ISSN:2319-9873

Research & Reviews: Journal of Engineering and Technology

Biogas Technology in Current Indian Scenario as Applicable to its Production, Maintenance and Utilization of the Slurry as Organic Manure after its Enrichment

Jyothilakshmi R*

Assistant Professor, Department of Mechanical Engineering, M.S.Ramaiah Institute of Technology, Banglore-560054, Karnataka, India

Research Article

Received date: 25/08/2015

Accepted date: 25/09/2015

Published date: 30/09/2015

***For Correspondence**

Jyothilakshmi R, Assistant Professor, Department of Mechanical Engineering, M.S.Ramaiah Institute of Technology, Banglore-560054, Karnataka, India
E-mail: jyothirswamy@gmail.com

Keywords

Gas pipe, Feed stock, Biogas, Slurry.

ABSTRACT

The gas which is produced by the anaerobic digestion of organic waste material is known as biogas. This gas is highly inflammable. It is also known as marsh gas and popularly called as gobar gas. Biogas is mainly a mixture of methane and carbon dioxide. In addition a small amount of hydrogen and a trace amount hydrogen sulphide and ammonia may also exist. Based on the nature of feeding biogas plant would be broadly divided into 3 types namely Batch type which is the one in which the organic waste materials to be digested under anaerobic condition are charged only once into a container which may be called as digester and no more feeding will be there till the end of operation. Semi continuous type in which a predetermined quantity of feed material mixed with water is charged into the digester from one side at specified interval of time say once a day and the digested material equivalent to the volume of the feed flows out of the digester from the other side. The digestion volume remains always constant and third type which is continuous type in which the feed material is continuously charged to the digester with simultaneous discharge of the digested material. Current study deals with the design of an operating and maintenance of the digester for the smooth operation and efficient gas production. The procedure is designed thorough study of the bio digester at different loading conditions. It also deals with the importance of biogas slurry as an organic fertilizer which is a byproduct of bio gasification and its utilization. Enrichment and application of biogas slurry as manure.

In Indian scenario, Biogas can be a substitute for dung and firewood and it can meet the rural energy demand and also become a clean source of energy. It is a renewable energy source and can become a replacement for natural gas and Liquid petroleum gas. Different tests that can help in accessing biogas as a contender for new generation energy source are controlled cooking test, kitchen performance test, boiling test etc. 1.0 m^3 of biogas is equal in energy content to 1.7 L of bioethanol, 0.97m^3 of natural gas and 1.1 L of gasoline.

INTRODUCTION

In India biogas production by the anaerobic degradation of animal manure has been practiced for more than 50 years [1-9]. Since cow dung is mainly used as feedstock, biogas technology has mainly been developed for the digestion of animal

manure. About 60-80 Kg of fresh dung is needed to cover a single family's energy needs of which often too little is available [10]. Therefore to make the technology better adopted to meet the energy demand of rural population, there is a pressing need for other renewable feedstock which has already shown their potential for biogas generation, such as agricultural solid and liquid waste, agro-industrial organic wastes, domestic sewage and garbage, to generate adequate quantities of biogas [11]. This being the scenario different types of bio digesters are being designed which have tailor made requirements. A major problem in this field is operation and maintenance of these plants which should lead to higher gasification rates and increased cleanliness [12]. In this perspective current paper gives Clear operation and maintenance system which is scheduled for daily, weekly, monthly, annually and five yearly schedule of maintenance which helps the people running the plants [13]. The types of the biogas generators as depending on the type of the system used to store the gas, the digesters can be classified as fixed dome type and floating dome type [14]. In the fixed dome type gasifier the gas storage system and the digester is integrated with each other [15]. In the floating dome type, the biogas storage drum can be made out of steel, fiberglass, Ferro cement etc. and it is made to move up and down on a guided frame and the movement depends on the quantity of the gas stored [16].

Instructions to the Users

i) Open the gas pipe only in the morning when there is a requirement of gas and after utilization of the gas close the knob tightly

ii) Before opening the valves one must ensure that all the preparations for the cooking have been made, This would avoid the unnecessary wasteful consumption of gas

iii) Blue flame is an indication of efficient and optimum burning of gas. It tells that our vessel is getting the maximum heat without collecting soot

iv) The tips of the flame should be touching the bottom of the vessel .It is better to use vessels with flat bottom

v) Adjust the inflow of air to get blue flame by adjusting air injector nut in the burner.

