THE AEROBIC TREATMENT OF REVERSE OSMOSIS PERMEATE FOR REUSE

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ABSTRACT

The reduction of effluent streams and the demand for freshwater intake in the dairy industry, may be accomplished by the segregation and reuse of streams that can be readily treated. This study assessed the biodegradability and suitability for reuse of reverse osmosis (R/O) permeate from Kiwi Dairies Ltd processing factory (Hawera), using aerobic treatment.

Analysis of the permeate showed that there was a direct relationship between chemical oxygen and lactose concentration. The chemical oxygen demand of R/O permeate from two reverse osmosis membrane plants operating in parallel varied widely during the period of study. This wide variation in permeate chemical oxygen was directly related to the membrane efficiency.

Elemental analysis of the R/O permeate showed that iron and phosphorous would need to be supplemented to ensure balanced microbial growth.

The biodegradability was characterised by a series of batch tests to determine the biokinetic constants μ_m, K_S, $q_{s\,m}$ and Y_t. These tests showed that the biodegradability of reverse osmosis permeate is comparable to general dairy wastes. Batch tests were also performed on permeate from R/O membranes of varying performance efficiency, with different lactose and mineral concentrations. There were no conclusive variations in biokinetic constants between permeates from R/O membranes of varying performance efficiency.

Operation of a model activated sludge pilot plant showed that soluble COD removal

efficiencies of over 90% could be achieved at hydraulic retention times of 10 and 20 hours. The sludge settling characteristics were more favourable at a 10 hour hydraulic retention time. Sudden fluctuations in membrane efficiency caused shock loads resulting in a deterioration in treatment efficiency and sludge settling characteristics. Although the pilot plant achieved satisfactory reductions, soluble COD levels were not decreased to the level of 10 to 15 mg l^{-1} required to enable the reuse of the permeate.

In order to determine if low substrate levels could be achieved when aerobically treating R/O permeate from an efficient membrane plant, a laboratory scale reactor was used to treat permeate with a COD of 200 mg l^{-1}. It was established that R/O permeate could be aerobically treated to levels suitable for reuse, provided the previous membrane processes performed efficiently.

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