Design and development of 1m3 capacity of continuous production of bio gas plant.

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Conventional methods of fuel as an Energy source using different raw materials have been implemented in our country. The design and fabrication of equipments such as Biogas Plant have been implemented at various places above and below the ground Level.

Below ground level, it is the structural and technical architecture of developing the structure, considering the soil and hydrostatic pressure in the ground and also to some extent the ground water level .

The Biogas plant below soil is exclusively meant for organic waste such as Kitchen waste and toilet waste. Toilet linked biogas are also very important in waste management. In such biogas plant, the entire organic waste are converted and utilized as fuel, and the waste water which is resulted out of the methanogenic activity produces the waste water and is known as metabolic waste H_2O. This waste water thus generated in biogas plant is drained into sand filter and directly irrigated to garden.

Novelty in the present bio gas plant:

However, in a biogas plant, there is no production of sludge at all and it is below the ground level too. It means all the organic wastes are converted into biogas. However, in $1m^3$ capacity biogas plant, there is advantage of collecting sludge being above the ground level. In such cases, not only gas is generated is used as fuel, the waste water is used to irrigate kitchen garden. The sludge is de-watered, solar dried used as manure.

The $1m^3$ bio gas plant has 1000 liter capacity syntax tank of food grade serves as digester and 750 ltr capacity food grade syntax tank is used to collect the gas and serves as gas holder.


Sintex pure

However, the novelty of production of bio gas when required satisfies the installation of additional one 1000 litre capacity of reservoir tank as primary fermenter which is provided with baffles coated with bacteria .This primary fermenter is linked gradiently with biogas digester with valve arrangement to provide slurry as and when gas is exhausted. When the gas is exhausted it indicates the descending of the gas holder .At this point of notice slurry from the primary fermenter is allowed by opening the valve and thus allows the slurry to flow by gradient means to the digester,which is physically indicated the ascending position of the gas holder thus provides biogas as and when it is required.

This technology is further improved by installing any number of primary digester in any suitable place and through pipe line connection it could be taken to a common digester and having gas holder. It is now possible to provide more than one burner as the bio gas is made available provided there is continuous input of organic wastes.

Mechanical device in the primary fermenter:

Since the primary fermenter is 1,000 litre capacity where organic wastes are accommodated for fermentation , the baffles are supported by valves and bushes and agitated mechanically. This quick fermentation is facilitated at a required pH and temperature which again provides uniformity in the slurry production. There is a quality of using the food grade syntax tanks and pipes and this will never affect by external environmental factors nor even there will not be bulging of tanks. The fittings are of ISI grade and hence safe in use without any leakage of gas.

Cost of installation:

The cost of fabrication for the structure is about Rupees 75,000/- In primary fermenter, all organic wastes are put together ,digested and the slurry is formed in the primary fermenter is transferred to the digester by means of gradient flow controlling valve.

In present product, it is proposed to develop and fabricate an innovative technology using baffles in the reactor.

The 1000 litre capacity food grade reactor serves as primary fermenter. This is introduced with a pre-fabricated FRP again food grade baffles .These baffles are coated with bacteria as it is done one in life time. By this biological mechanism, the bacteria are self-generated just like in our living system, thus continuity of slurry is manufactured. This fabricated structure occupies 50% area inside the primary fermenter.

Diphasic anaerobic baffle bio gas reactor:

Taking advantage of this technology with one 1000 litre capacity biogas tank it is now possible to produce biogas without a gas holder. The 50% of the tank area is partitioned with baffles coated with bacteria and another 50% of this area inside the fermenter is filled organic wastes converted into slurry. Hence the name diphasic anaerobic bacteria coated baffled reactor. The system is manually operated to produce uniform slurry production at required time. The present system is aimed to reduce the cost of fabrication of the structure and free maintenance.

There is a provision for over flow of materials, sludge removal and de watering system.The sludge can be removed from the bottom and used as manure besides waste water generated could be used for kitchen garden. This reactor is fabricated to produce continuous sources of energy in the form of biogas.

