



International Journal of Engineering, Business and Enterprise Applications (IJEBA)

www.iasir.net

SUGAR INDUSTRY WASTE TO RENEWABLE ENERGY

Jayesh A Mahajan¹

Mechanical Engineering Department
PG Student R.G.T.U University Bhopal
India

Prof. M. K. Chopra²

Mechanical Engineering Department
R.G.T.U University Bhopal
R.K.D.F. COE Bhopal
India

Abstract: Due to the increasing demand for fossil fuels and environmental threat, a number of renewable sources of energy have been studied worldwide. The sugar industry is one of the earliest and most successful users of biomass & biogas for involving energy production. Biogas is the cheapest non-conventional energy produce from various organic wastes biogas is more economically viable for almost all the countries in the world.. Due to the existing difficulty of finding energy sources and reducing pollution, the use of renewable sources and improves the generation efficiency of renewable energy sources. In particular, the biogas comes from Sugar mill filter cake or Press mud collected from sugar mills and found to contain 75-80% organic matter, which mainly consists of cellulose, hemicelluloses, lignin, protein, sugar, wax etc. Like this kitchen waste contains 92% organic matter. Kitchen waste is collect from the society of sugar mill employees and nearest village. When kitchen waste mixed with press mud in different proportions have influenced biogas generation. Mixture of Press mud and kitchen waste then the generation of biogas increased significantly. The generated biogas is utilized for generation of electricity of sugar mill society and nearest village.

Keywords: Non-Conventional energy, Biogas, Social benefits of biogas production, biogas engine generator, performance of Electrical Energy.

I. Introduction

Energy is an important factor for any developing country. Ever increasing consumption of fossil fuels and rapid depletion of known reserves are matters of serious concern in the country. This growing consumption of energy has also resulted in the country becoming increasingly dependent on fossil fuels such as coal and oil and gas. Rising prices of oil and gas and potential shortages in future lead to concerns about the security of energy supply needed to sustain our economic growth. Increased use of fossil fuels also causes environmental problems both locally and globally. India is the largest producer of sugar in the world. In terms of sugarcane production, India and Brazil are almost equally placed. I study another biogas plants. Various types of feedstock can be used for the production of biogas: animal manure and slurries, crop residues, organic wastes from dairy production, food industries and agro industries, wastewater sludge, organic fraction of municipal solid wastes, organic wastes from households and from catering business as well as energy crops. From sugar industry the press mud emits obnoxious odor causing environmental pollution. The present methods for disposal of press mud are not economically suitable and pollute the environment. As it contains appreciable proportion of biodegradable organic matter, it has very good potential for the production of biogas. In addition, the digested slurry can be used as a good quality fertilizer. The objective of this work is to improve the biogas generation capacity of conventional biogas plant of sugar mill. In mostly sugar mill utilized feedstock is press mud. I study the utilization different feedstock press mud with kitchen waste which is easily collected that is mix in suitable proportionate ratio. The generated biogas is utilized as production of electricity. Developing countries are host to three-quarters of the sugar industry in the world. [1] AD process variables or optimized control parameters on the basis of various estimation and control algorithms under development and testing. Some experiments have been performed. They have proved the good performances of the presented biogas plant. [2]

Advantages of biogas technologies: The production and utilization of biogas from AD provides environmental and socio- economic benefits for the society as a whole as well as for the involved farmers. Utilization of the internal value chain of biogas production enhances local economic capabilities, safeguards jobs in rural areas

and increases regional purchasing power. It improves living standards and contributes to economic and social development. [3]

Renewable energy source-The current global energy supply is highly dependent on fossil sources (crude oil, lignite, hard coal, natural gas). These are fossilized remains of dead plants and animals, which have been exposed to heat and pressure in the Earth's crust over hundreds of millions of years. For this reason, fossil fuels are non-renewable resources which reserves are being depleted much faster than new ones are being formed. The World's economies are dependent today of crude oil. There is some disagreement among scientists on how long this fossil resource will last but according to researchers, the "peak oil production" has already occurred or it is expected to occur within the next period of time Unlike fossil fuels, biogas from AD is permanently renewable, as it is produced on biomass, which is actually a living storage of solar energy through photosynthesis. Biogas from AD will not only improve the energy balance of a country but also make an important contribution to the preservation of the natural resources and to environmental protection. [4]

Reduced greenhouse gas emissions and mitigation of global warming- Utilization of fossil fuels such as lignite, hard coal, crude oil and natural gas converts carbon, stored for millions of years in the Earth's crust, and releases it as carbon dioxide (CO₂) into the atmosphere. An increase of the current CO₂ concentration in the atmosphere causes global warming as carbon dioxide is a greenhouse gas (GHG). The combustion of biogas also releases CO₂. However, the main difference, when compared to fossil fuels, is that the carbon in biogas was recently up taken from the atmosphere, by photosynthetic activity of the plants. The carbon cycle of biogas is thus closed within a very short time (between one and several years). Biogas production by AD reduces also emissions of methane (CH₄) and nitrous oxide (N₂O) from storage and utilization of untreated animal manure as fertilizer. When biogas displaces fossil fuels from energy production and transport, a reduction of emissions of CO₂, CH₄ and N₂O will occur, contributing to mitigate global warming.

II. Principles for Production of Biogas

Organic substances exist in wide variety from living beings to dead organisms . Organic matters are composed of Carbon (C), combined with elements such as Hydrogen (H), Oxygen (O), Nitrogen (N), Sulphur (S) to form variety of organic compounds such as carbohydrates, proteins & lipids. In nature MOs (microorganisms), through digestion process breaks the complex carbon into smaller substances.

