

Thesis Title	Performance of an Anaerobic Hybrid Reactor Combining a Filter and a Sludge Bed
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Abstract

The technology on anaerobic hybrid reactor has been developed to overcome the drawbacks of both filter and sludge blanket reactors. The advantages of anaerobic hybrid reactors are to solve sludge washout problem, less supporting materials and low construction cost, and diminishing plugging or channeling problem during long term operation. The aim of this research was to compare the efficiency of three anaerobic hybrid reactors with different densities of nylon fiber for treating tapioca starch wastewater. The volume of each reactor was 6 litres. Nylon fiber was used as supporting medium of the packed bed zone which was at the upper part of the reactor. The packing zone was half of the total reactor volume. The densities of nylon fiber were 33, 22 and 11 kg/m³ in R1, R2 and R3, respectively. The distributions of non-methanogen and methanogen population in packed bed and sludge bed zones of anaerobic hybrid reactor were investigated.

During the 6 months of operation, the reactor R1, R2 and R3 were fed at various organic loading rates (OLR) from 0.5 to 4.0 kg COD/m³/day. At OLR 4 kg COD/m³/day and HRT 5.4 days, the results of R1, R2 and R3 were as follows : 87, 84 and 70% COD reduction ; 0.18, 0.17 and 0.09 m³CH₄/kg COD_{reduced} ; 750, 890 and 1890 mg/l of total volatile acid and 67.3, 57.5, and 42.3 g of biomass, respectively. When HRT was shortened to 3 days at OLR 4 kg COD/m³/day, total biomass concentration increased to 72.5 and 63.0 g in R1 and R2,

respectively. However, COD reduction was only 74 and 62% and total volatile acid concentration increased to 1610 and 2360 mg/l, respectively.

It was found that 95% of organic removal occurred in the sludge bed zone. At short hydraulic retention time, TVA reduction was observed in the packed bed as well.

The microbial activity and population were determined by serum vial and Most Probable Number (MPN) techniques. The microbial activity was tested using 0.1% and 0.5% glucose and 0.1% acetic acid. At 4 kg COD/m³/day and HRT 5.4 day, the numbers of methanogens in R1, R2 and R3 were 5.22×10^9 , 3.94×10^9 and 2.97×10^8 whereas the non-methanogens were 3.41×10^{11} , 1.92×10^{11} and 1.03×10^{11} , respectively. The number of methanogens in R3 was the lowest which correlated with its low performance. At the same organic loading rate but shorten HRT to 3 days, the attached and suspended methanogens in the R2 decreased from 1.64×10^9 and 2.30×10^9 to 5.04×10^8 and 3.75×10^8 , respectively. With the higher density of nylon fiber in the R1, no change in the attached biomass was observed. Nevertheless, the methanogenic population in sludge bed zone was reduced.

Keywords : Anaerobic hybrid reactor/Performance/Biomass/Microbial activity/Microbial population