

## Treatability and kinetic analysis of anaerobic moving bed biofilm reactor treating high strength milk permeate

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Received 24 April 2008; Accepted in revised form 15 August 2008

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### ABSTRACT

High strength milk permeate wastewater with chemical oxygen demand (COD) of 50–77 g·l<sup>-1</sup> from cheese making process was treated respectively under sub-mesophilic (20–25°C) and mesophilic (35–40°C) conditions using bench-scale anaerobic moving bed biofilm reactors (AMBBR). Organic loading rates (OLR) were gradually increased from 0.5 to 6.2 g total COD (TCOD)·l<sup>-1</sup>·d<sup>-1</sup> and from 1.5 to 11 g TCOD·l<sup>-1</sup>·d<sup>-1</sup>, achieving maximum stable OLRs at 5.5 and 9.5 g TCOD·l<sup>-1</sup>·d<sup>-1</sup> with corresponding hydraulic retention times (HRT) as 14 and 6.8 days, respectively, under sub-mesophilic and mesophilic condition. Within the maximum stable OLR levels, ratios of VFA (volatile fatty acids)/TA (total alkalinity) were well maintained under suggested limit of digester failure in most cases. Therefore, TCOD and soluble COD (SCOD) removal efficiencies were found to be 82% and 92% in sub-mesophilic treatment and 84% and 96% in mesophilic one. Kinetic analysis found the maximum substrate utilization rates ( $\mu_{\max}$ ) were 46.1 and 95.2 g SCOD·l<sup>-1</sup>·d<sup>-1</sup> along with maximum specific methane yield ( $Y_{\max}$ ) values being 0.301 and 0.313 l CH<sub>4</sub>·g<sup>-1</sup> SCOD removed, respectively, in sub-mesophilic and mesophilic treatments.

**Keywords:** Anaerobic moving bed biofilm reactor (AMBBR); High strength; Milk permeate; Kinetic model; Sub-mesophilic; Mesophilic

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