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The small-scale biogas generation sufficiency cooking energy for a family-sized unit

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Abstract

We present the production of biogas through the anaerobic digestion of cattle manure and its subsequent use in the generation of cooking energy for small families in Pongkhon, Sakon-nakhon of Thailand is currently economically attractive. This is a result of the findings from Pongkhon, Sakon-nakhon, which provides incentive rates for the production of gas cooking from biogas. Based on the concept of modular small-biogas plants, this analysis evaluates the economics of small-scale biogas utilization systems from fresh waste, cow waste and biomass. This system can save the cost of gas cooking at 92 % and reduce fresh waste in family at 98%.

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Keywords: small-scal biogas, gas cooking, sufficiency energy

1. Introduction

Biogas is a combustible mixture of gases (see figure 1). It consists mainly of methane (CH4) and carbon dioxide (CO2) and is formed from the anaerobic bacterial decomposition of organic compounds, i.e. without oxygen. The gases formed are the waste products of the respiration of these decomposer micro organisms and the composition of the gases depends on the substance that is being decomposed. If the material consists of mainly carbohydrates, such as glucose and other simple sugars and high-molecular compounds (polymers) such as cellulose and hemi cellulose, the methane production is low. However, if the fat content is high, the methane production is likewise high [1]. In recent, technology has the life cycle assessment of biogas upgrading technologies [2], the engineering design and economic evaluation of a family-sized biogas project in Nigeria [3], a storage of carbon dioxide captured in a pilot-scale biogas upgrading plant by accelerated carbonation of industrial residues [4]. In principle of overview of CO_2 capture technologies [5], a MSWI bottom ash for upgrading of biogas and landfill gas [6], and new technical, economic, and environmental assessment of amine-

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based CO_2 capture technology for power plant greenhouse gas control show in [7]. In the world important of the climate balance of biogas upgrading systems in [8]. The development of waste management for small-size biogas reactor recreate in local area with re-use fresh waste in family.

In this paper consist of introduction in section 1, theory and background of biogas in section 2, the efficiency of biogas for a family at 98% in result in section 3 and conclusion in section 4.

2. Theory and background

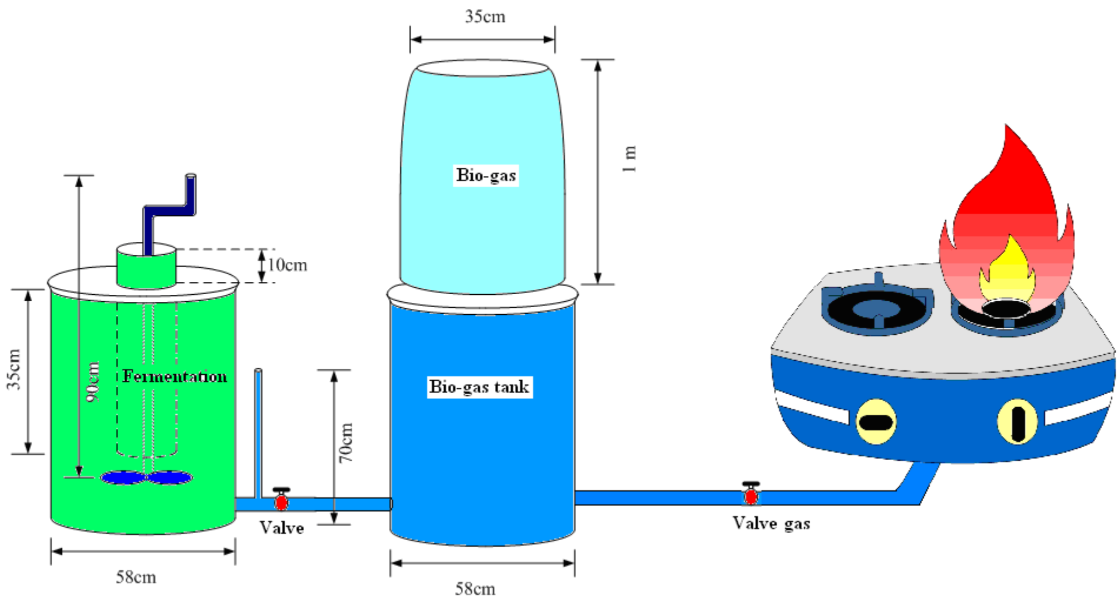

Fig. 1. shows the schematic of the fermentation bio-gas system for sufficiency a family-sized

Bacteria decompose the group consisting of 3 types.

