INVESTIGATION ON BIOGAS GENERATION AND WASTE MINIMISATION USING RICE HUSK (LIGNOCELLULOSIC BIOMASS) AND KITCHEN WASTE

Mr. Amol R.Rode[1], Dr. Ajay Swarup[2],

PhD Scholar, Civil deptt, SSSUTMS, sehore, MP [1],

HOD, Civil deptt, SSSUTMS, Sehore, MP[2]

Email: is4562000@gmail.com[1], ajy0381yahoo.com2,

ABSTRACT:

A three anaerobic digesters having capacity of 20 liters each for different feed ratios of kitchen waste and rice husk has prepared. In this paper, combustion analysis & Chemical analysis is done for rice husk & kitchen waste and investigation on biogas generation has done by considering three feed ratios of kitchen waste to Rice husk as 1:1, 1:3, and 3:1 respectively. Similarly, examination of reduction in parameters like as BOD and COD for retention period of 30 days is also done. The proportion kitchen waste to rice husk as (3:1) produces more biogas than that of other feed ratios. This paper suggests that 25% utilisation of rice husk along with kitchen waste slurry given optimum biogas than that of other ratios. Reduction in BOD and COD value found to be 65.21% and 44.82% respectively.

Keywords- *Anaerobic digester, Lignocellulosic biomas, kitchen waste, biogas generation, waste minimisation*

1. INTRODUCTION

Fossil fuels mainly including coal, petroleum and natural gas extracts by drilling and mining and burn to provide energy for use. Reduction in the quantity of fossil fuels and day to day increment in environmental pollution has encouraged and inspired the beginners to think for economical as well as green sources of energy. Improper disposal of organic waste such as kitchen waste cause environmental pollution as well as health problems. In developing country like India, crop cultivation and crop production is the leading occupation of the people and disposal of crop residues after harvesting is again a challenge for farmers. Crop residues rather thrown in an open area or burnt Causes pollution and health problems. On the other hand generation of biogas from organic waste along with lignocellulosic biomasses is relatively feasible method to recreate energy from biomasses. Anaerobic digestion of organic waste along with lignocellulosic biomasses is another best method of converting waste to energy and nourishing the soil by using by-product after digestion process. In the present study, Kitchen waste and rice husk gathered from central region of India and characterized to evaluate the ability of organic waste & ligncellulosic biomasses towards biogas generation. A three anaerobic digester each of 20 liters capacity has considered for every proportion of kitchen waste & Rice husk. The fees ratios of kitchen waste to rice husk as 1:3, 3:1, 1:3 has considered for study. The proportion kitchen waste to rice husk as (3:1) produces more biogas than that of other feed ratios. This study suggests that 25% utilisation of rice husk along with kitchen waste slurry given optimum biogas than that of other ratios. Reduction in BOD and COD value found to be 65.21% and 44.82% respectively.

MATERIALS AND METHODS

Waste Collection

Kitchen waste & Rice husk collected from central part of India. The kitchen waste was co-digested with Rice husk different proportions as 1:1, 1:3, and 3:1

Experimental Setup

Three digesters of 20 liters capacity has prepared for every proportion of co-substrate. Digester has been prepared with proper arrangement of Inlet, outlet and gas pipe and set up at farm in proper manner and shown in **[fig 2.1].**Details of digesters operations are given in **[Table 2.1].**

Fig. 2.1 Actual Model and Set up of Anaerobic Digester at farm

Table 2.1 Details of Digester Operation

Mode of digester operation	**Periodic condition**
Digester microenvironment	Anaerobic
Total retention time	30 days
Operating temperature	35+2
Feed volume	15 lit.

3.0 PRETREATMENT OF LIGNOCELLULOSIC BIOMASS (RICE HUSK)

Combustion Analysis & Chemical analysis has done on Rice husk. Various tests of combustion analysis such as moisture content, volatile matter contents, total solid contents, ash content, fixed carbon contents has done on the sample of rice husk by standard procedure of ASTM method. The various elements present in organic waste (Cow dung & Kitchen waste) and in lignocellulosic biomass (Rice husk & Rice straw) such as Carbon, Nitrogen, Oxygen and Sulphur is determined by Chemical analysis. Chemical analysis is conducted by EDXA using Scanning Electron Microscope (SEM), LEO 1430VP, [Zeiss, Germany.]

4.0 RESULTS AND DISCUSSION ON PRETREATMENT OF RICE HUSK

Results comparison of Combustion analysis & chemical analysis between obtained results and results from literature are presented in Table 4.1 & Table 4.2 respectively.

