Kitchen Waste & Toilet Linked Biogas Plant Future Implementation in Digas Village

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***Abstract*- The present invention concerns an anaerobic digestion of animal manures, energy crops and similar organic substrates. The process is capable of refining nutrients comprised in the digested biomass to fertilizers of commercial quality. The invention also provides a method for processing animal carcasses or fractions thereof including meat and bone meal etc. In digas village, any system not for waste management.so this help to provide better solution for the Kitchen Waste & Toilet Linked Biogas Plant in Tribal area of digas village. In rural areas where people are mostly dependent on fire wood or dung cake for cooking .purpose, biogas is a boon in improving health, environment and is economical. Biogas burns in blue flame without any shoot or odour like LPG. Most of the family's student can't study in night due to unavailability of electric supply and high cost of kerosene oil, biogas is a sustainable option and boon for such communities. Generally, Bio-gas plants are generated 60.8 % Methane and when Bio-gas with linked Toilet plant will generate 63.4 % Methane.**

***Index Terms*- Tribal area evolution, Eco-sanitation, Rural Development, Kitchen Waste & Toilet linked biogas plant, Sustainable Development, Sanitation, Drainage Network, Public Toilet**

I. INTRODUCTION

Digas is a large village located in Kamrej of Surat district, Gujarat. Chhaganbhai is the sarpanch of this village. The total 812 families residing as per Population Census 2011. A large part of the village is tribal area. The condition of Digas village Tribal area has required development. In village, Solid waste management system not available.so this help to provide Kitchen waste & Toilet linked biogas plant in Tribal area of digas village.

Generation and utilization of biogas from human wastes through bio digester has multiple benefits- it improves sanitation, gives bio energy at low cost and provides better quality of manure for agriculture purposes. The technology is an Ecosan as there is complete reuse of nutrients in human wastes and nothing is left to pollute environment.

Biogas can be generated from any biodegradable wastes through anaerobic digestion. Design of bio digester depends on quality and quantity of such wastes. Design of bio digester based on human wastes needs special consideration. The design should be free from manual handling of human wastes, it should not be visible at any stage and there should not be any odour.

In a toilet linked biogas plant there is minor modification in the design. The inlet pipe from cow dung mixing tank to biogas plant has one Y junction. Another arm of Y is connected with the incoming pipe from toilet. Since the connection from toilet pipe is underground, there is no visibility of human excreta.

Generally, Bio-gas plant are generated 60.8 % Methane and when Bio-gas with linked Toilet plant will Generated 63.4 % Methane. In rural areas where people are mostly dependent on fire wood or dung cake for cooking .purpose, biogas is a boon in improving health, environment and is economical.

II. SELECTION OF SITE

Site of biogas plant should be selected properly, it should not be water logged and soil should be hard (high bearing capacity). It should not be constructed in a shaded area. Sunlight helps increase digester temperature therefore, production of biogas.

Biogas plant should be as near to its use points- cooking and mantle lamps lighting. Longer the distance between biogas plant and its use will reduce gas pressure in gas pipe and hence will create problem.

A biogas plant of specific capacity should be selected based on the daily availability of cattle dung, users of toilet and water requirements.

III. MATERIALS REQUIRED FOR BIOGAS PLANT

The biogas plant can be set up with RCC or Bricks, Cement, Stone chips of 1/2" Coarse Sand, G.I. pipe 3/4" dia. sockets 30 cm, A.C. / PVC pipe 6" dia, Iron bars (6mm dia) for outlet tank cover, Paint (gas leak proof dibhapoxy), labour for digging pit, labour for construction, skilled masons, BG Stove, 10 m pipe line, lamp, accessories. Construction of plant with RCC should be preferred to avoid any chance of leakage.

IV. COMPONENTS OF A BIOGAS PLANT

(A) *Foundation*

The foundation of the plant is bowl shaped with a collar around the circumference. The construction of the digester dome is based on this collar. Dome is divided in 2 parts- Digester & Gas storage. The bottom part is called the digester, where the mixture of dung and water passes through inlet chamber and anaerobic digestion by the help of different bacterial groups takes place producing biogas. Retention time of digester is kept normally as 40 days.

Gas produced by the bacterial activity is stored in the upper part of the digester dome called gas storage. Capacity of the gas storage is designed for 50 % of the daily gas production capacity of the plant. However, as per requirement, gas storage capacity can be increased, depending on use of biogas.

(B) *Gas outlet pipe*

A nipple is fitted on the top of the dome, which is connected to a GI pipe of ½ inch. The gas reaches the kitchen through this pipe.

(C) *Inlet chamber*

Inlet is the point where cow dung is mixed with water before it passes to biogas plant through inlet pipe connected with chamber.

(D) *Outlet chamber*

Outlet chamber or liquid displacement chamber has two functions- it allows passage of effluent from the biogas plant and it determines the storage capacity of biogas plant.

(E) *Mold of Mild Steel (MS)*

During construction of biogas plant, it has been seen that design was not strictly followed by the mason concerned. Construction of dome is also a bit difficult.

To avoid such problem a mold of mild steel is very helpful. One time cost of construction is slightly higher but it save labour/ mason cost. Further there is no chance of deviation from the design, as the mold is strictly based on the design.

