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Design and Fabrication of Compact Biogas System

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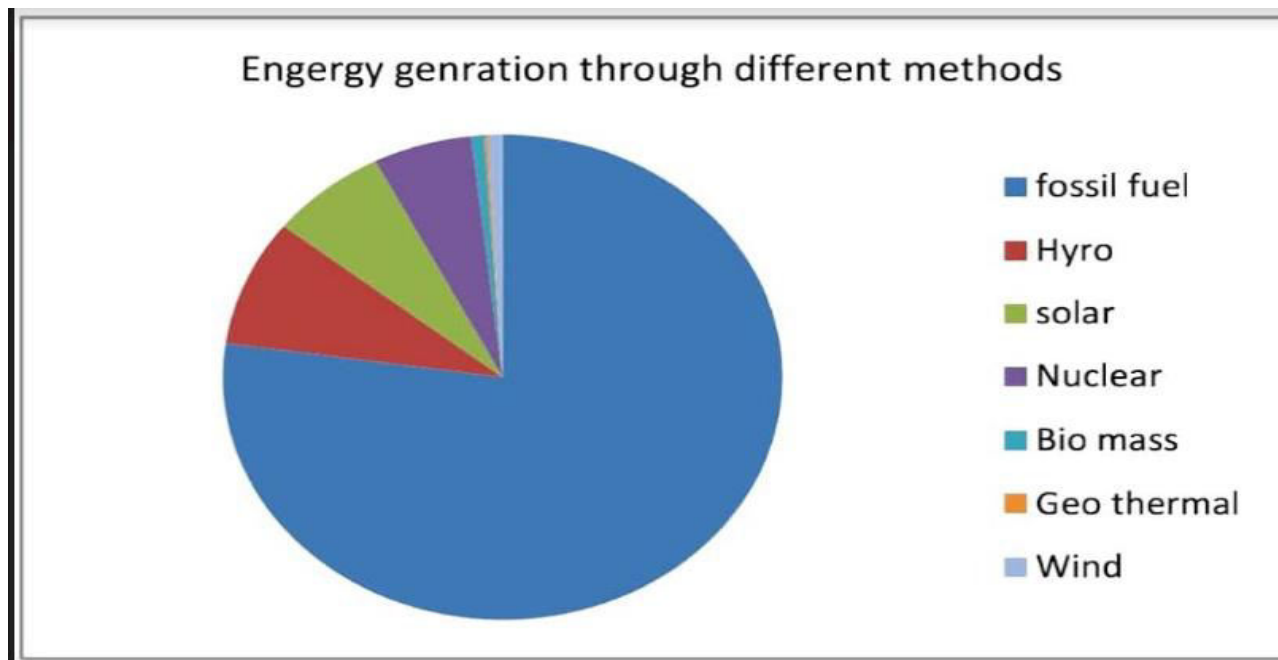
ABSTRACT: The domestic kitchen waste and hotels and restaurant food leftover and kitchen waste are used to feed in bio gas digester to generate bio gas. Through the anaerobic digestion the kitchen waste gets converted into bio gas, which is a also renewable energy source. The process of bio gas Generation is dependent upon some factors which is suitable temperature (above 30 degree Celsius) and PH value of organic waste (). Anaerobic digestion is a microbial process which is very necessary for bio gas production. Basically bio gas consists of Methane (CH₄), Carbon Dioxide (CO₂) Hydrogen Sulphide (H₂S). Bio gas also be used as cooking gas in domestic homes.

KEYWORDS: – Anaerobic digestion, bio gas, kitchen waste, PH level, Temperature

I. INTRODUCTION

The present scenario shows that due to increasing in energy demands and depletion of natural sources of fuel, it is very important to look for new source of energy i.e. renewable energy sources like wind, hydro electric, solar, nuclear, piezoelectric cells and bio mass energy. Bio gas is a good source of renewable energy and it is quite different from other source of renewable energy, because it consumes bio mass and releases bio gas which is mainly methane (CH₄) and it's by product is organic and naturally produces fertilizer, very useful in agriculture.

There are lots of food waste collected from domestic household and from hotels and restaurant disposal of this waste is creating big problem if it is post this waste anywhere that it creates it release methane directly in the environment and land fields release high amount of methane which also leads to global warming by anaerobic digestion if we can process solid waste by decomposition and organic fraction from anaerobic digestion we can convert this biomass to biogas and it also it gives natural fertilizer this process complete the eco cycle of nature by consuming the biomass to give biogas to use and also it gives natural fertilizer back to nature in many countries including India the field of biogas for household it almost UN explode because of inefficient design and non technical system of compact bio gas has lots of potential to reduce carbon footprints and also to reduce the use of LPG cylinder in house infection of the compact bio system which has unique design and monitoring controlling of biogas generation. Fig. 1: Energy generation through different methods



Biogas production principle kitchen waste has a rich nutrition and content very rich composition of chemical to generate biogas kitchen waste mainly include carbohydrate lipstick protein price of inorganic compound oxygen sulphur through the digestion process microorganism split or break the complex structure of carbon into smaller

Anaerobic Digestion-Anaerobic digestion is a sequence of processes by which microorganisms break down biodegradable material in the absence of oxygen. It is a process in which the bacteria are developed and they digest the waste and release bio gas.

