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BIOPHYSICAL FACTORS AFFECTING THE ANAEROBIC DIGESTION OF WASTE COOKING OIL IN MODEL SYSTEMS

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Abstract

The anaerobic digestion (AD) of fat-containing waste is often prolonged in time and problematic. Differences in AD performances could rely in a different probability for microorganisms to access the substrate. The aim of this study was to study the AD of waste cooking oil (WCO) with a biophysical approach. Two laboratory experiments were carried out using model systems consisting of WCO + hydration medium (HM) in 100 mL, static, in-batch reactors. In the first experiment, we assumed the WCO to HM (OtoW) ratio as an indicator of the accessibility of substrate to microorganisms: the higher the ratio, the greater the probability of feeding for the microbial cells. AD performances were evaluated in relation to 5 decreasing OtoW ratios. In the second experiment, we favored the formation of emulsions through alkalinisation, by adding to our model system 5 increasing amounts of KOH 1M (pH range from 6.7 to 10.1). High OtoW ratios (that is, relatively low volumes of aqueous phase) increased the CH_4 production rate while allowing CH_4 yields close to the theoretical. However, the highest OtoW ratio resulted in AD failure. A proper amount of alkali halved the time to join the maximum CH_4 production. Reasoning in terms of biophysical factors, more than in terms of oil concentration or inoculum-to-substrate ratio, could be helpful for the improvement of AD of fat-containing substrates.

Key words: alkalinisation, biogas, emulsions, interfaces, waste edible oils

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