Ushering In the Lunar New Year

A word from the Executive Director

I am very proud to share with you our first NEWRI newsletter for 2019. We are disseminating our updates with all of you as we celebrate the Lunar New Year (aka Chinese New Year). For me, the Lunar New Year will forever be special as it marks my anniversary of joining NEWRI. Indeed, I have now had the honor of serving as the Executive Director of NEWRI for one year. The time has gone by far too quickly and I have enjoyed working with the NTU and NEWRI teams immensely!

Beyond the numerous science and engineering achievements, some of which are highlighted in this newsletter, I am proudest of the amazing team of people we have at NEWRI. Together, we are a team of more than 300 people with diverse expertise and experience. As one of the newest members of the team, I must express my sincere gratitude for all the NEWRI team members who helped be through this challenging transition. Though the hours are long and the workload arduous, knowing that every member of our large team is working diligently to see NEWRI thrive is inspirational. The key to NEWRI’s continued success truly is the cohesiveness of our team along with the great support of NTU, the Singapore government entities, and our industrial partners.

In 2019, we plan to break ground on new projects that will transform the water and environment industries, while providing increased sustainability for our own community. For instance, we were recently awarded a grant to build a prototype food waste to energy treatment system at one of our canteens on the NTU campus. We also recently began full-scale operations of our unique gasification R&D testbed, which converts essentially 100% of the mixed solid waste from NTU to energy and inert recyclable materials. With regional changes in plastic waste handling, NEWRI technologies ability to convert mixed plastic waste to carbon nanotubes and other valuable products is gaining very rapid industrial and governmental interest. This year, NEWRI will open one of the first bioanalytical analysis facilities in Asia, capable of monitoring air, water, soil, and other environmental matrices for a variety of toxic endpoints using the latest generation of genomic, proteomic, and metabolomic techniques.

We also look forward to our community engagement and translation of our technical expertise. Enabled by the Lien Foundation and the government of Singapore, NEWRI will expand our reach of enabling underserved/developing communities in our region with safe water, sanitation, and/or renewable energy solutions. Within Singapore, we look forward to the development of a demonstration-scale net zero water campus testbed at NTU. With the support of Singapore government entities such as PUB and NEA, along with our industrial collaborators, and the diverse/cross-cutting expertise from all NEWRI centres, we intent to embark on the world’s first net zero water campus.

Without question, 2019 is going to be a very busy year with unparalleled opportunities for NEWRI and our partners. In closing, I feel deeply honored and humbled to work alongside some of the most tenacious and magnanimous faculty, staff, and students in the world. While benefiting from the most absolute state-of-the-art equipment and facilities, it is the people of NEWRI that make us among the world’s best in our water & environment Research, Engineering, and Deployment (RED) capabilities. It is with deep sincere gratitude that I enter into my second year at NEWRI, and not a single day passes that I do not feel privileged to be a part of this team! I wish each and every one of you a very happy and prosperous new year. Gong Xi Fai Cai!

Sincerely, Prof Shane Snyder

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Welcome to NEWRI!
NEWRI UPDATE – JANUARY 2019

Executive Director’s Note
Wishing all a happy and prosperous Lunar New Year

Future of Environmental Monitoring
The Future of Environmental Monitoring: In Vitro Bioassays to Evaluate Water Samples of Unknown or Complex Composition

Membrane Science & Technology 2019
14th International Conference of Membrane Science & Technology 2019

A Closer Look at our Analytics
TEM, CLSM, FESEM

Technology Highlight
Evaporometry (EP) for determining the pore-size distribution and Liquid Displacement Porometry (LDP) reading at a lower cost.