Since only one tank is used in the system and it is cost effective and at the same time it is eco friendly and is acceptable by consumers.

Revenue Generation

Expected gas production in volume operation and maintenance cost of the plant.

1m3 capacity bio gas plant:

1cu.m biogas plant will produce biogas equal to 0.40 kg of LPG unit per day.

The burning time would be about 2-2.5 hours per day (approximate).

Total bio wastes required would be 4-5 kg per day

Total bio gas production per month 12.9 kg

(1m3 biogas is equivalent to 2.5 kg of firewood)

Cost of LPG cylinder Rs.420/-

Based on the equation already provided

For example based on the present data available it is proposed as following;

1m3 bio gas plant produces 400 gms of biogas per day

2.5m3 capacity of 2 numbers will produce 400x2.5x2=2 kg biogas per day.

Requirement of bio gas per family per day with burning time 2 to 2.5 hours .

400 gms bio gas x 5 families per day require 2000 gms or 2kg of supply of biogas per day

However,for continuous supply of biogas to households 2 numbers of 2m3 capacity fermenters are provided .This saves fermenting time to feed to the bio gas plant digester.

a.It is proposed to construct two 2.5m3 capacity bio gas plant.

b.2 nos syntex tanks as fermenter tanks of 2.0 m3 capacity with necessary pipe line connections and 0.5 m3 clarifier.

c. Suitable burners .....5 Nos

d. Input required 20 to 25 kg which includes Coovum sludge ,water hyacinth and cow dung slurry.

e.The Coovum residents are the stake holders of the project and 5 adult family members will be trained .However, the project will be supervised by the team members of the project. Hence,the project is sustainable.

f. Supply of bio gas to 5 families exclusive of accessories(Refer Project Cost).

Apart from this biogas slurry production per plant corresponds to 4-5 litres per day. This slurry can be solar dried and used as cakes and will be sold rate of Rs.12 per kg. So, income from selling of biogas slurry corresponds to Rs.50/- per day.The production and money equity will be analysed once project is implemented.

a) Organic nutritional gardens

Organic nutritional gardening also adds to household income. Organically produced vegetable and other agricultural products adds to health of the family. At present nearly 65% of vegetables and food products are hired from neighbouring states at high cost. Moreover, these hired vegetable and food goods are chemically produced and it deteriorates our health. So, creating an opportunity for organic cultivation and leading the rural communities will satiate the demand within the community. Nowadays value added eco-form products have good demand owing to the health aspects. These quality products can be easily marketed in the farmer's market.

13. Techno-economic viability of the project and its self sustainability

The project envisages direct income generation program components (i.e., Kitchen Gardening) and indirect income generation programs(i.e., Biogas plant).

Biogas plant will substitute 63% of LPG and firewood requirements and help the beneficiaries to contribute per month per plant towards maintenance of the bio gas plant.After some period the investment of 5% of total cost of the bio gas plant will be compensated when taking into account the aim of eco-friendly waste management practice. Apart from the above biogas slurry is a very good nitrogeneous manure whereby the use of chemical fertilizers can be avoided. Selling of biogas slurry adds income to the family.

Sustainability:

To ensure the sustainability of the project the programme will be implemented with the active participation of the peoples organisations in the area. In the present context there is no doubt that the income generation programmes are included in the project can assure sound feedback. In order to make programmes sustainable, implementation and monitoring of various activities will be done through the people's organisations/groups.

Sustainability is there, since bio waste is used as in put . Biogas adds to the income since, it replaces LPG and other energies required for cooking. Turning waste into energy gets rid of waste in the premises. Biogas slurry is another advantage.

The model can be replicated in other locations (Where bio-degradable waste is abundant resulting in water contamination as well as environment pollution) through Local-Self Governments by persuading them to take up the project in the communities through annual plan allocation with a subsidy component. In short, the project is capable of improving the economical, social and cultural status of the people in the area.