MEMBRANE SOCIETY OF AUSTRALASIA

March 2025 Newsletter

What is covered in this issue:

- MSA-AMC 2024 highlights, IMSTEC 2025, XPrize
- Welcoming new MSA President and Board Directors
- Interview with Prof. Vicki Chen and Neil Palmer
- Latest membrane science and industry news

… and many more!

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MSA Annual Meeting and Conference 2024 Highlights

The MSA Annual Meeting and Conference 2024 was successfully held in December last year at the University of Technology Sydney. The conference was chaired by A/Prof. Leonard Tijing, Dr. Gayathri Naidu, Prof. Faisal Hai and Dr. Chi Cheng. A wide range of leading experts, researchers, and innovators from Australasia and beyond shared their groundbreaking contributions in membrane science and technology, alongside related disciplines. With over 100 delegates from 11 countries (Australia, China, Korea, India, Germany, Saudi Arabia, Japan, USA, Singapore, South Africa, Philippines), this gathering was a true testament to the power of collaboration and innovation in advancing membrane science and technology.

Organising Committee

Conference Chairs

A/Prof. Leonard Tijing

Dr. Gayathri Naidu

Prof. Faisal Hai

Dr. Chi Cheng

Dr. Andrea Merenda – Treasurer
Dr. Biplob Pramanik – Programme Coordinator
Dr. Nawshad Akther – Programme Coordinator
Dr. Filicia Wicaksana – Website/Registration Coordinator
A/Prof Huacheng Zhang – Award Coordinator
Dr. George Chen – Sponsorship Coordinator
Dr. Youngwoo Choo – ECR Symposium Chair
Dr. Fanmengjing Wang – ECR Symposium Chair

MSA Travel Awards

For this conference, MSA awarded 6 Travel Awards to 4 PhDs and 2 ECRs to cover the cost of conference registration fees for them to attend the conference and present their research work.

Awardees	
HDR	
1	Yasaman Boroumand
2	Gabriela Martins
3	Melike Benan Altay Geren
4	Weonjung Sohn
ECR	
1	Chen Wang
2	Andrea Merenda

Volunteers

MSA Annual Meeting and Conference 2024 Highlights

MSA- ISPT 2023 Awards

Best ECR Oral Presentation Awards

Usman Syed (*Winner)*
King Abdullah University of Science and Technology

Hoseong Han *(Runner-up)*
Commonwealth Scientific and Industrial Research Organisation; The University of Melbourne

Best Student Presentation Awards

Best Oral Presentation (*Winner*)	**Agnes Maria Mani** Homi Bhabha National Institute
Best Oral Presentation (*Runner-up*)	**Abdul Fahim Arangadi** University of Technology Sydney
	Shudi Mao University of Technology Sydney
Best Poster Presentation (*Winner*)	**Rockson Kwesi Tonnah** Macquarie University
	Oranso Themba Mahlangu Univ of South Africa
Best Poster Presentation (*Runner-up*)	**Lingping Zeng** Monash University
	Wanglin Zhou Nanjing Tech Univ
	Rokhsare Kardani University of Technology Sydney

MSA Annual Meeting and Conference 2024 Highlights

Plenary speakers

Prof. David Waite, University of New South Wales, presented about "Membrane-related Insights from a Career in Water Science and Technology: From Fractals to Membrane Synthesis and Deep Learning"

Dr. Alice Makardij, George Weston Foods, presented about "Emerging Trends in Membrane Clean-in-Place Systems for Food Applications"

Prof Seungkwan Hong, Korea University, presented about "Achieving Carbon Neutralization and Enhancing Climate Resilience by Advancing Technologies for Seawater Desalination and Industrial Wastewater Reuse"

Further information of the conference can be found at https://www.membrane-australasia.org/msa-amc2024.

Message from the New President

Dear MSA members,

Prof. Faisal Hai

Head of School of Civil, Mining, Environmental and Architectural Engineering

University of Wollongong

It is a great pleasure writing my first message for the MSA newsletter as the president of MSA. MSA newsletter has come a long way since its start. Our newsletter has become an important means of communication with the membrane experts in academia and industry. I commend the work of the newsletter team and look forward to working closely with the team.

Like the recent editions, the 45th edition provides an update about the recent prime activities of our society. In December 2024, we had the MSA annual meeting and conference which was highly successful in terms of the number and the variety of the participants. The current newsletter includes other popular sections such as interviews with academic and industry membrane experts, infographics, and recent research and industry news from the MSA members. I am sure you would enjoy reading the newsletter.

MSA will continue its effort towards shaping the research and development in our field. Our members and followers are our greatest strength. Please forward your feedback and suggestions to us.

Thank you for reading, and do not forget to register for our upcoming conference IMSTEC2025, which will be held in Gold Coast from Dec 8-11, 2025 (https://www.imstec.com.au/).

Regards,
Faisal

Welcoming New Board Directors

The MSA would like to welcome A/Prof. Jingwei Hou as our Social Media Coordinator and Dr. Hoseong Han as our new MSA Secretary. The MSA is incredibly grateful to Dr. Soo Leong, who stepped down as MSA Secretary in December last year and wish her every success in her future endeavours.

A/Prof. Jingwei Hou is currently an ARC Future Fellow and an Associate Professor (continuing) at the School of Chemical Engineering, the University of Queensland. Prior to his current role, he was an ARC DECRA Fellow at UQ (2019-2022), a postdoctoral fellow at the Trinity College, Cambridge University (2017-2019) and a research associate at the UNESCO Centre for Membrane Science and Technology (2015-2017).

A/Prof. Jingwei Hou has attracted over $5.5m in competitive grants as the lead CI, and contributed to over 50 plenary, keynote and invited talks. So far, he has 1 book chapter and over 150 publications in highly-ranked journals including lead author publications in Science, Nature Communications, JACS, Angew. Chem., Journal of Membrane Science, etc, which attracted over 11k+ citations and an H index of 63. He is the Membrane Separation Theme Leader of the ARC Centre of Excellence for Green Electrochemical Transformation for Carbon Dioxide (2023-2029). His main research focuses on understanding the physical properties of the microporous materials and translating them into useful devices for membrane separation, optics, energy storage and catalysis.

A/Prof. Jingwei Hou has co-chaired the previous 2023 Annual Conference of the Membrane Society of Australasia and will co-chair the upcoming 12th International Membrane Science and Technology Conference (IMSTEC2025).