Factors affecting effective bio gas Generation

(1) **Temperature** – To maintain an optimum temperature range is very necessary to have an effective bio gas production. There are various existing domestic bio gas plant were failed due to avoiding these parameters like temperature, ph etc. so we are using a temperature sensor and a heating device to have desired level of temperature to be maintain across the digester.

(2) **PH level** – We have used Ph sensor for proper monitoring of ph level of digester, because excess or low ph level can affect the process of bio gas Generation.

Bio Gas

Bio gas is mixture of various other gases like CO_2 , H_2S , CH_4 , these gases are produce by complete digestion of these raw material such as agriculture waste, food waste, animal and human waste, municipal waste, sewage. Bio gas is renewable source of energy and can be used instead of LPG.

Process involved in bio gas digestion

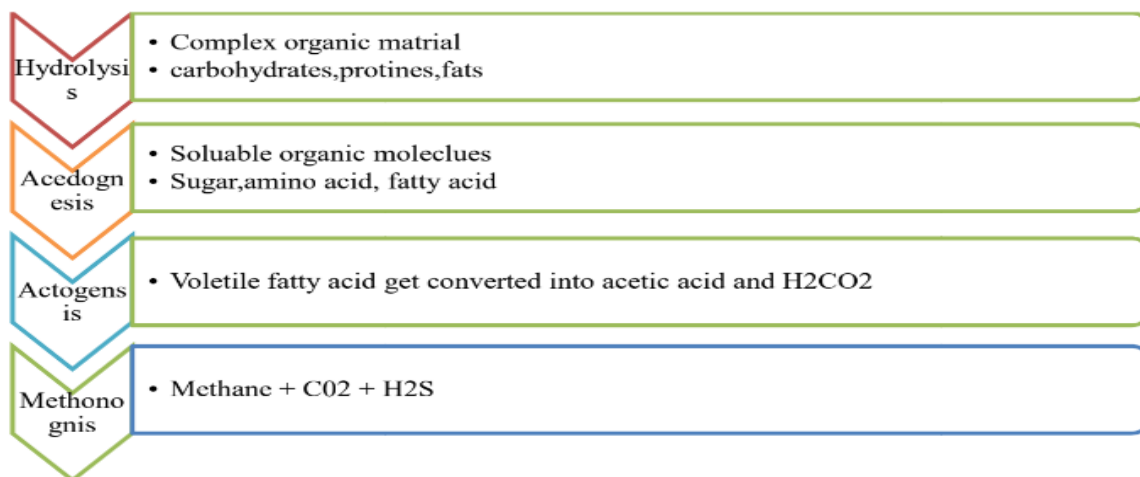


Fig.2: Process involved in bio gas digestion

II. DESIGN AND TECHNOLOGY

The compact biogas machine has a unique square shape design inspired by the home appliance ex- refrigerator washing machines. The machine has two box section upper head section and lower head, the upper head section is act as a brain of machine in which sensors and actuators microcontroller and gas filters are installed for a proper monitoring of bio gas. The lower box section is act as a digester.

