International Journal on Future Revolution in Computer Science & Communication Engineering
Volume: 3 Issue: 11
ISSN: 2454-4248
105 – 107

Food Waste to Biogas: A Performance Evaluation

Akila[1], Dhivya[1]& Nandhini Priya[1]& V. Kirubakaran[2]
[1]M.Tech. Renewable Energy Scholar, Rural Energy Centre,Gandhigram Rural Institute-Deemed University, Dindigul, India
[2]Asst.Professor, Rural Energy Centre, The Gandhigram Rural Institute-DeemedUniversity, Dindigul, India, *kirbakaran@yahoo.com*

ABSTRACT-Ministry of New and Renewable Energy is implementing the National Biogas and Manure Management Programme (NBMMP) in all the States and UTs of the country. About 47.5 Lakh biogas plants have already been installed in the country upto 31st March, 2014. During the year 2014-15, a target of setting up 1, 10,000biogas plants has been set. In India, approximately 5 million small scale biogas plants are currently in operation. The Biogas plant is the best option for households having feed material, to become self- dependent for cooking gas and highly organic enriched bio-manure. It provides the solution to protect the households from the problems of indoor air pollution and while saving on cost of refilling of LPG cylinders.**Bio gas -**a source from the waste is an excellent form of renewable energy. The waste fromfood, plant and animal is effectively processed & evolved in the form of energy which is a green &clean. By implementing Bio gas plants, greater benefits to the society and mankind is achieved.

Spectrum of benefits could be achieved in Bio Gas plant such as reduced GHG emissions, reduced dependency on imported fossil fuels, reduced carbon foot print, waste reduction, utilisation of waste to good, job creation, low water inputs, flexible and efficient use of bio-gas,benefits to farmers such as additional income to the farmers involved, use of digestate as excellent fertilizer and a Closed nutrient cycle.Biogas implementation using kitchen waste allows it to safe disposal of the waste & also reduces Landfills. The concept of our plant is based on Digestion, which is a biological process that occurs in the presence of anaerobic organisms at ambient pressures and temperature 35 – 70°C.Anaerobic Digestion is a microbial process for the production of biogas which consists of methane (CH4) and carbon dioxide (CO2)**. Bio gas is a clean & slow burning gas which has a calorific value of 5000- 5500kcal/kg (20935- 23028 kJ/kg)**& the process involves the following steps: **Pulverising the waste, Hydrolysis, Moisture removal, Pre Digestion, Main Digestion & Production of Methane Bio Gas.** Biogas thus produced, is being utilised as a cooking fuel in Ladies hostel at GRI. (Foran approximate strength of 1000 Nos and for one partial meal per day). The Digestate, thus produced as slurry is collected and used as manure for plants in campus.

GRI is glad to submit this paper as a real time project, which is based on sustainable development& could open avenues to rural economy and effective use of waste management – a mantra for all developing & developed countries.

*****

I.INTRODUCTION

Utilisation of natural resources, as stated by our ancestors as "Pancha bhootha" had taken its form in a scientific & technical avatar as "Renewable Energy". Solar, Wind, Tidal, Bio Energy, Geo-thermal are the names of various forms of natural energy which resolute their strengths in their own arena and benefit to the mankind in many ways.Biogas, which is distinct from other renewable energies because of its characteristics of utilisation and its transformation from "**Waste to Good**" involves various processes like collection of waste, Segregation to Organic waste and Feeding in the plant as per procedures. Need for fossil fuel greatly impacts the green lungs of earth, resulting in the increased activity of deforestation.Axing/Felling of trees or green wood highly impacts the environmentleading to scarcity of rainfall, land infertility, pollution etc. Asa normal practice till now, in many developing countries and in India as well, kitchen waste is disposed as landfill or discarded which cause public health hazards and diseases like malaria, cholera, typhoid. As Renewable energy students, we are greatly obliged to create awareness to mankind and be responsible for a clean, green and pollution free environment, by effectively utilising the kitchen wastes. Bio gas is produced by the microorganisms, through the bio-degradation of organic material under anaerobic conditions. Those which grow in the presence of oxygen are called aerobic while the other grow in the absence of gaseous oxygen are called anaerobic. It utilises approximately 60% of methane and 40% of carbon di oxide.

II.SET UP SPECIFICATION

Bio gas plant installed in GRIgirls' hostel has the capacity of 200kg/day. The maximum biogas output from this plant will be around 20-25m^3/day, whereas the LPG equivalent will around 10-12.5 kg/day. It consists of Crusher, Pre digester, Moisture separator, Main digester and Slurry collection tank.