Welcoming New Board Directors

Dr. Hoseong Han is a postdoctoral research fellow at CSIRO in Australia, focusing on developing novel nanomaterials for ion exchange membranes in reverse electrodialysis, aiming to advance energy-efficient membrane technologies. She completed her PhD in Chemical Engineering at the University of Melbourne under the supervision of Prof. Greg G. Qiao, Dr. Paul A. Gurr, and Prof. Paul A. Webley, and was awarded a full Melbourne Research Scholarship. Her PhD research centred on synthesising novel polymer materials and their applications, including ultrathin polymer films and nanocomposite structured gas separation membranes. The key aspects of her studies involved new strategies for controlled polymerisations, fundamental investigations of polymer growth, and in-depth studies on the continuous assembly of polymers (CAP) technology. She obtained her bachelor's degree in chemical engineering in 2016 and a master's degree in chemical engineering in 2019 from Yeungnam University, where she completed her master's thesis titled 'Studies on conducting polymer-based symmetric and asymmetric supercapacitors'. She has received several prestigious awards, including the Best Oral Presentation Award (Early Career Researcher) in 2024 and the Year of the MSA Student Award in 2013 from Membrane Society of Australasia (MSA). In 2023, she was honoured with the Best Oral Presentation Award at the 13th International Congress on Membranes and Membrane Processes (ICOM2023) by the World Association of Membrane Societies (MA-MS). Additionally, she received the Best Poster Award at the 5th SKY International Joint Symposium in 2018.

Australia's premier membrane science and technology event

IMSTEC 2025

12th International Membrane Science & Technology Conference

8 - 11 December 2025
Crowne Plaza, Surfers Paradise, Australia

Abstract submission deadline 30 April 2025

Please visit our website for more information
www.imstec.com.au

Sponsor package information

IMSTEC 2025

12th International Membrane Science & Technology Conference

CALL FOR ABSTRACT

TOPIC

- *Membrane materials*
- *Membrane processes and applications*
- *Separation, modelling and simulation*
- *Membrane operation and module design*
- *Membrane fabrication*

HOW TO SUBMIT

Submit your abstract via the **online submission on the website** or via email (**imstec2025@gmail.com**) using the abstract template provided.

Important date

- ***Submission Open**: 01 Mar - 01 May*
- ***Review Process** : 21 May - 10 Jun*
- ***Abstract Notification** : 30 Jun*
- ***Registration** : 01 Jul - 15 Nov*
- ***Early bird registration deadline** : 15 Sep*

Registration Fees

	Early bird	Standard
Full Reg (MSA)	1000 AUD	1200 AUD
Full Reg (non MSA)	1200 AUD	1400 AUD
Student Reg (MSA)	550 AUD	700 AUD
Student Reg (non MSA)	800 AUD	900 AUD
Single Day (MSA)	450 AUD	600 AUD
Single Day (non MSA)	600 AUD	700 AUD

DOWNLOAD TEMPLATE HERE

https://www.imstec.com.au/

A/Prof. Amir Razmjou
Edith Cowan University
Conference Co-chair

A/Prof. Jingwei Hou
The University of Queensland
Conference Co-chair

Exciting Opportunity: MSA Travel Awards for IMSTEC 2025!

Are you a Higher Degree by Research (HDR) student or an Early-Career Researcher (ECR) working in membrane science and technology? The Membrane Society of Australasia (MSA) Travel Award is now open to support your participation at IMSTEC 2025!

📍 Where? Crowne Plaza, Surfers Paradise, Australia
🗓️ When? 8-11 December 2025
💰 What does it cover? Early-bird registration fees (Student: AUD 550 | ECR: AUD 1000)

Eligibility
Active MSA membership for at least 6 months before applying
Accepted oral presentation at IMSTEC 2025
No prior MSA travel grant awarded in 2025

How to Apply?
Submit your application to the MSA Conference Travel Funding Committee at funding@membrane-australasia.org by **15 August 2025**.

🔗 Click here to download the application form: https://lnkd.in/gthtMtjW

This is just one of the many benefits of being an MSA member—stay tuned for more awards!

Last chance to register for XPRIZE Water Scarcity: Track A!

XPRIZE Water Scarcity, a competition designed to increase widespread access to clean water by creating reliable, sustainable, and affordable seawater desalination systems, is pleased to collaborate with the Membrane Society of Australasia to connect seawater desalination researchers and innovators across Australasia with this historic $119 million competition - the largest water prize in history!

Don’t miss your chance to compete in the XPRIZE Water Scarcity Track A - the deadline to register is March 31, 2025!

💧 How You Can Compete:

Track A - Desalination: System-Level Innovation challenges teams to rethink the desalination system; the winning team will reliably and most sustainably generate one million liters of potable water per day (1,000 m3/d) from seawater at the lowest cost, below current industry benchmarks, over the course of 1 year. Don't have a complete team or system yet? No problem, we encourage collaboration amongst teams - register now to meet and network with other participating teams!

Track B - Desalination: Novel Materials and Methods, will demonstrate a novel material and/or method that can sustainably and cost-effectively treat seawater to potable water quality, using any salt-water separation technique, with an operational lifetime of 10 years or more.

Questions? Contact us: waterscarcity@xprize.org.

Interview with Prof. Vicki Chen

Prepared by: Javad Farahbakhsh, Milton Chai, Mehdi Khiadani

In this newsletter, A/Prof Amir Razmjou interviews Prof Vicki Chen, discussing her background, academic journey and research in membrane technology. Prof Vicki Chen is one of the leading chemical engineers specialising in membrane science with over 25 years of research experience. She was executive dean at the University of Queensland and head of the school of Chemical Engineering at UNSW. She has also contributed significantly to the field through her directorship at the UNESCO Centre for Membrane Science and Technology at UNSW, and her publications in top journals in membrane science. Currently, she is UTS's Provost and Senior Vice-President.

Left: A/Prof Amir Razmjou Right: Prof Vicki Chen

Amir: Hello, Professor Vicki Chen. Thank you very much for the opportunity. It is great to have you here.

Vicki: Thank you very much. It is a pleasure to be part of this interview and MSA. I appreciate the opportunity.

Amir: Great, for the start, I would like to know if you could share a bit about your background?

Vicki: Certainly. I was born in Taiwan, but my parents immigrated to the U.S., and I grew up in a small town in Tennessee. I joke that I once had an accent like Dolly Parton! Later, I attended MIT as an undergraduate in chemical engineering. My father was also a chemical engineer, which influenced my decision to enter the field. I loved the interdisciplinary nature of chemical engineering, as it allowed me to combine biology, math, and practical problem-solving.

Amir: When did you start at MIT?

