2024 WA Student Water Prize Nominees

KUNLAY YANGDON, MURDOCH UNIVERSITY

Aerobic activated sludge using MBR technology

Kunlay's project successfully designed a wastewater treatment plant for the Murdoch precinct, using an aerobic activated sludge method enhanced by Membrane Bioreactor technology. The plant was designed considering the circular economy through integration of sludge recovery and reuse irrigation.

The project considered the challenges associated with MBR technology, such as membrane fouling, high energy consumption, and maintenance costs. A detailed strategy for the operation and maintenance of the wastewater treatment plant was developed that aimed to address these challenges and identify areas for future research. The project aims to support sustainable water management practices and enhance water security.

ALYSSA BARRON, THE UNIVERSITY OF WESTERN AUSTRALIA

In situ arsenic immobilisation using stimulated iron cycling

Arsenic is one of the most harmful and widespread groundwater contaminants globally. Alyssa's study assessed the viability of utilising Fe(II) injection to stimulate Fe-oxyhydroxide mineral formations to immobilise arsenic through adsorption, enabling *in-situ* remediation. The aim is to reduce the current reliance on inefficient pump and treat methods for contaminated groundwater.

The laboratory-based experiments successfully removed arsenic from water through Fe mineral formations. The study also examined the impacts of high sulfate, phosphate and salinity on Fe and sulfur mineralisation and the efficiency of arsenic retention to understand if there are limitations to this remediation approach for coastal aquifers.

EMANUEL BERTIZZOLO, THE UNIVERSITY OF WESTERN AUSTRALIA

Novel low-field nuclear magnetic resonance monitoring of anaerobic digestate during solid-liquid separation

Emanuel's research has investigated the use of advanced low-field Nuclear Magnetic Resonance (NMR) and Magnetic Resonance Imaging (MRI) technologies to monitor and optimise the dewatering process. A key opportunity to improve resource recovery from anaerobic digestion is the efficient dewatering of the digestate, which is essential for reducing volume, minimising transportation costs, and enhancing the usability of the by-product.

The study successfully demonstrated that low-field NMR and MRI could effectively probe the solids-rich regions of anaerobic digestate without losing critical information from the bulk material. This confirms the applicability of these advanced techniques in challenging environments where traditional methods often fail.

SAEEDE SOLTANI, MURDOCH UNIVERSITY

Life cycle assessment of struvite recovered from wastewater streams using five commercial-scale technologies

Struvite precipitation from wastewater enables capture of nutrients for recovery and reuse. Saeede's study conducted a comprehensive life cycle assessment of five commercial-scale struvite recovery technologies: Phosnix, Ostara's Pearl, Multiform, Phospaq, and NuReSys. The LCA followed the ISO methodology, and considered three feedstocks and nine different electricity generation scenarios to evaluate the environmental implications of struvite recovery and inform decision-making in the water industry.

The study found that the environmental impact of struvite recovery was influenced by the phosphorus concentration in the feedstock. Struvite recovery was found to offer a sustainable solution to nutrient pollution.

DHRUVIT SHAH, CURTIN UNIVERSITY

Experimental Investigation of an Air-Gap Membrane Distillation Module and Analysis of its Implementation with Solar Energy

Membrane Distillation is a thermal separation process which has high salt rejection capabilities, presenting a compelling alternative to reverse osmosis for small-scale desalination applications and treatment of high-salinity wastewaters.

Dhruvit designed and fabricated an Air-Gap Membrane Distillation module to test under a range of conditions. Feed salinities of 0g/L, 35 g/L and 60 g/L were tested with the module demonstrating high salt rejection capabilities, with each case meeting drinking water guidelines and maintaining a salt rejection factor of almost 100%. Integration with solar energy to offset high heating requirements can make this process cost-effective for on-farm desalination.

TRANG TRAN, THE UNIVERSITY OF WESTERN AUSTRALIA

Understanding the Effects of Changes in Sewer Wastewater Quality on Wastewater Treatment Plant Processes

Sulfides present a major issue for asset management and safety in water utilities. Chemical dosing is a widely used method to control sulfides, but it can alter wastewater composition and impact downstream treatment plant performance.

