Thesis Title	Effect of Recirculation Rate and Recirculation Mode on Biofilm Development during Start-Up Process in an Anaerobic Fixed-Film Reactor
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Abstract

The high efficiency reactor of anaerobic fixed-film was based on the attachment of microorganisms on supporting material. The microorganism was then developed to biofilm and can retain a large amount in bioreactor, resulted in high performance on organic loading rate, COD removal and biogas production. This experiment was carried out to study the effect of flow rate and mode of recirculation on biofilm development during start-up process. This was done in 300 ml-fixed film reactor. Nylon screen was utilized as supporting medium. The reactors were fed with synthetic wastewater containing glucose supplemented with nitrogen and phosphorus. The Alkalinity in the reactors were also regulated. The hydraulic retention time was 10 days. Four different flow rate of recirculations with upflow and downflow mode were 35, 100, 120 and 150 ml/min, respectively.

The results show that the flow rate had influence on the reactor performance. Higher recirculation rate resulted in higher organic loading rate with high COD reduction. During the first period of start-up, the performance of reactor at 120 ml/min was more than 98% COD reduction. At the flow rates of 35, 100 and 150 ml/min, the COD reduction was approximately 90%. It was also found that the distribution of microorganism in bioreactor was affected by flow rate. The ratio of attached biomass was high, 15-20% of total biomass (1.1-1.6 mg dry weight/gCOD), at the flow rates of 100 and 120 ml/min. In the case of low flow rate, 35 ml/min, biofilm slightly developed while that of high flow rate, 150 ml/min, the biofilm density

was high at the first 10 day and after that slightly decreased. In addition, higher recirculation rate had an effect on the microbial activities in glucose and acetic acid utilization.

The results showed that the mode of recirculation did not significantly influence the performance of reactor. The amount of attached biomass on supporting medium of downflow recirculation mode was much higher than the upflow recirculation mode. Microbial activity in attached biomass and suspended biomass were similar either upflow or downflow recirculation mode.

In conclusion, flow rate much more affected on the amonut of attached biomass and reactor performance than mode of recirculation. The appropriated flow rate for biofilm development during start-up process was 100-120 ml/min. The advantage from this result can be used for shortening start-up period hence the reactor can increase maximum loading rate in short time.

Keywords : Flow Rate / Mode of Recirculation / Biofilm / Start-Up / Downflow Recirculation / Upflow Recirculation