in Environmental Engineering from Shandong University in 2018. She is now pursuing her PhD studies in the School of Civil and Environmental Engineering, University of Technology Sydney, under the supervision of Prof. Hokyong Shon. Her research focuses on preparing novel membranes for organic solvent nanofiltration and desalination, using inkjet printing technology for membrane fabrication and modification, and combining machine learning for membrane performance prediction and optimisation.

MSA Travel Support

Truong Minh Vu (preferred name as Minh) is a Process Engineer with 9 years of experience in the research and development of innovative technologies for resource recovery from solid waste and wastewater and 4 years of engineering experience in the water and wastewater treatment industry across Australia and Vietnam. Minh received his Bachelor's degree in Environmental Engineering from Hanoi University of Science and Technology in 2014 and an M.Eng degree from the University of Wollongong Australia in 2019. Minh is currently completing his PhD in Environmental Engineering at the Centre for Technology in Water and Wastewater at the University of Technology Sydney. Minh's research interests focus on the development of an integrated system using membrane and steel-making slag to recover nutrients and energy from wastewater. To date, his research works have been published in 16 peer-reviewed papers and 4 book chapters in top-tier journals and publishers in the field. Minh has recently joined Infinite Water (IW) Australia as an R&D Process Engineer. At IW, he is working on some of Infinite Water's key applications, including wastewater recycling and reduction of disinfection by-products in drinking water production.

NX Filtration Supplies Its Direct Nanofiltration Membranes to Envirogen for Industrial Water Recycling in the UK

Envirogen, a leading international provider of industrial water treatment solutions and process filtration, selected NX Filtration for the delivery of its direct nanofiltration (dNF) membranes for an industrial water recycling project for a leading manufacturer of advanced materials and components in the North of England.

This project follows previous deliveries of microfiltration and ultrafiltration membranes from NX Filtration to Envirogen. The customer was looking for an optimal and sustainable solution enabling them to recycle more than 75% of their wastewater stream. Envirogen piloted various technologies on-site and selected NX Filtration's hollow fibre direct nanofiltration (dNF) membranes as the most effective and sustainable solution to remove or reduce key contaminants from the wastewater and enable the reuse at the customer's facilities.

The current set-up has a capacity of 45 cubic meters per hour and has been designed in a modular way, facilitating efficient future extensions to enlarge the capacity. Envirogen and NX Filtration previously worked together on projects related to microfiltration for a beer filtration application and ultrafiltration for a large industrial water treatment project in the UK.

Source: NX Filtration

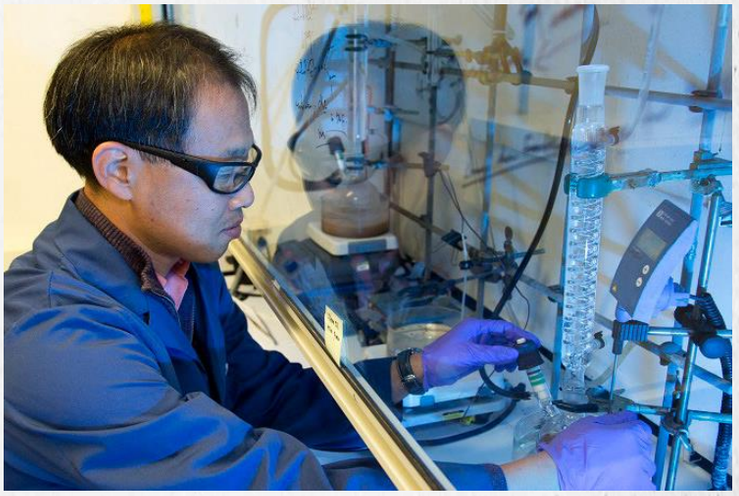
New High-temperature Fuel Cell Membranes for Automotive Applications

BY Mohadeseh Najafi

Most heavy-duty vehicles in Australia are fossil-fuel-based commercial vehicles that release around 1.5 to three tonnes of carbon dioxide annually. The infrastructure department said an estimated 620 Australians died in 2015 due to transport-related air pollution, equal to more than half the national road toll, costing the economy about $9.2 billion. (read more)

The shift toward fuel cell commercial vehicles, which produce virtually lower emissions or near-zero emissions, is expected to lead to the growth of the Global Fuel Cell Commercial Vehicle market. According to **Fortune Business Insights**, the global fuel cell vehicle market is expected to grow from USD 446.7 million in 2018 to USD 6,731.4 million by 2026. (read more)

Los Alamos National Laboratory scientists led by **Yu Seung Kim** have stepped forward to commercialise fuel-cell technology and make electric cars less expensive by overcoming the issues of current fuel cells, which operate at 60-80℃ and require large radiators and air intakes to stay cool enough to operate.



Dr. Yu Seung Kim said," We can increase the power to make a Tesla-like fuel-cell car".

Source: www.lanl.gov

They have successfully developed and designed high-temperature polymer fuel cells operating at 80-160℃ that are well suited for heavy-duty fuel cells. The high efficiency and commercialisation potential of these systems are proven by their 60% enhancement of the fuel cell's power density. They believe that they can make an affordable fuel-cell car instead of a battery-powered electric car.

