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Investigation on Biogas Generation and Waste Minimization from Cow Dung by Anaerobic Digestion

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Abstract- A three anaerobic digesters having capacity of 20 liters each for different proportions of cow dung and waste water like as 1:1, 1:1.5, and 1:2 respectively utilized for assessment of cow dung in the form of energy and reduction in parameters like as BOD and COD for retention period of 30 days. The proportion (1:1) gives better value in reduction of BOD and COD value and also in production of Biogas in the form of energy. Reduction in BOD and COD value found to be 43.01% and 19.64% respectively also biogas of about 106.89 lit has found to be generated through anaerobic digester**.**

Index Terms- Anaerobic digester, Biogas, BOD & COD, digested slurry, volumetric method

1. INTRODUCTION

Livestock manure, like cow dung in the absence of appropriate disposal methods can cause adverse environmental and health problems such as pathogen contamination, odour, air born ammonia, green house gases etc [1]. Anaerobic digestion has been considered as waste-to-energy technology, and is widely used in the treatment of organic wastes, for example: organic fraction of municipal solid waste, sewage sludge, food waste, animal manure etc [2]. Recently, large amount of cow dung generated from feedlot farming increases annually, most of which are disposed into landfills or are applied to the land without treatment. Anaerobic digestion provides an alternative option for energy recovery and waste treatment [3]. Biogas production has been attracting increasing attention as a bio-fuel of the future because biogas technology not only constitutes a bio-fuel source, but also can be applied in the various environmental pollutants. In this paper, Cow dung has assessed to study the reduction in parameters of digested slurry as well as energy recovered through anaerobic digester with consideration of three different proportions of cow dung and waste water as 1:1, 1:1.5, and 1:2 for 30 days of retention period. A three anaerobic digester each of 20 liters capacity has considered for every proportion of cow dung slurry. The digestion performance of cow dung has evaluated in the form reduction in BOD and COD value after 30 days of retention time for each proportion. The proportion of 1:1 given better values than other proportions towards reduction in BOD and COD value as 43.01% and 19.64% respectively. Similarly, the cumulative biogas production found to be 106.89 lit. at the end of 30 days of retention period.

2. MATERIALS AND METHODS

2.1. Waste Collection

Fresh cow dung and waste water collected from JAGDAMBHA DAIRY FARM, KINHI. The cow dung was diluted in waste water for different proportions as 1:1, 1:1.5, and 1:2.

2.2. Experimental Setup

Three digesters of 20 liters capacity has prepared for every proportion of cow dung slurry. 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].** Also details of mix masses of charge stock and waste water depicted in **[Table 2.2]**

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.

Table 2.2 Mix Masses of Cow dung with waste water

Mix Proportion	**Mass of Cow dung (Kg)**	**Quantity of Waste Water (Lit)**
1:1	0.25	0.25
1:1.5	0.25	0.375
1:2	0.25	0.50

2.3. ANALYTICAL METHODS

Chemical Oxygen Demand (COD), Bio-Chemical Oxygen Demand (BOD) analysis were performed at the Environmental Engineering lab as described in standard methods of APHA, 1995 at pre and post digestion period for every proportion of slurry. Daily Gas production was monitored by volumetric method.

3. RESULTS AND DISCUSSION

Analysis of pre & post digestion period i.e. on Day 1 and after 30 days of HRT for initial and final slurries for all digesters has done and results of BOD,COD and Gas productions for every proportion is given in **[Table 3.1],[Table 3.2],[Table 3.3]** respectively. Similarly, it is shown in **[Chart 3.1], [Chart 3.2], [Chart 3.3]**

Table 3.1 Pre and Post analysis of slurries for BOD determination

Mix Proportion	**BOD of fresh slurry in mg/lit**	**BOD of digested slurry in mg/lit**	**% Removal of BOD**
1:1	351	200	43.01
1:1.5	346	204	41.01
1:2	339	219	35.39

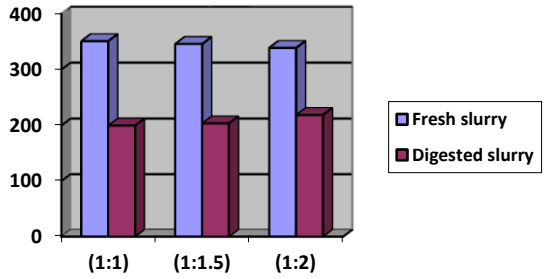

Chart 3.2 BOD Analysis of Fresh & Digested Slurries

Table 3.2 Pre and Post analysis of slurries for COD determination

Mix Proportion	**COD of fresh slurry in mg/lit**	**COD of digested slurry in mg/lit**	**% Removal of COD**
1:1	1088	896	19.64
1:1.5	1072	874	17.40
1:2	1056	880	16.66

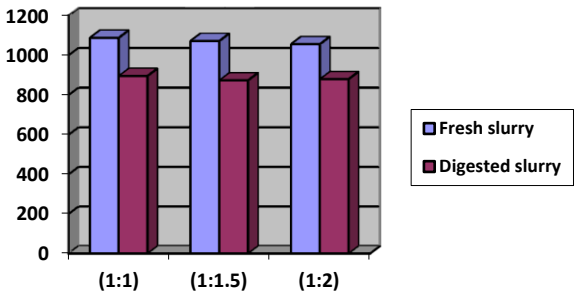

Chart 3.2 COD Analysis of Fresh & Digested Slurries

Table 3.3 Volume of Gas production in Lit

Mix Proportion	**Cumulative volume of Gas generated in Lit**
1:1	106.89
1:1.5	100.29
1:2	95.77

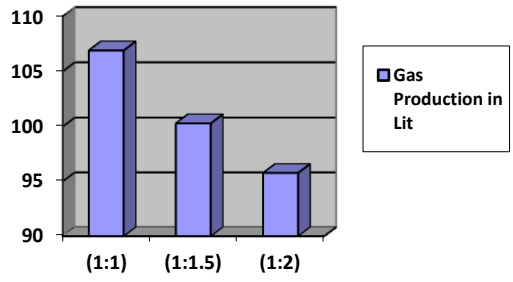

Chart 3.3. Volume of Gas Production in Lit

4. CONCLUSION

The results of this study indicate that parameters of Cow dung waste like BOD, COD shows higher rate of % reduction for 1:1 Proportion after anaerobic digestion and simultaneously potential for biogas production in waste shows higher value for same proportion.

According to the results, 43.01% reduction of BOD is possible in 30days of retention period. Similarly, 19.64% reduction of COD is also possible in 30 days of retention period.

Cumulative gas production is about 106.89 lit in 30 days of retention period.

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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