

## **BUILDING OF MINI BIO GAS PLANT USING ANAEROBIC DIGESTION OF ORGANIC COMPOUNDS**

**J. K. Singh<sup>1</sup>, Roshan Malakar<sup>2</sup>, Keshav Verma<sup>3</sup>**

*<sup>1,2,3</sup> Department of Mechanical Engineering, O.P. Jindal Institute of Technology, Raigarh (C.G.), India*

**Abstract**— The aim of this paper is to design and fabricate portable mini bio gas plant of capacity 20 liters. The proposed plant is of different aspect in design and operation for small-scale household digesters. It consists of a digester, plastic pipe, rubber pipe, tire tube, T-joint valve, nozzle valve etc. in this process 6 kg cattle dung and 6 liter water are mix through the hand. After the mixing process, the slurry emerges in the dome type container through the funnel. The dome type container is painted by black color for protection from sunlight and atmospheric air, if it present in the container then the algae forms into the slurry tank and then very less amount of methane gases is form inside the tank. After the emersion process of slurry in the tank, the tank is left for 7 or 8 days and at that time the anaerobic process will start and the slurry will decompose. Therefore the methane gas forms and collect at the top of the tank and it transfer from tank to the tire tube because of pressure difference between inside and outside environment. After the collection process of methane gas inside the tube, the nozzle valve is open and the methane gases are burn out by lighter or match box and then the heat energy can be utilized for application. This technology can be integrated with waste treatment energy generation and organic fertilizer production system very efficiently.

**Keywords**— Digester, slurry, anaerobic, integrated fertilizer, etc.

### **I. INTRODUCTION**

Biogas is formed by the natural degradation of organic manure under the anaerobic conditions. Microbiology controlled production of biogas is an important part of the global carbon cycle. Every year 600-800 million tons of methane are released into the atmosphere. This methane is produced when bacteria decompose organic material such as garbage and sewage, especially in the absence of oxygen. Biogas contains 55-65% methane and 35% carbon dioxide. Microbiology controlled production of biogas is an important for biogas plant. Methane is the main component of natural gas. It is relatively lean, burning, colorless and odorless. This gas can be used for cooking and heating. This is already being done on a large scale in some countries of the world. Farms that produce a lot of manure, such as hog and dairy farms, can use biogas generators to produce methane. This plant would have very high portability to the scale of a human being able to move by himself at anywhere. This project would also help to protect the earth global warming, which has risen to an alarming by creation of a non-conventional energy sources. Biogas plants are widely used in various countries of the world after humans knew the application of methane gas. Methane gas can be used in cooking and heating, biogas stove, fertilizers, lighting and power generation.

#### **Components used for building of mini bio gas plant**

- Digester
- Tire tube
- Rubber Pipe
- T-joint valve & nozzle valve
- Plastic pipe

## II. CONSTRUCTION DETAILS

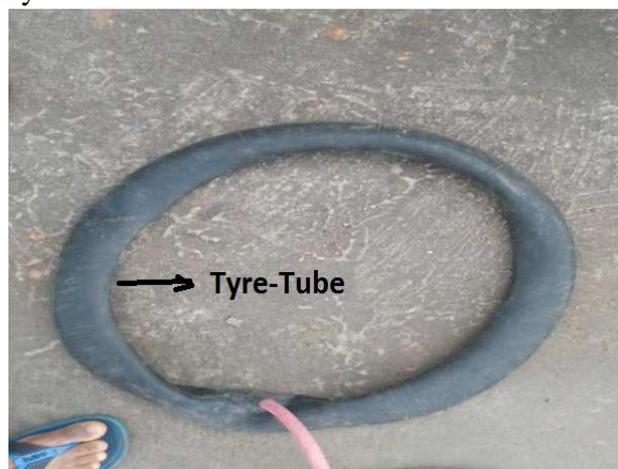
A mini biogas plant consists of a dome type tank known as digester, where we keep slurry. The tank contains one inlet pipe and two outlet pipe. With the help of funnel, slurry is pushed inside through inlet pipe. The methane gas goes into the tube via outlet pipe and while using the methane gas we need to open the valve which is connected with one of the outlet pipe. Generally tank is coated with black colour paint, otherwise production of algae will be taking place & methane gas generation will be interrupted.

**Digester-** The digester is a major component of mini biogas plant, at which the slurry exists. The main advantage of the digester is to maintain the temperature and pressure of slurry which is remain in the container. In general the coated digester is used for creation of methane gas because for the interruption of sunlight and air present in environment.



