



Technology to Produce Biogas from Coir Pith

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The area under coconut cultivation and coconut production is increasing in India, especially in Southern States. Even though the chief products from coconut are still oil and dried coconut (copra); product diversification and utilization of by-products are increasing. Among the by-products, fiber from the coconut husk and products derived from it still stand on the top position. In the developed countries, there is very good popularity for environment - friendly biodegradable coir-products, especially for coir geotextiles. But the by-product from coir production, the coir pith was merely a waste material till recent times. Usually, it was burnt in heaps along the road sides. The stain (tannin) oozing out from these heaps during monsoon causes environmental problems.

But this situation is changing by the evolution of new technology for the conversion of coir pith to bio-fertilizer. Apart from this coir pith is also used in brick manufacture and as a mulch for moisture conservation in flower - pots.

Coir pith for biogas production

There are about 77% volatile solids in coir pith. Bacteria produce methane from these biomaterials. The chief inflammable (burning) component in biogas is methane. But, another component of coir-pith, lignin, is difficult to degrade. This causes difficulty in producing biogas from coir-pith.

It was in this situation that an experiment was conducted by CPCRI and Coconut Development Board to find out the feasibility of using coir pith for biogas production.

Five KVIC model bio gas plants of 2 M³ capacity (Fig 1) were constructed for this purpose. For the convenience of obtaining cowdung, these plants

were constructed near the agronomy unit at CPCRI. Coir pith was obtained from a coir-industry unit at Kasaragod. The coir pith was utilized for experiment after sieving it through a chicken mesh, thus removing the bigger fibres.

The experiment was conducted using cow dung and coir-pith mixture in the following ratios :

- 1) 100% cow dung
- 2) 80% cow dung + 20% coir pith
- 3) 60% cow dung + 40% coir pith
- 4) 40% cow dung + 60% coir pith
- 5) 20% cow dung + 80% coir pith

These five mixture were prepared in the ratio cow dung + coir pith : water = 1:1

Coir pith, cow dung and water were taken in the ratio as specified for each experiment in a circular tank (Fig. 2) and it is thoroughly mixed using an electric motor. The well-mixed mixture was filled in the respective biogas plants along with some amount of slurry taken from other biogas plants, to accelerate the bacterial activity. This was done only in the first filling of the plant. The quantity of gas produced from each biogas plant was recorded on a gas flow meter connected to the respective plant (Fig. 3). The biogas produced from the five plants and

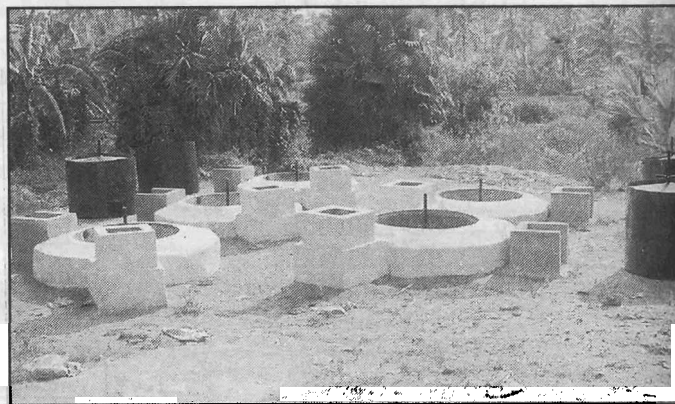


Fig 1 : KVIC Model biogas plants

coming out through five gas flow meter was connected to a 5 horse power dual fuel engine using a PVC pipe (3/4"). A common diesel engine can be converted into a dual fuel engine (diesel & biogas) by slight modifications (Fig. 4). As shown in the figure, the gas was fed through the inlet manifold of the engine. The engine was started as usual

