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Today's Need & Requirement of Biogas Plant's (Green-Energy)

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Abstract

The systems that are used to create bio-energy can greatly contribute to reducing greenhouse gases as they have the possibility of reducing the need to use fossil fuels. By providing a non-polluting energy source which is also renewable, the earth is being kept clean of harmful emissions. Biogas is also the ideal way to ensure that all areas have access to electricity. As a fairly cheap source of electricity, biogas is a fuel source that has the power to provide decent energy to the world. Deforestation is the result of trees being cut down and used as fuel for fires in areas where there is no access to electricity. With biogas, the waste that would be there anyway can be used to create fuel. This means that trees do not have to be cut down and plants do not have to be damaged.
Keywords: Cheaper, Energy, Emissions, Harnesses, Economy, Micro-Organisms

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I. INTRODUCTION

Biogas refers to a mixture of different gases produced by the breakdown of organic matter in the absence of oxygen. Biogas can be produced from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste. Biogas is a renewable energy source. Biogas can be produced by anaerobic digestion with methanogen or anaerobic organisms, which digest material inside a closed system, or fermentation of biodegradable materials. This closed system is called an anaerobic digester, bio digester or a bioreactor.

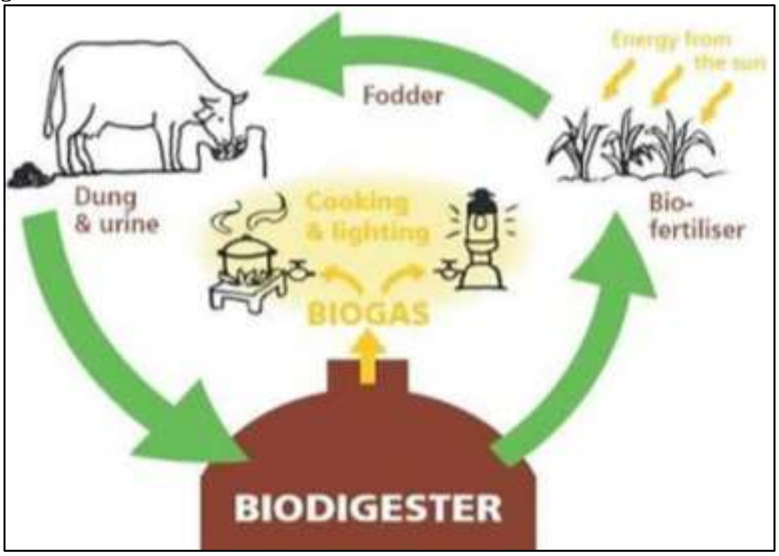

Fig. 1: General Cycle of Biogas

Biogas is primarily methane (CH_4) and carbon dioxide (CO_2) and may have small amounts of hydrogen sulphide (H2S), moisture and siloxanes. The gases methane, hydrogen, and carbon monoxide (CO) can be combusted or oxidized with oxygen. This energy release allows biogas to be used as a fuel; it can be used for any heating purpose, such as cooking. It can also be used in a gas engine to convert the energy in the gas into electricity and heat.

II. MATERIAL & METHOD

Anaerobic digestion is particularly suited to wet organic material and is commonly used for effluent and sewage treatment. This includes biodegradable waste materials such as waste paper, grass clippings, leftover food, sewage and animal waste. Large quantity of waste, in both solid and liquid forms, is generated by the industrial sector like breweries, sugar mills, distilleries, food-processing industries, tanneries, and paper and pulp industries. Poultry waste has the highest per ton energy potential of electricity per ton but livestock have the greatest potential for energy generation in the agricultural sector.

