ESIPS-MIPPS 2019 Project Summaries

Participating organisations:

- Shoalhaven Water
- Orora
- Evoqua Water Technologies - Memcor
- The Dow Coating Manufacturing Company (DCM) Geelong
- Parkes Shire Council
- Sydney Water
- Visy Pulp and Paper
- Ridley Corporation
- Griffith City Council

Projects:

Optimising Chlorine Dosing at the Water Distribution Reservoirs

Shoalhaven Water
Student: Sharon Suia Lesa
Academic Supervisor: Prof. Yuan Chen

This project focused on identifying the optimal chlorine dosing arrangement at the reservoirs, that will give the most consistent levels of chlorine residuals downstream within the various reticulation areas. The overall project methodology involved developing a series of hydraulic and chlorine decay models for the selected regions from within the Shoalhaven. A new series of chlorine dosage targets were then specified for each annual quarter, in addition to recommending the optimal dosing arrangement at the reservoirs that will give Shoalhaven Water better control, monitoring and overall better compliance with the ADWG regarding the free chlorine limits in drinking water.

Opportunities for Improvement in the B9 Boiler and Condensate System

Orora
Student: Michael Wilson
Academic Supervisor: Dr. Li Wei

In a manufacturing context with rising energy costs and increased social demand to address climate change, Orora is seeking methods to improve efficiencies across its energy intensive utilities. This project involved diagnosing and improving inefficiencies in the B9 power station and reviewing the process control philosophy in the drying system to develop a new control scheme that could allow waste heat to be reused instead of vented.

The project was effective in improving the underperforming boiler's efficiency by over 5%, reducing harmful carbon monoxide emissions from the inefficient boiler by 60% and reducing flash steam emissions from the main condensate tank by up to 20%, as well as outlining areas for further improvement within the system. On top of the significant financial benefits, the project directly contributed to the Orora EcoTargets of reducing carbon dioxide emissions and water use by 10% by June 2019 from 2013 levels.

Development of New Membrane Filtration Module for Wastewater Treatment

Evoqua Water Technologies - Memcor
Student: Yiyang Wu
Supervisor: Prof. Dianne Wiley

Evoqua Water Technologies is a leading provider of water treatment solutions. Its membrane business has been developing ultrafiltration membrane products for over 30 years. This project aims to enhance a current membrane filtration product and validate its performance. The project involved designing, making and testing a functional prototype. Initial results indicate a significant performance benefit. If the proposed product can be successfully introduced into production, it could result in significant reductions in capital cost of membrane installations.

An Experimental Study on the Development of Automated Membrane Massaging Mechanisms at Evoqua Water Technologies

Evoqua Water Technologies - Memcor
Student: Franco Licham
Supervisor: Dr. David Wang

In a world with growing scarcity and reduction of the quality of water, Evoqua, a leading manufacturer in water treatment systems, is constantly working to reach solutions to ensure the provision of the best water to the world. As a direct result of this growing demand, there was the opportunity to undertake my Thesis project with Evoqua involving the analysis, design and the build of a functional prototype for manipulating fibre membranes. My project marks the beginning of a new area of research at Evoqua having showed the possibility for automation within the manufacturing process.

Optimization Process of Industrial Waste Water Treatment

The Dow Coating Manufacturing Company (DCM) Geelong
Student: Guy Tanudisastro
Supervisor: A/Prof. Zongwen Liu

The optimisation process involved the use of exploring different methods to reduce the level of pollutants in the treated wastewater. Currently, the treated waste water is being sent to Dow's evaporation lagoon, however the long term objective is to recycle the majority of the water and irrigate the remaining portion. Irrigation water must abide by the Victorian EPA's regulations. One of the methods selected for improving water quality was to feed the biological treatment unit with molasses to help nitrifying bacteria further digest pollutants in the waste water. The improvement of this treatment has helped increase the company's compliance parameters, as well as refine their future $6 million waste water treatment project.

Characterising and modelling chlorine decay in Parkes recycled water

Parkes Shire Council
Student: Anjana Hariharan
Supervisor: Dr. Annalisa Contos

Parkes Shire Council is currently rolling out their Recycled Water Scheme that will supply recycled water to the Parkes region. To ensure that the water is safe for distribution to public spaces the recycled water needs to have sufficient chlorine residual. This project involved determining the chlorine residuals levels at the end user points and quantifying the factors that lead to chlorine decay in Parkes recycled water.