1. Psychrophilic. Bacteria will produce a small anoint of gas at the temperature between 0-10 °. With this temperature, it will stop the bacteria digest organic material not to be gas. And bacteria will die down.

2. Mesophilic bacteria will produce gas at the temperature between 30-40 ° C. The gases produced in moderate quantities but are more resistant to environmental changes as well. Although the temperature is a little different than this. This bacterium is able to survive.

3. Thermophilic bacteria will produce gas at the temperature between 50-58 ° C. The gas production volumes among the three types of bacteria, but bacteria are the most vulnerable to climate change can not put up with it a little. The rain and the temperature drop to about 2 degrees Celsius, causing bacteria to die instantly. So if you want to use bacteria to digest organic substances, you have to control the environment of the pond.

Biogas is the gas caused by the decomposition of organic matter. In a state of oxygen deficiency, the decomposition reaction initiated by bacterial groups Anaerobic bacteria called this process the "degrading anaerobic" organic + Anaerobic bacteria Biogas + waste + heat naturally Typically, this process occurs in lowland wet bottom of the lake and in the. deep underground or may arise out of human hands. For example, livestock waste ponds and landfills of organic matter in landfill are the biogas fermentation which include many buffalo dung as manure or pig manure, chicken manure crops such as grass, straw, peanut shell, rice, water or waste effluents from the industries such as alcohol, plant food manure, etc. However, if left in the area, there will be the decomposition of oxygen to CO_2 and water, but when the decomposition of organic matter without oxygen to CH4, which causes greenhouse effect (Greenhouse Effect) than CO_2 as CH_4 stability in the atmosphere. CH_4 and CO_2 4-5 times longer than CO2 2-5 times, the rate increases so that the manure anaerobic fermentation system. CH4 will be stored and used as an energy source to replace petroleum, and reduce the amount of CH_4 in the atmosphere manure anaerobic fermentation of organic material in manure. About 80% is converted to CH_4 from the many sources that the biogas (which contains CH_4 60-80%) produced from animal manure.

Biogas occurs when organic matter is decomposed by bacteria called. Bacteria methadone GT Nick Knowles. (Methanogenic) or methadone Fresno Janesville. (Methanogens) is a bacterium that reactions with organic matter. Generate methane and other gases. In anaerobic conditions (anaerobic) microbes because they are small creatures. State the need for it. And sensitive to the changing environment. Growth will slow if the physical and chemical changes in the environment and affect the production of biogas. These bacteria are naturally present in the manure, which are readily available in rural households.

1. Conversion to acid. (Acidification) microbial group 1 (the Genesis acid) acts to degrade complex organic compounds. Transformed into fatty acids. Then, microbiological group 2 (acetone production) will act as a change of fatty acid profiles compiler C Natick nodes i and lactic acid during the liberation of hydrogen and carbon dioxide.

2. The production of methane. Caused by bacteria, group 3 called Methanogens. Acid used in the first step is living and check out the CH4 the microbial group 4 are hydrogen and carbon dioxide, resulting CH_4 to process the gas above can perfected this process in Figure 1.

Gas	%
Methane (CH_4)	55 – 70
Carbon dioxide (CO_2)	30 – 45
Hydrogen sulphide (H_2S)	
Hydrogen (H_2)	1 – 2
Ammonia (NH_3)	
Carbon monoxide (CO)	trace
Nitrogen (N_2)	trace
Oxygen (O_2)	trace

Fig. 2. Composition of biogas. The actual make-up depends on what is being decomposed [1]

In fig. 2 shows the methane and whatever additional hydrogen there may be makes up the combustible part of biogas. Methane is a colourless and odourless gas with a boiling point of -162 °C and it burns with a blue flame. Methane is also the main constituent (77-90%) of natural gas. Chemically, methane belongs to the alkanes and is the simplest possible form of these. At normal temperature and pressure, methane has a density of approximately 0.75 kg/m3. Due to carbon dioxide being somewhat heavier, biogas has a slightly higher density of 1.15 kg/m3. Pure methane has an upper calorific value of 39.8 MJ/m3, which corresponds to 11.06 kWh/ m3. If biogas is mixed with 10-20% air, you get explosive air, which – as the name indicates is explosive [1].