V. DESIGN OF KITCHEN WASTE & TOILET LINKED BIOGAS PLANT

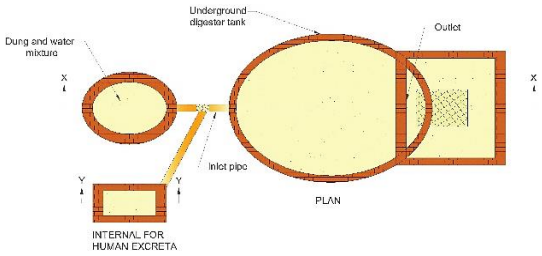

Fig. 1 Biogas Plant Plan

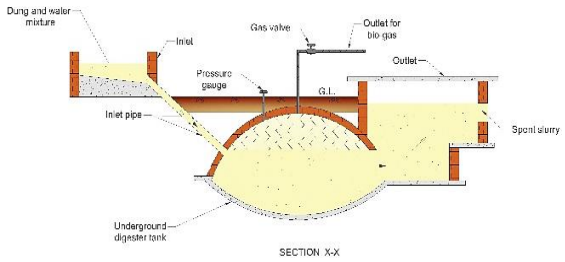

Fig. 2 Biogas Plant Section X-X

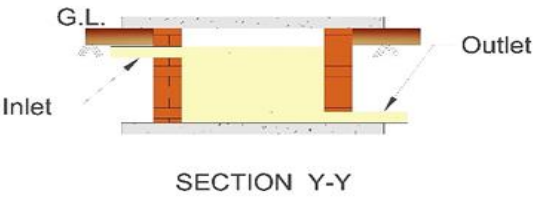

Fig. 3 Biogas Plant Section Y-Y

VI. PROCESS

(A) *Starting a digester with feed material*

Initial digestion process with cattle dung feed should start within few weeks depending upon the temperature.

Cow dung mixed with water in the ration of 1:1 should be filled at the level of outlet chamber. If available, effluent (5-10%) from a running biogas plant should be added to new biogas plant once at the start, as inoculums. Cow dung itself contains a lot of

methanogenic bacteria, therefore, in case of unavailability of working biogas plant and its effluent, biogas production will continue. Connection with toilet should be done simultaneously. However, if toilet is not ready, it can be connected later. Production of biogas starts within a few days. However, initially there is more percentage of carbon dioxide than methane, therefore it does not burn. Normally burnable biogas is achieved after 20th day. Thereafter it continues. Feeding of biogas plant with required quantity of cow dung should be made daily.

(B) *Total solid concentration in feed material*

Total solid in feed material is an important aspect. Around 8% TS is optimum for biogas production. In case of cow dung, this concentration is achieved after mixing cow dung with water in the ratio of 1:1, i.e., 10 kg of cow dung is mixed with 10 liter of water.

(C) *Testing the digester*

Smoke producing material is burnt inside the digester and thereafter all vents of the digester are closed and checked for leakage. Any section of the dome emitting smoke is identified and can be sealed.

Hydraulic testing for water leakages is done by filling half of the digester with water and marking the level. Thereafter, after a period of 6 to 7 days, the water level is rechecked. In case of leakages the water level will go down. However, in case of RCC structure there is no chance of leakage and thus such testing can be avoided.

VII. FACTORS AFFECTING BIOGAS

(A*) Temperature*

For optimum biogas production, a temperature of 35-370C is optimum. At lower temperatures gas production rate decreases. In winter season when temperature falls to 100 C or so, gas production almost ceases. However, in case of underground fixed dome digester like that of Deenbandhu model, there is least effect on biogas production due to atmospheric temperature difference. This is due to the fact that digester dome is covered with soil that acts as insulator. It has least impact on inside temperature.

(B*) pH*

The pH range suitable for biogas production is rather narrow i.e., between 6.6 to 7.5. A pH value below 6.2 (acidic slurry) and above 8.0 (alkaline slurry) becomes toxic to the bacteria.

VIII. MANURE VALUE OF SLUDGE FROM BIOGAS PLANT

Besides biogas, the manure of the plant has good plant nutrient value. It is directly used for agriculture purpose. The following is the comparative value of plant nutrients (N, P, K, value) from biogas manure and other compost

Table 1.1 comparative value of plant nutrients

Sl.No.	Name of constituent	Compost Manure (%)	Biogas slurry (%)
1.	Nitrogen	0.50-0.75	1.30-1.50
2.	Phosphorus	0.70-0.80	0.85-0.92
3.	Potash	1.20-1.50	1.50-1.65

IX. CONLUSIONS

Biogas constitutes mainly methane and carbon dioxide and trace amounts of hydrogen, nitrogen and ammonia. Methane is only burnable constituent. Percentage of methane varies in biogas plants based on cow dung alone and linked with toilet. It has been analysed that percentage of methane in toilet linked biogas plant is higher over without toilet linked and based on cow dung only.

Table 1.2 Percentage of methane in toilet linked biogas plant is higher over without toilet linked

Sl. No.	Source	Methane %	Carbon Dioxide %	Hydrogen sulphide (ppm)
1.	With toilet linked biogas plant	63.8	31.4	55.37
2.	Without toilet linked biogas plant	60.4	33.9	72.82

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