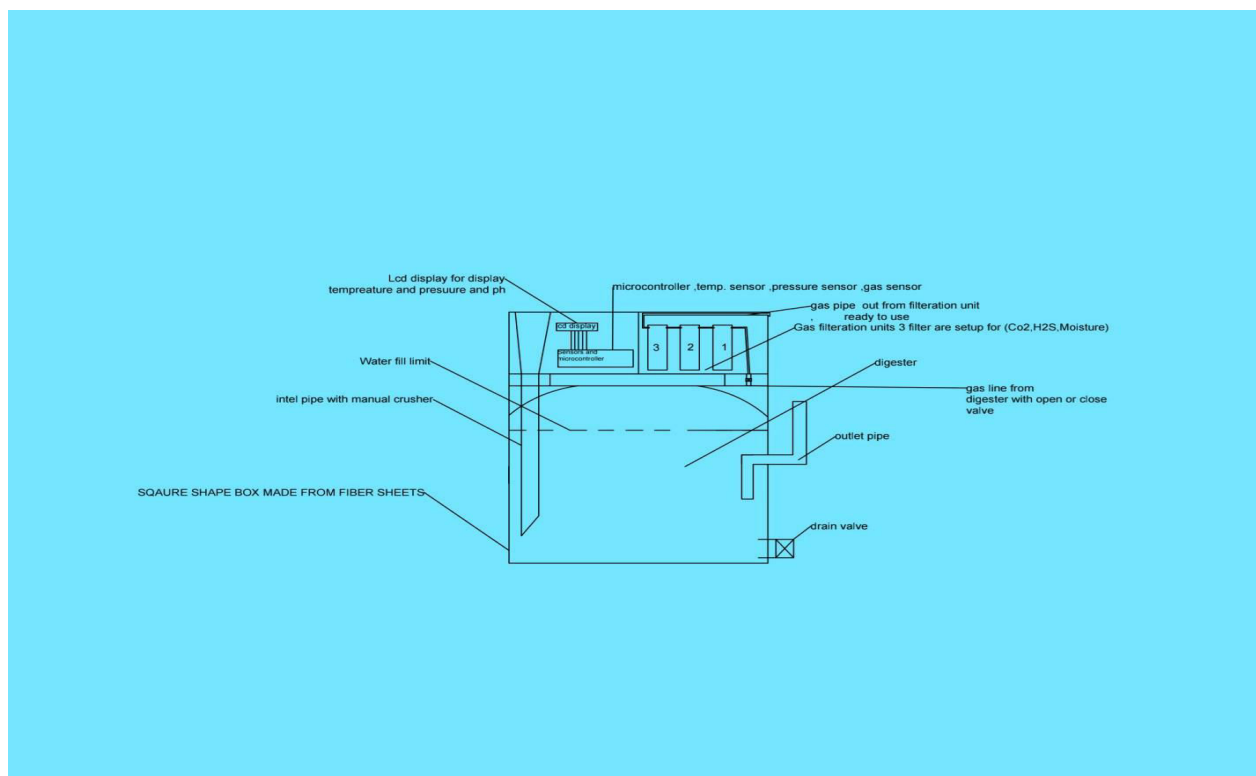


Fig. 3: (CAD DESIGN)

III. COMPONENT

Square shape design frame

The design profile has two component first is digester and second is monitoring unit. A 300 l polythene height density tank is fitted as a digester and a fiber sheet frame build around to give square shape design. The designed is developed by Kartik Khatik on 3d cad software AutoCAD.

The monitoring unit is second part of the design which is also made by fiber sheet and there are various components installing in it like sensors valves, filters, gas pipe and LCD display.

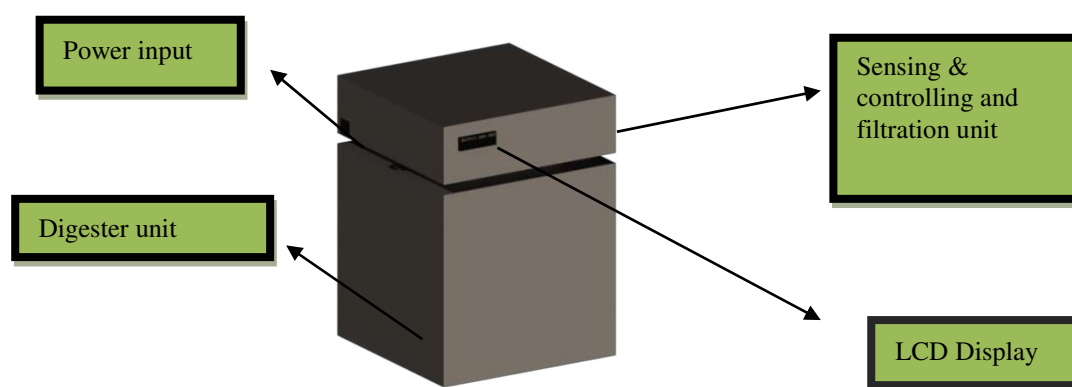


Fig. 4: 3D Auto Cad Model

Gas Filters

From the research and study shows that biogas is a mixture of some gases (CO₂, H₂S etc) and to get pure biogas we have to remove this gases from biogas so we use three stage filter for different purpose.

1. First stage filter – It is used for removal of Carbon dioxide.
2. Second stage filter – It is used for removal of Hydrogen Sulphide.
3. Third stage filter – It is used for removal for moisture content present in bio gas.

Sensors and Controlling

The research and study shows that many small scale biogas plants are built and they get fail because of not having proper monitoring and controlling of bio gas generation process so for proper mounting and controlling of the gas we used sensors.

