MIPPS 2021 Project Summaries

Participating organisations:

- AB Mauri Technology and Development Pty Ltd
- Central NSW Joint Organisation (CNSWJO)
- DuPont Memcor (Australia) Pty Ltd
- Griffith City Council
- Opal Paper and Recycling
- Orange City Council
- Orica Australia Pty Ltd
- Parkes Shire Council
- Separtis Pty Ltd
- Shoalhaven City Council
- Sydney Water Corporation
- Trility Group Pty Ltd
- Visy Pulp and Paper Pty Ltd

Projects:

Energy balances and analysis of large-scale fermentation

AB Mauri Technology and Development Pty Ltd
Student: Jun Wu
Academic Supervisor: Associate Professor John Kavanagh

This project aims to determine the heat generation and cooling requirements of industrial yeast fermentation for improvement of future equipment designs, yeast production efficiency and brew planning. The project includes an energy balance to find metabolic heat of yeast and draws relationship between biomass yield, sugar feed and heat generated.

Water loss management project in several Central NSW councils

Central NSW Joint Organisation (CNSWJO)
Student: Yuqing Li
Academic Supervisor: Associate Professor Vincent Gomes

This collaborative project between CNSWJO and three member councils (Parkes, Orange, Bathurst) aims to determine next steps in water loss management for all members. Based on literature, staff experience, past work and current loss quantification, a maturity model tool has been developed to benchmark utilities on overall water loss management and provide directions for improvement. This will facilitate the selection of strategies which the project has established for further economic evaluation.

Membrane Bioreactor (MBR) Module manufacturing improvement: Catalyst potting system and no-soft layer validation

DuPont Memcor (Australia) Pty Ltd
Student: Tate McGregor
Academic Supervisor: Dr David Wang

This project focussed on improving the manufacturing of DuPont's membrane bioreactor (MBR) wastewater filtration unit. The use of a catalyst polyurethane potting resin and the removal of the pot outer "soft" layer were both investigated using long-term experimental simulations. Promising results supported these production improvements for future implementation at DuPont.

Salinity dilution in Lake Wyangan

Griffith City Council
Student: Charles Little
Academic Supervisor: Professor Tim Langrish

An investigation into the history of salinity in Lake Wyangan to determine a suitable course of action for future management. A validated water and salt balance model was created to provide decision support for this management, allowing users to test various scenarios. This project involved frequent hands-on experimental work, including use of a boat to take surface transects, as well as some sediment sampling.

Minimising variations and stabilising the starch cooking process at the Opal Botany (B9) Paper Mill

Opal Paper and Recycling
Student: Elliot Sylvester
Academic Supervisor: Dr Li Wei

At Opal's Botany Paper Mill, cooked starch allows their 100% recycled carboard product to meet strength targets. Starch cooking is a complex process with many potential sources of instability and minimising these sources was the aim of this project. Through lab experiments and trials on the paper machine, the effects of variations in key cooking parameters on the cooking quality was investigated, including water quality, cooking temperature and enzyme dosing rate. From these experiments, recommendations could be made to help stabilise these parameters as well as improve the quality and efficiency of the starch cook.

Orange sewerage treatment plant carbon dosing trial

Orange City Council
Student: Claudia Jerogin
Academic Supervisor: Dr Amirali Ebrahimi Ghadi

Orange Wastewater Treatment Plant has historically had difficulty meeting the EPA licence requirements for effluent total nitrogen. The project consisted of a trial of carbon dosing of sucrose and glycerol to improve biological nitrogen removal. Following analysis of the denitrification potential, bacterial sludge composition and downstream plant operations sucrose was the favourable agent and found to improve nitrogen removal significantly.

Feasibility of Mine Tyre Recycling to produce fuels

Orica Australia Pty Ltd
Student: Anthony Stamell
Academic Supervisor: Professor Dianne Wiley

Orica is focused on working with their customers to understand their sustainability challenges, and design and develop product solutions that deliver commercial and sustainability value. One way to achieve this is through circular business models. The aim is to close product cycles and use materials and resources in the best way possible across the entire value chain. This project investigated the application and compatibility of renewable fuels derived from tyre waste in their bulk explosive product range. This project involved conducting explosive compatibility tests in Orica's Kurri Kurri mixing labs and enabled me to learn about Orica's sophisticated manufacturing supply chain.