Vicki: I started at MIT in 1979. It was an interesting time, as the energy crisis was ongoing. Initially, I thought I would end up working for a big petrochemical company, but by the time I graduated, the field was evolving. Chemical engineers were moving into pharmaceuticals and high-tech industries like semiconductors.

Amir: What about your PhD?

Vicki: I pursued my PhD at the University of Minnesota between 1983 and 1988. During that period, surface and colloidal science was undergoing significant transformations. People started measuring surface forces and understanding intermolecular interactions. Although I was in the chemical engineering department, my supervisor was a physical chemist, which gave me strong exposure to colloid and surface chemistry.

Amir: Did you focus on membranes for your PhD?

Vicki: Interestingly, no. However, I was always fascinated by membranes, partly because my father's PhD involved hollow fiber research.

Vicki: Plus, my colleagues at Minnesota were working on membranes, which kept me engaged with the field. To be honest, I really wanted to do membranes as a PhD student, but ended up not.

Amir: When did you move to Australia?

Vicki: In August 1988, right after my PhD. My husband is Australian, so we relocated to Sydney. I contacted Professor Chris Fell and Professor Tony Fane, which led to research opportunities in membrane science. I often tell people that my journey into academia was quite accidental. During my PhD in the U.S., most chemical engineering HDR students pursued careers in industry, with very few considering academia. However, when I came to Australia, I found the career pathway to be quite different, as the country lacked a large petrochemical industry.

Amir: What was your first role at UNSW?

Vicki: I started as a postdoctoral researcher in the membrane research group. At the time, the UNESCO Centre for Membrane Science and Technology was one of the first Centers of Excellence. I worked with Tony Fane and Chris Fell on protein filtration, particle filtration, and surface modifications.

Amir: When did you secure a permanent academic position?

Vicki: In 1996, I became a lecturer at UNSW. My transition to academia was somewhat accidental. Initially, I was focused on research, but Tony Fane asked me to cover a fluid mechanics and pumps course for a colleague on sabbatical. That teaching experience made me realise I enjoyed academia.

Amir: Interesting, when did you become the Director of the UNESCO Membrane Centre?

Vicki: Around 2006, I believe. Around the same time, I was promoted to full professor.

Amir: You later became Head of the School of Chemical Engineering at UNSW and then Dean of Engineering at the University of Queensland. When did those transitions happen?

Vicki: I became Head of the School of Chemical Engineering at UNSW in 2014, serving in that role for nearly four years before moving to the University of Queensland in 2018 as Dean of Engineering, Architecture and IT. In 2022, I joined UTS in my current position.

Amir: What are some of the most exciting or unexpected findings in your membrane research?

Vicki: One of the most exciting discoveries was related to superhydrophobic membranes. The project started due to inconsistencies in the literature on the addition of titanium particles to membranes. Some reports suggested it was a photocatalytic effect; others mentioned the topology effects. We wanted to resolve this and understand it better. It turned out to be more complex than we initially thought, but this work led to new insights into nanocomposite membranes and how roughness impacts them. We developed hybrid inorganic-organic composites with superhydrophobic properties. This work later evolved into the development of Janus membranes with dual superhydrophobic and hydrophilic surfaces.

This research had a significant impact, especially when I applied for the ATSE fellowship. One of the referees, an editor from *Journal of Membrane Science*, highlighted that our work changed how researchers approached membrane modification for superhydrophobicity, emphasising the role of surface topology and chemistry.

Vicki: This was a crucial contribution and made others rethink how altering surface architecture could result in entirely different behaviours, which was a shift from the traditional use of superhydrophobic polymers.

Looking back, this work spurred many of the advancements we have made in the last 20 years, including work on membrane distillation, surface coatings, and enzymatic processes. More recently, our research on metal-organic framework membranes complements this earlier work, and it is exciting to see how all these efforts connect and build on each other.

Amir: Amazing, I know that your superhydrophobic membrane research has been highly cited.

Vicki: Yes, that is right. I believe we have validated that this is perhaps one of the most exciting outcomes of our work.

Amir: Many early and mid-career researchers struggle with securing funding and permanent positions. What advice do you have for them?

Vicki: My first research grant was only $5,000, so I understood the challenges firsthand. I would suggest **starting small** by leveraging available resources and focusing on attracting students to support your research. It is also crucial to **diversify your funding sources**, as relying solely on government grants can be risky. Seek out industry collaborations and smaller funding opportunities to ensure financial stability. Engaging in these opportunities can be particularly challenging for early-career researchers (ECRs) because, unlike someone with an established research group who may have the capacity to take on extra tasks, ECRs often do not have that luxury.

Vicki: These smaller activities are essential for developing the skills necessary to communicate effectively and enhance your grant writing. One key aspect of this is honing your **communication skills**, particularly when writing grant proposals. I always tell people that the first paragraph of a grant is crucial; it should clearly articulate the significance of your research. **Building networks** is another important key, so engage with peers at conferences and professional organisations to expand your connections. Since the academic job market is highly competitive, it is wise to **think globally** and consider opportunities abroad. **Gaining teaching experience** will also improve your presentation skills, making you more versatile in academia.

Amir: Where do you see future opportunities for academic positions in Australia?

Vicki: It is becoming even more competitive. One of the challenges we might face is the potential constriction in funding, whether it is through government sources or international student fees. This could make opportunities for research-only tracks extremely limited. However, if we can maintain a solid ability to sustain both domestic and international students, we may still manage to create a steady flow of balanced academic positions. Last year, the higher education sector was significantly disrupted, and many vice chancellors mentioned they have never seen as much change in the past 10 to 15 years due to shifts in federal government policies, visa regulations, and other factors.

Flexibility will be key in navigating these challenges. People may need to consider moving abroad, shifting between cities, or taking different roles as opportunities emerge. Timing is crucial, and you can't just wait around for something to open up.

Vicki: You must actively position yourself to understand the available opportunities and be proactive. I also encourage researchers to seek teaching opportunities. No matter your focus, whether it is research-only or teaching, you will likely transition between these roles at some point. Having teaching experience as part of your skill set is valuable. It contributed significantly to my development as a better scientific and research presenter. Being open to different paths and keeping your options flexible will be essential.

While there might not be a complete lack of opportunities, the mix will change. Currently, the narrative is increasingly focused on impact and translation. Even if you are doing fundamental research, you will need to frame your work in a way that demonstrates its potential impact, as the emphasis is on how research can translate into real-world outcomes.

Amir: What is your advice for ECRs and MCRs who want to build their portfolio with publications and citations, but also aim to move towards commercialisation and entrepreneurship?