Characterising the Parkes- Peak Hill System Distribution system

Parkes Shire Council
Student: Hassanian Al Kabanchi
Supervisor: Dr. Alejandro Montoya

Parkes Shire Council has successfully commissioned a range of infrastructure upgrades, including a new water treatment plant (WTP) and reservoir to improve the town's potable water quality and capacity. The company is interested in understanding the new dynamic behaviour of the Parkes-Peak Hill water distribution network in terms of its hydraulic and quality characteristics.

The project encompassed the development of a range of tools for the effective management of water resources. An internet of things (IoT) based telemetry system was developed and integrated into the council's operating environment, saving the company $20,000 p.a. This platform offers close to real-time monitoring of water, rain and sewer resources in the region. The data was used in the modelling of the hydraulic and quality characteristics of the Parkes-Peak Hill distribution network. The models identified system inefficiencies and were used to put forward a range of improvements including the successful optimisation of chemical dosing at the WTP and suggestive pipeline modifications.

Hydrogen sulphide management for electricity generation from biogas

Sydney Water
Student: Chris Skellern
Supervisor: A/Prof. Vincent Gomes

Sydney Water utilises the biogas from its anaerobic digestion process to create energy in cogeneration engines across many of its wastewater treatment plants. This biogas is primarily methane, but invariably contains significant hydrogen sulphide and siloxane contaminants, which can cause corrosion, odour and regulatory issues. This project thus aimed to identify the lowest cost and most effective processes available to remove these two contaminants. It identified a novel treatment opportunity utilising filtered effluent to scrub hydrogen sulphide from the gas and highlighted knowledge gaps for further research in treating siloxanes using activated carbon.

Optimisation of the Water System at VP3&6

Visy Pulp and Paper
Student: Alana Saliba
Supervisor: Dr. Amirali Ebrahimi Ghadi

The main objective of this project was to stop the use of a Sydney Water owned sewer, utilised by VP3&6 to by-pass the WWTP to regulate mill water levels during process upsets. Two problems with the water system were greatly contributing to sewer use and thus required solving. The first problem was unblocking a cooling tower from scale and biofilm build-up as these deposits were greatly reducing the operational performance of the cooling tower. A clean-in-place system was devised and tested, whereby it was found to save VP3&6 up to 96% per annum in sewer use and routine cleans of the cooling tower.

The second problem was the flow optimisation of the filtration devices known as 'Gravity Strainers.' A series of process modifications were made to optimise strainer throughput and onset a number of benefits within the mill water system and balance. Its greatest outcome is that greater volumes of higher quality process water is now sent to the cooling tower, which ultimately leads to significantly decreased sewer use due to less deposit formation in the tower.

Energy and Process Optimisation

Ridley Corporation
Student: Joshua Djohari
Supervisor: Prof. Timothy Langrish

Ridley CSF Proteins is preparing a large-scale expansion which will include the addition of new production equipment to the site.
The project focused on a study to investigate the sufficiency of the current cooling and heating supply of the Maroota production site in preparation for the expansion, in addition to improving the overall performance of production equipment. This involved in estimating the current capacity of the site, identifying the bottlenecks, and proposing solutions to overcome the issues. Safety issues that have an effect towards the personnel and equipment on site were addressed. The finished work was able to identify critical issues to be addressed to the three systems studied and successfully improving the operational efficiency of the system, in addition to recommending continuous improvement strategies of the site for increased savings/revenue to the company.

Optimisation of Griffith Water Treatment Plant Processes

Griffith City Council
Student: Jiyu Zhou
Supervisor: Dr. Raffaella Mammucari

Griffith Water Treatment Plant was constructed in the late 80's with one of the first dissolved air flotation (DAF) treatment tanks installed in Australia. Nevertheless, rapidly deteriorating raw water quality causes periodic earthy-musty taste in drinking water and upsets the DAF performance. The project involved extensive bench-scale jar test and computational simulation to model the treatment processes in order to eliminate the taste and minimise the DAF clarified turbidity. The results provide Griffith City Council with recommendation in the optimisation of the plant operation and proposal for facility upgrades, in order to ultimately deliver portable water with a higher quality to consumers.