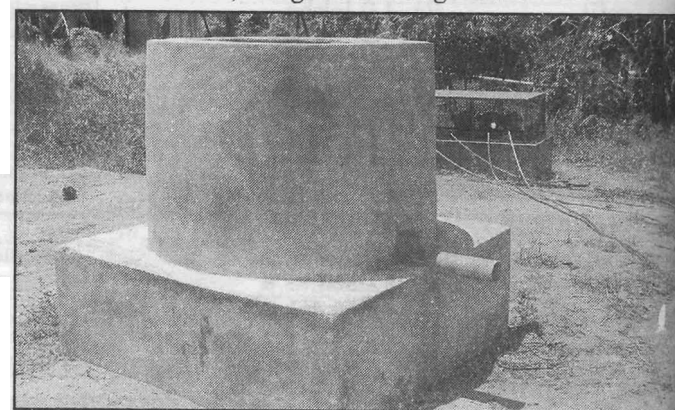


Fig 2 : Mixing tank

using diesel fuel. Once the engine picks up speed biogas was fed to it through the inlet manifold. Engine tries to accelerate since it was supplied with additional fuel (biogas). As the speed of the engine increases, a mechanism of the engine, which controls the engine speed and quantity of the fuel supplied to the engine-the governor - reduces the quantity of diesel to the engine and maintains a more or less constant speed

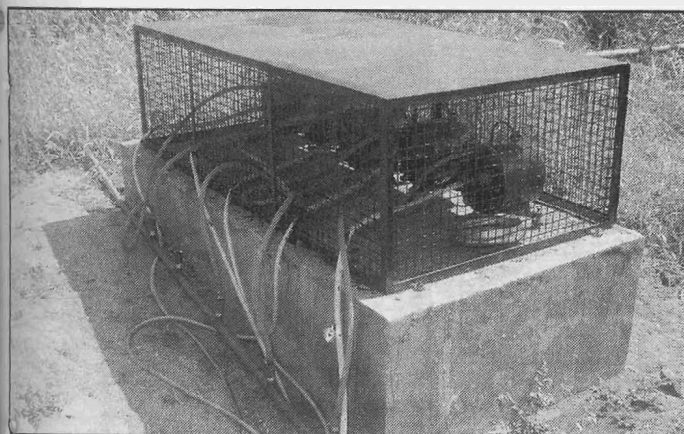


Fig 3 : Gas flow meters

RESULTS

Biogas production

The quantity of gas produced from each plant was recorded separately. The gas samples were collected only after the retention period, the time required to reach the gas production to its full extent, which was about 30 days. The quantity of gas produced from each mixture is given in Table 1.

Table 2 : Methane percentage in different combinations of coir pith & cow dung

Sl. No.	Constituent	Methane Percentage
1.	100% cow dung	60.2
2.	80% cow dung + 20% coir pith	71.4
3.	60% cow dung + 40% coir pith	59.6
4.	40% cow dung + 60% coir pith	57.4
5.	20% cow dung + 80% coir pith	55.3

The highest quantity of gas was produced from the mixture containing 80% cow dung and 20% coir pith. In all other mixtures, the quantity of gas produced was less than that produced from cow dung alone. It was also observed that maximum percentage of methane was produced by the mixture, which contained 80% cow dung and 20% coir pith. Percentage of methane obtained from various combinations of cow dung and coir pith is given in Table - 2.

Gas production and temperature

Gas production increases as the temperature increases. This common

phenomenon was observed here also, as seen in all other biogas plants. But this happened only up to a certain limit. After that the gas production became constant.

Slurry from bio-gas plant

Gas production stabilizes only after one month of filling the plant. After this, cow dung

which completed gas production, comes out (which is equal to the quantity of mixture added to the plant). This is called slurry, which is a good bio-fertilizer.

The quality of slurry from each plant was tested. The experiment was conducted on two phases and the results were tabulated as shown in Table - 3.

It has been proved in earlier studies conducted that; the most suitable C/N ratio for biogas production is 25-30. Here this C/N ratio was observed in the

Table 1 : Average production of biogas in different treatments

Treatment	Average production (Lit/day)
100% cow dung	879.23
80% cow dung + 20% coir pith	929.61
60% cow dung + 40% coir pith	653.74
40% cow dung + 60% coir pith	438.06
20% cow dung + 80% coir pith	332.32

mixture containing 80% cow dung and 20% coir pith. Therefore the gas production was the highest from this mixture.

Uses of Biogas

The current uses of bio-gas and the quantity required for each of them is given in Table - 4.

Table - 5 gives some of the commonly used feed stock and the maximum gas production from each one of them.

