

## Evaluation Of The Bio-Kinetics Of Cement Kiln Dust In An Upflow Anaerobic Sludge Blanket Reactor For Treatment Of Palm Oil Mill Effluent As A Function Of Hydraulic Retention Time

Anwar Ahmad<sup>a</sup>, Rumana Ghufra<sup>b</sup>

<sup>a</sup> Department of Civil Engineering, College of Engineering, King Saud University (KSU), PO Box 800, Riyadh 11421, Saudi Arabia

<sup>b</sup> Faculty of Civil Engineering and Earth Resources, University Malaysia Pahang (UMP), Lebuhraya Tun Razak, 26300 Gambang, Malaysia

### ABSTRACT

In this paper we operated an upflow anaerobic sludge blanket reactor (UASBR) continuously at 35 °C in order to observe the effects of varying the hydraulic retention time (HRT) from 3.5 to 34.5 d and varying the organic loading rate (OLR) from 1.5 to 46 kg COD m<sup>-3</sup> d<sup>-1</sup>. The pH of the digester improved, which we varied from 1.5 to 14.5 g L<sup>-1</sup> CaO-CKD, a range pH 7.5. A high COD degradation rate of 97% and mixed liquor suspended solids (MLVSS) of 99,000 mg L<sup>-1</sup> were achieved at an HRT of 24.5 d. The maximum methane yield was 0.346 l CH<sub>4</sub>/g COD<sub>removed</sub>. A CO<sub>2</sub> reduction of 87% was obtained at an OLR of 26.5 ( $r = 0.99$ ). The optimum conditions for digestion of the palm oil mill effluent were determined by studying the bio-kinetics of granulation. The growth yield ( $Y_G$ ) was 1.45 g VSS/g COD<sub>removed</sub> day; the specific biomass decay ( $b$ ) was 0.056; the specific biomass growth rate ( $\mu_{max}$ ) was 0.988 d<sup>-1</sup>; the saturation constant ( $K_S$ ) was 460; and the critical retention time ( $\theta_c$ ) was 2.464 d<sup>-1</sup>. With a feed flow rate ( $Q_F$ ) of 1.65 l/d, the upflow velocity ( $V_{up}$ ) was 0.6 m/h, and for a  $Q_F$  of 2.45 l/d,  $V_{up}$  was 0.75 m/h.

**KEYWORDS:** Bio-kinetics; Hydraulic retention time; Granules; Biogas; CO<sub>2</sub> reduction

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