Available online at www.pelagiaresearchlibrary.com

Pelagia Research Library

Der Chemica Sinica, 2011, 2(6):265-268

Pelagia Research Library
ISSN: 0976-8505
CODEN (USA) CSHIA5

The use of biogas technology in small scale farms in Nigeria

Yetunde M. Aladeitan

Chemical Engineering Dept., University of Abuja, Nigeria

ABSTRACT

The availability and consumption of energy is an index of prosperity in any nation, Nigeria needs more energy to meet the rising demand, due to the population outburst and more agricultural production. The global supply of coal, natural gas, and most importantly oil are becoming depleted, nuclear power is too dangerous, and without alternative energy sources we will experience a severe lack of energy in the future. Therefore it is necessary for us to discover alternative energy sources in order for our industrial and commercial future in the twenty-first century to be secure. For many years now, Nigeria has been facing an extreme electricity shortage.This deficiency is multi-faceted, with causes that are financial, structural, and sociopolitical, none of which are mutually exclusive. Biogas technology is the use of biological process, in the absence of oxygen, for the breakdown of organic matter into biogas and high quality fertilizer. Biogas is a combustible mixture of methane and carbon dioxide. The process also eliminates disease-causing organisms that cause disease in humans and animals. Potentially, this technology is a significant and profitable way of mitigating global climate change. This research paper seeks to explore the advantages of the technology as an alternative energy source.

Keywords: Biogas, biogas technology, anaerobic digestion.

INTRODUCTION

Energy consumption in the world has been expanding at relatively high rate. Energy fossil sources mainly come from oil, natural gas and from coal. These fossil fuel resources are expected to deplete after a number of years, therefore the need to look into other alternative source of energy to meet up with the world's ever growing demand for energy.

Biogas is a good renewable energy source; it is also known as landfill gas and is produced by wet organic waste decomposing under anaerobic conditions in a landfill. The waste is covered and mechanically compressed by the weight of the material that is deposited from above. This material prevents oxygen exposure thus allowing anaerobic microbes to thrive. This gas builds up and is slowly released into the atmosphere if the landfill site has not been engineered to capture the gas.

Landfill gas is hazardous for three key reasons. Landfill gas becomes explosive when it escapes from the landfill and mixes with oxygen. The lower explosive limit is 5% methane and the upper explosive limit is 15% methane. The methane contained within biogas is 20 times more damaging than is carbon dioxide [1]. Therefore, uncontained landfill gas, which escapes into the atmosphere, may significantly contribute to the effects of global warming by turning this human and animal waste into a mixture of carbon dioxide that can be used for lightning and cooking. A waste channel can be built from domestic toilets and shelters from animals into a sealed tank. The waste ferments and is naturally converted to gas and compost. In addition to the plant and animal waste, dead plants can also be added to the landfill. This further helps to reduce air pollution. During the process, an air-tight tank transforms biomass waste into methane producing renewable energy that can be used for heating, electricity, and many other operations that use any variation of an internal combustion engine. A *biogas plant* is the name often given to an anaerobic digester that treats farm wastes or energy crops. Biogas can be produced utilizing anaerobic digesters.

Production process

The process of biogas production takes place in anaerobic conditions and in different temperature ,mesophilic (25-40^{0}C) and thermophilic (50-55^{0}C) regimes of bioconversion. Biogas production in a thermophilic regime is much higher than for the mesophilic regime. Modern thermophilic bioreactors can produce 2-6 m^3 per m^3 of installation, which amounts to 5-15 kg of waste on a dry mass base (or 50-150 kg of wet mass). For mesophilic biogas installations, these values are 0.2-0.4 m3 per m3 of installation and 0.5-1 kg on a dry mass base (or 5-10 kg of wet mass) [2]. Biogas produced on such farms can be used not only for cooking and heating water, but for dairy production as well.

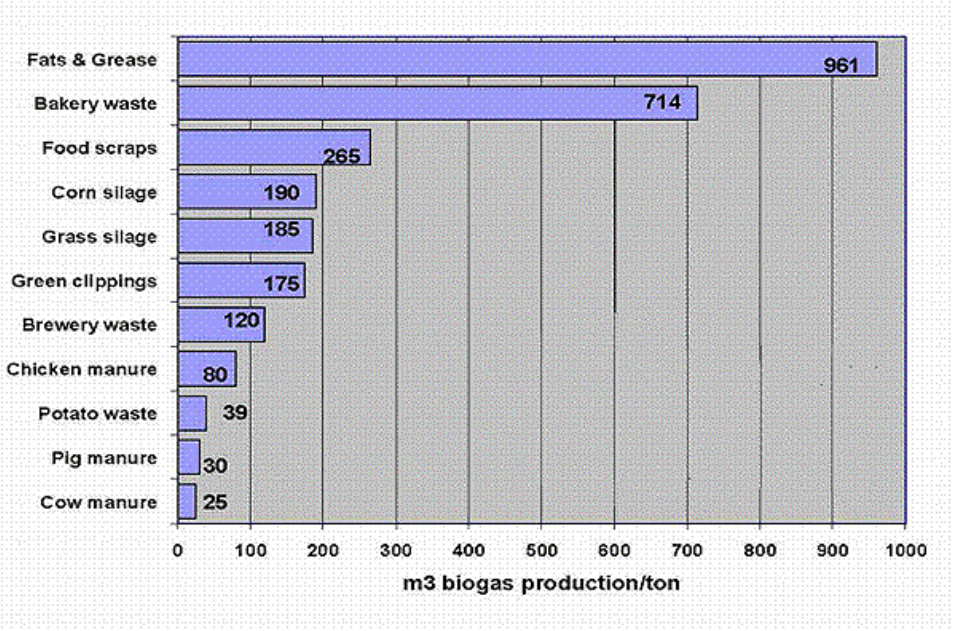

Fig 1, The Sources of Biogas Production [3].