Source: Arcola Energy

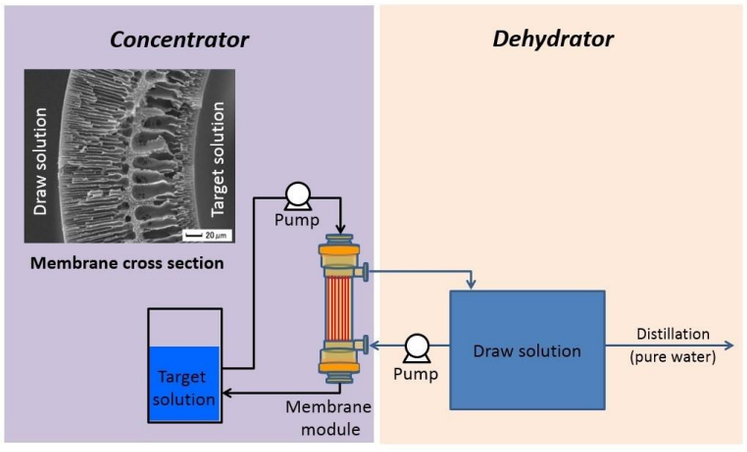
The paper *Protonated phosphonic acid electrodes for ion-pair high temperature polymer electrolyte membrane fuel cells* was published this year in Nature Energy.

Forward Osmosis Story: from Birth to Potential Protein Industry Application

BY Mitra Golgoli

Forward osmosis (FO) membrane system was introduced as a potential low-energy desalination system in 2006 that intrigued many research studies and industries to focus on its development in its early years. However, the energy efficiency of FO to revolutionise desalination always has been a heated discussion over the years. “An FO–RO desalination system cannot consume less energy than a standalone RO system to achieve a certain recovery” said Elimelech et al., 2015.

FO has been finding its way as an effective approach in other disciplines and markets such as valuable product recovery, food and beverage industry, and biomedical application. FO systems are attracting attention in these markets due to concentrating products without applying heat and pressure making the process suitable to concentrate valuable and sensitive components such as proteins, DNA, vitamins, and antibiotics without destroying their structure.



A developed FO membrane system for the high-level concentration of liquids by dehydration without heating or pressurisation to be used in food and pharmaceutical markets.
Source: www.asahi-kasei.com

Protein Market

Proteins are value-added substances that are widely used in the medical, nutraceutical, and pharmaceutical industries. Market to produce pure and concentrated protein has been predicted to have a value of 19.1 billion USD by 2030 with a CAGR of 10.6% annually from 2022 according to a new report by Grand View Research (read more). This intrigued the increasing demand for cost-effective techniques to purify proteins maintaining their structure with minimal contaminants.

Can FO play a role in protein economy?

Conventional approaches for protein separation like pressurised membrane systems face the challenges of protein denaturation and secondary protein contamination. FO has been proposed to be an alternative economical and sustainable system for continuous protein concentration without affecting its structure, composition, and activity. However, reverse salt flux can be a barrier for this application due to denaturing proteins by salt which can be solved using a novel draw solution (like HMTA+-SO3−) according to Liao et al., 2020. Overall, FO may be a potential technology in the future market of protein purification.

ARC Industry Fellowships

The opening of the ARC Industry Fellowship Schemes is planned for September-October 2022.

A suite of Industry Fellowships is being developed by the ARC, following the announcement of the University Research Commercialisation Action Plan, a $2.2 billion investment to place university innovation and industry collaboration front and centre of Australia's economic recovery.

The schemes will be open to all researcher career stages, and will aim to build researcher capability in commercialisation, industry collaboration and translation. The Schemes are also intended to promote workforce mobility across industry and academic settings and drive research commercialisation outcomes of industry.

Early career/Mid-career fellowships

- Support early career, mid-career researchers to collaborate with industry on high quality research,
- Contribute/drive research that solves industry-identified challenges or opportunities,
- Enhance the research collaboration, commercialisation and/or translation skills of early career researchers,
- Enable research, research training and industry activities in high quality and supportive higher education and industry environments,
- Promote diverse career pathways across university and industry settings,
- Contribute to economic growth, including through focusing on Australian Government priorities, such as the National Manufacturing Priorities/Map industry-identified challenges with potential projects that align to the scheme objectives.

Key issues that have already been identified by ARC stakeholders from industry and research settings:

- The objectives of each Scheme need to be clear
- Scheme design should maximise flexibility
- Fellows should be supported in both industry and academic settings
- Processes should be streamlined to support industry engagement
- Schemes should be designed with an awareness of the broader research and innovation ecosystem
- Administrative burden on applicants and industry should be minimised where possible

The ARC is closely considering this and other feedback in the design of the new schemes.

Australian Government
Australian Research Council

If you have any queries, please contact the ARC at urcs@arc.gov.au.

