Biomethanation and anaerobic co-digestion via microbial communities of microalgal *Hydrodictyon reticulatum* biomass residues with sewage sludge

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**Abstract**

The performance of co-digestion via the combination of microalgae residues and wasted activated sludge (WAS) was evaluated in batch and semi-continuous type anaerobic digestion (AD) reactors. Simultaneously, AD with WAS alone (R\(_1\)) and with the combination of raw microalgae and WAS (R\(_2\)) were conducted, respectively. In batch tests, compared with R\(_1\) (344 mL-CH\(_4\)/g-VS), co-digestion of WAS with microalgae residues (R\(_3\)) achieved 40% higher methane yield (498 mL-CH\(_4\)/g-VS), while R\(_2\) exhibited the lowest value of 148 mL-CH\(_4\)/g-VS. The semi-continuous type R\(_3\) digester reduced higher volatile solids (VS; 39%) at an organic loading rate of 1.0 kg-VS/m\(^3\)d, producing the methane yield of 292 mL/g-VS d. The R\(_3\) semi-continuous type digester had the highest concentrations of both total bacteria and archaea, showing a ratio of 1:1 among hydrogenotrophic and acetoclastic methanogens. The bacterial community was characterized as existence of the *Lactobacillus* genus as well as fermentative bacteria belonging to the *Clostridia* class syntrophically associated with hydrogenotrophic methanogens.

**Keywords:** Anaerobic co-digestion; Microalgae residues; Wasted activated sludge; Biogas; Microbial community