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

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Biogas generation based on market wastes is a promising technology to manage the solid wastes of the markets. This paper presents the results of two sets of laboratory experiments on biogas generation from the wastes of a rural vegetable market of Bangladesh under daily feed condition at ambient temperature. The easily biodegradable wastes were used as the feed for biogas generation. Cow dung, cauliflower stick, papaya and potato were the major biodegradable wastes. Daily average composition of the wastes was used as substrate for the experiments after cutting the wastes into small pieces (less than 4 mm in size). The total solids (TS) and volatile solids (VS) of the biodegradable portion of the market wastes were 17.84% and 13.85% 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. A 5 L reactor was initially loaded with 750 g waste and inoculum was added to make the effective volume of 2 L (single chamber reactor) in the first set. In the second set, two digesters of 1.5 L volume each 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 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 50 mL after dispensing equal volume of slurry from the reactor through the outlet. For the double chamber reactor, the first chamber of the reactor was fed daily with the same mixture as that of the single chamber reactor after taking out 50 mL slurry from the second chamber. The daily biogas production was measured by water displacement method and the daily temperature within the enclosed chamber was recorded with a thermometer. During the experiments, it was observed that the daily average temperature varied in between 19 and 27°C and it did not affect the rate of biogas production. The results of the experiments revealed that the stable rate of gas production was 0.25 $m^3/m^3/d$ at the organic loading rate (OLR) is 1.42 g VS/L/d. The outlet chamber produced roughly double volume of gas in total compared to the inlet chamber of the double chamber reactor. But the stable rate of biogas generation was 0.25 $m^3/m^3/d$ for the double chamber reactor at the OLR of 1.42 g VS/L/d. Consequently, the stable biogas generation was same for both the reactors in terms of organic loading and it was 0.18 m^3/kg of VS added.

Fig. 1: Variation of daily temperature and biogas production in the single chamber reactor and double chamber reactor with date of operation.

Recent Publication:

1. Jalil M A, Basar M S, Karmaker S, Ali M A, Choudhury M R and M S Hoque (2017) Investigation of biogas generation from the waste of a vegetable and cattle market of Bangladesh. International Journal of Waste Resources, 7:283.
2. Rahman M A, Jalil M A and M A Ali (2014) Transformation of arsenic in the presence of cow dung and arsenic sludge disposal and management strategy in Bangladesh. Journal of Hydrology, 518(C):486-492

Biography

Md Abdul Jalil has completed his BSc in Civil Engineering at Bangladesh University of Engineering and Technology (BUET) in 1986; MSc in Civil Engineering with a specialization in Environmental Engineering at the same university in 1988 and PhD in Civil Engineering at Tokyo University, Japan under Asian Development Bank Scholarship in 1993. He has conducted Postdoctoral Research on Water Management at Loughborough University, UK under Commonwealth Fellowship during 2005-2006. He was appointed as a Lecturer in the Department of Civil Engineering at BUET in 1986 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 till now in international and national journals, proceedings of conferences and seminars. He has presented a number of papers in home and abroad. He has worked as a member of different committees of national organizations. He also works as a Consultant and has completed over 50 important national development projects.

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