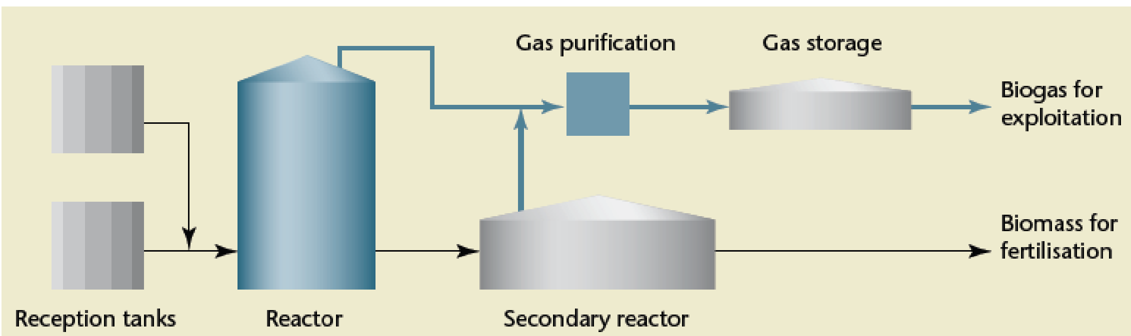

Fig. 3. shows schematic diagram of a communal biogas plant [1]

The animal manure enters the system in the reception tanks. It is then pumped to the reactor where the digestion and biogas production take place. In principle, both on-farm and communal plants have similar designs, but some parts will obviously be of different size depending on, for example, how much biomass they are meant to handle. In the following we describe a typical communal plant (see figure 3). The plant can be divided into a biomass system and a gas system. The reactor tank typically has a volume of 10-20 times the daily input of biomass for a thermophilic process and 15-25 times the daily input for the mesophilic process.

3. Result

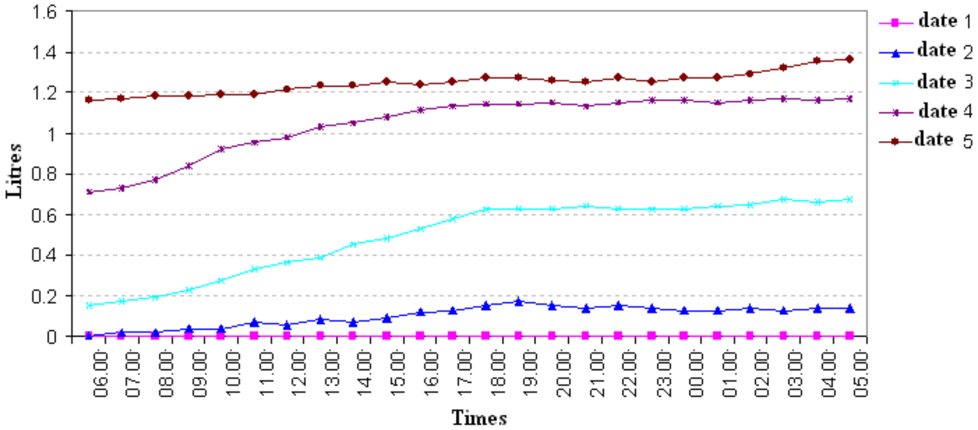

Fig. 4. shows the resulting biogas

Fig. 4 shows the relationship between the numbers of litres of gas; biogas is measured in the biological interpretation of the experimental time. It can be seen that there is far more to it. At the time the trial date is 1-5 in the biogas fermentation. The time of the inspection with sensors that measure the amount of biogas used for 24 hours in a day, the amount of each hour. From the experimental results, we know that fermentation biogas will be used for compost and biogas volume will increase significantly.

