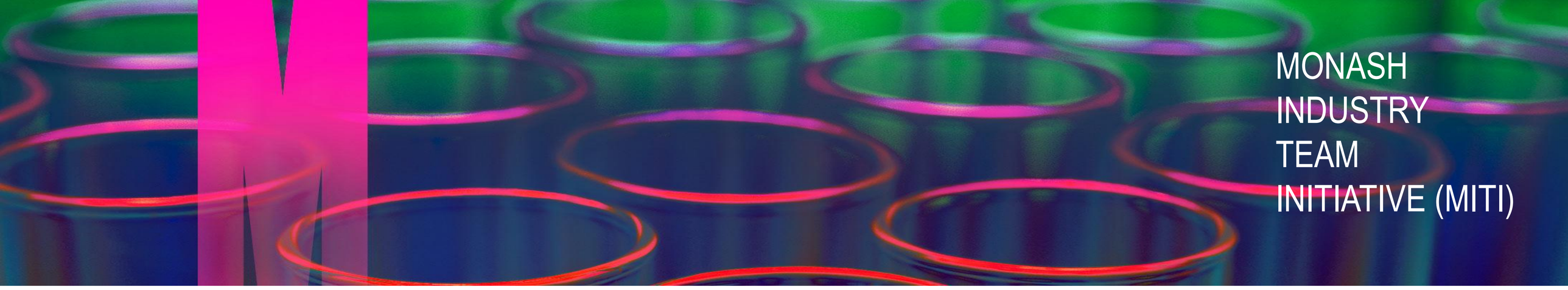


# MONASH INDUSTRY TEAM INITIATIVE (MITI)

## Novel approaches to improve solid-liquid separation and increase biogas generation from dairy farm manure and factory processed water

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## INTRODUCTION

### DEPARTMENT BACKGROUND

Agriculture Victoria Research (AVR) undertakes innovative research that benefits Victoria's agricultural sector including the dairy industry. Victorian dairy farms produce two thirds of Australia's milk. Research at the Ellinbank SmartFarm aims to improve farm productivity and benefit the environment as the farm seeks to become a carbon neutral dairy.

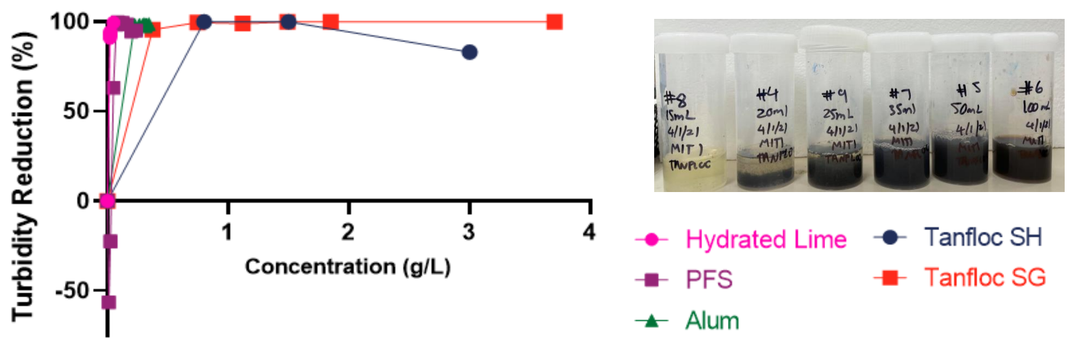
### PROJECT SCOPE

- Investigating the effectiveness of coagulant and flocculant treatment on solid-liquid separation of dairy farm effluent and factory processed water.
- Biogas production from the solid fraction of dairy effluent in combination with different inocula, treatments and through co-digestion using a laboratory scale anaerobic digester.

## PROJECT OUTCOMES

### DAIRY EFFLUENT SOLID-LIQUID SEPERATION

Coagulants and flocculants were tested for their ability to sediment the solid fraction of dairy effluent, to improve water quality of the liquid fraction (turbidity, pH, EC) and increase nutrient recovery in the solid fraction. These included: Hydrated Lime, Tanfloc SG and SH, Poly Ferric Sulphate (PFS), Polyacrylamide (PAM), Aluminium Sulphate and Psyllium Husk. Liquid fraction turbidity improvement, as well as price indicated that PFS was the preferred option. PFS was then used in combination with PAM and Alum, however no synergistic effect was observed.






### DAIRY FACTORY PROCESSED WATER TREATMENT

Several of the previously mentioned compounds were also tested on their efficacy at improving dairy processing water quality. PFS was found to be the most effective at reducing turbidity, by up to 20%.

### ANAEROBIC DIGESTION

Two experiments utilised the ANKOM RF1 Gas Production System to measure biogas produced during anaerobic digestion of manure over 14 days. The primary substrate was fresh scraped manure collected from a milking shed.

**Inoculum**: Two inocula sources, weeping wall sludge (WWS) and scraped manure (SM), were compared and used at a volatile solids ratio of 2:1 (inoculum to substrate). WWS drastically outperformed SM with a total gas production of 21 mL/g VS.

**Treated Substrate:** The effects of treating the scraped manure with PFS, PAM, Alum and PFS/PAM from the previous experiment were investigated to determine their impact on biogas production. All treatments were found to have a slight negative impact on biogas after 14 days.

**Codigestors**: Three substrates (food, brewery and dairy processing fat waste) were co-digested with manure to determine whether there was a synergistic effect on BMP. Food and brewery waste produced the largest amount of biogas of 22 mL/g VS.

## RECOMMENDATIONS

Coagulant and flocculant experiment

- Upscale to test at farm scale
- Increase sample source diversity
- Validate findings with replication
- Nutrient analysis of liquid fraction

Anaerobic digester experiment

- Upscale and measure methane
- Increase experiment duration
- ANKOM unit modification

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