

Start-up of a Continuous Stirred-Tank Reactor for Biohydrogen Production from Restaurant Organic Waste

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ABSTRACT

Recently, continuous stirred-tank reactor (CSTR) has been applied to degrade organic solid waste (OSW) in anaerobic digestion. If the anaerobic process is separated in two phases (hydrolytic-acidogenic and methane production steps), it is possible to increase the energy production due to the hydrogen (H₂) generation in the first step. The objective of this study was to start up a CSTR to generate H₂ from OSW of a restaurant in order to determine the operational conditions for increase the H₂ production. The start-up was obtained in three phases: 1) Inoculum activation with glucose, 2) Acclimation of inoculum to H₂ production in a discontinuous process and 3) CSTR operation. The reactor was constructed by acrylic with a total useful volume of 2L with a headspace of 0.3 L. The HRT was fixed in 24 h. The OSW was fed in a concentration of 20 gTS/L_{reactor}/d. The reactor was inoculated with anaerobic sludge from a brewery. Fermentative H₂ producers selected by a thermal shock pre-treatment (103-105 °C during 24 h). H₂, CO₂, methane and Volatile Fatty acids (VFA) were determined by gas chromatography. The results showed that inoculum activation with glucose was obtained in 3 d (H₂ percentage in biogas of 38%). The reactor was operated during two cycles of 24h. After, the CSTR was operated with H₂ percentages comprised between 33 to 51%. The reactor production begins in 59 mLH₂/L_{reactor}/d, and increase as the reactor was continually operated. The COD removal was 66%, and the digestate showed a remnant concentration of carbohydrates and proteins of 0.7 g/L and 2.7 g/L, respectively.

Keywords: CSTR; bio-hydrogen; organic solid waste.