Vicki: The transition to commercialisation can happen at different stages in your career, It is not always a choice between one or the other. If you are aiming for commercialisation, it is important to learn the language of industry, as that will benefit you whether you stay in academia or pursue commercialisation. Keep in mind that commercialisation is a long-term commitment, often taking years, and it may be challenging to return to a traditional academic path afterward. However, universities are becoming more open to people who have experience in industry. If you do transition to industry, maintaining some degree of publication, especially **quality over quantity**, is crucial if you wish to return to academia. Whether in academia or industry, there is an increasing emphasis on the quality and impact of your publications.

Vicki: In promotions and evaluations, for example, the focus is on the impact of your work and your role in those achievements, not just the number of publications. Even those pursuing commercialisation should aim to keep producing high-quality research.

Amir: Alright, let us talk about the future of membrane science. Where do you see membrane research heading?

Vicki: The areas of energy and sustainability will continue to be important, but they will evolve. Water will still be crucial, with a focus shifting to issues like **PFAS and emerging contaminants**. Energy will remain a key area, and it is important to consider how membranes fit into energy applications such as **battery separators, hydrogen generation**, and more. As the demand for both water and energy continues to rise, these fields will remain vital, though they may take new forms. These major areas will endure but adapt to emerging issues. Finally, **advanced materials** will be important, though large-scale adoption remains a challenge.

Amir: Now, let us move on to our rapid-fire question part. If you were not a scientist, what career would you have chosen?

Vicki : Architecture or economic history.

Amir : Best advice you ever received?

Vicki : A senior colleague once asked me, “Have you thought about being an academic?” That moment shaped my career.

Amir : Coffee or tea?

Vicki : Coffee in the morning, tea for the rest of the day.

Amir: If you could live in one city forever, which would it be?

Vicki : Sydney, it is multicultural and has great weather.

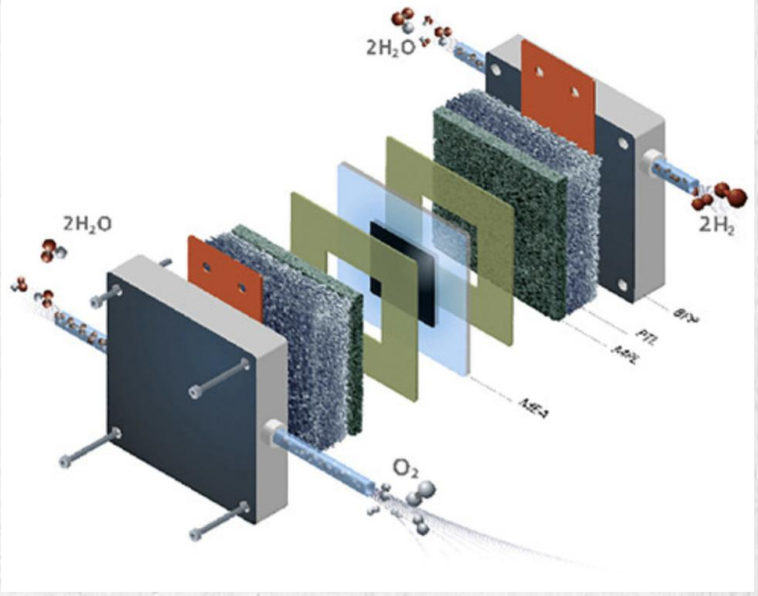
High-Durability AEMWE Systems for Hydrogen Production at Ultrahigh Current Densities

By: Hoseong Han and Mehdi Khiadani

The global demand for hydrogen has steadily increased due to its potential as a reliable energy resource. In 2023, the global hydrogen market was valued at approximately 170.14 billion US$, with projections indicating a compound annual growth rate (CAGR) of 9.3 % from 2024 to 2030, reflecting its growing significance in energy generation, storage and transportation.

Water electrolysis (WE) offers the advantage of producing high-purity hydrogen while simultaneously generating it in a partially compressed state. Anion-exchange membrane water electrolysis (AEMWE) is increasingly recognised as a cost-effective alternative to both proton-exchange membrane water electrolysis (PEMWE) and conventional electrolysis. However, among these technologies, AEMEW remains the least mature and requires significant technological advancements before it can be implemented.

Current state-of-the-art AEMWE systems typically operate at current densities below 3 A/cm^2. However, the associated cost increases logarithmically at low current densities, transitioning to a linear increase at higher current densities. Operating WE at current densities exceeding 3 A/cm^2 is challenging due to operational factors, material performance, and system design. Y. Zheng *et al.* significantly enhanced gas, liquid, and ion transport at the three-phase interface of AEMWEs, leading to the high durability of over 800 hours of operation at 10 A/cm^2. Using the Branion b-PTP AEM from NovaMea significantly improved the lifetime, achieving 23 h at 10 A/cm^2, whereas the commercial Sustainion X37-50 (grade RT) AEM lasted only 6 s. Additionally, the incorporation of anion exchange ionomer (AEI) Sustainion XB-7 and cation exchange ionomer (CEI) at the anode extended the lifetime to 54 h. Replacing the anode catalyst-porous transport layer (PTL) from nickel form to nickel felt further enhanced the lifetime to over 140 h while maintaining a similar cell voltage of approximately 2.54 V. Moreover, the forming of a three-dimensional (3D) structure improved charge and mass transfer, resulting in an exceptional lifetime of 850 h at 10 A/cm^2 and a reduced cell voltage of ~2.3V.



Schematic illustration of the AEMWE cell configuration (Source).

High-Durability AEMWE Systems for Hydrogen Production at Ultrahigh Current Densities

These results outperform state-of-the-art AEMWEs, which typically exhibit lifetimes of around 1000 h or less, with cell voltage in the range of 2 ± 0.3 V at current densities of 1 – 3 A/cm^2.

The CEI significantly enhanced the system's performance, but it may need to be replaced due to the environmental and regulatory restrictions on Nafion. Nevertheless, this study establishes the foundation for developing an ultrahigh current density AEMWE system, with a remarkable improvement in lifetime – surpassing the benchmark example by over 500,000 times. As renewable energy sources continue to become more affordable, AEMWEs could play a key role in the cost-effective production of hydrogen. Addressing durability challenges could unlock their full potential, with significant progress expected in the coming years.

