



POSTER

## Enhancement of biomethane production from the anaerobic co-digestion of sewage sludge and macroalgae by continuous and intermittent addition of glycerol

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### Abstract

Anaerobic digestion (AD) is a multifunctional bioprocess that allows nutrient recycling and reduction, production of biogas, and a sustainable bioenergy carrier. AD of macroalgae presents a promising source of bioenergy in the future. Macroalgae have high concentration of carbohydrates, making it suitable for biogas production, not competing with food crops for arable land and irrigation water.

This work aimed to enhance the methane (CH<sub>4</sub>) production from the anaerobic co-digestion of a mixture of sewage sludge (SS – from a wastewater treatment plant) and *Ulva* sp. (*Ulv* – macroalgae), with continuous and intermittent addition of crude glycerol (cGly – from vegetable oils), in a semi-continuous system.

Three 5 L stirred tank reactors (R1, R2 and R3) were fed with SS and *Ulv* (85/15 in total solids). The reactors were operated at 37 °C, with a 4 L working volume and inoculated with anaerobic granular sludge from a brewery industry. Until day 179, the reactors were fed only with SS, while the hydraulic retention time (HRT) has been continuously decreasing from 40 d to 20 d. After reaching stabilization at HRT of 20 d, *Ulv* and cGly were added to feed (until day 241). R1 was the control, without cGly. In R2, cGly was continuously supplemented, 2 % (w) of the mixture of SS and *Ulv*. In R3, pulses of cGly were applied once a week, with same amount introduced in R2 since the last pulse.

The AD of SS with an organic loading rate (g of COD of substrate per L of reactor and time) of 3.33 g L<sup>-1</sup> d<sup>-1</sup> achieved a CH<sub>4</sub> production (MP, expressed in L of CH<sub>4</sub> produced per kg of chemical oxygen demand (COD) of substrate fed – L kg<sup>-1</sup>) of 166 L kg<sup>-1</sup> with 39 % of volatile solid (VS) reduction. The addition of *Ulv* (R1) decreased the MP in 20%. The continuous introduction of cGly (R2) improved significantly the MP, reaching 204 L kg<sup>-1</sup> (51 % of VS reduction). Noteworthy, the intermittent addition of cGly (R3) showed the best results in terms of MP, 251 L kg<sup>-1</sup> achieving 56 % of VS reduction.