



Investigation of biogas generation from the wastes of a vegetable and cattle market of Bangladesh under daily feed condition

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Abstract

The results of two sets of laboratory experiments on biogas generation from the wastes of a rural vegetable and cattle market of Bangladesh under daily feed condition at ambient temperature are reported in this paper. Only the easily biodegradable wastes were used as the feed for biogas production. Cow dung, fish waste, ginger, cursed lobe, guava, and banana leaf were found to be the major biodegradable wastes of the market. Daily average composition of the wastes was used in the experiments. The total solids (TS) and volatile solids (VS) of the biodegradable portion of the market wastes were 24.06% and 18.28% respectively. The experimental setups were placed in a large closed chamber and were operated at ambient temperature as controlling temperature within a bioreactor at rural set up is very difficult. Daily feed reactors were used in the experiments. The solid wastes were cut to small pieces (less than 4 mm in size) for use in the experiments. In the first set, 750 g waste was initially placed in a 2.5 L reactor and inoculum was added to make the effective volume of 2.1 L (single chamber reactor). In the second set, two digesters each of 1.5 L volume were connected in series near the bottom to have a double chamber reactor. It was initially fed with 750 g wastes (350 g in each digester) and inoculum was added to make the effective volume of 1.3 L for each digester. Both the reactors were operated for 40 days. Considering the hydraulic retention time as 40 days, from the 2nd day of operation, the single chamber reactor was fed daily one time with a mixture of 18.75 g waste and required volume of tap water (natural groundwater)

to make the total volume of 52.5 mL after dispensing equal volume of slurry from the reactor through the outlet. For the double chamber reactor, the daily feed consisted of a mixture of 65 mL consisting 18.75 g waste and 47.5 mL water. The first chamber of the reactor was fed daily with this mixture once after taking out 65 mL slurry from the second chamber. The daily temperature within the enclosed chamber was measured with a thermometer and the daily biogas production was measured by water displacement method. During the experiments, the temperature varied from 19 to 27°C and it did not affect the rate of biogas generation. The results of the experiments revealed that the general trend of gas production was similar between the two reactors. There was basically no significant differences in the gas production trend and quantity of gas between the inlet and outlet chambers of the double chamber reactor. The stable rate of biogas generation was 0.25 m³/m³/d for the single chamber reactor at the Organic Loading Rate (OLR) of 1.63 g VS/L/d and 0.20 m³/m³/d for double chamber reactor at the OLR of 1.32 g VS/L/d. The stable biogas generation was same for both the reactors in terms of organic loading and it was 0.15 m³/kg of VS added.

Biography:

Md. Abdul Jalil received his B.Sc. in Civil Engineering in 1986 from Bangladesh University of Engineering and Technology (BUET). He obtained his M.Sc. in Civil Engineering in 1988 specializing in Environmental Engineering from the same university. He received his PhD in Civil Engineering in 1993 from Tokyo University, Japan under Asian Development Bank Scholarship. He conducted post-doctoral research on water management in Loughborough University, UK under Commonwealth Fellowship during 2005-2006. He was appointed as a Lecturer in the Department of Civil Engineering of BUET in 1986 just after his graduation. He was promoted to the post of Assistant Professor in 1989. He became an Associate Professor in 1996. He was appointed as a Professor in 2001. He has published over 40 papers up to now in international and national journals, proceedings of conferences and seminars. He presented a number of papers in home and abroad. He has worked a member of different committees of national organizations. He worked in a number of national and international research projects. He also works as a consultant and completed over 50 important national development projects.