Philanthropy Efforts
Updates from our CSR front

Events & Seminars
Catch up on the events and seminars from NEWRI

Main Feature
Singapore’s first waste to energy research facility @ Tuas South

Relooking at Upcycling Plastic Waste
Upcycling plastic waste into value-added carbon nanomaterials

Global Exposure
InnovFest Suzhou 2018

An Interview with Asst Prof Zhou Yan
We interview one of NEWRI’s rising talents in wastewater treatment – Assistant Prof Zhou Yan

Publications Focus
Highlighting progress in polymer science and how it affects water treatment: Fabrication, modification and applications

New Faculty Leadership @ NEWRI
Meet our new additions in NEWRI

Student Life
NEWRI students share their thoughts
MAIN FEATURE

ALL SYSTEMS GO for the WtE Research Facility @ Tuas South

NEWRI reached a major milestone in its waste-to-energy research facility project on the 17th of January 2019. The technology provider and the EPC contractor for the project, JFE – a leading player in slagging gasification – held a handover ceremony on that date.

The NTU-NEA WtE Research Facility is jointly developed for the National Environment Agency (NEA) and the Nanyang Technological University (NTU) through its Nanyang Environment and Water Research Institute (NEWRI), and supported by the Economic Development Board (EDB). Under the Energy National Innovation Challenge (ENIC) initiative, the plant will explore alternative measures to improve energy and resource recovery in the waste-to-energy domain. The facility is also the first waste to energy facility in Singapore based on slagging gasification technology.

“One behalf of JFE Engineering Corporation, I would like to express our deep gratitude to NTU-NEWRI, NEA, EDB and other invaluable stakeholders for placing their trust in JFE to carry out this project.”

– Mr Eichii Shibuya, Executive Fellow, Environmental Solution Sector, JFE

Continued next page
ALL SYSTEMS GO for the WtE Research Facility @ Tuas South

A first in Singapore, this test-bedding facility amongst other activities will:
- Focus on the treatment of diverse categories of waste
- Explore ways to upgrade the syngas from the process to enable more effective conversion of heat to electrical energy
- Serve as a training and education centre for experiments and ventures in the waste-to-energy domain

As part of the soft launch, Professor Umberto Arena, a chemical engineer and Ph.D. in Chemical Engineering from the University of Campania “Luigi Vanvitell”, Italy, who specialises in solid waste management, industrial pollution control engineering, and life cycle assessment of industrial processes, was specially invited to give a scientific presentation on “Gasification: A sustainable process for resource recovery from waste”.

The NTU-NEA WtE Research Facility will be officially operational in April, 2019.

Test your technology now!
Contact us for partnerships and collaborations
Prof Gregorz Lisak (Principal Investigator) g.lisak@ntu.edu.sg
Dr Wu Duo (Project Manager) wuduo@ntu.edu.sg
The Future of Environmental Monitoring: *In Vitro* Bioassays to Evaluate Water Samples of Unknown or Complex Composition

The United States Environmental Protection Agency has tens of thousands of chemicals listed in the Toxic Substances Control Act (TSCA); but the agency is struggling to get a handle on which are being produced and used. The situation is likely to be grimmer in developing regions which oftentimes lack the resources for environmental monitoring.

Even with the rapid development of analytical chemistry technologies (e.g. LC-QToF-MS), it remains impractical to track every compound because of time and cost limitations. Moreover, we do not yet (if ever) possess the capability to detect *all* kinds of chemicals as development of detection methods cannot keep up with the pace of the genesis of new synthetic compounds. Further, conventional methods cannot provide knowledge on the potential health impacts on life.

As such, environmental monitoring techniques using bioassays can provide a high throughput measurement of the potential toxicity of chemicals (individually or collectively) and also indicate presence of unknown toxic compounds. Traditional *in vivo* bioassays have many shortcomings (most prominently, animal cruelty) which make them poorly suited for routine environmental monitoring.

Thus, a shift is being made towards the development of rapid, inexpensive and simple, *in vitro* (typically, cell-based) bioassays for water quality screening. These methods can help elucidate mechanisms of toxicity and prioritise chemicals for further testing.

*In vitro* bioassays can provide measures of toxicity mechanisms by visualising the interaction of the chemicals with biological targets (e.g. reaction with DNA). The cells may respond through induction of adaptive stress response pathways. Cell viability, growth and proliferation are indicators of adverse effects on a cellular level.

