



BIOGAS FROM TEXTILE MILL WASTE (WILLOW DUST)



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Introduction

Willow dust is a waste generated during the processing of raw cotton in a cotton spinning mill. It contains short fibres, seed coat bits with or without fibres attached to them, leaf bits and other small plant parts; and has considerable cellulose content. In India, approximately one lakh tonnes of willow dust is generated per annum that is not much in use except for compost preparation. Willow dust is a bulky material and requires large space for storage when collected in bulk in a textile mill. In the rainy season, handling of willow dust becomes difficult as it starts decaying. Willow dust is sold at a low price mainly due to lack of sufficient storing place in textile mills. Chemical analysis shows that Willow dust contains about 26% cellulose, 16% hemicelluloses, 16% lignin and 1.5–2% nitrogen. Further, the C:N ratio of 28:1 makes it suitable for the production of biogas.

CIRCOT Process

At CIRCOT, pioneering work has been done on the production of biogas and biomanure from willow dust. The results indicate that it is possible to produce about 50 m³ of biogas containing about 55-60% methane in 45 days from 100 kg of willow dust. Based on this technology, a gas plant was set up at M/s. Apollo Textile Mills way back in 1981. Data generated on this plant helped in setting up plants in other selected textile mills.

Highlights of the Process

- 🌸 Dry fermentation process
- 🌸 Environment friendly and viable technology
- 🌸 Less water requirement
- 🌸 Production of two outputs: Biogas and Bio-manure
- 🌸 Willow dust based biogas plant found highly suitable for textile mills

Design of the biogas plant

The plant is constructed on about 100 Sq. m. of land. It requires setting up of three non-stirred digesters, each capable of handling 10 tonnes of Willow dust when the substrate to liquid ratio is kept at 1:1.5. The digesters are constructed in reinforced cement concrete and are partially underground. The digesters are separately connected through gas-flow meters, which in turn, are connected to a gas holder through a common header. Each digester has a separate by-pass for the carbon dioxide generated during the initial stages of biogas production. The gas holder is of the floating type and constructed from cast iron sheets. The weight of the drum is so adjusted as to exert a constant pressure of 7.5 to 10 cm water column pressure. The gas holder has the capacity of 70 m³. The material is loaded in the digester layer by layer followed by spraying of alkaline water and inoculum. When the loading gets completed, the lid is lowered till it rests within a water sealed compartment. The generated gas is collected in the gas holder for further uses.

Yield

About 500 m³ of biogas per tonnes of willow dust in 45 days

Economics

Capital investment	₹. 15.00 lakhs (Digesters: 3, Gas Holder:1)
Biogas Production / year	50000 m ³ biogas per year, manure: 30 tonnes (processing 100 tonnes willow dust per year)
Selling price	Biogas- ₹. 20/ m ³ and Bio-manure: ₹. 4000/- tonne
Products	Biogas, Bio-manure
Pay-back period	2 Years
Running cost	₹. 5 lakhs/ annum (cost of raw material, alkali, water and labour)

Note: 100 m³ of biogas is equivalent to 3 LPG cylinder of 14.5 kg each.



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