Original Research Paper

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Biogas-smart and sensible solution to global energy crisis.

Engineering

KEYWORDS: Biogas, microbial decomposition, digested slurry.

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ABSTRACT

Biogas is produced from microbial decomposition of carbonaceous material. Due to large cattle population in India, animal dung is used for biogas production. Kitchen and agricultural wastes can be used for biogas production. This gas can be used for cooking, lighting or any other purpose. Digested slurry is used as fertilizer. Central and state Government provides subsidy for biogas plant.

- **INTRODUCTION:** - Biogas is produced through anaerobic microbial fermentation of any degradable carbonaceous material. We can obtain biogas and digested slurry. Biogas is used for lighting, cooking, Ignition, electricity generation, vehicle fuel. Digested slurry is used as fertilizer.

- **Biogas:** - Biogas is produced through anaerobic microbial fermentation (decomposition in the absence of oxygen) of any degradable carbonaceous material. We can obtain biogas and digested slurry. Biogas is a methane rich gas. Biogas is used for lighting. When biogas enters into biogas lamp its mantle glows and emits light. The lamp consumes 0.15 m3 biogas per hour. For cooking both single and double burner biogas stoves is available, consuming 0.25 to 1.20 m3 biogas per hour. Petrol and diesel engines can run on Biogas. Petrol engines can run purely on biogas whereas diesel engines can run as dual fuel using both diesel and biogas. One KWh electricity can be generated from 0.8 m3 biogas. Vehicles can also run on biogas fuel. Digested slurry is used as fertilizer.

- **Digested Slurry:** - Digested slurry is an excellent fertilizer due to higher nutrients content, presence of plant nutrients, absence of weeds, liquid form.

- **Benefits of biogas plant:** - Cattle dung, urine, human excreta, kitchen wastes can be used effectively. Fuel at hand can be obtained. Saving of trees/forest, as biogas can be used for cooking; digested slurry can be sold in the market. Saving fossil fuels. Saving money. Saving cooking time in villages. High quality fertilizer can be produced. Local electricity generation. Improving the rural standard of living. Reducing air and water pollution. Biogas is a clean source of energy.

- **Size of biogas plant:** -

Source: - Mnre.gov.in

Biogas plant can be divided in two types. Fixed drum type and floating/movable drum type. Size of biogas plant depends upon availability of raw material (dung) and biogas utilizing capacity. Individual biogas plant up to 10 m3 and community biogas plant up to 80 m3 are built of Deenbandhu model. Deenbandhu is a low cost fixed dome type biogas plant model. Substrates must be in slurry form and degradable.

- **Site selection:** -

The Bio-Gas Digester:

Source: - Gstatic.com

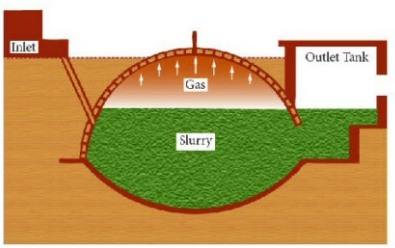
Biogas plant should be constructed at 10 to 15 feet distance from a wall or tree. Open place with direct sun light. Near animal house and water source. Up-land area should be selected. It should be near biogas utilizing place (55 feet or less).

- **Government Subsidy:** - Central and state Government provides subsidy for biogas plant. For individual biogas plant Rs. 3000 ± 1500 and for commercial purpose 60:40 ratio of subsidy is provided by central government (Ministry of new and renewable energy, New Delhi).

- **Materials:** - Bricks, Cement, Kapachi, Grit, Reti, GI pipe, AC pipe, Black color etc. are required for construction of biogas plant.

- **Operation of biogas plants:** - After construction of biogas plant leak proof gas pipe is fitted at gas outlet. Inner surface of dome is painted with enamel. The required quantity of dung is mixed with equal amount of tap water to make slurry and then fed into the plant to create anaerobic environment inside the plant. 1 m3 biogas plant will require 500 kg dung and 500 liter water to fill it fully. The gas outlet is turned off for 10 days. After this the outlet is turned on and the gas is removed in atmosphere. This gas should not be used for cooking due to high proportion of carbon dioxide. The gas outlet is again put off and opens after 24 hours. This gas can be used for cooking, lighting or any other purpose. The required amount of dung mixed with equal amount of tap water should be added daily. Feeding material added into the plant will take some time for its microbial degradation. This time is known as retention period or hydraulic retention time (HRT). Depending upon the zones HRT will vary from 30 to 60 days.

- **How biogas is produced:** -



Source: -Grassrootsindia.com

Biogas is produced from microbial decomposition of carbonaceous material. Hydrolytic bacteria break down the carbonaceous material into smaller pieces. Acetogenic bacteria convert proteins, fats and carbohydrates of these materials into organic acids, carbon dioxide, hydrogen and ammonia. Methanogens converts these organic acids into methane and carbon dioxide. Biogas comprises methane (60%) and carbon dioxide(40%) as major gases.

- **Raw Materials:** - Due to large cattle population in India, animal dung is used for biogas production. Kitchen and agricultural wastes can be used for biogas production.

- **Maintenance:** - For successful operation of biogas plant utmost care should be taken. Feeding material should be mixed well with equal amount of water. Tap water should be used for feeding. Feeding material should be added once in a day during morning time. The pipe connected between gas outlet of plant and burner should be cleaned monthly. During winter add hot water at 60 °C. Addition of animal urine in place of water to prepare slurry of feeding material increases biogas production. Biogas plant should be covered with soil to protect it. If cracks visualize close it by cement.

- **CONCLUSION:** - Biogas is smart and sensible solution for global energy crisis. Biogas is a clean source of energy. The construction of biogas plant is feasible in village areas due to large cattle population. Biogas is produced from microbial decomposition of carbonaceous material. Biogas plant should be constructed at 10 to 15 feet distance from a wall or tree. Open place with direct sun light is preferable near animal house and water source. Biogas is used for lighting, cooking, Ignition, electricity generation, vehicle fuel. Digested slurry is used as fertilizer. Biogas can be used in a sustainable way by bridging the energy deficit in greener way by reducing pollution and waste of our cities. Biogas plant can be made from household scale to large commercial scale.

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