METHODOLOGY AND MATERIALS

Daily Maintenance Schedule

a) Add the recommended quantity of dung or any other material thoroughly mixed with water

b) Use proper slurry mixture and remove stones, soil and sand particles

c) Use clean feed stock free from soil, straw etc.

d) Clean the mixing tank after use

e) Never feed the tank when the gas is being used in the kitchen

f) In winter better to use warm water and also use animal urine while preparing the slurry

Weekly Maintenance Schedule

a) Use a long bamboo pole for stirring the slurry through the outlet tank in case of fixed dome plant and rotate the drum in case of KVIC model

b) Clean gas burner and other appliances

c) Open the water tap to drain off moisture condensed in the pipeline

d) The nozzle of biogas lamp should be properly cleaned

Monthly Maintenance Schedule

a) Remove the scum by using special tool with a long handle there by increasing the efficiency of the plant.

b) If compost pits are provided next to the outlet tank, then check level of the slurry in it. If filled divert the slurry to the next compost pit.

c) Check all valves, gas outlet pipe and fittings for leakage.

Annual Maintenance Schedule

a) Check for gas and water leaks from pipe and appliances

b) Repair the worn out accessories

c) Open the gate valve and remove all gas from the plant. After this check the level of the slurry in the outlet chamber

Five Yearly Maintenance Schedule

a) Empty the plant and clean the sludge and inactivate material from the bottom of the plant if the gas production has reduced.

b) Never enter the plant when the digester is filled with slurry. Even after emptying the plant allow 24hrs aeration as a pre-cautionary measure.

c) Give a thorough check to the entire gas distribution system for possible leakage.

d) Re-paint the ceiling of the dome and gas storage chamber with black enamel paint.

e) Re-charge plant with fresh slurry.

UTILIZATION OF BIOGAS SLURRY

Contents of the Biogas Slurry

The anaerobic decomposition of organic wastes in the biogas plant leads to the production of bio digested slurry [17]. The bio digested slurry is a very good manure. Bio digested slurry is the by-product obtained from the biogas plant after the digestion of the dung and generation of the gas. It is a very good manure. The nutrients contents NPK get enriched in the bio digested slurry. The elemental analysis of bio digested slurry using X-ray reveals that the Silicon, Phosphorous, Sulphur, Potassium, Calcium and iron are present with 65.595, 8.275, 3.117, 7.623, 11.693 and 3.698 percent respectively [18,19]. NPK content of each type of the feed stock is shown in **Table 1.**

Table 1. Average Micronutients present in the digested slurry [19].

Sl. no	Manure	N% content	P_2O_2% content	K_2O% content
1	Biodigested slurry	1.5-2.5	1.0-1.5	0.8-1.2
2	Fresh cattle dung	0.3-0.4	0.1-0.2	0.1-0.3
3	Farmyard Manure	0.4-1.5	0.3-0.9	0.3-1.9
4	compost	0.5-1.5	0.3-0.9	0.8-1.2
5	Poultry manure	1.0-1.8	1.4-1.8	0.8-0.9
6	Cattle urine	0.9-1.2	trace	0.5-1.0
7	Paddy straw	0.3-0.4	0.8-1.0	0.7-0.9
8	Wheat straw	0.5-0.6	0.1-0.2	1.1-1.3

The bio digested slurry has a great potential as organic manure and it can be applied to all crops. Bio digestd slurry is as valuable as main product of the biogas plant [20]. In addition it reduces pollution, save energy required to produce chemical fertilizer.

Enrichment of the Bio digested Slurry

The nutrient values of the bio digested slurry can be increased considerably by means of enrichment, thereby reducing the quantum of slurry required for application to get the desired level of nutrients. An effective method of treating such manure is to enrich them with fertilizer nitrogen and with phosphate fertilizers to obtain concentrated organic mineral fertilizer which could be applied in comparatively smaller quantities [21]. One of the popular methods of enrichment is Impregnation in which enrichment can be done by taking 11 Kg of urea and 31 Kg of super phosphate and dissolving them in about 15 litres of water. This solution is absorbed in 48 Kg of dry low grade manure and mixed thoroughly and spread out in the shade to dry. The enriched manure would then contain 5 percent of P_2O_5 in addition to the original contents. Such impregnated manures have been found to give high response in field experiments.

