

## **An Investigation of Two-Stage Thermophilic and Mesophilic Fermentation Process for the Production of Hydrogen and Methane from Palm Oil Mill Effluent**

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### **ABSTRACT**

The two-stage process of combined hydrogen and methane production with the recirculation of digestate sludge using palm oil mill effluent as substrate was investigated. During the first stage, an up-flow anaerobic sludge blanket reactor (UASB) was operated at thermophilic conditions [hydraulic retention time (HRT)–2 days, organic loading rate –75 gCOD L<sup>-1</sup>d<sup>-1</sup>] for hydrogen production. The operation performance at short HRT and low pH was useful to separate the acidogenesis from methanogenesis. The effluents from UASB reactor containing mainly acetate and butyrate were fed into a continuous stirred tank reactor (CSTR) for methane production under the mesophilic temperature at two different HRTs (5 and 3 days). Both UASB and CSTR reactors were operated for 120 days continuously and a stable production of the hydrogen and methane was obtained simultaneously. The total hydrogen and methane yields obtained 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% in the two stage process. © 2016 American Institute of Chemical Engineers Environ Prog, 2016

**KEYWORDS:** palm oil mill effluent; two-stage process; renewable energy; COD removal

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