Progress in biotechnological science has certainly made *in vitro* bioassays for environmental monitoring more appealing. The extracellular flux (FX) analysers (left), for example, can measure oxygen consumption rate and extracellular acidification rate of live cells, interrogating key cellular functions such as mitochondrial respiration and glycolysis.

References and further reading:


More information about biotechnology & bioprocesses in AEBC @ NEWRI. [Click here](#)
RELOOKING AT UPCYCLING PLASTIC WASTE

Upcycling plastic waste into value-added carbon nanomaterials

NEWRI-R3C has developed a technology for synthesis of multi-walled carbon nanotubes (MWCNTs) from non-condensable gases produced during plastics pyrolysis. This is an add-on process that can be integrated to existing plastic pyrolysis-to-oil plants at minimum cost and generate value-added product with a much higher price than oil.

MWCNTs can be produced from a variety of plastics including mixed plastic waste and flexible laminate waste, which are challenging to recycle by other techniques. Based on the lab-scale studies, the properties of MWCNTs produced by plastics recycling are comparable to commercial carbon nanotubes from conventional feedstock.

The synthesized carbon nanotubes can be potentially applied in production of polymer composites and materials for electrocatalysis or energy storage devices. To test the use of MWCNTs from recycled plastic in industrial applications, the synthesis of representative batches at sufficient quantity (several kg) is required.

A demo-prototype has been designed and constructed for the synthesis of such large batches of MWCNTs from plastic waste. The research will prove technical feasibility of the current technology and allow us to evaluate the quality of produced carbon nanomaterials.

Objectives

- To develop and test a scalable demo prototype for the synthesis of MWCNTs from plastic waste.
- To synthesize representative batches of MWCNTs for the assessment of product quality.
- To identify suitable applications of MWCNTs.

More information about resource recovery in R3C @ NEWRI, Click here
14th International Conference of Membrane Science & Technology 2019

Singapore Membrane Technology Centre (SMTC) will be hosting the next “Membrane Science and Technology” Conference (MST2019) on 13 to 14 June 2019 at the Nanyang Executive Centre @ Nanyang Technological University, Singapore.

The MST conference is a biennial event jointly organized by universities in Singapore, Malaysia, Indonesia, Thailand and Iran. The MST2019, proudly organized by the Singapore Membrane Technology Centre (SMTC), Nanyang Environment and Water Research Institute (NEWRI), at Nanyang Technological University (NTU) of Singapore will showcase the recent advancements of membrane research, development and applications related to water production and desalination, wastewater treatment and reclamation, gas and liquid separations & purifications, energy issues, the environment, special needs, and more.

The conference is a forum for exchange of ideas and thoughts, and discussions for the global membrane community. Additionally, it also serves to build important professional networks.

Conference topics
• Membranes for desalination, water and wastewater treatment
• Membranes for gas and liquid separations
• Membranes for fuel cell and energy applications
• Membranes for food and bio-product applications
• Membranes for pharmaceutical and medicine applications
• Membranes for special needs
• Novel membranes and fabrication methods – functionalized, responsive, modified, bio-, nano-membranes
• Advanced methods and sensors for membrane and process characterization
• Modeling and simulation

Plenary speakers include

Jeffrey McCutcheon, U Connecticut, USA
Yung Chang, Chung Yuan Christian U, Taiwan
Johannes Vrouwenvelder, KAUST, SA
Ivo Vankelecom, KU Leuven, Belgium
Kang Li, Imperial College London, UK
Michael Guiver, Tianjin U, China

For more information, please visit our conference website at https://memsis.org/mst2019, email: MST2019@ntu.edu.sg.
GLOBAL EXPOSURE

