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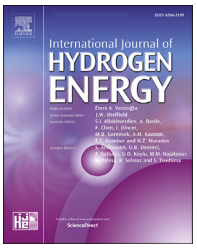

UASFF start-up for biohydrogen and biomethane production from treatment of Palm Oil Mill Effluent

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ABSTRACT

A start-up study was conducted to produce biohydrogen and biomethane from Palm Oil Mill Effluent (POME) using a two-stage up-flow anaerobic sludge fixed-film (UASFF) bioreactor. 100% molasses was used to start the system, and POME was added at 10% increments until it reached 100% after 59 days. During this period of continuous operation, the HRT and temperature were adjusted in order to optimize the condition for biogas production. Hydrogen and methane gas production fluctuated between 53–70% and 90–95%, respectively, in the last four days of operation (days 56–59), with POME percentage being increased from 70% to 100% (30%–0% molasses). Using 100% raw POME led to a total COD removal of 83.70%, average gas production rates of 5.29 L H_2 d^{-1} (57.11% H_2) and 9.60 L CH_4 d^{-1} (94.08% CH_4), in their respective units. This output is comparable to, if not better than using 100% molasses as substrate. This work concludes that based on the relative consistency of biogas production on days 56–59, the two-stage UASFF bioreactor operating at a final HRT of 4 h and temperature of 43 °C has taken a period of two months for start-up.

Introduction

In Europe countries like United Kingdom, Austria, Sweden, Asia Pacific region (India, China, Japan), and Southeast Asia (Thailand, Malaysia and Indonesia), biogas production using microbial degradation (i.e. anaerobic digestion) has become a favourable method to deal with the large volume of organic wastes produced [1]. The effective use and conservation of current resources together with the production of energy from biomass have become crucial with the growing demand for energy, affected environment and diminishing energy sources. Hydrogen (H_2) is a clean energy; can be used as a fuel for transportation or for generating electricity. Biohydrogen (Bio H_2) and biomethane (Bio CH_4) (also known as biohythane)

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