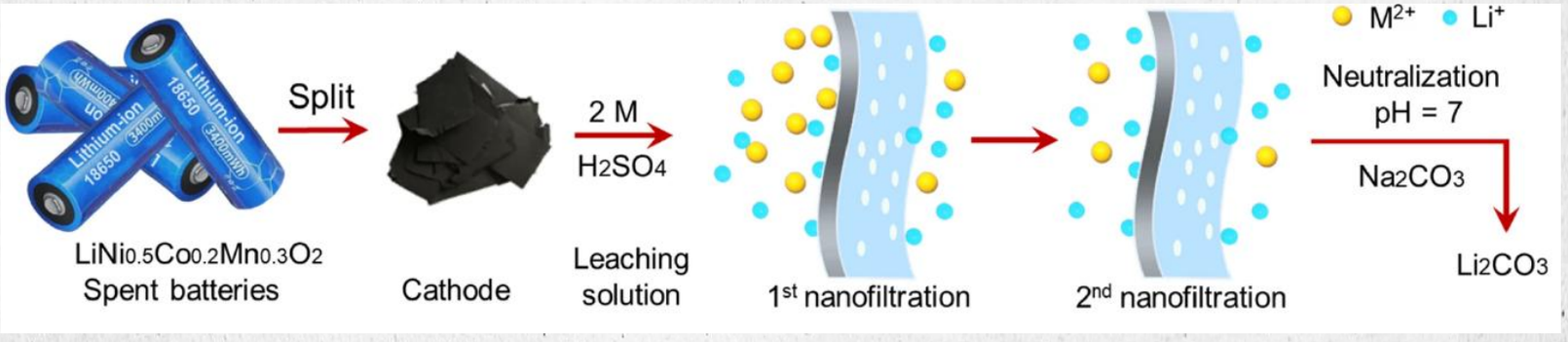
Membranes Redefining Ion Separation in Extreme Environments

By: Amin Sarmadi and Mehdi Khiadani

In a transformative leap for sustainable resource recovery, Yafei Su et al. unveiled a cutting-edge nanofiltration membrane that separates ions under extreme pH conditions. Published in Nature Communications in November 2024, the study introduces the TAD-TBMB Thin Film Composite Membrane (TFCM), which is engineered to resist degradation in concentrated acids and bases—conditions that typically compromise conventional membranes. This advancement has significant implications for industries such as battery recycling, metallurgy, and wastewater treatment, where reliable ion separation is required in aggressive chemical environments (source).

Efficient ion separation in environments with pH levels below 0 or above 14 is essential for processes like lithium recovery from spent batteries. With roughly 250,000 tons of spent lithium-ion batteries discarded annually, environmental concerns and potential lithium shortages are increasingly pressing, as demand is expected to exceed current mining capacities by 2040. Traditional recycling methods, including pyrometallurgy and hydrometallurgy, are energy-intensive and depend on inefficient neutralisation processes or the use of organic solvents. Furthermore, conventional polyamide-based membranes, which perform well within a pH range of 2–11, are unsuitable for these harsh conditions due to amide bond hydrolysis, rendering them ineffective for separating ions such as Li^+, Ni^{2+}, Co^{2+}, and Mn^{2+} from acidic leachates containing 2–3 M H_2SO_4 (source).

The TAD-TBMB TFCM overcomes these limitations through an interfacial quaternisation reaction between 1,4,7,10-Tetraazacyclododecane (TAD) and 1,3,5 Tris(bromomethyl)benzene (TBMB), which



Schematic illustration of Li_2CO_3 extraction from a representative spent battery ($LiNi_{0.5}Co_{0.2}Mn_{0.3}O_2$) using a leaching solution containing 2 M H_2SO_4 with an ion concentration of 6.2 g L^{-1} (source).

Membranes Redefining Ion Separation in Extreme Environments

forms stable C–N bonds that are resistant to chemical degradation. The membrane demonstrates a permeance of 11.3 L m^{-2} h^{-1} bar^{-1} and achieves a 97% rejection rate for cobalt ions in 2 M H_2SO_4, surpassing many current alternatives. Notably, it retains its performance after 70 days of immersion in 3 M H_2SO_4, HNO_3, HCl, or 3 M NaOH—15 times longer than the commercial benchmark MPS-34. In continuous filtration tests with actual battery leachates (2 M H_2SO_4, 6.2 g L^{-1} ions), the membrane maintained its stability for 30 days (as shown in the schematic). In practical applications, the membrane significantly enhanced lithium extraction from spent $LiNi_{0.5}Co_{0.2}Mn_{0.3}O_2$ batteries. A two-stage nanofiltration process utilising the TAD-TBMB TFCM increased lithium purity from 13.6% to 98.9%, producing Li_2CO_3 with 99.1% purity—a critical component for new battery production. This efficiency and durability suggest that the membrane could be transformative for sustainable resource recovery (source).

Moreover, the technology holds promise for acid recovery in metallurgy and the treatment of acidic wastewater in the paper industry, where conventional membranes are inadequate. Testing with different types of lithium-ion batteries, such as LFP batteries, is crucial and can lead to different results because their varying chemistries lead to different leachate compositions. Although challenges such as scaling production and validating long-term durability beyond 70 days remain, the development of this membrane highlights the potential of advanced materials to address sustainability challenges and enhance resource recovery processes (source).

Interview with Neil Palmer: A Journey Through Water Treatment & Desalination

Prepared by: Yasamin Hamidian, Shayan Abrishami, Milton Chai

We had the pleasure to interview Neil Palmer, who is very well known throughout the global water and desalination industry sectors. He has over 40 years of experience in the water industry in Australia covering both public and private sectors. He is currently the Chief Technology Officer at Osmoflo.

Left: A/Prof Amir Razmjou Right: Neil Palmer

Amir: Hi Neil, can you please tell us about your professional journey to reach your current position?

Neil: I'm a civil engineer with a master's degree in engineering science from the University of New South Wales. I originally graduated from the University of Adelaide 50 years ago, in 1975.

I spent about 20 years with Government in the South Australian Engineering and Water Supply Department, and then a further three years with the Environment Protection Authority as Senior Wastewater advisor. In 1989-90, I spent two years working in Fiji under an Australian staffing assistance scheme, operating the Suva sewerage system.

In 1997, I joined United Utilities (formerly North West Water), moving from the government to the private sector. In 2008, I joined Osmoflo, then left in 2010 to become the Chief Executive of the National Centre of Excellence in Desalination based at Murdoch University in Perth. In 2016, I joined Tonkin Consulting and then returned to Osmoflo in 2020 as Chief Technical Officer.