**Fig-1 Digester**

**Tire Tube-** Tire tube is one type of container, which is used to contain the methane gas, which forms from solid digestion of slurry.



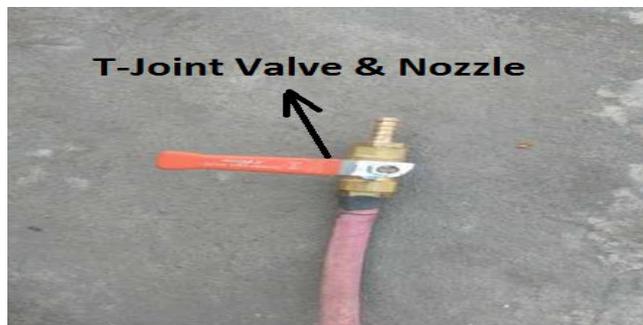
**Fig-2 Tyre-Tube**

**Rubber Pipe**-The rubber pipe is pipe which is use to transfer the methane gas to the tire tube. It is flexible coated pipes which minimize the loss of methane gas and methane gas sufficiently moves to the tire tube.



**Fig-3 Rubber Pipe**

**T-Joint Valve**- The T-joint valve is a perpendicular valve, which is used to connect the pipe and the nozzle which is used to remove the methane gas to the environment and it burn out.



**Fig-4 T-Joint Valve & Nozzle**

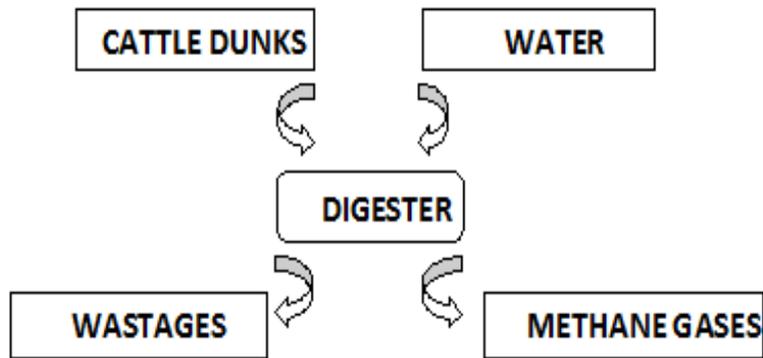
**Plastic Pipe** - The plastic pipe is a secondary require component, which is use in inlet and outlet flow of slurry and wastage. The pipe has to easy move the slurry in the container and easy removes the wastage from the container. The clamps are also plastic elements which are used to and close the inlet and outlet pipe.



**Fig-5 Plastic Pipes & Clamps**

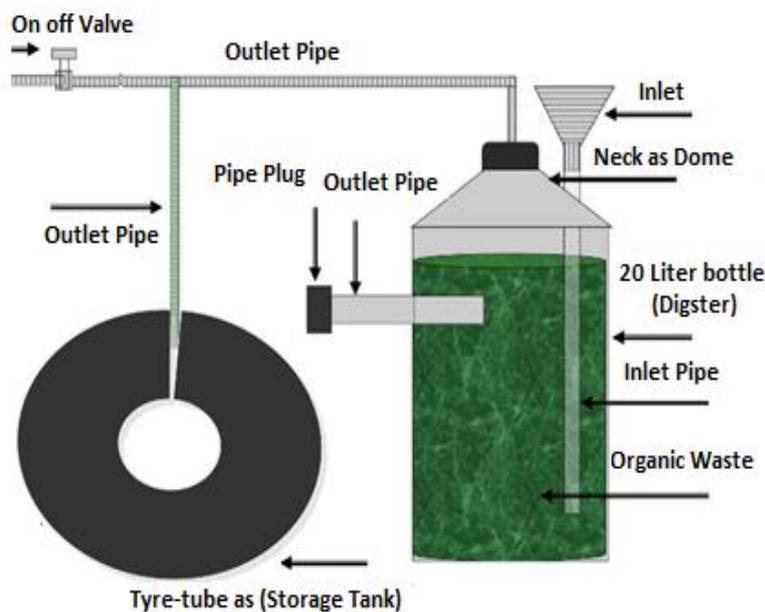
### III. METHODOLOGY

The various form of biomass mixed with the same quantity of water. In our project we took 6 kg cattle dunk and 6 liter water and mix through the hand. Therefore after the mixing process, the slurry emerges in the dome type container through the fennel. The dome type container is painted by black color for protection from sunlight and atmospheric air, if it present in the container then the algae forms into the slurry tank and then very less amount of methane gases is form inside the tank. After the emersion process of slurry in the tank, the tank is left for 7 or 8 days and at that time the anaerobic process will start and the slurry will decompose.