With 2019 designated as a year of promoting zero-waste, efforts for a global reach had begun earlier. In the previous year, NEWRI’s Mr Bill Ho (Director for NEWRITECH – NEWRI’s business development) was a guest speaker in InnovFest Suzhou, China to share our focus on waste challenges in Singapore and introduce NEWRI. He also elaborated on:

- NEWRI’s capabilities in gasification and pyrolysis technologies as part of the solutions to tackle such challenges.
- Preliminary studies on life cycle assessment and financial returns on plastic recycling to carbon nanotubes.
- Appropriate investment model(s)

InnovFest Suzhou is a leading international Innovation and Entrepreneurship Festival in China that is hosted and organised by NUSRI (NUS Suzhou Research Institute) and the Block71 Suzhou. This event is committed to building a key cross-border platform to link China technology companies with innovations overseas, especially innovations from Singapore and beyond.

http://www.nusri.cn/InnovFest-Suzhou-2018/

A CLOSER LOOK AT OUR ANALYTICS

In this issue, we focus on some of the equipment that NEWRI has to offer in our world class laboratories. From capturing high resolution fluorescence information, to visualizing nanoscale topographical details, to providing morphological, material & elemental information for samples such as bacteria, nano-materials and membranes, the NEWRI Analytical Cluster offers state of the art, high precision equipment for research needs.

Transmission Electron Microscope (TEM)
- TEM Imaging (80kV-120kV)
- Scanning TEM Imaging (STEM)
- Selected Area Electron Diffraction (SAED)
- Energy-Dispersive X-ray Spectroscopy (EDS)
- Ultramicrotome sectioning & Staining

Field Emission Scanning Electron Microscope (FESEM)
- To visualize topographical details (nano-scale)
- Examples of FESEM application include:
  - Morphology of coatings on materials
  - Low Vacuum (LV) capability
  - Energy Dispersive X-ray Spectroscopy (EDS) capability

Confocal Laser Scanning Microscopy (CLSM)
- CLSM captures fluorescence information from samples’ fluorophores
- Allows visualization of sections of extremely small structures
- Airyscan capability

More information about NEWRI’s Analytics Cluster,
Click here
AN INTERVIEW WITH  Assistant Prof Zhou Yan

Assistant Prof Zhou Yan is the Deputy Director, Advanced Environmental Biotechnology Centre, Nanyang Environment and Water Research Institute (NEWRI-AEBC). Her background includes areas such as municipal and industrial wastewater treatment and reclamation, energy efficient biological processes development, biological nutrient removal and recovery, as well as biosolids management.

Having published many journal papers and patents, Prof Zhou Yan is not content with being a faculty member. Dr Zhou Yan's project collaborations with industry have resulted in leaps of development in the areas of wastewater management with organisations such as Global Foundries, Micron, Mitsubishi Electric Asia and Kurita. We caught up with Prof Zhou Yan for a quick interview.

Could we know about your background and expertise? What attracted you to your field of research, and eventually to NEWRI? My background is in environmental engineering and chemical engineering. I have been working in the water treatment and resource recovery field for almost 15 years. My research has been focused on energy efficient water treatment and reclamation processes, sludge pretreatment and dewatering, resource recovery and reuse.

Reducing and control of environmental pollution was my prior research goal when I was younger 😊. I developed various wastewater treatment facilities and processes to reduce the pollutants in wastewater. However, I realized I was totally wrong after I joined NEWRI, where the research emphasizes on sustainable solutions for environmental problems. I really learnt a lot in my first few years during my post-doctorate in NEWRI. That certainly helped me to develop my current and future research directions.

Which projects from your career are you most proud of? Why and what is the impact of that? I am very proud of my water recycling projects with Micron and Global Foundries. Modern wafer and semiconductor manufacturing industries demand large quantities of water at ultra-pure level that is unprecedented in industrial application. My project team investigated the water saving potential in the two companies, and identified innovative design and implementation of wastewater treatment and water recycling processes. The two full-scale plants help the companies save 7 – 10% of total water consumption, which is about 1000 CMD each. These two projects are model projects that encourage many other industries to consider the water saving as part of their sustainable development strategy. For instance, we are currently working with SATS and Hitachi to study their water saving potential and propose energy efficient water recycling systems.