Sensor and controlling	Purpose
Temperature sensor	sense the on-going temperature
Small Induction coil heater	For maintaining fixed temperature
Pressure Sensor	For sensing pressure and weight

MQ 2 gas sensor	For sensing any leakage of bio gas
LCD Display	For display all sensing values
Microcontroller (Arduino Uno R3)	It controls all sensor and actuators
Water level indicator	Its Indicated the level of water in digester

- Temperature sensor – Model name - Ds18b20 ,Rated power – 0.5 to 5.0v,Waterproff
- Induction coil heater – 100W
- Pressure sensor - Model Name – MD Ps002 , vacuum pressure sensor
- MQ 2 gas sensor – Model name – MQ 2, power requirement- 5v,Max sensing range- 10000, Min. sensing range – 200, Used to detect the presence of CH₄, LPG, Butane and Smoke in air
- Display screen – Model name – TL -0146 , 1602 LCD shield module display
- Water level Sensor – Model name – SEN18, water level sensor depth detection.
- Microcontroller
- Ph sensor

Manual crusher

To reduce the time of gas generation and also to increase the efficiency of burger system we have to crush the food waste before entering to digester after crushing the food waste is divided into a small particles so the digestion process take faster

Manual stirrer

For proper decomposition of food waste a manual stirrer is used to mix well the food waste in digester

Digester & Inlet outlet pipes

Digester is a main component of this machine in which digestion of food waste take place where the bio gas generation take place and also it should be air tight, show a high density polyethanyle plastic 300 liter water tank is used as a digester. (300 liter High density HDPE tank) and in the place of in outlet pipe the PVC pipe are used the diameter of 3 inches.

Other minor parts gas pipe of 1.5 inches, drain valve of 5 inches, open or close valve).

OBSERVATION TABLE –

SR.NO.	LOCATION	TYPE OF WASTE	DATE OF INPUT	OF SIZE SYSTEM	OF GAS PRODUCTION IN (GM)
1	Udaipur(GITS)	Kitchen waste +cow dung	19/ 02 /2022	300 liter	100 gm
2	Udaipur(GITS)	Kitchen waste +cow dung	25 /02 /2022	300 liter	100gm
3	Udaipur(GITS)	Kitchen waste +cow dung	04 / 04 /2022	300 liter	100gm



4	Udaipur(GITS)	Kitchen waste +cow dung	15 /04 /2022300 liter	130 gm
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IV. METHODOLOGY

As per identification of problem we started to work on this project to reduce carbon footprints and to promote renewable energy. Initially there are lots of designed made and we visualized in cad software like AutoCAD and solid works. But finally we developed a Square shape boxy designed inspired by home appliance like washing machine and refrigerator. Our team done lots of research that why domestic home bio gas system are not acceptable by homes easily then we find a reason for it, that pervious and existing compact bio gas system are non technical and may not have proper designed and not look like a home appliance or machine that we decided to develop a feasible designed which also look better and have technical monitoring of the process

Firstly kitchen waste and garden waste is feed into digester through inlet pipe and manual crusher than the digestion process start it will take some time to full digestion of waste ,during the digestion the induction heating coil heat the water in digester in a range of 30 to 35degree Celsius and maintain a effective environment in digester , it will also reduce time and digestion take place faster ,during digestion pressure also get monitored and it get convert into volume ,which is display on LCD display that how much amount of gas is form in gram, temperature and Ph also display on LCD screen . after that the gas is form it will go in filtration unit and get filter ,where the unwanted gas are removed and we get pure bio gas which is methane .

V. CONCLUSION

The use of LPG in domestic home and restaurants and hotel is very high ,it necessary but it also promote pollution ,so compact bio gas machines is best alternative of burning gas in domestic homes .these type of small system is very efficient and compact and it solve to problems 1. To reduce carbon footprints 2.to have better solid waste management. domestic homes can easily used compact bio gas system of size 1000 liter and 500 liter in 1000 liters there is a 400 gm gas produced daily and in 500 liter system there is 300 gm gas produces daily and our project is about 300 liters in which 100 gm gas produced daily and by using this we also be more conscious about our mother earth.

REFERENCES

1. Kale, S.P and Mehele, S.T. kitchen waste based biogas plant.pdf. Nuclear agriculture and Biotechnology/ Division.
2. Karve .A.D. (2007), Compact biogas plant, a low cost digester for biogas from waste starch. <http://www.arti-india.org>.
3. Karve of Pune A.D (2006). Compact biogas plant compact low-cost digester from waste starch. www.bioenergylists.org.
4. Shalini sing, sushil kumar, M.C. Jain, Dinesh kumar (2000), the increased biogas production using microbial stimulants.
5. Ranjeet Singh, S. K. Mandal, V. K. Jain (2008), Development of mixed inoculums for methaneenriched biogas production



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