At Osmoflo, I focus on innovations, research and development, membrane research and project support. Osmoflo has about 300 employees worldwide (about 200 in Australia) and has built more than 600 desalination plants in 35 years. Our largest plant was in Barka, Oman, at 57 megalitres per day. We're currently designing a 30 megalitre per day seawater plant for Hunter Water Corporation and a 24 megalitre per day plant for Rio Tinto in Western Australia.

Amir: When did you first encounter membrane technology?

Neil: In 1999, we were invited to submit a proposal by Queensland Nickel Industries in Townsville. We hadn't done one before and bid it somewhat casually, but our bid was accepted.

We built what I believe was the first dual membrane plant in Australia, with 12 megalitres per day capacity. It treated tailings water from the nickel refinery and recycled it back to the front of the plant. The system used Memcor microfiltration, and a pioneering desalination system from overseas, which was assisted by an electromagnetic field to minimise scaling.

Though the anti-scaling system didn't work as expected, we had to augment the plant and eventually got it operating the required flow at 87% recovery. It was a rewarding project because we took ordinary wastewater from tailings ponds and recycled it as high-quality water, reducing dependence on the local bore field and stopping environmental discharge into Halifax Bay.

Amir: What has been the most exciting or significant membrane-related achievement during your career?

Neil: The most exciting development I've seen has been membranes with printed brine spacers. These are 3D printed dots fused onto the surface of the polyamide membranes. They create a much smoother passage for water flow, which minimises concentration polarisation, reduces driving pressure, makes cleaning easier, and allows more membranes to fit into an eight-inch module. We've installed them on plants with difficult feed water with excellent results.

This innovation by Aqua Membranes is one of the biggest developments since we changed from cellulose acetate to thin film composite polyamide membranes about 40 years ago.

Another significant advance was when the industry standardised on eight-inch (200mm) membranes, which made membranes into commodities and forced manufacturers to compete on performance and price. As a result, some desalination plants in the Middle East can now produce water for all-inclusive cost of less than 40 cents USD per cubic meter.

President Kennedy made a bold statement in 1961 that "…if we could convert seawater to freshwater cheaply, it would dwarf every other scientific accomplishment…" Along with his commitment that the US would send a man to the moon within a decade, this has happened —membrane development has transformed cities like Perth that now heavily depend on desalinated water due to climate change.

Amir: What was the biggest challenge you encountered during your career in membrane technology?

Neil: Commercially, our biggest challenge was with the Queensland Nickel plant—our company's first desalination project. It featured a patented anti-scaling system that ultimately didn't work as intended. We also pioneered using 15-inch membranes instead of standard 8-inch ones which were challenging to handle because they were very heavy.

The subcontractor responsible for building the plant was not able to pass the performance tests. It was about a $20 million project, and it cost an extra $10 million to expand the plant to produce the warranted capacity.

We eventually had to use conventional anti-scaling methods to achieve 87% recovery. Had we not been able to restore the plant to meet our warranted capacity, the penalties would have run into many millions of dollars with damage to our reputation.

Despite these challenges, the plant was ultimately profitable, and the project had significant environmental benefits. More importantly, it introduced me to key figures in the industry, including David Furukawa, then president of the International Desalination Association, who connected us with other significant people in the field.

Amir: What advice would you give to early or mid-career researchers about building bridges between academia and industry, particularly for securing funding?

Neil: The more I progress in life, the more I

realise relationships are important. Early career researchers should join industry bodies like the Australian Water Association or the Membrane Society of Australasia—but don't just join them. Volunteer to be on organising committees to get to know people and have them get to know you.

For developing new ideas into commercial reality, there's what they call the "Valley of Death," where you need investment to demonstrate a process, but investors want proof it works first. Government programs like Australian Research Council grants and Cooperative Research Centres are designed to bridge this gap.

We're currently partnering with Flinders University on a biofilm research project and supporting a PhD student. Getting industry partners is always a challenge, but relationships are crucial in persuading companies like Osmoflo to invest.

When people approach me with ideas seeking investment, I ask two key questions:

1. Where is your pilot plant operating?

2. Can I speak with the operator?

Operators are fearless in giving honest advice about whether something works. Early career researchers should consider attending Water Industry Operators Association conferences to learn and make valuable industry contacts.

Amir: What qualities or skills do you believe are essential for graduates to succeed in companies like Osmoflo?

Neil: First, I look at their experience to assess if they're intelligent and capable. Second, I consider their work or research experience. PhDs or those with advanced degrees typically know how to act professionally, work hard to meet deadlines, and can communicate effectively both in writing and presentations.

Personally, I love to hire PhDs. They hit the ground running, though not all Australian industry shares this view.

Beyond technical capabilities, I look at what else they do besides work. Involvement in clubs, sports, music groups, or volunteer work tells me about their character, persistence, and ability to work in a team without necessarily being paid. These experiences also help when interacting with important people who may decide whether to fund your project.

Amir: If you weren't an engineer, what career would you have chosen?

Neil: I love music, so I might have become a music teacher.

Amir: What is the best piece of advice you have ever received?

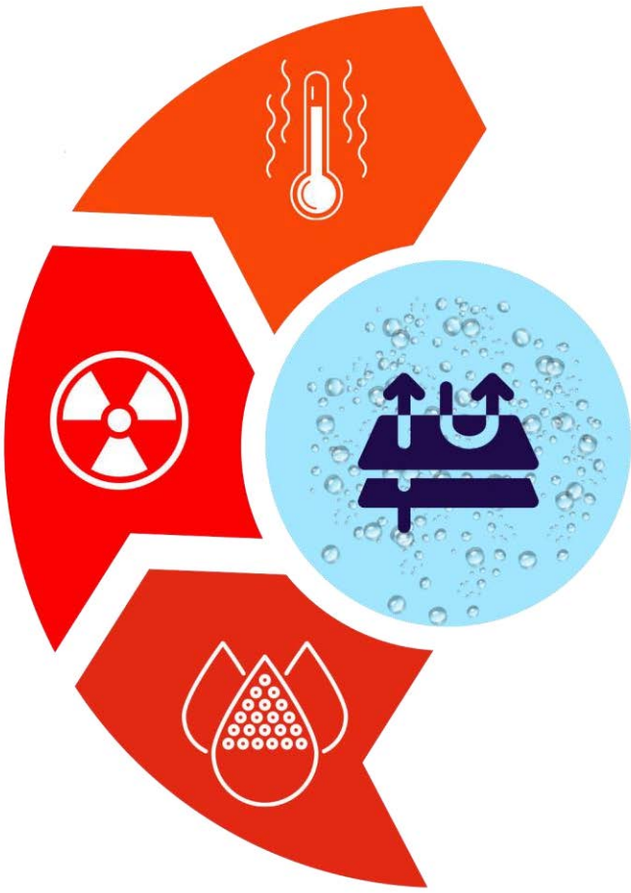
Neil: It's summed up in a statement: Never attribute to malice that which can be attributed to stupidity. Often you get angry when people have said something, but it's usually not because they are nasty, it's because they made a mistake or something hasn't been clarified.