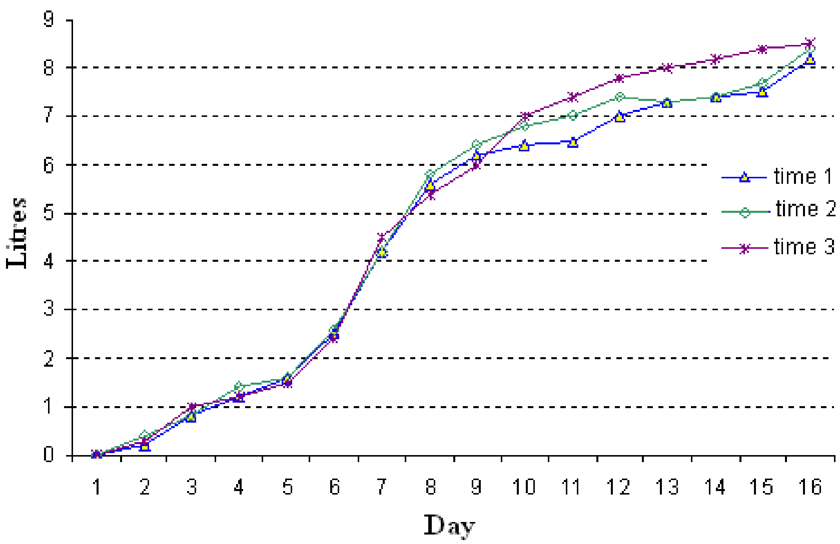

Fig. 5. show the relation of bio gas quantity and amount fermentation date

Fig. 5 shows the gas rate of the biogas. Experiment biogas from the first round will have a maximum of 15 days. Fermentation gas depends on the gas tank to the one designed for family consumption. We can be offset by use with natural gas. This research was designed to fit four people with one of the family of graphs of a gas flow rate of 200 litres of fermentation biogas yield results 8 litres / cycle fermentation.

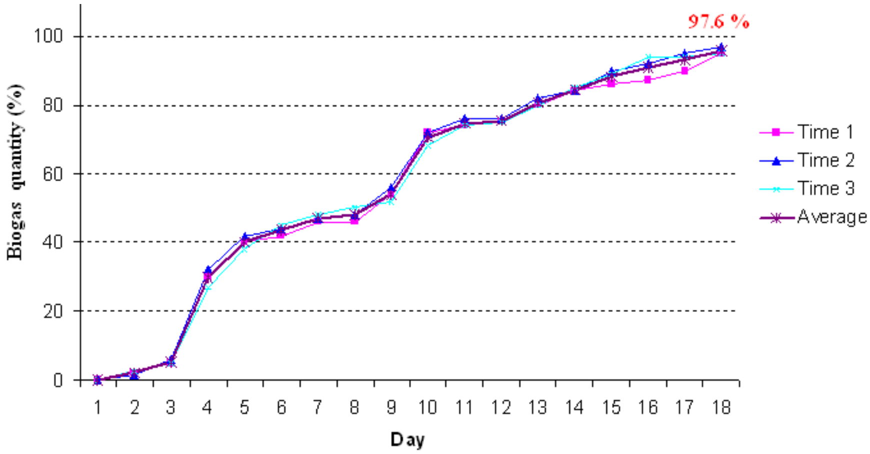

Fig. 6. shows the relation between percent of biogas quantity and fermentation date

In Fig. 6 show the result fermentation of maximum biogas is 97.6% for 100% fresh waste from a family. The fresh wastes in family, which can be take in the tank reactor of biogas by fermentation time on 16 -18 days for the efficiency 98%. The biogas quantity can be design biggest more than this system by add sized and underground design for security of life. The graph shows 3 times for average value the biogas quantity, which related fermentation time.

4. Conclusion

The biogas technology offers a good potential energy option for Sakhon-Nakon of Thailand through its various advantages. However, the adoption and success of biogas technology remain very low. Factors identified as positively promoting the development of biogas in Sakhon-Nakon, including younger/male head of household, the increase of farm income or the amount of cattle owned, the larger household size and the increasing cost of traditional fuels. This study has therefore built on the existing informational gap and presented an integrative approach for multi criteria sustainability assessment of biogas production in Sakhon-Nakon. The result was designed to fit four people with one of the family of graphs of a gas flow rate of 200 litres of fermentation biogas yield results 8 litres / cycle fermentation. With respect to technical sustainability, it is shown that the biogas life cycle for the three digesters has an inherent energy deficit that can only be overcome by operating the digesters, at least, for a period between 16 and 20 days per a family.

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