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KEY WORD: SULFATE REDUCTION / SULFATE REDUCING BACTERIA / CARBON SOURCE

ANUTARA PIANGKAEW : CONTROLLING THE LEVEL OF SULFATE REDUCTION BY THE AMOUNT OF SULFATE AND TYPE OF CARBON SOURCES. THESIS ADVISOR

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The purpose of this research was to investigate the role of sulfate concentration and type of carbon source in controlling the sulfate reduction level in UASB system. The research has 2 parts, each part contain 3 experiments. The first part used sugar as carbon source whilst the second part used acetate. The same size of UASB reactors in both parts were used to feed 8 liters of synthetic wastewater having constant COD concentration of 500 mg/l. Three levels of sulfate concentration, i.e., 42, 84 and 840 mg/l, were studied.

It was found in the first part that using sugar as carbon source having COD concentration of 500 mg/l and three levels of sulfate concentration, i.e., 42, 84 and 840 mg/l, the efficiency of COD removal were 89.4%, 92.3% and 89.5% respectively. The levels of sulfate reduction were 90%, 87% and 66%, and the effluent sulfide concentrations were 13, 24 and 176 mg/l respectively. The produced gas quantities were 1,005, 886 and 101 ml/day, and the ratios of methane producing bacteria:sulfate reducing bacteria were 1:0.47, 1:0.62 and 1:1.37 respectively. In the second part, using acetate as carbon source and the same levels of sulfate concentration, the efficiency of COD removal were 96.8%, 96.7% and 93.5%, and the levels of sulfate reduction were 80%, 82% and 72% respectively. The effluent sulfide concentrations were 11.5, 22 and 200 mg/l, and the produced gas quantities were 1,350, 1,254 and 0 ml/day respectively. According to the experiment, it was shown that when using sugar as the carbon source , sulfate reduction levels would be 87% and 90% at COD:sulfate ratios of 6 and 12, respectively. The results were not much different when using acetate as the carbon source because there was excessive COD but limiting sulfate in the system. Therefore, almost the entire sulfate was reduced to nearly the same extent. It maybe concluded that when COD:sulfate ratio was higher than 6, maximum sulfate reduction could be expected and sulfate concentration would never limit the reduction reaction. On the contrary, when the COD:sulfate ratio was 0.6, sulfate reduction levels were 66% and 72% when using sugar and acetate as carbon source respectively. This showed that the sulfate reduction was decreased due to excessive sulfate as well as limited COD in the system. Therefore, COD concentration controled the sulfate reduction level. On the other hand, the COD:sulfate ratio less than 0.6 sulfate would determine the levels of sulfate reduction.

Moreover, at the COD:sulfate ratio of 12 and 6, the result showed that when using acetate as carbon source, the level of sulfate reduction was decreased compared with using sugar. Since some portion of COD used to reduce sulfate came from the volatile fatty acid and fermented hydrogen, which was not found in the acetate experiment. On the contrary, at the COD:sulfate of 0.6, the result showed that when using acetate as carbon source, sulfate reduction level was increased. Since the acid forming bacteria and the bacteria utilized hydrogen used a part of COD when using sugar as carbon source. But when using acetate, the role of both groups of bacteria was limited. Therefore, this part of COD was used to reduce sulfate instead, consequently excessive sulfate increased sulfate reduction.

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