

Effect of Organic Loading Rate on Hydrogen (H₂) and Methane (CH₄) Production In Two-Stage Fermentation Under Thermophilic Conditions Using Palm Oil Mill Effluent (POME)

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ABSTRACT

The present study dealt with hydrogen and methane production in a sequential up-flow anaerobic sludge blanket (UASB) and continuous stirred tank reactor (CSTR) at thermophilic temperature. The POME was used as a suitable substrate of carbon source. The effect of various OLR was investigated from 25 kg-COD/m³·d to 125 kg-COD/m³·d at a constant hydraulic retention time (HRT) of 6 h. The UASB-H₂ reactor was operated successfully at the OLR of 75 kg-COD/m³·d when the proportion of H₂ in biogas, volumetric production rate of H₂, specific hydrogen production rate (SHPR) and H₂ yield reached the maximum values of 35%, 2.1 l/d, 175.15 ml H₂/g MLVSS-d and 49.22 ml H₂/g COD_{applied} respectively. Further, the effluent from the UASB was directly fed into the CSTR at various OLR ranging from 4 kg-COD/m³·d to 20 kg-COD/m³·d for CH₄ production. The maximum CH₄ content, volumetric production rate of CH₄, specific methane production rate (SMPR) and CH₄ yield obtained were 65%, 13 l/d, 325.13 ml CH₄/g MLVSS-d, and 155.87 ml CH₄/g COD_{applied} respectively. The effluent from CH₄ reactor was recycled at feed flow rate recycle ratio of 1:1 to UASB unit and pH was maintained at 5.5, subsequently resulted in COD removal of 85%.

KEYWORDS: Renewable energy; Anaerobic digestion; Acidogenesis; Methanogenesis

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