Table 4.1 Result Comparison of Combustion Analysis

Feed Materials	Present work			Literature data			Authors
	FC	ASH	VM	FC	ASH	VM	
Rice husk	09	15	69	19.2	18	62.8	Miles et al;1995
				16.95	21.24	61.81	Channiwala and parikh;2002

Table 4.2 Result Comparison of Chemical Analysis

Feed materials	Present work			Literature			Author
	C (%)	N (%)	O (%)	C (%)	N (%)	O (%)	
Rice husk	29.30	0.355	39.75	38.9	0.6	32.0	Kirubakaran et al., 2009
				49.3	0.8	43.7	Miles et al., 1995

5.0 RESULTS AND DISCUSSION ON BIOGAS GENERATION

Kitchen waste (organic waste) is co-digested with rice husk for a retention period of 30 days. Feed ratios for kitchen waste to rice straw are taken as 1:1:2, 1:3:2 and 3:1:2 (kitchen waste: rice husk: water) and optimum feed ratio suggested from this study towards biogas generation. Volume of biogas generated from all fees ratio is shown in chart 5.1

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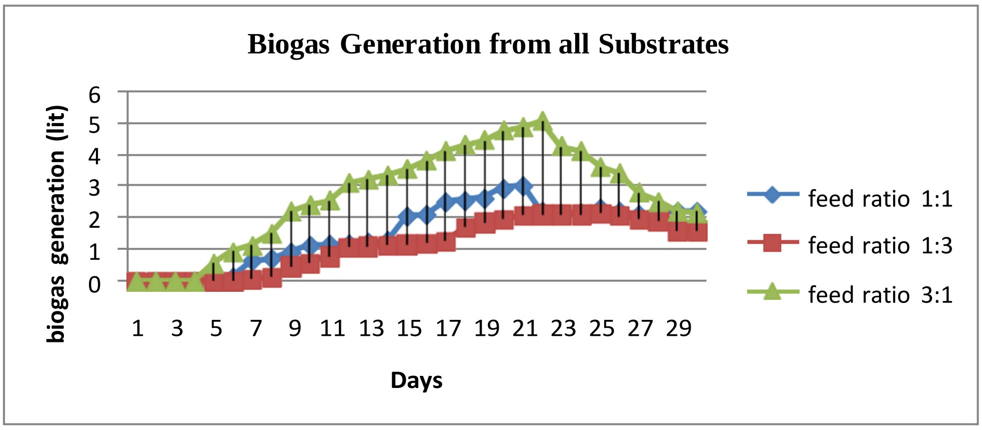

Chart 5.1 Biogas Generated from all feed ratio

Biogas generated from feed ratio of 1:3 is found to be very less as compared to other feed ratios. Maximum biogas generated from feed ratio 3:1. The maximum volume of biogas generated for this optimum ratio is 0.0026m3/day. This study suggests that 25% utilization of rice husk along with kitchen waste slurry given optimum feed percentage of straw for co-digestion.

6.0 WASTE MINIMISATION

Value of BOD & COD is determined by using BOD incubator & COD digester as per standard test procedure according to IS: 3025 (Part 44) reaffirmed 2006 and Method for chemical analysis of waste water EPA-60014-79-020, USEPA method 410. The result related to reduction of BOD & COD value at various intervals is presented in table 6.1 & 6.2 respectively.

Table 6.1 Result of Biochemical Oxygen demand

Feed materials/substrates	Initial BOD (mg/lit)	BOD after 5days (mg/lit)	BOD after 15 days (mg/lit)	Final BOD (mg/lit)	Reduction in BOD (%)
Kitchen waste & Rice Husk	32200	29100	13100	11200	65.21%

Table 6.2 Result of Chemical Oxygen demand

Feed materials/substrates	Initial COD (mg/lit)	COD after 5days (mg/lit)	COD after 15 days (mg/lit)	Final COD (mg/lit)	Reduction in COD (%)
Kitchen waste & Rice Husk	53100	48100	38200	29300	44.82%

Percentage of reduction in BOD value is found as 65.21% & COD reduction as 44.82% for Co-substrate of Kitchen waste & Rice husk.

2.0 CONCLUSION

The cumulative gas production from 30 days of retention time for feed ratio of 3:1 (kitchen waste to rice husk) is found at day 20 & 21. Similarly gas production for ratio 3:1 is more than other ratios. Hence, it is concluded that 25% of utilization of Rice husk in kitchen waste slurry is possible to get optimum biogas.

According to the results, Percentage of reduction in BOD value is found as 65.21% & COD reduction as 44.82% for Co-substrate of Kitchen waste & Rice husk for 30 days of retention time. Hence, it is conclude that waste of anaerobic digester can be minimized with respect to hydraulic retention time.

Hence, the system is comparatively easy to operate and cost efficient in sustainable approach and the end products of anaerobic digestion are natural gas (methane) for energy production, heat produced from energy production, nutrient rich organic slurry and other marketable inorganic solids

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