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Investigation of biogas generation from the wastes of a vegetable market of Bangladesh

This paper presents the results of two sets of laboratory experiments on biogas generation from the wastes of a rural market of Bangladesh. Only the easily biodegradable wastes were used as the substrate for biogas production. Daily average composition of the wastes was used in the experiments. Cow dung, cauliflower stick, papaya and potato were the major biodegradable wastes. The average total solids (TS) and volatile solids (VS) concentrations of the raw substrate were determined and found to be 17.84% and 13.85% respectively. The experimental setups were placed in a large closed chamber containing a room heater. The room heater was operated at 35°C to maintain a favorable condition for anaerobic digestion of the substrate. Daily feed reactors were used in the experiments. In the first setup, 750 g waste was initially added in a 5 L reactor and inoculum was added to make the effective volume of 2 L (single chamber reactor), and a double chamber reactor (two digesters of 1.5 L volume each, connected in series) 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. The single chamber reactor was operated for 58 days whereas the double chamber reactor was run for only 23 days. Considering the hydraulic retention time as 40 days, from the 2nd day of operation, each reactor was fed daily with a mixture of 18.75 g wastes 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. The second set of experiment was similar to the double chamber reactor of the first setup, but it was operated for 58 days including the last 16 days operation at room temperature as the heater became out of order. In case of the first setup, the temperature varied from 31°C to 36°C and it did not affect the rate of biogas generation. The results of the experiments revealed that for the organic loading rate (OLR) of 1.30 g VS/L/d, the daily stable biogas generation rate was 0.23 m³/kg of VS added for the single chamber reactor, and the daily average rate of biogas production for the later half of the operation period was 0.40 m³/kg of VS added for the double chamber reactor. During the second set of experiment (double chamber reactor), the temperature varied in between 32°C and 36°C when the room heater was on and it did not affect the rate of biogas generation, and the average rate of biogas generation was 0.29 m³/kg of VS added for the OLR of 1.30 gVS/L/d. The room temperature varied from 22°C to 25°C and the sudden drop of the temperature by about 10°C affected the rate of biogas production greatly. At the room temperature, the stable rate of biogas generation was only 0.08 m³/kg of VS added.

Biography

Abdul Jalil has completed first grade junior scholarship, Education Board scholarship, and BUET merit scholarship. He received his BSc in Civil Engineering in 1986 from BUET. He obtained his MSc 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 Postdoctoral 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 37 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 45 important national development projects.

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