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Development of a nonlinear response surface model to predict the volume of biogas yield of a fixed dome digester charged with cow manure

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Waste to energy conversion is playing significant role in advancing economic development and health quality in the society. One of the technologies that exploits waste to energy conversion is biomass technology. The study focused on the development of a response surface model to predict the biogas production with input parameters being pH of slurry, slurry temperature and product of ambient temperature and global irradiance for an underground fixed dome digester fed with cow dung using continuous method. The fixed dome digester was fabricated with high density polyethylene (HDPE) PVC plastic and the data acquisition system comprised of temperature sensors, pH sensor, pyranometer, biogas analyser, gas flow meter and dataloggers. The results depicted that the hydraulic retention period for the anaerobic digestion was 50 days and the cumulative volume of biogas produced was 39.55 m3 while the reactor volume was 2.5 m3. It was determined that the measured daily biogas yield and the predicted value during the hydraulic retention period mimic each other with a correlation coefficient of 0.987 and a mean absolute error of 0.0002. The findings from the study can lead to the conclusion that the nonlinear surface response model can predict the biogas yield with high accuracy based on the acceptable values of the correlation coefficient and mean absolute error.

Keywords: fixed dome biodigester, waste-to-energy conversion, response surface model, correlation coefficient, mean absolute error

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

MSc

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