There are 2 types of digestion process:

1. Aerobic digestion.
2. Anaerobic digestion.

The digestion process occurring in presence of Oxygen is called Aerobic digestion and produces mixtures of gases having carbon dioxide (CO₂), one of the main "green houses" responsible for global warming.

III. Experimental setup

The installation of the biogas system (digester size: 1000 L, gasholder: 750 L) was carried out on my home terrace by working on mixture of press mud and grinded kitchen waste use for feedstock for biogas system. To guarantee direct sunlight (9h from 8:00am to 5:00pm). 60kg of dried cow dung (TS: 23%, VS: 74%) were gradually mixed by hand with water in 25 L buckets and straw material was removed. The homogenous mass was then poured into the digester. Approximately 300 L of effluent (pH: 6.38, TS: 0.12%, VS: 12%) from nearest biogas existing plant was added to the digester and served as part of the inoculum. This effluent had previously been enriched with includes flour and yeast bacteria. Following the installation and inoculation, the digester was left without feeding for 10 days, in which the change in gas composition was recorded and the gas released on a daily basis.

IV. Feeding plan

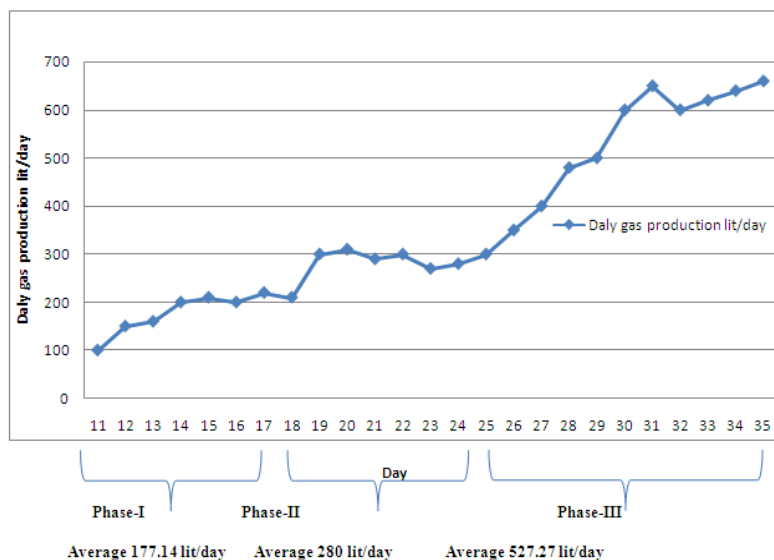
Phase 1: Start-up The quantity of feedstock during the start-up period (first week) was continuously increased by 150g per feed until 1kg in the morning and 1kg press mud in the evening was reached. Press mud fed for one week (2kg per day), 1kg twice a day was given into the inlet pipe through a funnel and subset quaintly flushed with 10 L of water. The effluent (10 L) landed in the overflow bucket, which was emptied daily.

Phase 2: Feeding strategy the following minor adjustments of the feeding method were consequently applied when first feeding 1 kg of press mud morning and evening 0.5 kg kitchen waste and 0.5 press mud. The cut up feedstock was mixed previous to the feeding by giving it into a bucket and filling it up to the 5 L morning and 5 L evening make with water (stored in a container next to the digester to guarantee equal temperatures). The well stirred diluted feedstock was then poured as influent through the inlet-pipe to minimize the risk of blocking. The effluent in the overflow bucket was two to three times fed back for flushing the inlet pipe (20-30l), hereby mixing the bacteria of the effluent with the fresh influent. The amount of 2kg per day was chosen as it represents a realistic quantity of organic waste produced by an average household.

Phase 3: Maximum load After a break of one week, the feeding load of both substrates was increased up to 3kg press mud and 1kg kitchen waste total 4kg/day (in morning 2kg press mud and evening 1kg press mud and 1kg kitchen waste) to observe if the operational, biological or chemical-physical limit was reached.

V. Result

As an indicator of the anaerobic process stability, development of the pH, Temperature, Total solid in % and gas production inside the digester during phase 1, phase 2 and phase 3. The pH was measured twice per day before feeding in the morning (8:30am) and evening (4:30pm). Generally, pH-values below 6 should be avoided as it restrains the activity of the methanogenic bacteria. The amount of daily feed is shown as well as the digester temperature at medium height (average 30.8°C). Daily gas in phase I, phase II and Phase III production per day shows in Graph 1.



Graph 1 Daly gas production inside digester in lit/day

VI. Discussions

As the pH-value reacts with quite some delay to changes in quantity and quality of feeding substrate. Graph 1 shows in phase I the average gas production is 177.14 lit/day the daily feed is 2kg press mud. In phase II some changes are done in the same feed: 1.5 kg press mud and 0.5 kg kitchen waste; the gas average production is 280 lit/day. In phase III the feed is increased to 4 kg per day (3kg press mud and 1kg kitchen waste); the average gas production is 527.27 lit/day. In phase II and III pH is stable and there is more gas production than in phase I.

VII. CONCLUSIONS

Renewable energy produced from sugar industry waste that is press mud contains 75-80% organic matter, which mainly consists of cellulose, hemicelluloses, lignin, protein, sugar, wax, etc. Like this sugar industry waste, kitchen waste contains 92% organic matter. I used press mud in the first phase and obtained the reading for biogas production. In phase second I used 25% kitchen waste and 75% press mud, and the generation of biogas increased significantly. From the results obtained, it can be concluded that the same quantity of feed stock we achieve the maximum quantity of biogas produced when we mix the different feed in a specific ratio.

VIII. References

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