

Abstract

The anaerobic digestion process is a waste management method that is driven by microbes and therefore, it's vital to understand the basic operation kinetics. This study demonstrates the kinetic study for twenty market wastes inoculated with rumen fluid at mesophilic temperature. The substrates consisted of blended market wastes inoculated with rumen fluid for a seven days hydraulic retention time. The experimental data obtained were used for kinetic studies by fitting the data to Linear, Exponential, Gaussian, Logistics, and Modified Gompertz kinetic models. The results obtained showed that high cumulative biogas was observed in the market wastes mixed sample at 3500 mL followed by sweet potato, potato, and banana wastes at 2000 mL and 1700 mL respectively. The un-inoculated wastes fruit and vegetable wastes mixtures produced 300 mL, blank rumen 700 mL while co-digestion of waste with rumen matter produced 3500 mL of biogas. The kinetic evaluation of the biogas generation data showed that the coefficient of determination (R^2) was in the following ranges for all the twenty market wastes, linear model: 0.5478 - 0.9973, exponential model: 0.9099 - 0.9984, Gaussian model: 0.879-0.9932, Logistic Growth model: 0.9602 – 0.9963 and Modified Gompertz model: 0.9987 – 0.9999 respectively. Therefore, the Modified Gompertz model yielded high-accuracy result. Further, biogas generation from these models showed high accuracy with 25.96 mL/g cumulative biogas in contrast to the experimental yields of 23.58 mL/g with slight deviations of 2.87 %