NITROGEN AND PHOSPHORUS REMOVAL FROM DAIRYSHED EFFLUENT USING A SEQUENCING BATCH REACTOR

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Brian Ellwood

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Abstract

It is apparent that present dairyshed effluent treatment systems are not capable of complying with regulations generated by Regional Councils implementing the Resource Management Act 1991. This has created a need for research into dairyshed effluent treatment.

To develop an improved treatment system for dairyshed effluent, research was conducted with two main study objectives; to characterise effluent from the dairyshed holding yard and anaerobic pond, and to develop a sequencing batch reactor (SBR) for the removal of nitrogen and phosphorus.

The carbon characterisation showed that there was a large difference between dairyshed effluent and domestic effluent in the proportion of carbon in each fraction.

When treating dairyshed wastewater to reduce BOD, nitrogen and phosphorus concentrations it was not possible to treat either the yard effluent or the anaerobic effluent without addition of external materials.

The BOD reaction rate constant for the yard effluent at 0.2 d^{-1} was similar to a typical domestic wastewater value of 0.23 d^{-1}. The anaerobic pond effluent BOD reaction rate constant of 0.16 d^{-1} was lower than the yard effluent value indicating that the anaerobically treated effluent was hard to treat aerobically.

A pilot scale SBR treating dairyshed effluent was operated for 75 days. Startup procedure used a 50/50 mixture of anaerobic pond and aerobic pond effluents which was successful in establishing a biomass capable of nitrifying anaerobic pond effluent. The startup time to establish a nitrifying population was 17 days.

The sludge was found to settle well, with a maximum sludge volume index of 54 ml/g measured during the SBR operation. Sludge bulking was not seen as a problem.

Nitrification performance a large proportion of the bacteria were lost took only 5 days to recover. With the addition of alkalinity nitrification reliably reduced the effluent ammonia concentration to 5 mg/l.

From the cycle analysis the first order reaction rate constants for nitrification were; ammonia reduction 0.7 hr^{-1}, TKN reduction 0.4 hr^{-1} and nitrate formation 0.2 hr^{-1}. These constants could be used in future work to optimise stage times.

KEYWORDS: Sequencing Batch Reactor; Dairyshed effluent characterisation; readily available carbon; nitrogen and phosphorus removal; activated sludge; venturi aerator; Sludge Volume Index.

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