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Utilization of Olive Mill Wastewater with Domestic Wastewater for the Production of Biogas and Microalgal Biomass

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Abstract

Despite the large number of technologies proposed for the treatment and utilization of olive mill wastewater (OMW), its management is still a major problem in olive oil producing regions. This works examines the application of two different processes for OMW treatment and utilization: a) anaerobic co-digestion of OMW with domestic wastewater and use of anaerobic digestate for microalgae cultivation and b) microalgae cultivation of OMW diluted with domestic wastewater and use of microalgal biomass for biogas production. For the first scenario, a 1L-anaerobic reactor was operated continuously in a draw-and-fill mode for a period of almost 100 days using as a feedstock a mixture of OMW with domestic wastewater at a ratio of 1:1. The effluent of the anaerobic digester was used for the cultivation of microalgae *Clorella sorokinana* in an automated flat-plate gas-lift photobioreactor (Labfors 5, Infors HT) with a working volume of 1.8 L. The anaerobic digestate was diluted with domestic wastewater at a ratio of 1:10 prior to use. For the second scenario, a mixture of raw OMW diluted with domestic wastewater at the same ratio (1:10) was used for the cultivation of *Clorella sorokinana*. The produced microalgal biomass was used for the determination of its biochemical methane potential (BMP). Results shown that COD reduction in the anaerobic digester was about 75% while the biogas production was about 250 ml/L reactor/d. In addition, total phenols reduced at about 60% during anaerobic digestion. The optical density and the suspended solids in the photobioreactor after 5 days of cultivation was increased from 0.25 and 0.1 g/L to 0.75 and 0.7 g/L, respectively. For the second scenario, the COD as well as total phenols reduction in the photobioreactor was about 60%. However, reduced optical density and suspended solids was observed at the end of experiment. In addition, BMP test shown that the biogas produced from microalgal biomass was not significant in comparison with raw OMW. In conclusion, the use of anaerobic digestion as a first step and the subsequent use of anaerobic digestate for microalgae cultivation seems more efficient for biogas and microalgal biomass production.

Keywords: anaerobic digestion, biogas, photobioreactor, microalgae, wastewater treatment

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