Amir: What is one word that you would use to describe your R&D journey in the industry setting?

Neil: Curiosity.

MEMBRANES IN HARSH CONDITIONS

By: Mahsa Golmohammadi, Milton Chai



High Temperature

- **Effects:** Polymer degradation, thermal expansion
- **Solutions:** Ceramic membranes, heat-resistant polymers
- **Practical application:** Geothermal brine treatment, Steam processing, Hot industrial wastewater treatment.

Radiation

- **Effects:** Chain scission, cross-linking
- **Solutions:** Radiation-resistant materials, shielding layers
- **Practical application:** Nuclear waste treatment, Radioactive material processing.

High Salinity

- **Effects:** Concentration polarization, Scaling/precipitation, High osmotic pressure, Membrane degradation, Reduced permeability
- **Solutions:** Anti-scaling agents, High-pressure operation, Flow optimization, Surface modification
- **Practical application:** Seawater desalination, Lithium brine processing, Oil and gas produced water.

High Pressure

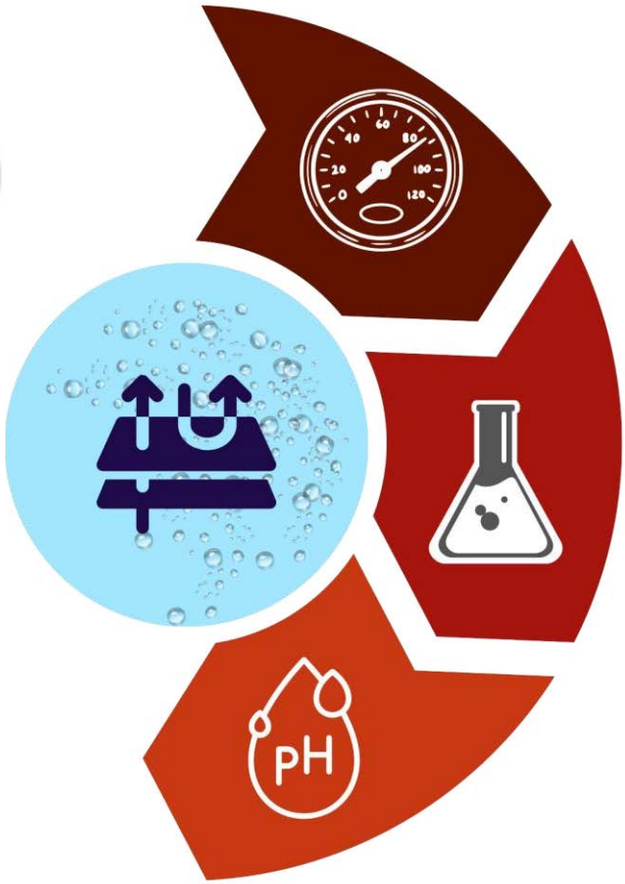
- **Effects:** Membrane compaction, mechanical stress
- **Solutions:** Composite materials, reinforced structures
- **Practical application:** Reverse osmosis desalination, Deep-well injection, High-pressure gas separation

Chemical Exposure

- **Effects:** Chemical degradation, surface modification
- **Solutions:** Chemical-resistant materials, surface treatments
- **Practical application:** Chemical processing plants, Mining operations, Industrial cleaning processes.

Extreme pH

- **Effects:** Hydrolysis, structure changes
- **Solutions:** pH-resistant materials, protective layers
- **Practical application:** Metal processing, Acidic mining effluents, Alkaline cleaning processes.



The Future Path of Generative AI in the Membrane Industry

By: Shokat Akbarnezhad, Milton Chai

This article is based on a presentation by Markus Guerster, the founder and CEO of Mount Blanc AI, where he explored the role of Generative AI in manufacturing, with a special emphasis on membrane filtration equipment.

Understanding Generative AI and Its Future

ChatGPT, a form of Generative AI, has quickly become well-known. To put it into perspective, while platforms like Spotify took about six months to reach one million users and Instagram took three, ChatGPT hit one million users in just five days.

However, Generative AI is more than just ChatGPT. It's a subset of narrow AI that generates content like text, images, music, voice, and videos. It is important to note that AI isn't here to replace humans. Rather, I see it as a tool to enhance human capabilities and productivity.

Think of the relationship between a gardener and their tools. The invention of tools like a shovel didn't replace the gardener; rather, it enhanced their ability to work efficiently, allowing them to achieve results that would be impossible with just their hands. AI works in a similar way. It is a tool designed to process large volumes of data, automate repetitive tasks, and even learn from experience.

Just as a shovel cannot determine where to dig, AI depends on human guidance. Humans set the objectives, supply the data, interpret the results, and make the final decisions. While AI may change the nature of certain jobs,

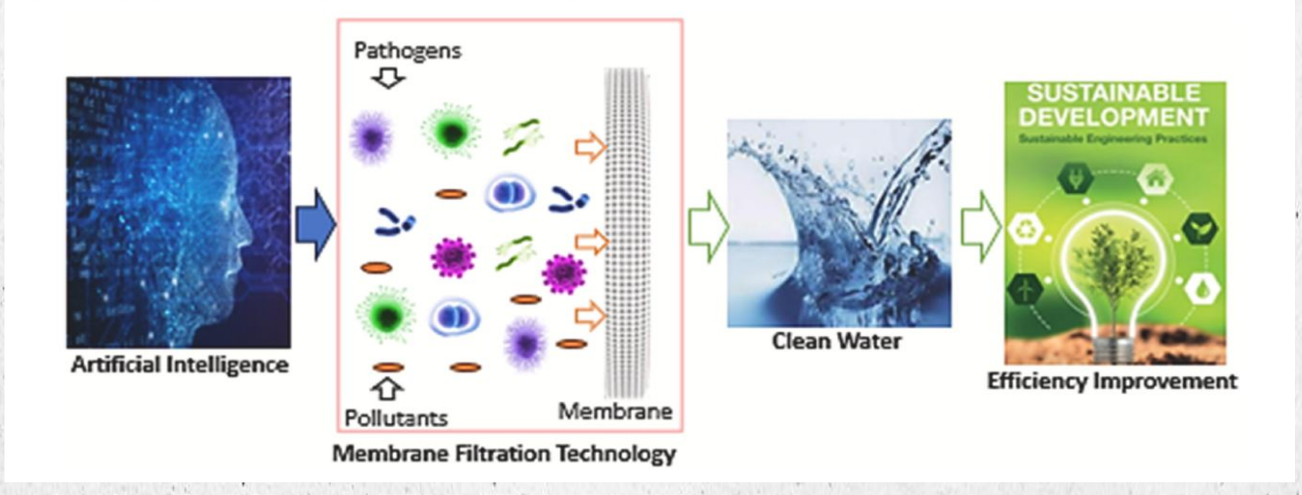


Fig. 1. Artificial intelligence tool using membrane process for wastewater treatment [source].

much like the shovel altered gardening, it doesn't eliminate the need for human judgment, creativity, understanding, and empathy. Like a gardening tool, AI is unlocking new opportunities for innovation and growth.

