Evaluation of Biogas Plant for Domestic Energy Supply using Cow Dung

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***Abstract*— The world energy need is increasing everyday due to rapid increase in population. The non renewable energy demand has decrease drastically over the years due to negative effect associated with their use. Many develop and developing countries in the world are now putting effort in renewable energy. This work studied production of biogas for domestic energy use using cow dung as feedstock in the biogas plant. The volume of the biogas plant is 60 litres and the Inoculum used was sewage sludge. The feedstock to water ratio is 1:2. The experiment was conducted at University of Nigeria, Nsukka. The volume of biogas, atmospheric temperature and digester temperature were monitored everyday. The maximum digester temperature recorded was 43°C and maximum volume of biogas produced during the experiment was 14.6 litres.**

***Keywords*— Energy, Feedstock, Renewable Energy, Biogas, Digester Temperature.**

I. INTRODUCTION

Due to pollution reduction and energy production, various types of Anaerobic digester have been installed and have been operated worldwide including cassava starch production factory in Thailand [1 2]. Biogas has been explored as an alternative to petrol and diesel for domestic purposes and as well industrial purposes [3].

From the beginning of the industrial revolution, global energy demand has been rapidly increasing [4]. As a consequence, fossil fuel reserves are rapidly decreasing which causes an increase in energy prices [5]. Effects of global warming are no more negligible [6]. Emissions of carbon dioxide and methane should be reduced and temperatures must not be allowed to rise by more than two degrees. Both the UN and the EU have set the climate goals [7]. The Swedish government has also introduced stricter targets; no biodegradable waste should be put in landfills after 2005 [8]. For these reasons, one of the major challenges for industrialized countries is energy supply for the future. Recently, numerous ideas have been considered to develop alternative energy sources such as biogas production [9].

Biomass has a huge potential for biogas production. Biogas is a renewable gas. It contains methane, which is produced when biological material is broken down by microorganisms in an anaerobic environment. Methane is the energy-rich component of both biogas and natural gas [10]. Biogas can be generated from a large numbers of raw materials and can be used for variable energy services such as heat, power or as a vehicle fuel [11]. It could replace approximately 20 - 30% of the natural gas consumption [12].

Biomass has huge potential for biogas production. There are many advantages and benefits of deriving biogas from biomass.

- Because of the economic pressure, many farmers have been forced to find alternative incomes. Biogas production is subsidized in many countries, giving the farmer an additional income [13].
- The cultural landscape is changing. Biogas production from energy crops and manure might provide maintenance of the structure of the landscape within small farms [14].
- It saves raw material. For example, if crops are used to produce biogas, one hectare can yield twice as much energy as it would if the raw material were used to produce ethanol.
- Instead of leaving biomass to natural deterioration, energy is produced from them.
- Production of biogas yields both energy and fertilizer. Therefore there is no need to buy mineral fertilizer [15].
- It helps with the reduction of landfills.
- Disposal costs of organic wastes are reduced.
- Nitrate leaching is reduced and the health of plants is increased.
- The digested residue from the biogas plant has less odor.
- The climatic protection goal that were agreed in the Kyoto Protocol is supported.

II. MATERIALS AND METHODS

Collection of Feedstock

The feedstock used was cow dung collected from three different homes. The cow dung has been exposed to sun radiation for two weeks. The inoculums used were collected from discharged anaerobic waste charged with sewage sludge. The three different homes which the cow

dung was gotten from were located at University of Nigeria, Nsukka.

Experimental method.

The waste was measured and appropriate weight of the waste was recorded. The inoculum used was also measured and recorded. Anaerobic plant (digester) of volume 60 litres was set up for the experiment. The waste to water ratio is 1:2. The digester was charged with the cow dung and monitored daily .The biogas yield, atmospheric temperature and digester temperature value were recorded.

Statistical Analysis.

ANOVA test was performed with software SPSS 16.0 to see the statistical significant difference between substrate data in the digester. The statistical significance level was selected at p-value<0.05.

III. RESULTS AND DISCUSION.

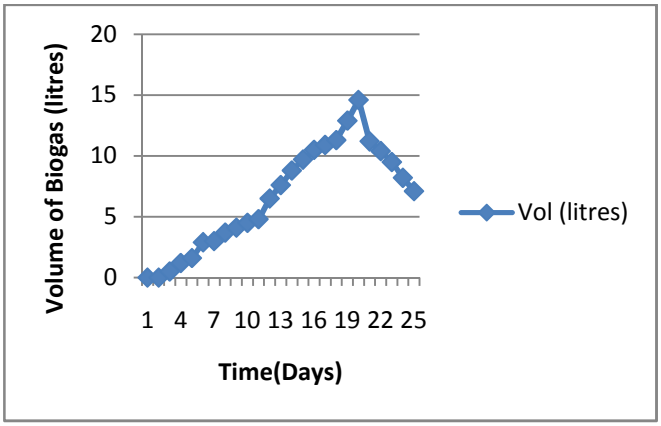
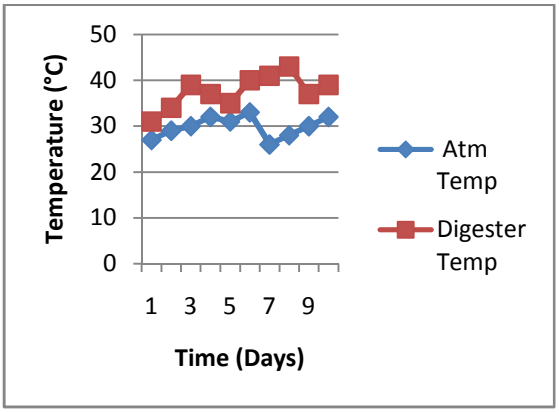


Fig.1: A graph of volume of Biogas (litres) versus Time (Days).



The experiment indicated that biogas could be produced from animal dung by anaerobic degradation i.e. breaking down of feedstock to generate biogas. The result obtained showed that biogas production increased gradually from day 1 to day 25.There was no yielding at day1 and day2 due anaerobic microorganisms such as; acidogen, acetogen and methanegen not strongly active at initial stage. Also the lignocelluloses content of the feedstock are not broken down. From fig 1 the maximum volume of biogas produced from the experiment was 14.6 litres and the minimum volume of biogas yield was 0 litres. The maximum atmospheric temperature and digester temperature recorded during the experiment was 33°C and 43°C.

IV. CONCLUSION.

The energy demand in homes and industries is increasing everyday. This work centred on the production of biogas from cow dung to meet the energy need in homes. The biogas produced from this work could be used for cooking and powering of generator at homes.

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