

## Process Enhancement of Hydrogen And Methane Production from Palm Oil Mill Effluent Using Two-Stage Thermophilic and Mesophilic Fermentation

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### ABSTRACT

The present study investigates the technical possibilities of hydrogen and methane production from palm oil mill effluent (POME). The production was carried out in two stage (thermophilic and mesophilic) continuous phase with recirculation of the digestate sludge. The reactors used for the present study, up-flow anaerobic sludge blanket reactor (UASB) and continuous stirred tank reactor (CSTR) were operated under thermophilic and mesophilic conditions, respectively. The UASB reactor was operated at 2 days hydraulic retention time (HRT) and 75 kgCOD m<sup>3</sup> d<sup>-1</sup> organic loading rate (OLR) for hydrogen production. The effluents from UASB reactor containing mainly with acetate and butyrate were directly fed into CSTR for methane production and 5 days HRT was maintained. Both UASB and CSTR reactors were operated for 120 days continuously, and a stable production of the hydrogen and methane was obtained in the separate reactors. The maximum hydrogen and methane production rate achieved was 1.92 L H<sub>2</sub>L<sup>-1</sup> d<sup>-1</sup> and 3.2 L CH<sub>4</sub> L<sup>-1</sup> d<sup>-1</sup>, respectively. The cumulative hydrogen and methane yields were 215 L H<sub>2</sub>/kgCOD<sup>-1</sup> and 320 L CH<sub>4</sub>/kgCOD<sup>-1</sup>, respectively with the total COD removal efficiency of 94%. *Thermoanaerobacterium* species was dominant in hydrogen reactor, while methane reactor was dominated with *Methanobrevibacter* sp.

**KEYWORDS:** Palm oil mill effluent; Two-stage process; Hydrogen; Methane

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