Installation of Balaji Biogas System and its Application with Purification and Bottling Biogas Unit

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Introduction

At present our country is facing various problems which become more serious in next coming years. Demand of petroleum products is increasing, India has spending a big budget for importing these products and on the other hand our country faces serious problems like environmental pollution, disturbance in weather & global warming.

India is an agriculture-based country and there is abundant availability of resources but these are not properly used and commercialized. In spite of all the developments and technologies are available yet the rural people facing the shortage of energy. The prime challenge for the country is to provide the minimum energy services to allow the rural people to achieve decent standard of living. The biogas plant is a boon to the Indian farmers. The two main products of the biogas plants are enriched compost manure and methane where as compost manure helps to meet the fertilizer requirements of the farmers in a more economical and efficient manner and boost agricultural production. Biogas is used for cooking and lighting purposes and in larger plants , as motive power for driving small engines.

Indian government have installed gobar gas plants, which are approximately 12,00,000 small, 3,40,000 medium, and 4,000 big gobar gas plant. If 20,00 gobar gas plants of 120 M^3 has been installed then approximately 6842 Lakh Rs. of diesel/petrol can save, but this project is failed in few years no body have think that why this project is failed.

Few years back KVIC & other agencies related to installation of bio gas plant installed two types of Biogas plant one was fixed dome and second was floating dome. Fixed dome digester was covered by concrete gas holder while floating dome digester was made up of metal (iron) sheet gas holder. Fixed dome digesters require one month for installation. After some times these types of digesters faced problem of scum deposition on upper surface which can not removed easily, ultimately biogas production effected. In these plants high maintenance cost was required for removing scum. On the other hand floating gas holder (metal sheet) was

corroded due to contact with water and hydrogen sulfide. Second problem was that at the time feeding few amounts of mud particles was present with feed, gradually this mud deposited in the lower surface of digester. Due to these problems digestion and gas formation is effected. Following problems keeping in mind we designed a low cost, easy and quick to install, durable, easy to maintain and anti corrosive type of biogas plant.

Materials and Methods

For 10 M^3 biogas plant

A. Permanent Equipment

Cutter for sheet, Drill machine, Grinder, Tools, Chopper cutter, Other accessories

B. Expendable equipment and supplies

1. Hire of equipment-

Welding machine with welding rods

Press machine- medium size

2a.One molding for digester of 10 M^3

Sheet for molds 16 gauze (1.5 tons), Angles 35x35x5 (1 ton)

C. Raw material for casting

Stone ½ inch 2.4 m^3, Sand 2.1 m^3 ,Cement 1100kg, Brick 100 , Concrete pipe 3 (300+30x1000mm) , slurry pump, Gas Holder 1Pc.concrete bar- 8 kg labor cost for 5 days 2

Construction Methodology

Digester moulding

Digester molding is very easy and can be prepared by an experienced technician

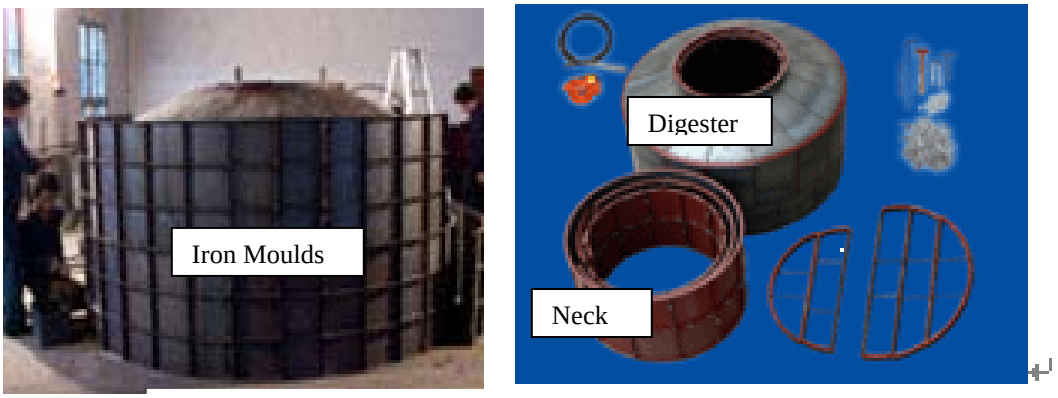


Fig 1. Iron moulds for concrete digester installation

Gas holder (glass reinforced plastic)

We used a light weighted material gas holder (Fig. 2) we choose rein forced glass fiber plastic, this type of gas holder is light in weight, anticorrosive and high tensile strength, gas holder is the main component of the biogas plant, on the top of gas holder there is a valve that can eliminate the atmospheric pressure. When there is a requirement to replace solid fermentation material like straw in the digester or to repair the digester gas holder can taken out from the digester easily. The gasholder is 1.65 M^3 gas capacity.