Singapore's non-domestic sector uses about 55% of its current water supply and this is projected to increase to 70% in 2060. Water recycling contributes to sustaining Singapore's long-term growth and development into a liveable, sustainable, resilient city of the future.

Continued next page
What do you see as some of the key future directions for AEBC?
Considering the needs of sustainable development for process design and product value chain, we have four major research directions in AEBC. (1) Energy efficient bioprocess for wastewater and waste treatment; (2) Biosolids management and generation of valuable resources; (3) Novel bioassay platforms for assessing environmental quality; (4) Biological treatment systems for industrial waste and remediation.

What is your research and career plan for the next few years?
I had so much fun in the field of water treatment and resource recovery. I believe I shall continue this direction for at least another 5 years. At the same time, I will pay attention on the emerging environmental issues/problems, e.g. microplastics, antibiotic resistant microorganisms. I am currently an Assistant Professor in School of Civil and Environmental Engineering. So, my short-term career plan would be to work really hard towards P&T.

What do you think NEWRI should do to not only maintain but grow its recognition as one of the world’s best environment and water research institutes?
I have been with NEWRI for more than 10 years. During those 10 years, NEWRI has grown impressively fast. I really appreciate NEWRI giving me the opportunity to grow and mature with her. To me, NEWRI has never been at the maintaining stage, but always at growing and expanding. This can be clearly reflected by our excellent research output, strengthened connection with industries, strong capability in engineering design and implementation, etc. All of these make NEWRI unique. NEWRI has been doing great.
Evapoporometry (EP) for Determining the Pore-Size Distribution

Evapoporometry is a novel technique for the determination of the pore-size distribution of membranes and other porous materials such as catalysts, adsorbents and electrodes. NEWRI is currently building a prototype instrument to both validate as well as exhibit the technology to potential industry partners who might be interested in building a commercial instrument based on the same. The prototype is pending characterization to prove reproducibility and reliability.

Comparison Between EP and LDP

Evapoporometry (EP) | Liquid Displacement Porometry (LDP)
---|---
Requires measuring only instantaneous mass that can be obtained with microgram accuracy | Requires measuring the instantaneous pressure and volumetric flow rate that cannot be measured as accurately
Can measure PSD on both surfaces of membrane | Measures PSD of throat or minimum pore diameter
Uses Kelvin equation to obtain pore diameter and direct measurement of pore mass | Uses Young-Laplace equation to obtain throat diameter and uses this minimum diameter in Hagen-Poiseuille equation to obtain pore volume that should be based on average diameter
Can characterize porous membranes, catalysts, adsorbents and electrodes | Requires applying high pressure to characterize smaller pores and flow through porous medium to obtain volume of pores
Does not require applying high pressure or flow through the porous medium | Constrained to using specialized low surface-tension, wetting, non-volatile liquids
Can use variety of both wetting and non-wetting volatile test liquids including water | Cannot distinguish between PSD on outer and inner or lumen side of hollow fiber membranes
Can characterize PSD on both outer and inner or lumen side of hollow fiber membranes | Can characterize biofouling layers
Can characterize biofouling layers | Cannot characterize biofouling layers
Corrects for adsorbed t-layer | Does not correct for adsorbed t-layer
Can assess effect of internal pore fouling on PSD since no flow through membrane pores is required | Cannot assess effect of internal pore fouling on PSD owing to flow through pores removing fouling deposits
Can characterize multi-bore ceramic membranes | Not adapted to characterize multi-bore ceramic membranes
Can determine PSD of just the continuous pores and also PSD of continuous and dead-end pores (important for catalysts) | Determines only PSD of continuous pores
Smaller lab footprint and less costly instrument | Larger lab footprint and more costly instrument

Contact us for partnerships and collaborations
Asknewri@ntu.edu.sg

MARKET PLACE @ NEWRI

Market Place (IP showcase) features our notable novel IPs from our 5 centres of excellence. In an effort to showcase our exciting technologies, we present a platform to reach out to industry creating an informative and concise technology display that is ever evolving.