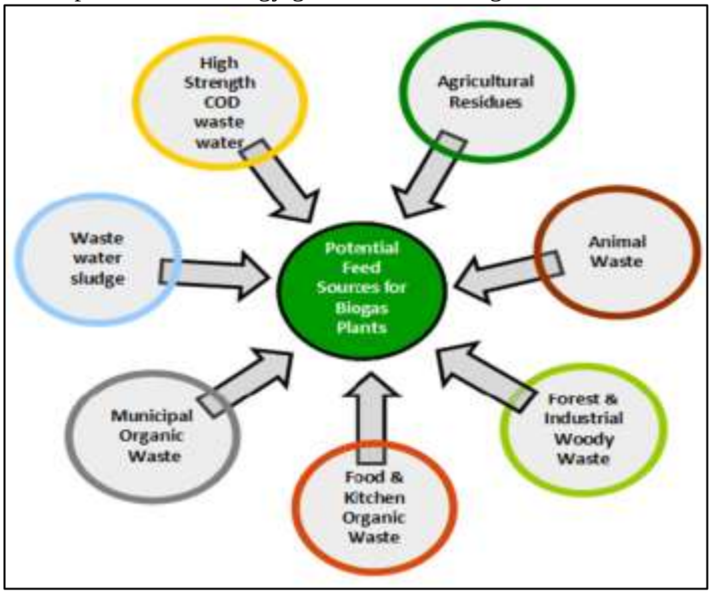

Fig. 2: Material of Biogas Production

A wide range of organic substances are anaerobically easily degradable without major pretreatment. Among these are leachates, slops, sludges, oils, fats or whey. Some wastes can form inhibiting metabolites (e.g.NH3) during anaerobic digestion which require higher dilutions with substrates like manure or sewage sludge. A number of other waste materials often require pre-treatment steps (e.g. source separated municipal organic waste, food residuals, expired food, market wastes and crop residues).

III. BIOGAS PRODUCTION AND COMPOSITION

Biogas is made in a biogas digester. We call it a digester because it is a large tank filled with bacteria that eats (or digests) organic waste and gives a flammable gas, called biogas. The bacteria in the Gesi550 biogas digester need to be cared for like you would care for an animal. If the bacteria have too much or too little food they get sick. You must feed the bacteria every day with a mixture of food waste and water. In addition to biogas, the Gesi systems make waste water that is rich in nutrients. This water may be poured over your plants to help them grow.

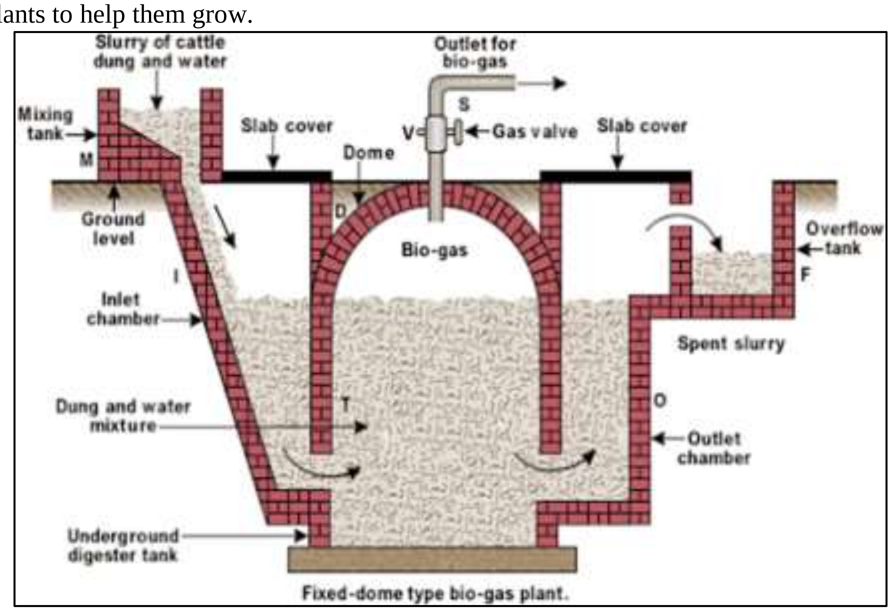

Fig. 3: Biogas Production

Biogas systems make use of a relatively simple, well-known, and mature technology. The main part of a biogas system is a large tank, or digester. Inside this tank, bacteria convert organic waste into methane gas through the process of anaerobic digestion. Each day, the operator of a biogas system feeds the digester with household by-products such as market waste, kitchen waste, and manure from livestock. The methane gas produced inside biogas system may be used for cooking, lighting, and other energy needs. Waste that has been fully digested exits the biogas system in the form of organic fertiliser.

