

Kinetic model discrimination on the biogas production in thermophilic co-digestion of sugarcane vinasse and water hyacinth

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Abstract

Co-digestion between sugarcane vinasse (Vn) and water hyacinth (WH) at various mixing ratios of 0:1, 1:0, 1:3, 3:1, and 1:1 was carried out under thermophilic conditions (55 °C) for 60 days. The effect of various mixing ratios on the pH changes, soluble chemical oxygen demand (sCOD) reduction, and cumulative biogas production was investigated. The first order, modified Gompertz, and logistic function kinetic models were selected to fit the experimental data. Model discrimination was conducted through the Akaike Information Criterion (AIC). The study revealed that co-digestion shows better performance compared to the mono-digestion of both substrates. Vn:WH mixing ratio 1:1 with inoculum to substrate ratio (ISR) of 0.38 g VS_{inoculum}/g VS_{substrate} is the most favorable ratio, achieving sCOD reduction efficiency and cumulative biogas production of 71.6% and 1229 mL, respectively. Model selection through AIC revealed that ratio 1:1 was best fitted to the logistic function kinetic model ($R^2 = 0.9897$) with Y_m and K values of 1232 mL and 31 mL/day, respectively.

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