Fig. 2b. Gas holder

Construction of Plant

Generally the digester is made of concrete and bricks require 15 days for installation. In this design we are using moulds for quick installation of digester. The total depth of digester from the surface is 10 ft, 5 ft height is used in constructing digester and 5 ft height is used for constructing neck for gas holder the raw material is very cheep using smashed stone, sand, cement, & taking 2 days for installation with the help of moulds.

Construction of biogas plant is very easy and quick in this technology we are using prefabricated iron moulds. One mould can cast up to 1000 biogas plant. First day dig a hole of 10 ft dia and 10 ft depth (Fig. 3a) then assemble moulds in hole as shown in Fig 3b. and 3c. Second day casting by concrete mixture with the help of vibrator. Assemble neck mould and cast by concrete Fig 3e. and Fig 3f. now built inlet and outlet Fig. 3g. IVth day remove iron mould and provide proper moisture to concrete digester. Vth day fill digester by feed mixture of cow dung or agro residue (Fig 3h) and fitted gas holder (Fig. 3i). Covering inlet outlet & gas holder by concrete bar (Fig. 4.)

Fig. 3a. Dig a hole in the ground (Ist day)

Fig. 3b. Assemble the lower part of mould (Ist day)

Fig. 3c. Assemble the upper part of mould (Ist day)

Fig. 3d.Casting the digester (IInd day)

Fig. 3e. Assemble the digester mould (IInd day)

Fig. 3f. Casting the digester (IInd day)

Fig. 3g. Built the Inlet and outlet (IIIrd day)

Fig. 3h. Feeding agroresidue and cow dung (Vth day)