A. *Composition*

Component	Agricultural waste	Landfills	Industrial waste
Methane CH_4	50–80	50–80	50–70
Carbon dioxide CO_2	30–50	20–50	30–50
Hydrogen sulphide H_2S	0.70	0.10	0.80
Hydrogen H_2	0–2	0–5	0–2
Nitrogen N_2	0–1	0–3	0–1
Oxygen O_2	0–1	0–1	0–1
Carbon monoxide CO	0–1	0–1	0–1
Ammonia NH_3	Traces	Traces	Traces
Siloxanes	Traces	Traces	Traces
Water H_2O	Saturation	Saturation	Saturation

Fig. 4: Composition of Biogas

IV. IMPORTANT ROLE OF BIOGAS IN FUTURE

Any renewable energy source is regarded as exceptionally important in our modern society. With a changing climate that is resulting in intense droughts, devastating hurricanes and a diminishing ozone, investing in a clean, renewable energy source is definitely the way of the future. Biogas is fast becoming a valuable energy source which is contributing to the electric capacity which is being generated throughout the world. A recent UNEP report stated that the total amount of renewable energy which was generated in 2012 exceeded 1 470 GW which was a dramatic increase from the amount generated in 2011.Currently renewable energy accounts for one fifth of the overall energy consumption used around the world. Forestry, crops, sewage, industrial residue, animal waste, and municipal waste are all used to create the biogas renewable energy. Traditionally biogas was used for cooking and heating purposes but these days it is being used for a number of other things as well. By the year 2050 it is thought that biogas will account for around one third of all energy.

Biogas is already being used in rural areas as well as in urban areas. Based on the industry needs, the creation of biogas is creating many job opportunities. The most common way that biogas is created is by combustion (burning). Biochemical processes also have the power to produce clean energy.

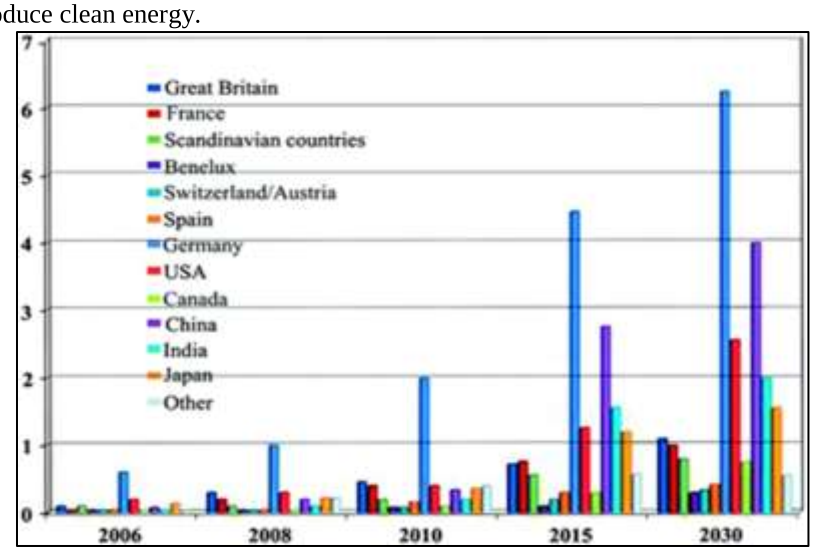

Fig. 5: Biogas Uses in Future

V. FACTOR AFFECTING OF BIOGAS PRODUCTION

This study investigated the main factors influencing digester temperature and methods to reduce heat losses during the cold season in the subtropics. Four composite digesters (two insulated and two uninsulated) were buried underground to measure their internal temperature (°C) at a depth of 140 cm and 180 cm, biogas production and methane (CH4) concentration in biogas from August to February. In parallel the temperature of the air (100 cm above ground), in the slurry mixing tank and in the soil (10, 100, 140, and 180 cm depth) was measured by thermocouple. The influent amount was measured daily and the influent chemical composition was measured monthly during the whole experimental period. There are mainly six factor affecting of biogas production. Which are given below

A. *Sub-layer composition (Slurry)*

"Biogas is produced under anaerobic conditions; the process is denominated as anaerobic digestion. The major constituent of biogas is methane (55-70%), CO2 (30-45%) and some traces of gases such as H2S and ammonia. Common digester feedstock (feeding material) is cow, buffalo, and pig manure"

B. *Temperature*

The optimal temperature for a biogas plant depends on the composition of the biomass used. Nitrogen content and pH value are crucial factors in selecting the optimal processing temperature. Research in biogas production indicates that the optimal temperature for mesophilic bacteria is around 37°C and around 55°C for thermophilic bacteria.

