

Anaerobic digestion of cattle dung at higher solid concentration in modified Janata Biogas Plant

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■ **Abstract :** The biomass as renewable source can be utilized for production of biogas which can be produced through anaerobic digestion of animal excreta and other agricultural wastes. The main raw material used for biogas production is cattle dung and most of the biogas plants installed in India are operated at 10 per cent total solids concentration. To achieve this, equal quantity of water should be added with dung and this large quantity of water required for operation of biogas plants is an important constraint in propagation of biogas technology in rural areas, particularly in water scarce regions of the country. To overcome the above said problems, an investigation was undertaken to study the anaerobic digestion of cattle dung at higher solid concentration in modified Janata biogas plant. The results indicated that on an average 203 litres of biogas / kg dry matter was produced from cattle dung at total solid concentration of 15 per cent in modified Janata biogas plant with an average methane content of 60 per cent. It was also observed that the nitrogen, phosphorus and potassium contents of digested slurry (cattle dung after digestion) were 1.50, 1.40 and 0.48 per cent, respectively as compared to that of 1.26, 1.20 and 0.40 per cent, respectively for fresh cattle dung, which indicated that digestion of cattle dung at higher solid concentration also results in rich nutrient fertilizer.

■ **Key words :** Anaerobic digestion, Total solids, Modified Janata biogas plant, Biogas, Cattle dung

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In India, the firewood is the main source of fuel in rural areas that leads to air pollution after combustion. Due to deforestation, the availability of firewood is decreasing day by day and the price of fossil fuels like coal, natural gas, kerosene etc. are increasing. On the other hand, the biomass as renewable source can be utilized for production of biogas, which is a combustible gas. This gas can be used for cooking, heating etc. thereby reducing the consumption of other fuels. The main raw material used for biogas production is cattle dung and most of the biogas plants installed in India are based on cattle dung and operated at 10 per cent total solids (TS) concentration. To achieve this, equal quantity of water is to be added with dung. The large quantity of water required for operation of a biogas plant is an important constraint in the propagation of the biogas technology, particularly in water scarce regions of the country. The solid state anaerobic digestion process could be used as an effective tool for solving the above problem. By using solid state digestion technology, loading rate could be increased to the optimized level, the

output rate of gas per unit digester volume could be increased, additional water requirement could be minimized and the digested sludge handling problem could be eliminated to a greater extent and can be easily handled and directly transported to the field.

Ranade *et al.* (1987) studied the production of biogas at different total solids content in cattle dung. They recommended a dung water mixture having 14 per cent TS for water scarcity areas. Shyam (2001) reported that the modified biogas plants for solid state digestion of cattle dung required very little or no water for mixing with the cattle dung and generated 50 per cent higher gas as compared to common biogas plants. He also reported that solid-state digestion makes handling of input slurry and digested slurry much easier than the conventional plants. It has been reported that average biogas production in modified Janata biogas plant was 204.30 litres per kg of dry matter at 16 per cent total solids and at 10 per cent solid content it was 176.54 litres per kg of dry matter which showed 15.72 per cent increase in gas production at 16