ESIPS-MIPPS 2020 Project Summaries

Participating organisations:

- AB Mauri
- Coregas
- DuPont
- Goldenfields Water
- Griffith City Council
- Opal
- Parkes Shire Council
- Shoalhaven City Council
- Sydney Water
- Trility Group
- Visy Pulp & Paper

Projects:

The chemistry and biological impact of various alternative additives to dry yeast as processing and product performance aids

AB Mauri
Student: Annika Allen
Academic Supervisor: Dr. Raffaella Mammucari

Highly active dried yeast (HADY) products can be optimized in relation to their performance through the use of protective additives. This project examined the impact that various additives used in industry have on HADY as processing and product performance aids. An effective way to mix these additives into yeast crumble at pilot scale was also examined and validated.

Energy Balances and Analysis of large-scale fermentation

AB Mauri
Student: Kelsey McKenzie
Academic Supervisor: A/Prof. John Kavanagh

This project was aimed to model an industrial sized bubble column fermenter while accounting for imperfect mixing. This model was created by breaking the fermenter down into smaller compartments based on localised regions of homogeneity. The outputs from the model gives detailed information about the metabolic activity of yeast and can predict the amount of heat generated by yeast growth.

Liquid Tanker Payload Optimisation

Coregas
Student: Sonya Kovacevic
Academic Supervisor: Prof. Marjorie Valix

This project evaluated strategies for Coregas to optimise liquid tanker payloads. A tanker model was developed as a basis for maximising payload subject to legal axle group load constraints by determining the optimum modifications of relative axle group locations. Such a tool is envisaged to be useful for Coregas in improving business decisions around product distribution and managing transport costs by increasing the time between customer tank fills.

Characterising and testing the effect of different fouling agents on membranes

DuPont
Student: Edward Yu-Hao Qiu
Academic Supervisor: Dr. David Wang

Fouling is an issue prevalent in many membrane systems for industrial use. As manufacturers of membrane technologies, DuPont aims to provide the best tools for water treatment by tackling the fouling problem. This project lays the foundations for this goal through the determination of characteristics of fouling materials on the membranes they provide, with a focus on algal surrogates due to the increasing prominence of algal fouling in industries. The obtained results create a database for DuPont which future research into this area can branch out from. The final outcome will allow the company to recommend the most suitable membranes for a variety of jobs and satisfy customer needs.

Mount Arthur water source quality and treatment options

Goldenfields Water
Student: Mitchell Farlow
Academic Supervisor: Prof. Patrick Cullen

Goldenfields Water County Council experience a high volume of customer complaints pertaining to water quality. This project consisted of assessing the severity of the issue, verifying the cause of complaints and proposing potential options for improving the status quo. It was concluded that different water treatment options and their economic viability needs to be studied in greater detail, with improved management of the distribution scheme being required in the meantime.

Investigating the influence of wind on the hydrodynamics of North Lake Wyangan

Griffith City Council
Student: Chris Butson
Academic Supervisor: Prof. Tim Langrish

Griffith City Council is responsible for the management and rehabilitation of North Lake Wyangan which, due to blue-green algal blooms, closes for extended periods of time during the summer. This project centered around investigating the hydrodynamics of the lake with a particular focus on wind. This was achieved through the development, calibration and validation of a 3D wind-driven hydrodynamic model. The model was used to investigate management scenarios and idealised environmental conditions. Recommendations for hydrodynamic based lake management strategies were proposed and further research avenues were identified.

Evaluation of plastic levels in the paper making process feed steam and maximising sending the fine rejects stream to farmland instead of to land fill

Opal
Student: Sabina Aunedi
Academic Supervisor: Dr. Li Wei

The fine rejects are waste stream generated from the production of paper out of recycled feed at Opal. These rejects can be dispatched to farms which utilise the organic content for land application and soil enrichment purposes, given the contaminant levels satisfy EPA requirements. A robust quantification method based on mass and image analysis has been developed in this project, which established a current plant contaminant baseline and facilitated accurate and objective trend analysis. The impact of various operational set points on the contaminant levels in the fine rejects was assessed, affording a maximum 73 wt% contaminant reduction. Ultimately, the project served as a preventative measure against exemption termination and a $6.3 million loss due to landfill costs.

Modelling the Parkes-Peak Hill Water Supply

Parkes Shire Council
Student: Kane Sayer
Academic Supervisor: Dr. Annalisa Contos

Parkes Shire Council expects significant short-term growth. This project remapped the towns water mains network for accuracy and developed a hydraulic model of the water distribution system. The model can direct areas for renewals and growth. Identification of decommissioned infrastructure realised an immediate saving in asset depreciation.

Tablet dissolution technology in water reservoirs

Shoalhaven City Council
Student: Sarah Torrington
Academic Supervisor: Prof. Yuan Chen

Shoalhaven Water re-chlorinates 7 of their remote water reservoirs using a tablet dissolution method. However, the residual chlorine concentration from these reservoirs often fails to meet regulatory requirements. This project aimed to investigate the root causes of the inconsistent chlorine concentrations and improve the chlorination method; specifically, increasing the control and consistency of chlorine residuals and improving operator safety.

The project involved simulating fluid and dissolution patterns using theoretical models, experimental verification using 3D printed mini-reservoirs, and on-site chlorine monitoring using both automatic and manual techniques. The effectiveness of the currently used dissolution method and alternative chlorination methods were comprehensively assessed. It was found that using tablet chlorinators is a viable way to improve the re-chlorination of these reservoirs, which provides Shoalhaven Water with an entirely new re-chlorination option offering both high safety and sufficient residual control.

Design of a mobile unit for cleaning and disinfection of stormwater channels after wastewater overflows; using recycled water instead of drinking water

Sydney Water
Student: Alex Riley
Academic Supervisor: A/Prof. Vincent Gomes

The design of a mobile wastewater treatment unit for the clean-up of sewage impacted waterways. The project involved progressing an idea into an achievable concept ready for investment from Sydney Water. The following phases of concept development were performed: understanding the design problem, setting treatment targets, options assessment, PFD creation, 3D modelling and economic analysis.

Backwashing techniques on Macarthur water filtration plant

Trility Group
Student: Max Curtis
Academic Supervisor: Dr. Alajendro Montoya

Backwashing techniques and filter start-up strategies were investigated at the Macarthur Water Filtration Plant. The project was aimed at controlling filtered water quality, improving filter health and refining plant response to fluctuations in influent water quality. The recommendations proposed saw consistent filtrate control within Australian Drinking Water Guideline and new contractual values, as well as the implementation of new methods to complement existing knowledge, helping to form a well-rounded response to variable influent water quality. An 18% reduction in backwash water and 4% reduction in backwash electricity consumption annually resulted from the recommended changes. The new strategies would also allow filtration KPI’s to continue to be met securing approximately 20% of the plants' current annual income.

Reducing landfill rejected by the combisorters

Visy Pulp & Paper
Student: Samuel Potter
Academic Supervisor: Dr. Amirali Ghadi

Visy Smithfield is a paper recycling facility. For my placement, I worked in the Stock Preparation area, which is responsible for separating the recycled paper fiber from contaminants using cleaning and screening equipment. My project involved reducing the amount of paper fiber sent to landfill from the Combisorter Screening Units. Retaining this fiber allows Visy to reduce its environmental impact and its landfill costs. I designed and engineered solutions to permit a CombiSorters reject reduction by 25% and energy consumption drop by 40%.