C. *Hydraulic Retention time (HRT) & Solid Retention time (SRT)*

Hydraulic retention time (HRT) is the average period that a given quantity of input material remains in the digester to be acted upon by the methanogens. In a cattle-dung plant, the retention time is calculated as:

HRT = total volume of the digester / volume of input added daily

$$HRT = Vd / Vi$$

The steady-state performance of thermophilic (55 °C) and mesophilic (35 °C) anaerobic digestion as a function of solids retention time (SRT) was evaluated in laboratory digesters at SRTs ranging from 4 to 15 days, and in pilot-plant digesters at a 20-day SRT.

D. *The reaction medium of pH*

The experiments were performed in a batch mode using tofu whey waste water indigenous at pH 3.7 and neutralized wastewater at pH 7 Concentrations were varied at 20, 50, and 100% wastewater. Our results showed that at low pH of tofu wastewater did not have a negative influence on anaerobic digestion of tofu wastewater in a batch mode. A further addition of wastewater into the reactor (batch-wise) also showed a similar trend. It suggests that the presence of adequate buffer capacity was more important than adjustment of wastewater pH.

E. *Corbon – Nitrogen Ratio*

The highest destruction of volatile solids of 93 percent was achieved at C:N of 20 followed by C:N 30 and 15. A shortened BMP test is adequate for evaluating optimum admixtures.

F. *Moisture Content*

Study was to examine the effects of soil moisture, irrigation pattern, and temperature on gaseous and leaching losses of carbon (C) and nitrogen (N) from soils amended with biogas slurry (BS). Undisturbed soil cores were amended with BS (33 kg N ha−1) and incubated at 13.5°C and 23.5°C under continuous irrigation (2 mm day−1) or cycles of strong irrigation and partial drying (every 6 weeks, 1 week with 12 mm day−1). During the 6 weeks after BS application, on average, 30% and 3.8% of the C and N applied with BS were emitted as carbon dioxide (CO_2) and nitrous oxide (N2O), respectively.

VI. ADVANTAGE OF BIOGAS

Biogas gives many advantages for the environment, companies and people involved. The advantages are: Biogas is a green energy source in form of electricity and heat for the local grid. Considerable environmental advantages - less emission of the greenhouse gasses methane, CO2 and nitrous oxide. Producing biogas gives many advantages for the environment, companies and people involved. The advantages are:

- Biogas is a green energy source in form of electricity and heat for the local grid.
- Considerable environmental advantages - less emission of the greenhouse gasses methane, CO2 and nitrous oxide.
- Environmentally friendly recirculation of organic waste from industry and households.
- Less odour inconveniences when spreading slurry on the fields - fermented slurry smells considerably less than normal slurry and the smell decreases faster.
- Plants absorb fermented slurry better, increasing the yield on the fields.
- Protection of subsoil water - improved nitrogen exploitation reduces leaching and thereby drinking water contamination.
- Reduced costs for artifical fertilizer.

VII. DISADVANTAGES OF BIOGAS

- First of all it is explosive gas, so you have to take care while working with it. Generating biogas is easy, you require a close chamber and non-presence of oxygen and your work is get done. But while storage, you have to take care about the space. It should be open space, Always try to store gas outside the home (store at roof, garden).
- Second disadvantage is gas density. As compare to LPG, you require more biogas to cook food. So 1 meter3 biogas digester can generate only 25 minutes of cooking (depend upon the input of digesters and environmental condition etc).
- Transportation is biggest issue. It is very difficult to transport the bio gas. So if you are looking for commercial purpose than it is very difficult and costly process to store at one place and transport.

VIII. CONCLUSION

In the study area the biogas user household benefit. From reduce indoor smoke, improve sanitation and better lighting. The biogas installation make each household to save on average 144 min per day (from fuel wood collection cooking, cleaning utensils /kitchen materials) and there is also reduction in the physical stress and health improvement. In addition, the slurry and waste from the biogas plants provide a high quality fertilizer that can be used improve to soil fertilizer and increase productivity. In agriculture depending rural communities in the study area. Use of biogas provide an annual saving of 3834.56 Birr from fuel wood, Birr 1242.34 from charcoal, Birr 130 from dung cake and Birr 270 and Birr 720 from kerosene chemical fertilizer, respectively with Net cash flow of Birr 1537 per HH/year.

There are some challenges that must be tackled in order to ensure sustainable future of biogas technology.

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