Table 3 : Chemical analysis of slurry

Sl No.	Constituent (average of 5 samples)	Organic carbon	P%	K%	N%	C/N ratio
1	100% cow dung	24.23	1.8776	0.484	1.187	20.41
2	80% cow dung + 20% coir pith	29.12	1.637	0.469	1.112	26.18
3	60% cow dung + 40% coir pith	28.47	1.787	0.401	1.713	16.62
4	40% cow dung + 60% coir pith	33.23	1.353	0.286	1.773	18.74
5	20% cow dung + 80% coir pith	34.67	0.667	0.334	1.64	21.14



Table 4 : Biogas use and requirements for certain applications

SI No.	Application	Specification	Gas requirement m ³ /hr
1	Cooking	5 cm burner	0.33
		10 cm burner	0.47
		15 cm burner	0.64
2	Gas lamps	per lamp of 100 candle power	0.33
		2 mantle lamp	0.14
		3 mantle lamp	0.17
3	Dual fuel engine 80% biogas	per hp	0.45-0.51
4	Refrigerator	per 100 litres	0.1 -0.13
5	Incubator	per 100 litres	0.05-0.08
6	Boiling water	per 1 litre	0.11

As explained earlier, the biogas from all the 5 plants was led to a 5 HP dual fuel engine, which runs on diesel and biogas. The gas was fed to the inlet manifold of the engine, which supplies air to the engine. A valve connected near to the engine regulated the gas flow. After starting the engine, this valve was opened and gas fed to the engine. It was observed that, the 5 HP diesel engine working for about 8 hours consumed about 10m³ of biogas, thereby reducing diesel consumption by nearly 5 litres. A centrifugal pump used for irrigation was operated using this engine.

From the studies conducted at CPCRI, it was observed that about 11% more gas was obtained from a mixture of 80% cow dung and 20% coir pith,

than from cow dung alone. More gas production occurred at 28^o-33^oC. Diesel consumption of a dual fuel engine could be reduced significantly by using biogas as fuel.

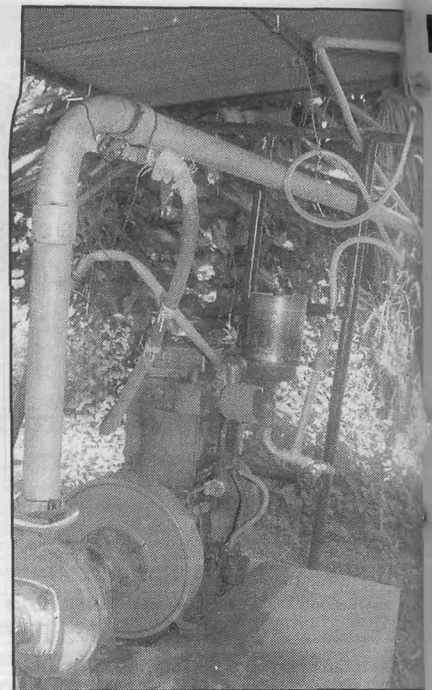


Fig 4 : Dual fuel engine - a modified diesel engine which can run on diesel and biogas

Table 5 : Amount of biogas production per unit weight of feedstock

SI No.	Feed stock	Maximum gas production m ³ /kg of dry matter	% Methane (Approx.)
1	Dung	0.33	60
2	Poultry manure	0.42-0.45	65
3	Night soil	0.38-0.42	65
4	Dry leaf powder	0.45	44
5	Sugar cane thresh	0.75	45
6	Maize straw	0.81	46
7	Activated sludge	0.62	44
8	Dung + coconut pith	0.83	71
9	Straw powder	0.93	46

CNO PRICE HOVER BELOW US\$500/MT

In the first week of May 2000, price of coconut oil dropped to US\$485/MT, CIF Rotterdam, the lowest since November 1993. This is in contrast with the price in the corresponding period last year which rocketed to US\$945/MT. The drop in price was due to supply pressure from the Philippines and Indonesia. Meanwhile, demand for coconut oil remained sluggish. Coconut oil price in the international market is noted for its volatility. In the 1970s and 1980s price of coconut oil moved up and down sharply. During the 1970s, the price difference of coconut oil between the highest and the lowest levels was as much as US\$730/MT. This trend continued from 1980 to 1984 with the difference declining to US\$691/MT. In 1985-89, the price swings resulted in a narrowing the difference to US\$298/MT.

- The Cocomunity