BIOGAS FROM COIR-PITH

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1. Introduction

In India coconut is cultivated as commercial crop. The coastal strip as well as inland plains of the southern peninsula is the favourable areas where the tropical climate favors the palm to grow very luxuriantly. Apart from the southern states of Andhra Pradesh, Karnataka, Tamilnadu and Kerala. It is also being cultivated in the other states and territories such as Maharastra, Bihar, Madhya Pradesh, West Bengal, Orissa, Goa, Pandichery, Andaman and Nicobar and Lakshdweep Islands. To a major coconut-producing country like India, where the traditional and better known uses of the coconut are already well established. Coir pith is a waste product obtained during the extraction of coir fibre. It is being produced at 3.5 lakhs of tones annually and accumulated in the industrial yards, causing environmental pollution, fire hazard and disposal. Coir pith is very light and hygroscopic in nature. It can absorb 8 times its own weight of water. If a suitable commercial use for the daily output of coir pith in a defibring unit can be found, it will be of great advantage to the industry.

With rapid modernization, the energy needs are steeply increasing. In view of the national priority accorded to the development of alternate sources of energy to supplement the conventional, it was considered more appropriate to concentrate on the possibility of developing a suitable system for the utilization of coir pith as an energy resource.

The aim of the present work was to conduct experiments on coir pith to yield biogas in a mini-biogas plant.

3. Experimental procedure

The mini-biogas plant as shown in fig. 1 consists of a digester, a gas - holder and a gas circuit. The digester is provided with an inlet feed pipe for feeding raw materials and an outlet pipe for discharging digested slurry. This arrangement automatically discharges the digested slurry through the outlet pipe when the fresh charge is fed in through the inlet pipe. The digester has a capacity of 250 litres. The gas- holder is used to collect the gas produced by the fermentation process and to create anaerobic conditions inside the digester. The gas-holder is provided with a stirrer assembly which helps to mix the slurry properly. The gas-holder has a volume of 0.106 m^3. The gas circuit involves a cast iron elbow pipe, a cast iron gas valve to regulate the gas flow, a manometer to measure the pressure in the gas holder and the stove.

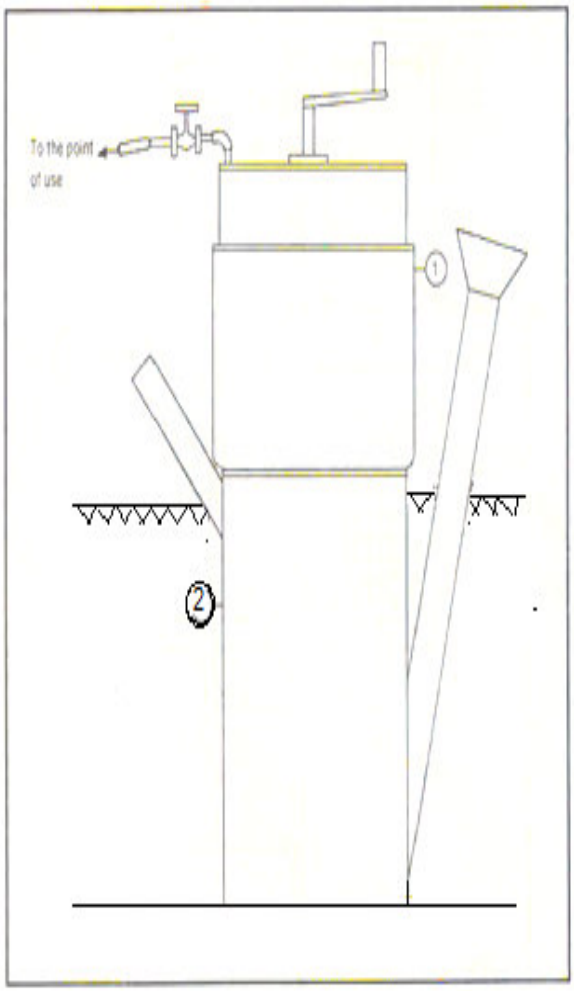

Fig. 1 Mini-biogas plant

1. Stirrer 2. Gas-holder 3. Inlet pipe 4. Outlet pipe 5. Digester

About 250 *l* of slurry containing 8% solid were taken as a charge for the digester. The scum formed in the digester was broken daily by gentle stirring. The pressure build-up in the gas-holder. Temperature of the slurry and the volume of gas produced were measured daily. The gas was analyzed using an orsat apparatus. A high retention time (HRT) of 40 days was taken for the experimental analysis. The gas produced was methane (55 to 60%).

4. Results and discussion

The chemical analysis of coir-pith is given in table 1. Even though the cellulose in the coir pith is 27.04, the average gas yield per kg of coir pith is 0,017 m^3/kg which is lower than that (0.20 m^3/kg) of cowdung. This is because of coir pith is fibrous. The other reason could be high carbon/nitrogen ratio (115.38/1). Since the carbon/nitrogen ratio is too high, the fermentation process is limited by nitrogen availability. To initiate and accelerate the fermentation process, cowdung was added to coir pith while preparing the charge.

Table 1. Analysis of coir pith

Substance	Percentage
Lignin	30.50
Cellulose	27.04
Organic carbon	30.00
Nitrogen	0.26
Phosphorous	0.01
Potassium	0.78
Calcium	.36
Magnesium	0.31
Iron	0.06
Manganese	11.50 ppm
Zinc	8.50 ppm
C/N # ratio	115.38
# C/N = carbon/nitrogen	

Fig. 2 shows that the average gas yield per kg is found to be maximum for the charge having a coir-pith/cowdung ratio of 3/2. The maximum gas production during the third week for coir-pith/cowdung ratios of 3/2 and 4/1 is 0.118 and 0.069 m^3/kg respectively. Coir pith has a dry calorific value of 4200 kcal/kg; where as the calorific value of biogas is 5000 kcal/kg.

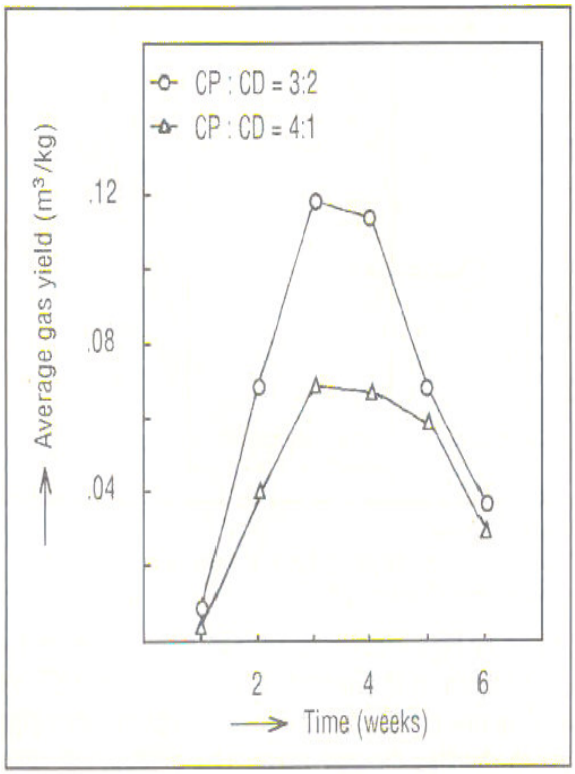

Fig. 2 Average gas yield and coir pith: cow-dung ratio

CONCLUSIONS

The waste, namely coir pith, from the defibring units of the coconut industry can be used to yield biogas. The use of cowdung in addition to coir pith accelerates the fermentation process in the biogas plant.

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