

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^a, Rumana Ghufra^b

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

^b 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⁻³ d⁻¹. The pH of the digester improved, which we varied from 1.5 to 14.5 g L⁻¹ 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⁻¹ were achieved at an HRT of 24.5 d. The maximum methane yield was 0.346 l CH₄/g COD_{removed}. A CO₂ 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_{removed} day; the specific biomass decay (b) was 0.056; the specific biomass growth rate (μ_{max}) was 0.988 d⁻¹; the saturation constant (K_S) was 460; and the critical retention time (θ_c) was 2.464 d⁻¹. 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; CO₂ reduction

DOI: 10.1016/j.seppur.2014.06.047