Trang's project modelled the impacts of dosing $Mg(OH)_2$, $FeCl_3$, and oxygen to manage sulfide using the SeweX model with input data from the Water Corporation's Southern sewer network. The project showed $Mg(OH)_2$ and $FeCl_3$ could have positive impacts on wastewater composition for improving nutrient treatment downstream, however oxygen, while reducing sulphides, also lowered the levels of volatile fatty acids, which are important for nitrogen removal.

YASAMAN BOROUMAND, EDITH COWAN UNIVERSITY

Development of novel titanium based composite membranes for lithium separation from brines

Yasaman's research focuses on advancing Direct Lithium Extraction (DLE) technology, specifically using ion exchange adsorbents in composite membranes. DLE methods offer significant advantages over conventional lithium extraction techniques such as solar evaporation, including faster extraction times, lower water consumption, and reduced carbon footprint.

The central hypothesis of this research is that titanium-based composite membranes, specifically utilising lithium titanium oxide (LTO) adsorbents, can be developed to efficiently extract lithium from aqueous solutions, surpassing current DLE methods in terms of selectivity, speed, and environmental impact. This project will see LTO membranes created, their properties characterised, and performance assessed against existing DLE techniques.

SONAM TSHERING, CURTIN UNIVERSITY

Including Hydraulics in Optimising Groundwater Abstraction Scheduling

Groundwater is widely used to meet water demands in Western Australia and is crucial for sustaining wetlands, lakes, and bushland. However, this resource is increasingly under pressure due to climate change.

Sonam's project aimed to address this challenge by developing a scheduling model that uses advanced optimisation and simulation techniques to improve groundwater abstraction. InfoWorks WS Pro was used to simulate hydraulic effects within the groundwater bore collection pipe network that could be integrated into a linear optimisation model. This approach improves precision and reliability in abstraction targets, boosts operational efficiency, and reduces costs enabling improved water resource management.

HOANG LONG NGUYEN, THE UNIVERSITY OF WESTERN AUSTRALIA

Disentangling the drivers of evapotranspiration variations through space and time in the Banksia woodlands of the Swan Coastal Plain

Most of Perth's groundwater supply comes from the Gnangara Mound 'Superficial' aquifer underlying the Banksia woodlands of the Swan Coastal Plain. The Banksia woodlands frequently experience wildfire and hazard reduction burning. The impacts of this fire regime on the ecosystem's water balance are uncertain, and the direction of hydrological changes is contested.

Hoang's research has used a variety of evapotranspiration and recharge measurements to evaluate the ecosystem's hydrological response to the fire regime over multiple sites and fires. The project aims to improve management of the Gnangara Mound groundwater resource and foster holistic decision-making surrounding fire and water considerations.

AUSTRALIAN WATER ASSOCIATION

STUDENT WATER PRIZE

Rewarding students for excellence in water-related studies and research, providing a forum for students to display their academic excellence, innovation, and/or research findings to future employers, clients and the water sector.

MOHADESEH NAJAFI, EDITH COWAN UNIVERSITY

Harnessing the power of surface modification for developing nano/microplastics resistant membranes for water/wastewater treatment

Microplastic pollution in water is an emerging issue that poses significant risks to both human health and the environment. Membrane technology has proven to be one of the most effective treatment methods. However, existing commercial membranes face limitations from fouling, which reduces their efficiency and lifespan.

Mohadeseh's project proposes that by introducing different functional groups and polymers onto the membrane surface, the modified membranes will exhibit improved resistance to fouling, without compromising on water permeability. This would result in improved operational lifespan and efficiency in water and wastewater treatment applications.

WA Water Award Winners will be announced at the Water Awards Dinner on Friday 1ST November 2024

If you would like any further information on tonight's projects, nominees or information relating to the Australian Water Association, please contact:

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