Fig. 3i. Installation of gas holder

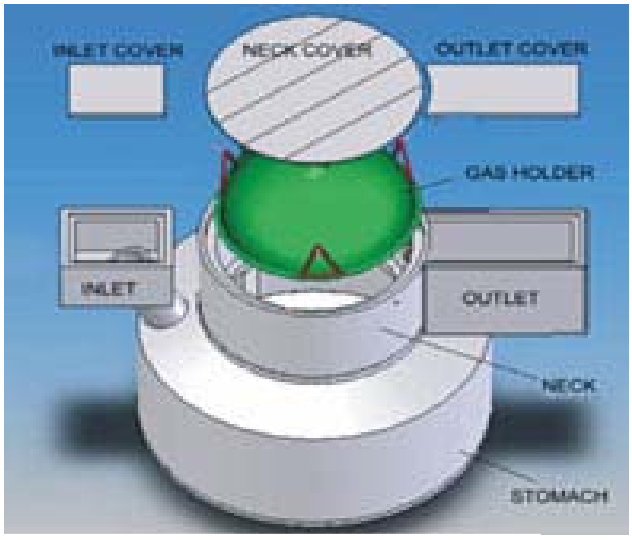


Fig. 4. Three dimensional view of new technology biogas plant

Design for high capacity biogas plant

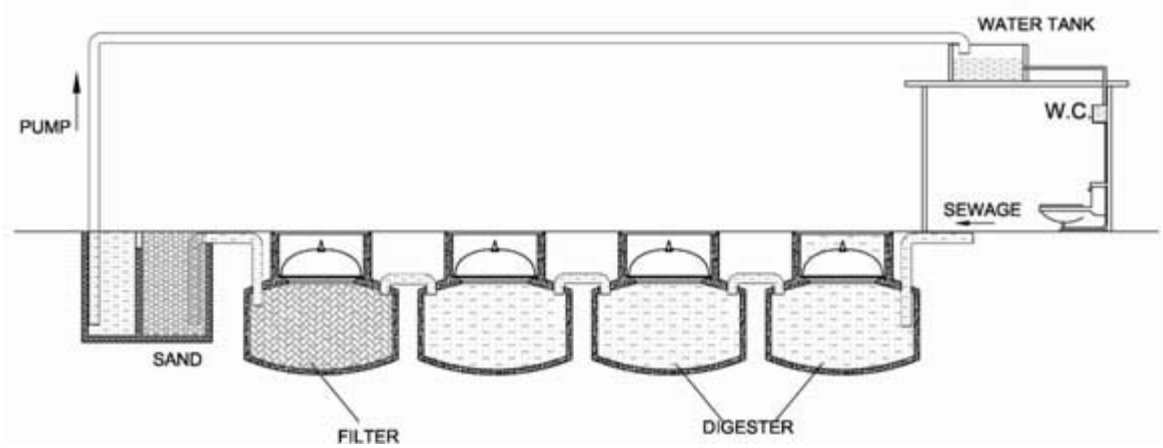


Fig. 5. Design for high capacity biogas plant

Mechanism of Biogas Collection in Plant

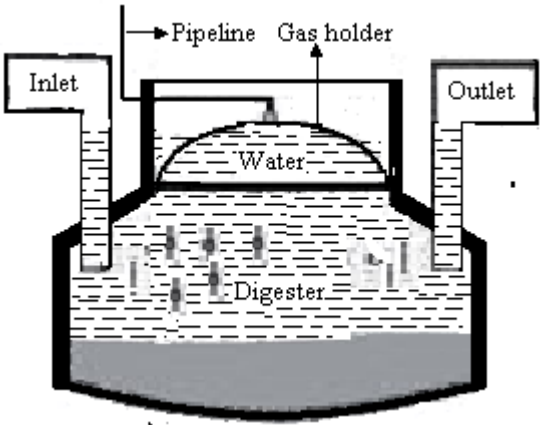


Fig. 6a. Plant with out biogas

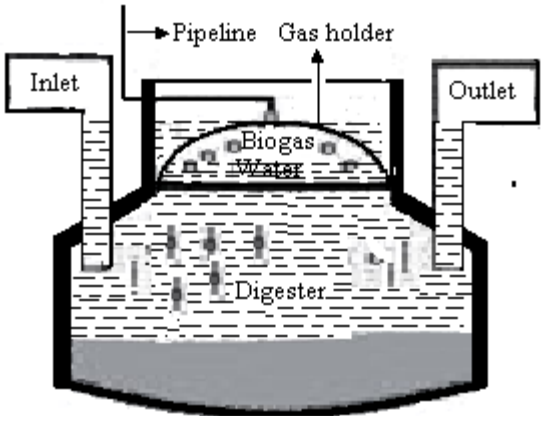


Fig. 6b. Plant with biogas, side water level increasing

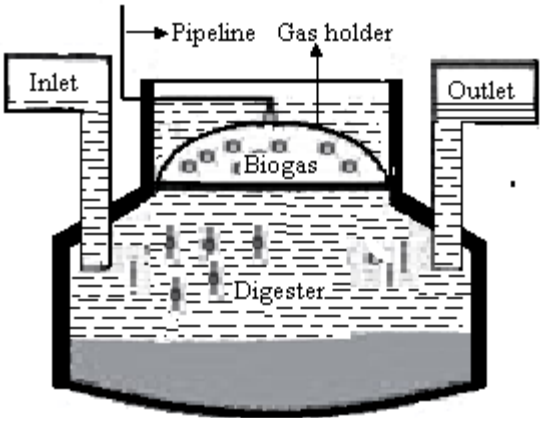


Fig. 6c. Gas holder with biogas water level is increasing)

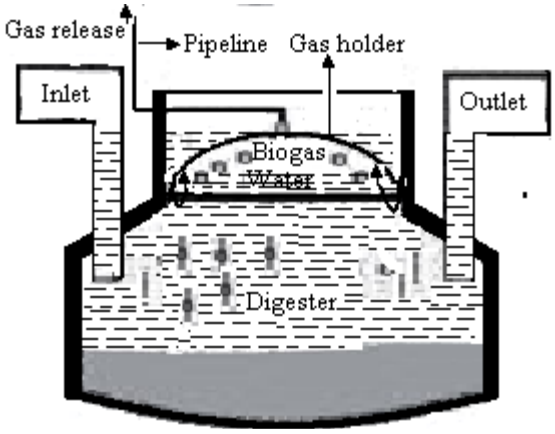


Fig. 6d. Biogas released water level decreasing.

Fig. 6. Mechanism of biogas production

Fig 6a. Shows that gas holder is filled with water. In Fig 6b. the microbial activity increasing biogas is formation is started, which is collected on the top of gas holder due to increase in pressure in side the gas holder water moves towards out side the gas holder in fig 6c. gas holder is completely filled with biogas and water level becomes high outside the gas holder. In Fig. 6d. When biogas is released water moves toward inside the gas holder and water level is decreasing outside the gas holder.

Improvement in quality of biogas (Removal of Hydrogen Sulfide)

Hydrogen sulfide is present in biogas produced during the anaerobic digestion of biodegradable substances. It is produced from the degradation of proteins and other sulfur containing compounds present in the organic feedstock to the digester. The concentration of hydrogen sulfide in the biogas depends on the feedstock and varies between 0.1% to 1%. The toxicity and corrosive properties of sulfides dictate stringent control of their release into the environment and contact with iron steel as in tanks, pipelines, valves, and pumps.

