

Optimization of Biogas Production in a Batch Laboratory Digester Using Total Solids, Substrate Retention Time, and Mesophilic Temperature

Abstract.

Optimization was done by investigating the interaction effects of total solids, mesophilic temperature, and substrate retention time on biogas production in a batch biodigester. The volume of the biodigester was 0.15m³. Central composite design of Response Surface Methodology was used to design the experiment. Total solid levels were varied from 6.31% to 9.68%, temperature was from 26.59°C to 43.41°C, and substrate retention time was from 9.95 to 20.04 days. Analysis of results was done using Design Expert software statistical package (version 10.0.0.3). It gave a coefficient of determination of 0.9665 which indicated a high correlation between the variables. All the variables had a significant effect. The highest biogas production rate of 75.41litres/day (or 0.50 m³ of biogas per m³ of digester volume per day, m³ /m³ d) was achieved at a level of 8% total solids, a temperature of 43.41°C, and a substrate retention time of 15 days.

Authors:

Barasa H. Masinde, Daudi M. Nyaanga , Musa R. Njue and Joseph W. Matofari