Biogas in Thailand

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Introduction

Presently, animal farms in Thailand have been growing up very fast. It cause a lot of waste and water pollution problem, especially from pig farms. Pig farms are important cause of declining of environment and this problem is worsening everyday. Biogas technology is a technology that farmers who raise animal have used in their farms for a long time. This technology has been supported by a lot of government organization. In the present, we use biogas technology in animal farms not only for the utility of the waste and gas but also for eliminate the waste from the farms and keep our environment clean.

Theoretical Background

About Biogas

Biogas is gas which occurs from dung or other organic matters that is digested by bacteria in anaerobic digestion environment. This gas is mixed gas among methane 60-80%, carbon dioxide 20-40%, and a little bit of nitrogen, hydrogen, and hydrogen sulfide and the rest is vapor. Methane is the most elements in biogas. This element has inflammable quality, so we can use for providing heat energy, providing light, and running machine.

Technologies are available

Anaerobic Digestion is a technology that is widely used. There are two steps in the process of producing biogas:

1. Large organic molecule such as fat, carbohydrate, and protein in form of solution is digested until become volatile acids by acid-producing bacteria.

2. Organic acid is changed into methane and carbon dioxide by methane-producing bacteria.

Condition

Condition of digesting organic matters and producing gas:

1. **Temperature.** Anaerobic Digestion can occur in the widely range of temperature, between 4 and 60 degree Celsius, depend on type of bacteria.

2. **pH.** is very important for fermentation. The proper range of pH is between 6.6 and 7.5. If pH is too low, it is dangerous for bacteria that produce methane.

3. **Alkalinity.** is the ability to maintain level of pH. The proper alkalinity for fermentation id between 1,000 and 5,000 mg/L in form of calcium carbonate (CaCo3)

4. **Nutrients.** The organic that proper for the growing up of bacteria has nutrients of C:N and C:P in the proportion of 25:1 and 20:1, respectively.

5. **Inhibiting and Toxic Materials** such as evaporable fatty acid, hydrogen, or ammonia can prohibit the process of anaerobic digestion.

6. **Organic and characteristic of organic for the processes of digest** are different depend on factors that involve.

7. **Type and pattern of Biogas Plant.** Biogas Plant can be separated by working characteristic, feature of waste that is used to be raw material, and efficiency into two types.

    - **Slow ferment plant or ferment plant for solid.** Three types of ferment plant for solid that we usually use are:
        (a) Fixed dome digester
        (b) Floating drum digester or Indian digester
        (c) Plastic covered ditch or Plug flow digester

- **Fast ferment plant or polluted water treatment plant** is divided into two types.
  (a) Anaerobic Filter (AF)
  Filter can be made from a lot of material such as stone, pebble, plastic, synthetic fiber, and pieces of bamboo. For Anaerobic Filter, bacteria increase and grow up on the FixedFilm. Gas is kept in the plastic that cover trough. We usually use a board to protect sunlight and increase gas pressure.
  (b) Upflow Anaerobic Sludge Blanket (UASB)
  Bacteria attach on the organic sludge that move around the ferment plant. UASB work by control the speed of polluted water. Polluted water is controlled in order to make it flow in from the bottom to the top of the water treatment plant. The light sludge is going to float out with the polluter water and the heavy sludge is going to sink to the bottom of the water treatment plant.

Biogas in Thailand

About Biogas

Biogas is natural gas that occurs from the process of digesting organic matters using biological treatment in anaerobic digestion environment. Biogas occurs in the areas that have waste water from factory which transfigure agricultural and livestock product such as tapioca mill, palm oil refinery, canned fruit factory, alcohol factory, abattoir, and pig farm. Primary element of biogas is methane. Methane is known as one of Green House Gas which is twenty-one time more dangerous than carbon dioxide. As a result, if we let biogas float in the air, it will destroy our environment. Presently, we have technology that can convert waste water from factory into biogas, and then we can use biogas as fuel in place of fuel oil, in producing electricity, and etc.

Relative places and Production

- Abattoir in Phitsanulok
  Production of biogas : developed biogas system which consists of Upflow Anaerobic Sludge Blanket (UASB), method of water treatment in anaerobic system, and Wetland System in order to produce biogas which is the replacement of liquefied petroleum gas (LPG) in the working process of pig abattoir. This system provides good quality in water treatment and reducing expend for fuel.

- Palm oil refinery in Krabi
  Production of biogas : developed water treatment in anaerobic system which can produce 3,600 cubic meter of biogas per day. They use this biogas as fuel for dynamo.

- Tapioca Mill
  Production of biogas : use Anaerobic Baffled System which has High Density Polyethylene (HDPE) cover on ferment plant to produce biogas. They can produce and use 70,000 cubic meter of biogas per day. They use one part of biogas in place of fuel oil in their producing process. And another part, they are planning to produce electricity for sale.

- Thai Elephant Conservation Center in Lampang
  Production of biogas : produces biogas from elephant's excrement. Six elephants provide approximately 250-300 kilograms of excrement per day and they get approximately 15-20 cubic meter of biogas per day. Most of biogas is methane which they use as fuel for cooking and running water pump for agriculture.

- Lanna Product Co., Ltd.
  Production of biogas : use the benefit from process of transfiguration of goods, food, and cosmetic to produce biogas which can be converted into electric energy and heat energy for produce feed and use in their own farm.

- Pakchong Farm in Nakhonratchasima
  Production of biogas : Biogas system is using trough plant and follows up with 2,000 cubic meter UASB treatment plant for water treatment from pig farm.

