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Original Research Paper

Synthesis of Biogas as a Renewable Energy from Organic Waste Mixture by Anaerobic Fermentation

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ABSTRACT

An alternative method of obtaining gaseous fuel is through the anaerobic fermentation of wet livestock (animal and vegetable) wastes to produce biogas which is a mixture of methane (45-75%) and carbon dioxide. The process occurs in two stages. In the first stage, the complex organic substance contained in the waste is acted upon by a certain kind of bacteria called acid formers and are broken into small chain simple acids. The second stage produces methane and carbon dioxide by another kind of bacteria. The calorific value of this biogas ranges from 16000-25000 kj/m^3. It is an excellent fuel for cooking and lighting as well. When blended with diesel, it is a very good alternate fuel for compression ignition engines and can yield diesel savings of 72 to 80%. Thus, by means of suitable apparatus, biogas is produced from animal waste and vegetable waste with high calorific value (more than 16000-25000 kj/m^3).

INTRODUCTION

Due to the increase in the price of petroleum and its demand, the environmental concerns about pollution from burning gases, biogas is becoming a booming area of high concern. The attractive features of biogas are (1) it is plant derived, not a fossil fuel and as such, its combustion does not increase current net atmospheric levels of carbon dioxide, a greenhouse gas, additionally. (2) It can be domestically produced, offering the possibility of reducing petroleum import. (3) It is biodegradable and relative to convectional gas fuel (Selvamurugan et al. 2013).

Biogas is distinct from other renewable energies because of its characteristics of using, controlling and collecting organic wastes and at the same time producing fertilizer and water for use in agricultural irrigation. Biogas does not have any geographical limitations nor does it require advanced technology for producing energy, also it is very simple to use and apply. Biogas is a gas mixture and obtained by disintegration of organic materials in anaerobic conditions. 1m^3 biogas has 5000-5500 kcal energy, according to methane rate. It is an uncoloured and odourless and weaker than air. Its density rate, according to air is 83% and the octane number is 110. Subject of waste management, legislated and selling of electricity obtained from biogas is given an incentive bonus for increasing speed of this development. Nowadays, one of the most important problems of the world is environmental pollution. Increase of CO_2 emission because of using fossil energy sources cause global warming and climate change, which affects human life negatively. Biogas process can help reduce CO_2 emission born of using fossil energy sources, and also it reduces demand of fossil energy resources (Aremu & Agarry 2013).

Anaerobic digestion has been found a very good method to reduce organic matter and odours, destroy pathogens and produce energy (methane). Furthermore, anaerobic digestion is a good option to reduce mass volume of animal and vegetable wastes in the present environment. The objective of this study is to analyse, in terms of quantity and quality, the release of biogas and methane from animal waste and biodegradable vegetable waste and select the optimum ratio of the mixture as 60:40 for the study.

MATERIALS AND METHODS

Collection of Raw Materials

The vegetable waste was collected from Anna market, and animal waste from rural areas of Coimbatore, Tamilnadu. The mass of raw material for the mixture in the ratio of 60:40 as given in Table 1.

Preparation of Raw Materials

It was ensured that foreign materials like earth, sand, gravel, sawdust, etc., did not enter the digester. The slurry was pre-