**Fig-6 Flow Chart of Mini Bio-Gas Plant**

During this one week, bacteria present in the slurry decompose or ferments the biomass in the presence of water. As a result of anaerobic fermentation, biogas is formed, which starts collecting in the dome of the digester. As more and more biogas starts collecting, the pressure exerted by the biogas forces the spent slurry into the outlet chamber. From the outlet chamber, the spent slurry overflows into the overflow tank. The gas valve connected to a tire tube, where the methane gas is collected. For methane gas transformation, the one rubber pipe inlet is connected in the container at the top and outside rubber pipe is directly connected with tire tube where the methane gas contained and one outside nozzle at which biogas are remove through the T-joint element.



**Fig-7 Biogas Digester Diagram**

### **Energy calculation of biogas plant-**

Formula to calculate total gas production

For cattle dung max. gas production /kg =  $0.05 \text{ m}^3 / \text{kg}$

Total gas = Total dung in kg  $\times 0.05 = \text{m}^3$

Calculation for 4 animals each producing 8 kg dung, if we are successful to collect that all

Total will be  $8 \times 4 = 32 \text{ kg}$

Total gas =  $0.05 \times 32 = 1.6 \text{ m}^3$  if  $> 1 \text{ m}^3 = 19 \text{ Mega joules}$

So  $1.6 \times 19 = 30 \text{ MJ}$

To convert it to KWh =  $30 / 3.6 = 8.3 \text{ KWh}$

### **Calculation for cooking-**

Medium Stove uses 9 MJ of energy /hr.

(Manure of 3 animals is fuel for stove to run for 2.5 hrs.)

$8 \times 3 = 24 \text{ kg dung} = 24 \text{ kg} \times .05 = 1.2 \text{ m}^3$

$1.2 \times 19 \text{ MJ} = 22.8 \text{ MJ} / 9 = 2.5 \text{ hours}$

## **IV. RESULT & DISCUSSION**

- Now the Biogas has been formed and we can use for many applications, like: cooking and heating, biogas stoves, fertilizers, lighting and power generation.
- Biogas technology offers a waste set of benefits. It is a challenge to develop and design of biogas plant which deliver cost, improved robustness, functionality, ease of construction, operation and maintenance would aid t Biogas technology offers a waste set of benefits. It is a challenge to develop he market penetration of biogas plants.
- Many of small scale digesters do not require high maintenance and more or less adaptable to the climate condition of many of developing countries.
- Hower, adopting of biogas digester is low in many countries despite the great potential to gain a wide verity of benefits, both from the socioeconomic and enviermental point of view.
- By enhancing energy availability and simultaneously protect the surrounding as soil, water and air, a lot of benefits could be gained.

## **V. CONCLUSION**

- Household digesters represent a boon for farmers and rural people to meet their energy needs.
- These digesters helps in two ways, one is to reduce waste and other is o provide valuable energy.
- Although they have been used for many years modernization is needed to overcome the draw backs in the long run for providing valuable household energy.
- The awareness by people of their technical issues and governmental subsidy plans could be provides more benefits from household digester.

## **VI. FUTURE SCOPE**

- Enriched biogas is made moisture free by passing it though filters, after which it is compressed up to 200 bar pressure using a gas compressor, it can use more beneficially.
- Compressed gas can be store in high pressure steel cylinder and used for cooking.
- There is a large potential of this technology that can uses in buses, tractors, cars, auto rickshaws, irrigation pump sets and in rural industries by this valuable energy.
- This will help to meet energy demand for rural masses and reducing the burden of petroleum demand and other conventional source and will improve economic status by creating employment generation in rural are
- The potential of waste energy is more powerful as compare to conventional resource of energy which improves and fulfills the energy demand of rural area.

- This technology can be integrated with waste treatment energy generation organic fertilizer production system.

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#### AUTHORS BIOGRAPHY

**Mr. Jitesh Kumar Singh**, born on 10.02.1978, completed graduation in Mechanical Engineering from The Institution of Engineers (India). He has completed his post graduate in Mechanical Engineering from Maharshi Dayanand University-Rohtak, Haryana, India. **Roshan Malakar, Keshav Verma, Vikram Sonkar, Shitesh Nayak** are the final year students of Mechanical Engineering Department at OP Jindal Institute of Technology, Punjipathra, Raigarh, C. G. India.