Fig 1: Pakchong Farm's biogas plant [1]

- Aphichat Farm in Ratchaburi
  Production of biogas : Biogas system is using trough plant and follows up with 2,000 cubic meter UASB treatment plant for water treatment from pig farm.

Fig 2: Aphichat Farm's biogas plant [1]

- K.P.K. Farm in Ratchaburi
  Production of biogas : Biogas system is using trough plant and follows up with 1,000 cubic meter UASB treatment plant for water treatment from pig farm.

Fig 3: K.P.K. Farm's biogas plant [1]

- S.P.M. Farm in Ratchaburi
  Production of biogas : use 5,000 cubic meter BG-V2 biogas system.

Fig 4: S.P.M. Farm's biogas plant [2]

- Kittiwat Farm in Chiang Mai
  Production of biogas : use 1,000 cubic meter BG-V2 biogas system.

Fig 5: Kittiwat Farm's biogas plant [2]

- Chirasak Farm in Ubon Ratchathani
  Production of biogas : use 2,000 cubic meter BG-V2 biogas system.

Fig 6: Chirasak Farm's biogas plant [2]

- C.P. Chomthong Farm in Chiang Mai
  Production of biogas : use 1,000 cubic meter BG-V2 biogas system.

Fig 7: C.P. Chomthong Farm's biogas plant [2]

- Bunmi Farm in Ratchaburi
  Production of biogas : use 4,000 cubic meter BG-V3 biogas system.

Fig 8: Bunmi Farm's biogas plant [2]

- Veerachai Farm in Ratchaburi
  Production of biogas : use 8,000 cubic meter H-UASB biogas system.

Fig 9: Veerachai Farm's biogas plant [2]

- Nhongbua Farm in Ratchaburi
  Production of biogas : use 4,000 cubic meter BG-V2 biogas system.

Fig 10: Nhongbua Farm's biogas plant [2]

Government Initiative Programs

- Applying energy conservation strategy plan in 2002-2011. This plan includes four main ideas.

    1. Energy conservation which is composed of factory, building, and house energy conservation and transportation energy conservation.
    2. Using renewable energy
    3. Personnel officer development
    4. Public relations

- Projects that are supported by Energy Conservation Promotion Fund are as follow:

    1. Promotion of using renewable energy
    2. Demonstration of using solar power for Jitlada garden
    3. Promotion of producing charcoal and managing wood resource
    4. Developing wind power for water pump
    5. Testing electric energy saving device on highway
    6. Appling biogas technology for water treatment in tapioca mill for the protection of power and environment
    7. Promotion of producing biogas for using as power in tapioca industry
    8. Improve the collecting gas system in order to support the producing electricity by using biogas from garbage pit project
    9. Promotion of using biogas from abattoir water treatment system

- Drafting regulation to buy electricity from small renewable energy producer, including private, government, state enterprise, and any people who have their own dynamo. The process of producing electricity should be in line with the buying electricity regulation, for example the electricity that is produced from wind power, solar energy, and biogas can provide electricity for selling department of Electricity Authority on condition that electric power which provide into the system should not more than one megawatt.

Discussion

Producing biogas uses less capital than other fuel. Benefits from biogas are as follow:

- **Biogas is inflammable and provides heat.** As a result, we can use it for cooking, light a lamp, and producing electricity. Moreover, we can use it with water heater and animal food mixing machine.
- **Reduce the pollution from spreading out of insect and smell.** Dung that we ferment is digested, so smell and fly's egg in that dung are destroyed by process of fermentation.
- **Get fertilizer.** The waste that we get from biogas fermentation is used as fertilizer better than dung and manure because in the process of fermentation compound of nitrogen in dung has been changed to the form that benefit for plants.
- **Making feed.** We can dry the waste from fermentation before mix it with feed for cow and pig in the proportion of 5-10 kilograms of dry waste for 100 kilograms of feed. This method is going to reduce cost of production and the animals are going to grow up as usual.
- **Reduce amount of plant disease and the spreading out of weed.** Anaerobic Fermentation reduces some amount of bacteria that cause some plant diseases and destroy the flourish of weed seed. As a consequence, if we use the dung that has been fermented, the spreading out of weed is going to decrease.

References

[1] http://www.biogastech-cmu.com/space1.html

[2] http://www.biogastech-cmu.com/space2.html

[3] http://www.palarnfarm.com/know/bio.htm

[4] http://www.dmf.go.th/variety/variety.vocab.eng.asp

[5] http://www.geocities.com/originalbiogas/index.htm

[6] http://www.geocities.com/originalbiogas/Benefits.htm

[7] http://www.geocities.com/poem99.geo/article/oct24.html

[8] http://homepage.eng.psu.ac.th/eec/jn3.html

[9] http://www.efe.or.th/index.php?option=content&task=view&id=219&Itemid=39

[10] http://www.eppo.go.th/nepc/doc-NEPC-2545-01-pr18apr45-3.html

[11] http://www.efe.or.th/index.php?option=content&task=view&id=219&Itemid%20%2039&limit=1&limitstart=1

[12] http://www.efe.or.th/index.php?option=content&task=view&id=24

[13] http://www.parliament.go.th/energy/energy%20quiz.doc

[14] http://digital.lib.kmutt.ac.th/news_content.php?n_id=241

[15] http://www.eppo.go.th/doc/report-2546/5-policy-measure.html