Effect of seeding ratio on acidogenic biokinetics in high ammonia concentration

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Abstract

Anaerobic digestion is one of the well-known methods for biological treatment handling of concentrated organic matter such as swine wastewater.[1] The anaerobic digestion can reduce organic loading but also hydrolyze non-biodegradable organic matter.[2] The feces from the scrapper-type barn are usually collected to make compost and the urine is discarded with swine-slurry wastewater by ocean-dumping or treated by biological methods. The lagoon, aerobic digestion, anaerobic digestion, SBR, A^2/O, and UCT have been applied for treating swine wastewater.[3]

In this study, as a result of the analysis of swine wastewater, the total and soluble chemical oxygen demand was 130g/L and 60g/L, respectively. And the volatile fatty acid as chemical oxygen demand equivalent was 45g/L, which was 75% of soluble chemical oxygen demand. Before everything else, ammonia nitrogen concentration was 6.5 g/L. From biochemical acidogenic potential test, it was concluded that the enhanced acidification process to manage swine waste should be operated in the ammonia nitrogen concentration of less than 1.2 g/L. In the result of seeding ratio experiments with artificial wastewater[4], the lag period of acidogens was taken the long time because of the inhibition by the ammonia[5], however no difference of period by the seeding ratio was not shown. The Haldane-based biokinetics were also evaluated using a method of fourth order Runge-Kutta approximation.[6,7] The nonlinear least squares (NLLS) method with a 95% confidence interval was also used. The ranges of maximum microbial growth rate, μ_{max}, and half saturation coefficient, K_s, for acidogenesis of various seeding ratio with artificial wastewater were 6.1 ~ 12.6 d^{-1} and 45,000 ~ 53,500 mg glucose/L, respectively. Also, the methanogenic microbial yield coefficient, Y, and microbial decay rate coefficient, k_d, and inhibition substrate concentration, K_{si}, for the reactors were determined to be 0.32 ~ 0.465 μgDNA/mg glucose; 0.42 ~ 1.01 d^{-1} and 51,500 ~ 55,600 mg glucose/L,

respectively.

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