AI is a permanent part of our world. Although the concept dates back to the 1960s, we are currently experiencing a new era of AI that has been evolving over the past 15 years. Several factors are driving this progress, including the availability of large datasets, significant computational power, breakthroughs in machine learning, and substantial global investments from governments, universities, the public sector, and private enterprises.

Generative AI in the Industrial Context: A Game-Changer

A recent study by IoT Analytics reveals that AI is a key focus for CEOs, with topics like Generative AI, ChatGPT, conversational AI, and Industry 4.0 gaining increasing attention. But what can AI truly offer industries? The key to unlocking its potential lies in combining large public generative AI models with industrial data. This fusion opens up numerous applications across four main areas: Sales and Marketing, Product Development, Supply Chain Optimisation, and Operations.

These sectors present great opportunities for companies looking to experiment with AI, marking the beginning of the Generative AI era. Understanding and leveraging its potential is crucial for staying competitive. Additionally, generative AI can assist in troubleshooting by helping identify the root causes of issues. Once pinpointed, these issues can be addressed to prevent future failures.

Case Study- AI-Driven Optimisation in Dairy Farm Membrane Filtration

For instance, consider a dairy farm operation processing up to 2 million liters per day using membrane filtration equipment for protein separation. The farm faced challenges related to resource allocation and the validation of its Cleaning-In-Place (CIP) process.

By connecting to their S7 PLCs and streaming over 200 data points into AI algorithms, Markus and his team processed more than a billion data points. The results were promising validating over a thousand cleaning cycles, optimising resource usage, and improving batch durations.

Wondering how to implement AI in your organisation? Consider these three key steps:

1. **Generate Value for the Business:** Start small and experiment with low-cost AI initiatives. This approach will allow you to quickly realise value and expand its impact across the organisation.

2. **Acquire Knowledge**: While AI tools like GPT are easy to use, integrating them with your data can be complex. Stay updated, attend training, and engage with multiple vendors to find the best solutions.
3. **Ensure Security and Privacy**: Ensure everyone understands proper AI usage. Choose the right vendor with strong privacy and security practices to safeguard your organisation's data.

Lastly, keep experimenting. The cost is minimal, and you may be amazed at the innovative solutions your team can create when provided with the freedom and the right tools.

Markus Guerster's Vision for the Future of AI in Industry

As we conclude, I want to share my vision for the future of AI in industry. When I finished my PhD and entered the workforce, I had an idealistic belief that data would be readily available, well-organised, and easy to work with, leaving most of the focus on algorithm development. However, my experience in the industry revealed the chaotic reality: data is often scattered across different systems like MES, ERP, and PLCs, making it difficult to trace crucial information, especially when solving issues like customer complaints. This situation often feels like navigating a maze of disconnected systems. My vision for the future is a unified system where AI allows users to easily access information by simply asking questions, much like I did with GPT. AI would integrate data from all sources and provide clear, useful answers in real time. For example, a user could ask about the status of a machine, and AI would respond with an update on its operations and any issues. In this scenario, AI acts as a tool that handles the heavy lifting behind the scenes, gathering and organising data to present it in a meaningful way. The human user still makes the final decisions, but AI makes the process more efficient. (Source)

Veolia and Mistral AI Partner to Drive Ecological Transformation with Generative AI for Resource Efficiency

The collaboration between Veolia and Mistral AI underscores the growing role of generative AI in advancing resource efficiency, which resonates with the potential transformations in the membrane industry. By integrating AI for real-time decision-making in industrial operations, this partnership exemplifies how generative AI can enhance sustainability and optimise processes such as water management and waste sorting. This aligns with the ongoing shifts in industrial technologies, demonstrating the future path of generative AI in optimising operations and driving ecological transformations, much like its potential impact on the membrane industry.

“This partnership with Mistral AI marks a decisive step in our commitment to accelerate innovation and better respond to all the challenges caused by global warming. In line with the GreenUp strategic plan, Veolia plans to increase the efficiencies brought about by digital and artificial intelligence in particular to optimise its customers' water and energy consumption, waste sorting and recycling, and strengthen predictive maintenance.

By integrating generative artificial intelligence into the management of our sites and industrial processes, we are strengthening our ability to innovate and optimise our know-how in order to decarbonise, depollute and regenerate resources.” - **Estelle Brachlianoff, CEO of Veolia.**

“This partnership highlights how GenAI can help make plants smarter. Over the past few years, plants have increasingly integrated digital sensors and tools. Our models enable these rich data streams to provide more valuable insights for operators and Veolia's customers, contributing to accelerate Veolia’s mission to drive ecological transformation.**”** - **Arthur Mensch, CEO of Mistral AI.**

(Source)

Upcoming Membrane Events

CURRENT EVENTS	DATE OF EVENT	ABSTRACT SUBMISSION
NAMS 2025 Tennessee, USA https://www.membranes.org/nams-2025	17 – 21 May 2025	**Closed**
7th International Conference on Desalination Science and Technology 2025 (DESAL 2025) Florida, USA https://www.elsevier.com/events/conferences/all/desalination-science-and-technology	16 – 19 November 2025	**6 June 2025**
12th International Membrane Science and Technology Conference (IMSTEC 2025) Queensland, Australia https://www.imstec.com.au/	8 – 11 December 2025	**1 May 2025**

MSA Newsletter Taskforce

Meet our newsletter team for this March edition!

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(Newsletter Coordinator and Editor)

Dr. Milton Chai
(Associate Editor)

A/Prof. Mehdi Khiadani
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Dr. Shiyang Huang

Dr. Hoseong Han

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Shayan Abrishami

Yasamin Hamidian

Amin Sarmadi