CLICK HERE to view Market Place @ NEWRI
In this series, we feature one, from the numerous publications to highlight in this segment:

**PROGRESS IN POLYMER SCIENCE**
*Volume 77*, February 2018, Pages 69-94

**Progress in electrospun polymeric nanofibrous membranes for water treatment:**
Fabrication, modification and applications

YuanLiao, Chun-HengLoh, MiaoTian, RongWang, Anthony G.Fane

**Abstract**
Research on membrane technologies has grown exponentially to treat wastewater, recycle polluted water and provide more freshwater. Electrospun nanofibrous membranes (ENMs) exhibit great potential to be applied in membrane processes due to their distinctive features such as high porosity of up to 90% and large specific surface area. Compared with other nanofiber fabrication techniques, electrospinning is capable of developing unique architectures of nanofibrous scaffolds by designing special assemblies, and it is facile in functionalizing nanofibers by incorporating multi-functional materials.

This review summarizes the state-of-the-art progress on fabrication and modification of electrospun polymeric membranes with a particular emphasis on their advances, challenges and future improvement in water treatment applications. First, we briefly describe the complex process governing electrospinning, illustrate the effects of intrinsic properties of polymer solutions, operational parameters and surrounding environment conditions on the formation of nanofibers and resultant nanofibrous membranes, and summarize various designs of electrospinning apparatus. That is followed by reviewing the methods to prepare multifunctional composite ENMs, assorted into three categories, including modification in nanofibers, loading target molecules onto nanofibers surface, and implementing selective layers on the ENM surface.

Comprehensive discussion about past achievements and current challenges regarding utilization of composite ENMs in water treatment are then provided. Finally, conclusions and perspective are stated according to reviewed progress to date.
Celebration of Community Project Handover

2018 was a significant year for NEWRIComm and its community partners as we celebrated the handover of four completed projects in Indonesia, Laos and Myanmar through a series of events in the respective project sites. The success of these community projects attracted media coverage in both broadcast and prints.

Sumedang, Indonesia – First Biogas Village from Tofu Wastewater

The official handover ceremony of the 18m$^3$ community-run tofu wastewater treatment plant in Giriharja Village, Sumedang, Indonesia was held at Gedang Negara on 26 September 2018. The event was graced by Mr. Erwan Setiawan, Wakil Bupati Sumedang, and was supported by over 80 government officials, Giriharja tofu association, local partners and media. Giriharja Village is the first village to benefit from biogas from treatment of tofu wastewater.

Clean Water Access for Watugajah Village, Gunungkidul, Yogyakarta Indonesia

Also in Indonesia, NEWRIComm celebrated the remarkable success of its expansion project at Watugajah Village as part of its continued efforts in the Gunungkidul Regency. The event was attended by Ms. Aning Sri Mintarsih, Head of field implementation and supervision of Gunungkidul Planning Board, Institut Teknologi Yogyakarta, local communities, partners and media.

NEWRIComm and LEF Fellow Mr. Agus Suyanto with the support of Watugajah Village completed the 90m deep well in a short span of seven months from design to commission. The deep well with a main distribution network provides 17m$^3$ of clean water daily to over 400 residents.
PHILANTHROPY EFFORTS

Vientiane, Laos
On 18 October, the Centre of Excellence was officially handed over to National University of Laos (NUOL), as a model facility of wastewater management using anaerobic digester. The wastewater treatment plant with the anaerobic digester was reconstructed after a review of the first commissioned facility. NUOL will incorporate the model facility into their curriculum for their environmental science programme.

Hlaing Thar Yar, Yangon Myanmar
On 5 October 2018, a 5m³ reverse osmosis water treatment system was handed over to Don Bosco Kindergarten in the presence of local community influencers such as the Buddhist head monk, Village head and the Salesian Sisters.