In addition to its unpleasant odor, hydrogen sulfide reacts with enzymes in the blood stream and inhibits cellular respiration resulting in pulmonary paralysis, sudden collapse and death. Continuous exposure to low (15-50 ppm) concentrations will generally cause irritation to mucous membranes may also cause headaches, dizziness, and nausea. Higher concentrations (200-300 ppm) may result in reparatory arrest leading to coma and unconsciousness. Exposure for more than 30 minutes at concentrations greater than 700 ppm has been fatal. Balaji biogas developed low cost desulfurizer which is capable to remove 98% hydrogen sulfide from biogas.

Fig. 7. Different Capacity Desulfurizer

Advantages of New Technology Biogas System

To renovate the traditional fixed dome hydraulic biogas plant. We have developed a hydraulic biogas plant- The new technology Balaji Biogas system. The new technology biogas system carries on almost all the advantages of the traditional fixed dome hydraulic biogas plant, and overcomes its main disadvantages.

1. Easy and quick to be built

Any working mason through one day's study is able to build the new technology Biogas system with 100% success rate. New technology biogas system can be built in 48 hours.

2. Solid organic material (straw and grass etc.) can be used.

Comparison with reference to fermentation material

Solid organic material	The traditional fixed dome hydraulic biogas plant	New technology biogas system
Animal wastes	Permitted	Permitted
Agro waste	Not permitted (difficult to remove)	Permitted (convenient to replace solid fermentation material)

3. Easy to maintain

Comparison with reference to maintenance

Items	The traditional fixed dome hydraulic biogas plant	The new technology biogas system
To mend the gas leak of gas-holder	Dangerous and difficult the job is done inside the biogas digester; there is a possibility of poisoning. The leak cannot be found.	Safe and easy The job is done on ground. There is no possibility of poisoning. The leak can be seen, and can be mended directly.
To mend the leak of the digester	Dangerous The digester outlet is too small that the air circulation in the digestries bad. So there is a possibility of poisoning.	Safe The digester's outlet is large enough that the air circulation in the digester is good. So, there is no possibility of poisoning.

4. Durability

The concrete digester can last over thirty years. The glass fiber reinforced plastic gasholder can last over ten years. When the gasholder is worn out, a new one can replace. So the new technology biogas system can last over thirty years.

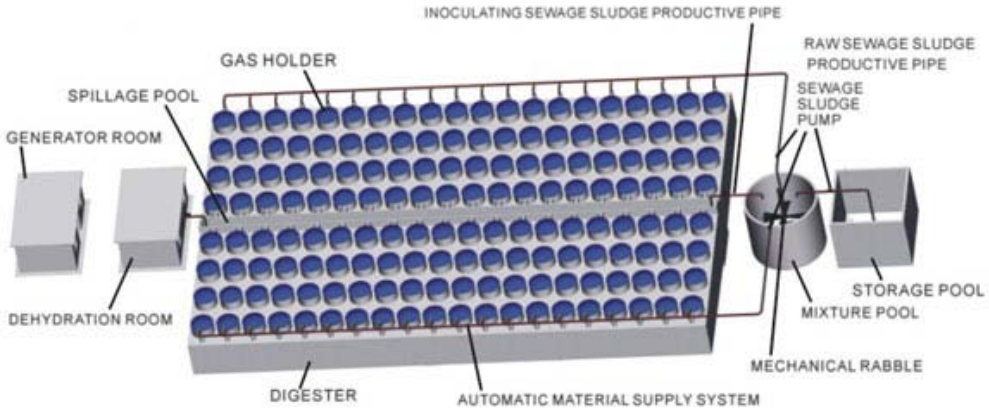
5. Excellent safety features

There is no possibility of biogas poisoning to the users. When the gas holder is taken out from the digester, there is no biogas left in the digester. The digester's outlet is 1.5m in diameter that is large enough to keep sufficient fresh air in the digester so, it is safe to repair the digester, and safe to replace fermentation material.

Application with Biogas Purification and Bottling Unit.

Biogas produced from KVIC model having 58-60% Methane, 35-40% Carbon dioxide and 1-1.5% hydrogen sulfide where as biogas produced from Bala ji model containing Methane 65-

68%, Carbon dioxide 30-35% and 1-1.5% hydrogen sulfide. It is clear from the observation that methane content is 7-8% higher. Biogas purification means to remove carbon dioxide and hydrogen sulfide from methane. At presently in biogas purification unit (Fig. 8) lime is used as solvent for carbon dioxide. When Balaji is used with purification unit, 10-12% decrease in lime consumption is observed, which directly effects the cost of purified biogas.



(a)

(b) (c)

Fig. 8. (a) Bala ji biogas plant (b) Biogas purification unit (c) Van run by methane rich biogas

Conclusion

It was confirmed from the above study that the Balaji Biogas system having high success rate as compared to other biogas models. It is also cleared that for biogas purification plant the required quantity of lime is reduced when biogas is used which is produced from Balaji Biogas system. However some modification can also be done according to requirement.