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CLEANING THE CLEANING SOLUTION – AN INDUSTRY APPROACH TO CIP RECOVERY

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ABSTRACT

The Dairy Process Engineering Centre (DPEC) has positioned a new group of industry personnel to be champions of clean-in-place (CIP) management on Australian dairy manufacturing sites, through its latest industry project, "Cleaning the cleaning solution". Using a real factory for a case study and a cross-functional team from eight dairy sites, three equipment supply companies and a university researcher, strategies have been identified for Australian dairy companies to significantly reduce the chemical consumption and environmental impacts of CIP through effective recovery and reuse.

A milk evaporator was selected as a highly fouled system to determine the feasibility of localised and centralised chemical recovery from CIP. When first evaluating cleaning solution for potential reuse, it is important to understand the characteristics of the fouling material to be removed. CIP cycles on the milk evaporators at the case study site were evaluated for soil profiles to determine the most effective locations for chemical recovery and the most efficient cut-off times for chemical recovery.

Using recovered CIP solutions, following long production runs on milk evaporators, technologies were evaluated on-site for their potential to remove fouling material (measured as a reduction in chemical oxygen demand, COD) from the used cleaning solution. A reconditioned milk separator, converted to operate as a clarifier, was evaluated for its effectiveness in removing impurities from caustic solution. Results were comparable to those using a fit-for-purpose centrifugal clarifier and a hydrocyclone. However, none of these technologies demonstrated any significant reduction in COD of cleaning solutions, with only minor spinnable solids present in cleaning solutions from the case study site and from other participating sites. Chemical flocculation did not improve separation efficiency, with only the creation of weak density-neutral flocs. Size exclusion technologies provided more satisfactory removal of fouling material from the CIP solution. A stainless steel microfiltration plant was effective at removing more COD than the density-based technologies and a nanofiltration plant provided results indicating prolonged extension of a cleaning solution's life within a dairy site.

Evaluations of the performance of other cleaning processes on the sites of the project team members supported work performed by DPEC. With the completion of evaluations on eight dairy sites and reuse limitations developed using DPEC's cleaning rig, technical guidelines were developed for the selection and evaluation of CIP chemical recovery technologies.

The implementation of chemical recovery systems on site was assessed for localised and centralised CIP systems, using the case study evaluations and guidelines for CIP reuse. Sodium discharges from plants can be reduced by 80 to 95% using chemical recovery compared to single-use. Most recovery options were financially favourable for large dairy operations with centralised CIP systems, whereas simple reuse is still the most cost effective for smaller localised CIP recovery systems.