Thesis Title	Effect of Lactic Acid on Biogas Production
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Abstract

In the course of anaerobic digestion of pineapple peel to methane gas, lactic acid is a major intermediate compound accumulated during the degradation of cellulose and glucose at high organic loading rate. The high concentration of organic acids leads to the failure of anaerobic treatment process. The aim of this work was to study the effect of lactic acid concentration on biogas production. The experiment was categorized into 3 parts : 1) effect of lactic acid concentration on its acid utilization by using mixed culture ; 2) effect of acetic acid on lactic acid utilization by using mixed culture and supplementing with 2-bromoethane sulfonate ; and 3) effect of lactic acid on acetoclastic methanogenesis by using enriched culture.

In an experiment where initial lactic acid concentration was varied from 20-100 mM, the initial degradation rate of acid depends upon the initial amount of lactic acid utilizing bacteria. After that the increase in lactic acid utilizing bacteria leads to the increase of degradation rate followed upon the acid concentration. Lactic acid at 20-50 mM was completely utilized, whereas 100 mM of lactic acid can utilized only 40 mM and acetic acid was accumulated greater than 30 mM leading to an inhibition of lactic acid utilization. The higher concentration of lactic acid, the faster methane production was observed at the beginning period when compared with the lower concentration of lactic acid. It might due to the competition in the utilization of acetic acid degraded from lactic acid between Desulfovibrio (sulfate-reducing bacteria ; SRB) and methane-producing bacteria (MPB).

To study the effect of intermediate, acetic acid, on the conversion of lactic acid to methane gas, 2-bromoethane sulfonate was added into the mixture solution of lactic and acetic

acids as an acetoclastic methanogenesis inhibitor. It was found that lactic acid utilization was inhibited at 50 mM of acetic acid where the total acid concentration was not high. If the concentration of total acid was higher than 120 mM, the degradation of lactic acid would depend on the total acid and the ratio of acetic acid to lactic acid in mixture solution.

In an experiment where the effect of lactic acid on acetoclastic methanogenesis was studied, enriched culture of acetoclastic methanogen was used as an inoculum in the mixture of lactic acid and acetic acid. This enriched culture was mostly utilized only acetic acid therefore lactic acid was kept in the process. When acetic acid was fixed 20 mM and lactic acid was varied, it was found that no the inhibition of acetoclastic methanogenesis when the concentration of lactic acid was increased up to 100 mM. It was noted that, when lactic acid concentration was increased, it promoted acetoclastic methanogens to converse acetic acid to methane. These results suggested that the inhibition of acetoclastic methanogens was not the result of high lactic acid concentration but it was acetic acid above 40 mM that caused the inhibitory effect.

Keywords : Anaerobic digestion/ Biogas/ Lactic Acid/ Volatile fatty acids