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Research Article

Anaerobic co-digestion of waste yeast biomass from citric acid production and waste frying fat

The application of spent yeast for biogas production has been studied only in the context of breweries so far. This study is focused on the anaerobic digestion of concentrated yeast biomass (CYB), being a by-product of citric acid biosynthesis. Two experimental set-ups were used in order to test CYB as a mono-substrate and co-substrate for closing the loop in accordance with the 'bioeconomy' approach. The results show that CYB allows for obtaining a high biogas yield, with a maximum of $1.45 \text{ m}^3_{\text{N}}/\text{kg}_{\text{VS}}$ produced when CYB was used as a mono-substrate. The average methane concentration was $66 \pm 4\%$. However, anaerobic digestion of CYB alone was difficult to perform because of a tendency for over-acidification, meaning that the maximum possible organic loading rate was $1 \text{ kg}/(\text{m}^3 \cdot \text{d})$. Repeated clogging of tubes with coagulated biomass also disturbed continuous feeding. In contrast, the co-digestion of CYB with waste frying fat at a ratio of 1:20 showed stable operation during a 70-day fermentation period. The biogas yield using the substrate mixture was $1.42 \text{ m}^3/\text{kg}_{\text{VS}}$ at an organic loading rate of $2 \text{ kg}/(\text{m}^3 \cdot \text{d})$. The methane concentration reached $67 \pm 4\%$ and the acetate concentration did not exceed 30 mg/L during the entire fermentation.

Keywords: Anaerobic digestion / Citric acid / Waste frying fat / *Yarrowia lipolytica* / Yeast

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