The Hlaing Thar Yar community lives in a slum like condition without clean water access. Partnering with St John Bosco Kindergarten, a water treatment system using reverse osmosis technology was commissioned and placed at St John Bosco Kindergarten, producing up to 5m³ of clean water daily. The Salesian Sisters have been trained by NEWRIComm to operate and maintain the facility.

NEWRIComm administers the Lien Environmental Fellowship (LEF). The LEF programme aims to enable successful applicants from universities, research institutions, government agencies, non-government organisation and non-profit organisation based in Southeast Asia, and South Asia to improve water and sanitation management for their home communities by developing and implementing scalable and sustainable technology-based solutions. With an emphasis on full-scale implementation and education, LEF seeks to accrue benefits beyond the award recipients, and towards the communities. Through NEWRIComm, NEWRI’s know-how is deployed to help communities through training, education, and implementation of engineering solutions.

CLICK HERE for NEWRICOMM
**NEW FACULTY LEADERSHIP @ NEWRI**

**Associate Prof Ng Kee Woei**, a mechanical engineer by training, he completed his PhD at the Yong Loo Lin School of Medicine, National University of Singapore, in 2006. Dr Ng underwent postdoctoral training at the Institute of Molecular and Cell Biology and at the Institute of Medical Biology, A*STAR. He has worked on a number of projects to tissue engineer skin, bone and cartilage. He is also interested in pursuing fundamental understanding of cell-material interactions, including the toxicological influence of nanomaterials.

Assoc Prof Ng's area of expertise is **nature derived nanomaterials and nanotoxicology** and is the Deputy Director for Environmental Chemistry and Materials Centre (ECMC).

[Assoc Prof Ng Kee Woei's profile](#)

**Assistant Prof Fei Xun Chang** from Civil and Environmental Engineering, NTU (since July 2018) received his PhD in Environmental Engineering University of Michigan, Ann Arbor (2016). He was a Postdoctorate Fellow in Ali I. Al-Naimi Petroleum Engineering Research Center, King Abdullah University of Science and Technology for two years (Sept. 2016-May 2018) and did his postdoctoral research in Civil and Environmental Engineering, University of Michigan (Jan.-Sept. 2016). Dr Fei research interests include solid waste management, environmental engineering, and geoenvironmental engineering.

Asst Prof Fei’s area of expertise is **waste management, resources recovery and landfill remediation** and is the Deputy Director for **Residues & Resource Reclamation Centre (R3C)**.

[Asst Prof Fei Xun Chang’s profile](#)

**Assistant Prof Liu Wen (Paul)** is a reaction engineer specialising in carbon capture, chemical looping and methane conversion processes. Dr Liu completed his undergraduate training as a chemical engineering at University of Cambridge. He stayed on to do a PhD with John Dennis, who leads the Combustion Group at Department of Chemical Engineering and Biotechnology. After spending some time at the Department of Engineering as a postdoctoral researcher under the supervision of Stuart Scott, Paul joined the Cambridge Centre for Advanced Research and Education in Singapore (CARES) in 2014, as a senior research fellow affiliated with NTU. He taught chemical engineering at Newcastle University's Singapore campus since 2016 and re-joined NTU in 2018.

Asst Prof Liu’s area of expertise is **chemical engineering and chemical looping** and is a Cluster Leader for **Residues & Resource Reclamation Centre (R3C)**.

[Asst Prof Paul Liu’s profile](#)

**Assistant Prof Abid Hussain's** research focuses on the development of innovative technologies for bioenergy and recovery of value-added products from diverse waste streams including municipal solid waste (MSW), wastewater and agri-waste. In this regard, he has centered his efforts on the following key themes: (1) Microbial electrochemical technologies (METs) (2) Dry anaerobic digestion and integrated processes (3) Bioconversion of waste gases to precursor chemicals. He has extensive experience in the application of electromagnetic radiations for production of bioactive compounds from food processing refuse. He spearheaded waste-to-energy and climate change adaptation projects at international organizations such as United Nations (UN) and The Energy and Resources Institute (TERI). At the National Research Council of Canada (NRC), he led governmental initiatives on decentralized approaches for solid waste management and wastewater treatment for remote communities.

