ABSTRACT

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More than 70 percent of methane gas generated in anaerobic digestion process are attributable to acetic acid; therefore, the methanogenic population existing in the system is extremely crucial. However, methanogens are notorious for its slow growth, resulting in a relatively small population size. The conversion from acetic acid to methane gas, hence, becomes the rate-limiting step of the biogas production from various types of wastes. Consequently, the main objective of this research was to increase methanogenic population by the method of enrichment for enhancement of acetoclastic methanogenesis. The utilization of the enriched culture at various concentration of acetic acid were observed and compared with that of the mixed culture without enrichment from anaerobic digestor. The degradation of propionic acid was also studied.

An increase of methanogenic bacteria from the anaerobic digestor was succeeded in enrichment by the dilution method and culture enrichment technique in various basal medium supplemented with 15 mM acetic acid as sole carbon source. After many consecutive transfers, acetoclastic methanogen was enriched from the DF media containing 1×10^{8} cells/ml compared with 2×10^{4} cells/ml in the mixed culture. The enriched culture was fluoresced when illuminated at 420 nanometer. The cells were rod-shaped with flat ends and utilized acetate to methane and carbon dioxide. These characteristics were similar to *Methanosaeta* sp. (*Methanothrix* sp.).

An increase of acetoclastic methanogen accelerated acetic acid conversion to methane gas and alleviated acetic acid inhibition on methanogenic bacteria. Acetic acid utilization in acetoclastic enrichment culture still increased with increasing acetic acid to 120 mM whereas that in mixed culture reduced when acetic acid exceeded 70 mM. In addition, propionic acid degradation was retarded and accumulated in the system when the produced acetic acid from the breakdown of propionic acid was exceeded 3 mM. The increasing of acetoclastic methanogens in mixed culture inoculum accelerated the propionic acid degradation when acetic acid concentration was immediately removed. It was noted that an increase in methanogenic bacteria enhanced acetoclastic methanogenesis, alleviated acetic acid inhibition on both methanogen and propionate-utilizing bacteria, and improved the performance of the system.