Upcoming Membrane Events

CURRENT EVENTS	DATE OF EVENT	ABSTRACT SUBMISSION
IWA World Water Congress & Exhibition 2022 Copenhagen, Denmark www.worldwatercongress.org	11 – 15 Sep 2022	Past
13th World Filtration Congress San Diego, CA, USA www.wfc13.com	05 – 09 Oct 2022	Past
IDA 2022 World Congress: Charting Resilient Water Solutions. Sydney, Australia www.wc.idadesal.org	09 – 13 Oct 2022	Past
MSA ECR Symposium Monash University (Clayton), Melbourne, AUS www.imstec2022.org/ecr-symposium	03 Dec 2022	**Registration open now!**
MSA Industry Workshop Monash University (Clayton), Melbourne, AUS www.imstec2022.org/industry-workshop	04 Dec 2022	**Registration open now!**
11th International Membrane Science and Technology Conference Monash University (Clayton), Melbourne, AUS www.imstec2022.org	04 – 08 Dec 2022	Past
13th International Congress on Membranes and Membrane Processes Makuhari Messe, Chiba, Japan www.icom2023.jp	09 – 14 Jul 2023	TBA

A Key Overlooked Parameter in Reverse Osmosis Desalination

By Javad Farahbakhsh

The global reverse osmosis (RO) market size has been estimated to reach USD 7.09 Billion in 2030 and register a revenue CAGR of 9.9% over the forecast period (read more). Surging demand for RO has motivated scientists to improve the RO system measurements. For a long time, salt flux was assumed constant under different feed concentration in RO system. The scientists unanimously agreed on the solution diffusion mechanism for salt flux and retention measurements. However, the current method does not accurately show the salt flux and retention rate under different feed concentrations. The main parameters in current model are independent of feed concentration, while data shows that salt retention is highly dependent on feed salt concentration.

Source: NEWater

The new method

In a recent interesting study, Professor Biesheuvel and Elimelech introduced a new parametrization method for salt flux in RO desalination process. According to previous studies, the main parameters in the salt rejection formula should be connected to feed salt concentration as salt retention changes by various feed concentrations. The newly announced formula considers the effect of feed changes on salt rejection and salt flux. This is a crucial difference from the current model, where the feed salt content variation is absent. It is believed that the problem in the common method is not related to some transport mechanism inside the membrane and the probable answer is just in considering feed concentration. ”We make this claim because inside the membrane transport is quite similar for all datasets, with similar values for salt flux and water flux found in all datasets”, said Prof. Biesheuvel in journal membrane science letters(read more).

What is the main outcome

It is expected that the newly added parameter allows for a much better comparison between RO membranes and optimization of membrane performance. The RO membranes also show more accurate data in salt flux and rejection under the different conditions. This is a key formula for industry related projects to have a better judgment of membrane performance.

New MSA Newsletter Taskforce

Dr. Amir Razmjou (amir.razmjou@ecu.edu.au**)**

Dr Amir Razmjou is a tenured lecturer at Edith Cowan University (ECU) and Editorial board member of the Journal of Desalination. He has supervised more than 20 HDR students, has held leadership roles in several industrial projects. He has over 10 years of expertise in surface nanoengineering and membrane technologies with more than 150 high-impact refereed journals (>5800 citations and an h-index of 38 and h10 of 89, April 2022). Dr Razmjou's current research focuses on direct lithium extraction, ion selective membranes, sensors and machine learning for material discovery.

Dr. Masoumeh Zargar (m.zargar@ecu.edu.au)

Dr. Masoumeh Zargar is a tenured lecturer, an ARC DECRA Fellow, and a Vice-Chancellor Research Fellow at the School of Engineering, Edith Cowan University (ECU). She has extensive experience in membranes and nanomaterials science and technology and has been working with several industry partners on industry-led research projects over the past five years. She currently leads an active research group encompassing more than 10 HDR students and research associates. Her current research focuses on the development of functional materials and membranes for water and wastewater treatment, desalination, solar distillation, water resource recovery, circular plastic economy, and the removal of emerging contaminants from water (e.g., microplastics, nanoplastics, PFAS).

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Dr. Milton Chai is a postdoctoral research fellow at the University of Queensland working under the supervision of Dr. Jingwei Hou and Prof. Vicki Chen. He received his PhD in Chemical Engineering from the University of New South Wales in 2019. He has extensive experience in thin film metal-organic framework (MOF) membrane development, biocatalysis and ion selective membranes. His current research focuses on MOF membranes for critical minerals recovery.

New MSA Newsletter Taskforce

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Weonjung Sohn is currently a 1st year PhD student at University of Technology Sydney under Prof. Hokyong Shon's supervision. Her main research interests include biological nitrification process in membrane bioreactors, and reverse osmosis technology for nutrients recovery in a circular economy from blackwater such as urine.

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Vedant A. Joshi is currently a 4th year student pursuing Integrated M.Tech. in Chemical Engineering with Specialization in Petroleum and Petrochemical Technology from Institute of Chemical Technology Mumbai MarJ. His research interest lies in the domain of Enhanced Oil Recovery, Aromatic Extraction and Process Modelling and Simulation.