Bioaugmentation strategy for enhancing anaerobic digestion of high C/N ratio feedstock with methanogenic enrichment culture

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Abstract: To investigate whether bioaugmentation could improve the digestion performance of high C/N ratio feedstock without co-digestion with nitrogen-rich substrate, different forms of enriched methanogenic culture were introduced to the continuous feed digesters. The performance efficiency of bioaugmentation on digestion improvement was compared. The effect of bioaugmentation on microbial community composition was revealed as well. Results demonstrated that routine bioaugmentation with liquid culture (containing the microbes and the medium remains) showed the best performance, with the organic loading rate (OLR), methane percentage, volumetric methane production (VMP) and volatile solid methane production (VSMP) higher at 1.0 g $L^{-1}d^{-1}$, 24%, 0.22 L L^{-1} d^{-1} and 0.23 $Lg^{-1}VSd^{-1}$ respectively, compared to the non-bioaugmentation control. Whole genome pyrosequencing analysis suggested that consecutive microbial consortium addition could reconstruct the methanogens community by increasing the populations of acetoclastic methanogens *Methanothrix*, which could accelerate the degradation of acetate and methane production.

Keywords: Bioaugmentation, high C/N ratio, methanogenic propionate-degrading culture, microbial community

1. Introduction

Anaerobic digestion (AD) is a promising technology that combines with the organic waste treatment and renewable energy production. Many kinds of organic waste have been used as feedstock for AD, such as manure, agricultural crops, food waste, sewage sludge, wastewater and microalgae. C/N ratio of the substrates is a crucial factor in the production of biogas because an appropriate nutrient balance is required by anaerobic microorganism

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