 ISSN: 2454-4248
105 – 107

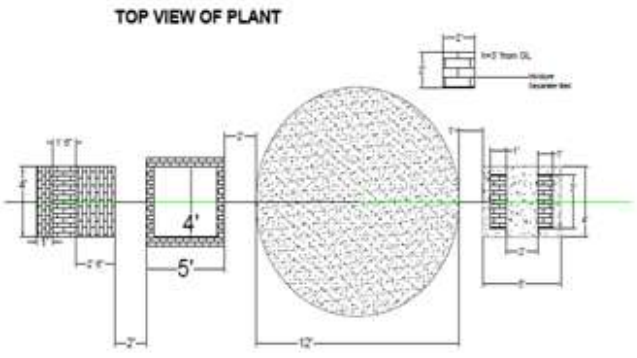
III.PLANT DETAILS

S.no	Particulars	Digester	Gas Holder
1	Material	FRP	FRP
2	Height	10’	4’ 6’’
3	Diameter	10’ 8’’	10’
4	Volume	$25M^3$	$10m^3$
5	Gas line	1.Braided Hose and UPVC pipe are used to installation work	

IV.DETAILS ABOUT ELECTRICAL USAGE

S. no	Particulars	Phase	H.P	Current(amps)	K.W
1	Crusher machine	3	2	3.5	1.5
2	Sludge Pump	3	1	2.5	0.75
3	Bio gas Blower	Single	0.25	1.7	0.2

V. FIGURE OF TOP VIEW OF PLANT



VI. CRUSHER

Initially food waste from the kitchen mess is collected and poured it into this machine which grinds the waste using a 3 phase, 2 H.P motor. Crusher is a manual machine used to reduce the size, or change the form of waste food like semi solid, so they can be more easily disposed of or recycled, or to reduce the size of a solid mix of raw materials, so that pieces of different composition can be differentiated. Crusher is made of stainless steel by the attachment of bevelled gears and blade.

VII.DIGESTER

The wastes from the crusher with little amount of water is fed into the pre digester for the process of anaerobic digestion. A digester is a huge vessel where chemical or biological reactions are carried out. Anaerobic digestion is a series of processes in which microorganismsbreak down biodegradablematerial in the absence of oxygen. It is used for industrial or domestic purposes to manage waste and/or to release energy. The digestion processes begins with bacterial hydrolysis organic polymers such as carbohydrates, and make them available for other bacteria. Acidogenicbacteriathen convert the sugarsand aminoacidsinto carbon dioxide, hydrogen, ammonia, and organicacids. Acetogenicbacteriathen convert these resulting organic acids into acetic acid, along with additional ammonia, hydrogen, and carbon dioxide. Finally, methanogensconvert these products to methane and carbon dioxide. The gas produced through methanogenesis bacteria in the digester is collected in the dome. The generated biogas is stored in the dome and at the top, the biogas trap hole is provided. From the trap hole the flexible pipe line is connected up to the kitchen, where it is connected to the biogas stove for cooking food.

VII. SLURRY COLLECTION TANK

Post digestion process, the slurry coming out of the digester is the rich fertilizer; this is stored in the compost pit provided at the outlet of the digester. Later that can be collected in trucks and transported to the fields. The Biogas thus produced, have different applications such as domestic cooking, lighting and for internal combustion engines.

VIII. CONCLUSION

Monitoring of this unit is done in-house by the Renewable Energy students daily basis & readings are taken to check the quality & quantity of gas and documented as a project study. Implementation of this unit not only serves the purpose of recycling but to produce Renewable Energy as well& toboost Rural Economy & sustainable environment. Bio Gas Production process achieves its successful implementation asa technology and as a Sustainability factor as well. The Digestate which is formed as slurry from Bio Gas is well utilised as agricultural Manure, thus making the process cycle as successful closed loop & the **Supply chain mantra** of ***“ Cradle to Cradle”***

Reference

[1] MINISTRY OF NEW AND RENEWABLE ENERGY-National Bio Gas & Manure Management Program,

[2] G D Rai, ENERGY SOURCE -DNES (Department of Non-conventional Energy sources,]

ISSN: 2454-4248
105 – 107

[3] RANJEET SINGH, S. K. MANDAL, V. K. JAIN (2008), Development of mixed inoculum for methane enriched biogas production

[4] KALE, S.P AND MEHELE, S.T. kitchen waste based biogas plant.pdf. Nuclear agriculture and Biotechnology/ Division.

[5] KARVE .A.D. (2007), Compact biogas plant, a low cost digester for biogas from waste starch. http://www.arti-india.org.

[6] The University of Southampton and Greenfinch Ltd. – Bio digestion of kitchen waste A comparative evaluation of mesophilic and thermophilic bio digestion for the stabilisation and sanitisation of kitchen waste.

[7] KARVE OF PUNE A.D (2006). Compact biogas plant compact low-cost digester from waste starch. www.bioenergylists.org. M.C. JAIN, DINESH KUMAR (2000), the increased biogas production using microbial stimulants

[8] Tanzania Traditional Energy Development and Environment Organization (TaTEDO), BIOGAS TECHNOLOGY- Construction, Utilization and Operation Manual.