Biogas provides poor rural women and men in developing countries like Nigeria with clean and renewable energy all year round. Electricity generated by biogas lights the lamps that allow children to study in the evening. It frees women from the time-consuming chore of collecting firewood and enables them to undertake value-added activities. And thanks to biogas fuel, rural kitchens are now free of smoke and ash, for a healthier household environment. As fertilizer, the

organic residue that is an end-product of the biogas process boosts the productivity of agricultural products. The table below shows the sources of biogas production.

As we can see from figure 1, organic wastes that contains a high percentage of fats and grease are capable of producing a higher quantity of biogas.

Biogas units are becoming more and more widely used in rural areas of developing countries. Because biogas units are environmentally friendly and do not require large investments, biogas has the potential to become the 'fuel of the poor'.

The several benefits of the use of biogas includes: saving the already depleted fossil fuels, saving time collecting firewood, protecting forests, using crop residues for animal fodder instead of fuel, saving money, saving cooking time, improving hygienic conditions, producing high-quality fertilizer, enabling local mechanization and electricity production, improving the rural standard of living, and reducing air and water pollution

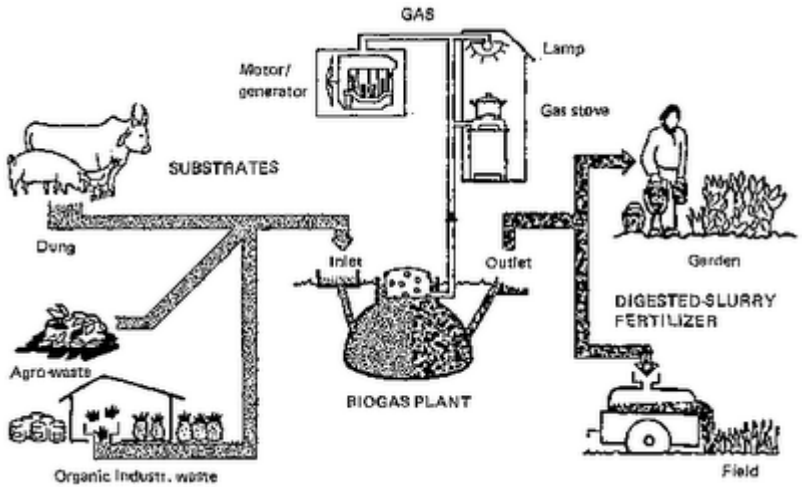

Fig 2. Production and uses of biogas [4]. (www.google.com)

Energy serves as an input into the production of goods and services in the nation's industry, transport, agriculture, health and educational sectors. In Nigeria were the power supply is epileptic, biogas will be a good alternative for the farmers to power their machinery and also help supply electricity which will keep the farm running, many agricultural farms have closed up because of the problem of poor power supply, the use of generators is not cost effective at all since most farmers are just working on a small scale. With the emergence of biogas technology small scale farming will be upgraded to large scale farming, this will in turn improve the ecomomy greatly. If compressed, biogas can replace compressed natural gas for use in vehicles Methane within biogas can be concentrated via a biogas upgrader to the same standards as fossil natural gas, which itself has had to go through a cleaning process, and becomes *biomethane* . If the local raw biogas produced from digestion is roughly 60% methane and 29% CO_2 [5]. with trace elements of H_2S. Generation of biodegradable wastes is illustrated in the table below.

Table 2: Biodegradable Solid Wastes Generated from Domestic Activities in Some Cities and States of South Western Nigeria.

City/State	Population(year 2003)	Biodegradedable wastes(Metric tonsT per week)
Akure	316,925	46,271
Ibadan	1,650,806	33,050
Ijebu-Ode	330,799	54,773
Osogbo	253,430	38,852
Oyo	371,355	69,128

Source: [6]

Prospects and challenges

Even though there are several opportunities in the biogas sector, there are however challenges that cannot be ignored. Biogas technology development has several constraint i.e. lack of technical expertise, production and construction cost, lack of awareness on the technology. In the emergence of these constraints, there is therefore a need for a strong commitment from every component of the society.

CONCLUSION

The technology appears to be economically attractive in most cases and Nigeria with vast biomass resources must do everything possible to develop and use her abundant biomass resources more effectively. Biogas is a technology worth exploring.

REFERENCES

[1] http://bio-gas-plant.blogspot.com/2011/05/introduction-to-biogas-technology.html (viewed November **2011**)
[2] J. Mohammed, S. Kamran, M. Fororogh; International conference on food engineering and biotechnology Landfill Biogas production process IPCBEE vol 9 Singapore **2011**
[3] The Sources of Biogas Production (http://integratedenergyindustries.com/biogas-process.html) viewed November **2011**, Biogas production
[4] http://www.google.com.ng/search?q=biogas+productiondiagram(viewedNovember **2011**)
[5] O. Olanrewaju. and A. Ilemobade, Waste to Wealth: A Case Study of the Ondo State Integrated Wastes Recycling and Treatment Project, Nigeria
[6] I.K Adewumi, M.O Ogedengbe, J.A Adepetu. and Y.L Fabiyi., *Journal of Applied Sciences Research* 1(3): 285-291 (**2005**).