Eco-efficiency for Australian dairy processors

Fact sheet 2: Water recycling and reuse

Water and effluent management can represent a significant cost for dairy processors. Dairy processors who can reduce water use without compromising quality or hygiene standards will benefit from reduced water supply and effluent charges.

Water quality and reuse

The location and type of processing plant and options for effluent discharge influences the type and level of water reuse and recycling. For example factories in regional areas often have the option to use effluent water for irrigation while plants in urban areas may be more focussed on treating and reusing wastewater on site.

Membrane filtration is a higher level treatment that recovers product or removes unwanted components. This improves the quality of the permeate increasing the possibilities for reuse within the plant.

Some wastewater steams are relatively clean and can be recycled or reused almost immediately while others may require some form of treatment prior to reuse. HACCP plans play an important role in ensuring that hygiene standards, which are critical to producing a quality product, are met. How the water is to be reused will largely determine the quality required and thus the level of treatment necessary. For example all water that will be in contact with product must be of drinking water quality and meet the Australian Drinking Water Guidelines. Depending on quality, recovered water from evaporator and boiler condensate can be used in numerous areas of the plant including boiler and cooling tower feed water, CIP systems, dryer wet scrubbers, indirect cooling in heat exchangers and pump sealing water. As explained further over-page, condensate water may require treatment to prevent bacterial growth, to adjust pH and water hardness or to remove solids depending on the level of product contamination, odour and potentially corrosive dissolved solids.

Segregating wastewater steams also enables plants to maximise the ability to reuse wastewater and helps reduce product loss. Automatic on-line monitoring of each stream for pH, conductivity and turbidity can be used for the diversion of wastewater to the correct stream.

Reuse of pasteuriser sanitiser water

Murray Goulburn in Leitchville recovers pasteuriser sanitising water by returning it to the hot water system. The plant collects around 8 kL of 85°C water per day, which was previously sent to drain, saving around 2900 kL/yr. The cost of installation was $8000 for a double butterfly valve, non-return valve, pipework and programming. A conductivity sensor and divert valve is used to divert water that may be contaminated.

Reuse of instrument cleaning water

The Dairy Farmers plant in Malanda reuses water used for cleaning instruments such as turbidity meters. The water is stored and pumped back into the water treatment (clarifier) system saving $5200 annually or 26 000KL.

Recovery of wastewater for ash sluicing

Bonlac Foods in Spreyton recovers wastewater for the sluicing of ash from coal fired boilers. The capital cost of the system was $34 000 with anticipated savings of $15 000/yr in water and trade waste charges.

Condensate Recovery

Condensate recovery from drying and evaporation processes

Condensate recovery systems are widely used in Australian dairy factories and can provide a substantial percentage of total water supplies. Around 87% of raw milk is water and this can be almost fully recovered to potentially provide up to 100% of total water requirements. The benefits of condensate recovery can be two-fold with savings in water consumption as well as in the recovery of heat energy.

Vapour condensate, also known as 'cow water', can be used in numerous areas of the plant such as boiler and cooling tower feed water, CIP systems, reconstitution of powdered products, cheese curd wash water, dryer wet scrubbers, indirect heating (via heat exchange) and pump seal water.

Factors affecting the quality of vapour condensate include[1]:

- the type of product that is being evaporated
- the stability of evaporator operation
- the place of extraction e.g. condensate from the earlier stages (effects) of an evaporator can be used after monitoring as boiler feed water, while that from the later stages are usually suitable for washing floors and plant exterior
- continuous inspection and monitoring of the condensate quality
- the ability to chemically clean all the systems used to collect and convey the condensate
- care taken by operating personnel
- avoidance of mixing of condensate with other types of water that may encourage bacteriological growth
- effective treatment such as addition of disinfectants, carbon filtration, ion exchange, reverse osmosis and biocides (for cooling towers)
- pH treatment if condensate is acidic to avoid corrosion.

Condensate is a good source of heat energy which should be utilised. Significant savings in heating costs can be realized by recovering the heat energy for purposes such as pre-heating product or boiler feed water.

Condensate recovery from boiler and steam distribution systems

By recovering the steam condensate from boilers and steam distribution systems the operating costs, chemical use and amount of makeup water required by the boiler can be significantly reduced. A condensate return system also reduces energy costs as the already hot condensate requires less energy to reheat. Steam traps, condensate pumps and lines should be routinely inspected and maintained.

Recovery of evaporator condensate

Bonlac in Spreyton recovers milk evaporator condensate which is cooled before being sent to process water tanks with mains water makeup. The water is sanitized with chlorine dioxide dosing by recirculation. Whey permeate evaporator condensate is recovered hot and is used to supplement boiler feedwater, hot water or is sent to irrigation. The trace organics in milk condensate rules out its use in some product contact applications. The plant found that the acidity of recovered condensate plus excess acid from chlorine dioxide dosing caused corrosion problems in non-stainless steel piping and equipment. It is important to specify corrosion resistant piping material and also provide for pH adjustment.

Recovery of condensate water

Murray Goulburn in Koroit installed a condensate water recovery tank and automated their water recovery system. The initiative has increased the site's water holding capacity by 1 million litres and saves the plant $50 000 annually. For a capital outlay of $200 000 the plant now obtains over 90% of total water requirements from recovered condensate.

1 IDF 1988. Bulletin No. 232/1988, *The Quality, treatment and use of condensate and reverse osmosis permeates*

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For further information see the *Eco-efficiency for the Dairy Processing Industry Manual*, August 2004 or contact the UNEP Working Group for Cleaner Production: phone 07 3365 1432, email p.prasad@uq.edu.au
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