Following are Different Methods of Applying Bio digested Slurry as Manure

1. Air dried bio digested slurry can be applied by spreading on the agricultural land.

2. The liquid slurry can be mixed directly with the running water in the irrigation canal.

3. It can be coated in seeds prior to sowing.

4. Can be used for fish culture.

The nutrient values of bio digested slurry can be increased considerably by means of enrichment. It can be enriched with fertilizer nitrogen, phosphate etc.

CONCLUSION

Enrichment can be done by taking 11 kg of urea and 31 kg of super phosphate and dissolving them in about 15 litres of water. This solution is adsorbed in 48 kg of dry low grade manure and mixed thoroughly and spread out in the shade to dry.

From the studies related to the operation and maintenance of the biogas plants it can be concluded that the proper maintenance on the scheduled time will lead to efficiency improvement of the bio gasification process and increased biogas yield. It also ensures cleanliness in the vicinity of the plant which is otherwise is a very difficult task. So two things namely higher gas yield and healthy and optimal working conditions can be achieved by following the above mentioned maintenance schedules. Bio

digested slurry can be better utilized as organic manure which is rich in NPK contents. Its enrichment increased the efficiency further and results in higher yields.

REFERENCES

1. Biogas: A manual or repair and maintenance. Vivekananda Kendra, NARDEP, Kanyakumari 1993.
2. Planning and management of Non-Conventional Energy development, CIRE 1995.
3. Biogas as vehical fuel, A trend setter report.
4. Hashimoto AG. Microbial hydrolysis of thermochemically treated and untreated manure-straw mixture, Agricultural wastes, 1982; 4:345-364.
5. Kalia VC, et al. Biomethanation of plant materials, Biosource technology, 1992; 41: 209-212.
6. Kapadi SS et al. Biogas upgradation and utilization as vehicle fuel, Proceedings of the joint international conference on Sustainable Energy and Environment Hua Hin, Thailand: JGSEE 2004; 206-209.
7. Khandelwal KC and Mahdi SS. Biogas Technology-A Practical hand book, Tata McGraw Hill Publishing Company Ltd., New Delhi 1986.
8. Kumar S and Jain MC. Dry anaerobic fermentation of cow dung water hyacinth mixture in multiple batch fed digesters 1988.
9. Mittal KM. Biogas systems, Principles and applications, New age international(P) Ltd, New Delhi,1996.
10. MNES Report “Renewable Energy in India and business opportunities”. MNES, Govt. of India, New Delhi 2001.
11. Nirmala B and Gaur AC. Effects of carbon and nitrogen ratio on rice straw biomethanation, Journal of rural Energy 1997; 11:1-16.
12. Singh JB and Anil Dhussa. Manual on Deenbandhu Biogas plant. Tata Mcgraw hill Publishing Company Ltd, New Delhi 1988.
13. Srivastava P K, et al. Technology and Applicationas of Biogas, Jain Brothers, New Delhi 1994.
14. Vijay VK. Studies on utilization of biogas for improved performance of duel fuel Engine, ME(Ag) Thesis,CTAE,Udaipur,1989.
15. Vijay VK, et al. PMV Biogas Scrubbing and Bottling Systems, Proceedings of the international conference at IIT, Kharagpur, 2004; 236-240.
16. Viresh K and Javare Gowda S. Biogas users guide, RBDTC, UAS, GKVK, Bangalore 2002.
17. Viresh K and Venkatachalapathy. Practical manual on Biogas Production and utilization, RBDTC,UAS, Bangalore 2003.
18. Tulasidas TN, et.al. Digested slurry utilization of the biogas slurry and its uses, 2014.
19. Viresh k, et al. Biogas Technology, Regional biogas development and training cenrtre, Dept of Agricultural science, GKVK Bangalore.
20. Nijaguna BT, Biogas Technology, 2013.
21. Mittel and Dhamija, Biogas End uses a technical approach, 2014.