عنوان مقاله:

Kinetics of carbon dioxide, methane and hydrolysis in co-digestion of food and vegetable wastes

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خلاصه مقاله:

Kinetic models which can express the behaviors of hydrolysis and biogas generation more precisely than the conventional models were developed. The developed models were evaluated based on the experimental data of six batch reactors. Anaerobic digestion test was co-digestion of food and vegetable waste with inoculating horse dung by 15% of the total wet weight, at the temperature of 37oC. For hydrolysis, the modified model was developed from an original first-order kinetic model. The modified first-order kinetic model was proved to be better than the original one with the hydrolysis rate constant in the range of 0.22- 0.34/day and hydrolyzable rate of 0.80 to 0.84. Kinetics of carbon dioxide and methane were developed from a current potential model. The comparison between experimental data and modeling values had the high correlation of determination (0.9918-0.9998) and low root mean square errors (0.08-4.51) indicating the feasibility of the developed model. In which, the evolution of methane showed the rate constant in the range of 0.031-0.039/day. The carbon dioxide from fermentation accounted for 12-44% of the total observed carbon dioxide. Thus, separation of fermentation and methanogenesis by various reactors may reduce the price of methane enrichment significantly. There was a lag time between methanogenesis and fermentation in reactors (λ = 7-11 days). Also, the biogas yield was in the range of 431.6-596.9 Nml/g-VS with the CH4 concentration of 56.2-67.5%. The best methane yield (393.7 Nml/g-VS) was in a reactor with food waste to the vegetable waste ratio by 1.8:1 (wet basis) and C/N ratio by 25.4.

کلمات کلیدی:

Anaerobic digestion (AD); Carbon dioxide (CO2); First-order kinetic (FOK); Food waste (FW); Methane (CH4); Modified first-order kinetic (MFK); Vegetable waste (VW).