Asst Prof Abid’s area of expertise is **bioelectrochemistry, resource recovery** and is a Cluster Leader for **Advanced Environmental Biotechnology Centre (AEBCC)**.

[Asst Prof Abid Hussain’s profile](#)
EVENTS & SEMINARS

Enhancing staff knowledge and experiences, NEWRI holds regular in-house workshops and seminars by fellow researchers and visiting professors, scientists, institutes, and external visits; allowing knowledge to diffuse throughout the organisation. Here are some highlights:

“Environmental Sustainability in World’s Fastest Growing Regions: Challenges and Opportunities for Water and Waste Management” (31 Jan 2019)
Prof Shane Snyder, Professor of Civil & Environmental Engineering and Executive Director of the NEWRI at NTU Singapore

“Antibiotic-resistant bacteria in wastewater and the use of sustainable treatment technologies against them” (17 Jan 2019)
Prof Hong Peiying, King Abdullah University of Science and Technology (KAUST)

“Gasification: a flexible process for resource recovery from waste” (17 Jan 2019)
Professor Umberto Arena, University of Campania “Luigi Vanvitelli”, Italy

STUDENT LIFE

In our student segment, we speak with our NEWRI students and discover their experience, thoughts and aspirations. Find out what’s burning their midnight oil and what is driving them forward.

“I’m pleased to be a part of one of the best environment & water research institute in the world. The years in NEWRI have been irrefutable and indelible! I have been exposed to many opportunities and challenges where the exposure and experience working with well-reputed researchers and advanced research facilities have helped me to reach new heights not only in academia but in my personal life. I’m excited about my future career direction. NEWRI has great opportunities for anyone who embraces the challenge.”

Withinage Don Chanaka Udayanga - Currently 4th Year (R3C)
Current research area - Heavy metals immobilisation during pyrolysis of sewage sludge

“I feel extremely excited to work at NEWRI every single day. NEWRI nurtures true talent, an empathetic and energetic work force who enjoy their work. They warmly welcome passionate people around the globe to pursue their research, while offering a respectful and safe environment for each and every person irrespective of their level in the hierarchy that integrates innovative research in an interdisciplinary way!!”

Gopi Tejasri - Currently 3rd year (AECB)
Current research area - Treatment of textile wastewater

“My 1.5 years research journey in NEWRI has been fulfilling and interesting so far. Currently, I’m working on the Hybrid Oxidation Separation Technology (HOST) setup located in ECMC, a synergistic process combining both Advanced Oxidation Processes (AOP) and membrane separation for water and wastewater treatment. NEWRI has a vibrant research culture, where I’ve met fellow researchers from various backgrounds and expertise, from which we are allowed to explore and exchange knowledge for interdisciplinary ideation. Moreover, I’ve never failed to get technical support and guidance from NEWRI staffs whenever I request for support during my project execution. With best wishes and supports I’ve gained from NEWRI community, I hope to keep my research project rolling for greater advancement and contribution.”

Jeremine Lee Wen Jie - Currently 2nd year (ECMC)
Current research area - Hybrid Oxidation Separation Technology (HOST)

NEWRI already has a running group that gathers weekly (Tuesdays) and is gathering speed (pun intended). Even if you are starting out, marathon training or just want to get some exercise with an energetic bunch, come run with us! More info, email victor.leong@ntu.edu.sg

FIVE REASONS TO RUN.
- Better mood
- Better sleep
- Reduces high blood pressure
- Reduces cardiovascular disease
- Better brain performance

NEWRI Update
1 CleantechLoop, CleanTechOne, #06-08, Singapore 637141
(Off Nanyang Avenue/CleantechView)