Modelling the Parkes Reticulation: Low-Level Zone

Parkes Shire Council
Student: Samuel Vail
Academic Supervisor: Dr Annalisa Contos

Parkes Shire Council sought to develop an understanding of their potable water reticulation through hydraulic and water quality models. These models were able to assist with future development considerations as well as current operations by providing insight into reputational risk management of fire-flows and deliverable water quality throughout the reticulation.

Liquid waste solutions plant and technologies review

Separtis Pty Ltd
Student: Helaine Liew
Academic Supervisor: Associate Professor Alejandro Montoya

The liquid waste project with Separtis required analysis of historical wastewater quality data to establish criteria for comparison of treatment technologies. Viable technologies were identified, leading to experimentation on lab-scale equipment. Scale-up calculations informed the design of a prototype system and techno-economic evaluation, which informed a market analysis.

Optimisation of satellite odour control dosing units for wastewater sewer pump stations

Shoalhaven City Council
Student: Suzannah Keene
Academic Supervisor: Professor Yuan Chen

Shoalhaven Water manages a network of 240 sewer pump stations in the Shoalhaven region. Odour control systems, such as ferrous chloride dosing and oxygen injection, are currently used throughout their network. However, they provide limited odour reduction, demand high operational and capital costs, and have frequent performance and maintenance issues. This project aims to explore emerging technology - dosing waste-activated sludge – as a more effective, reliable, and affordable odour control solution. This method is expected to target odour at the source and meet regulatory requirements.

A series of bench-scale tests have been carried out to verify the feasibility of this method, and the optimum range of dosing quantities throughout the day has been determined. It is estimated that the total cost savings for the pump station studied are $500,000 over the asset lifetime, and similar savings are projected for other sewer pump stations in the network.

Powder activated carbon dosing (PAC) to reduce dissolved organic carbon (DOC) in treated water

Sydney Water Corporation
Student: James Haskis
Academic Supervisor: Professor Marjorie Valix

DOC is an important component of raw water which acts as both a precursor to serious Disinfection Byproducts and as a significant consumer of Chlorine treatment. This project aimed to improve the removal of DOC at Sydney Water's five Water Filtration Plants by optimising coagulation conditions and investigating the potential for PAC to be added to treatment. Optimal coagulation pH and PAC dosing levels were identified which significantly lower DOC levels and have the potential to improve water quality for millions of consumers, reduce ADWG compliance risks and lead to significant cost savings in Chlorine consumption.

Project 1: Disinfection at the MacArthur water filtration plant

Trility Group Pty Ltd
Student: Ly Nguyen
Academic Supervisor: Professor PJ Cullen

The trial and validation of artificial intelligence in improving coagulation control and filter performance was investigated at the MacArthur Water Filtration Plant. This project involved verifying the outputs from the predictive model and data analytic tools through various experiments on filter health and optimal coagulant dosing. It was found that by implementing these tools, a 4% decrease in coagulant usage could be achieved while filter performance can be enhanced by correcting flow distribution.

Project 2: Optimisation of MacArthur's ammonia dosing system and improvement in residual measurement methods

Trility Group Pty Ltd
Student: Jack Brady
Academic Supervisor: Dr Raffaella Mammucari

MacArthur Water Filtration Plant uses a chloraminated disinfection system, which requires tight control over the ratio between chlorine and ammonia. MacArthur has been struggling with this, and the project launched an investigation into reasons why, with recommended changes to the PLC being the outcome. Review into ammonia residual measurements was also conducted with the installation of a HACH5500sc ammonia analyser at the centre of this. Suitable laboratory techniques for residual ammonia measurement in chloraminated systems was also reviewed, with the salicylate method recommended

Dry Feet

Visy Pulp and Paper Pty Ltd
Student: Stephen Sheahan
Academic Supervisor: Dr Gustavo Fimbres Weihs

This project involved optimising the performance of two Drum Filters and improving other aspects of the site's water management, the aim of which was to reduce the occurrence of flooding by improving the Water Clarification System that cleans and recycles the mill's process water, increasing Visy's workplace safety and further reducing their environmental impact.