

A SMALLHOLDERS COPRA DRYER USING AGRICULTURAL
WASTE AS A SOURCE OF ENERGY

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INTRODUCTION

Fresh coconut meat contains about 45 to 50 percent moisture content on wet basis and it has to be dried to 5 percent moisture content for safe storage and further processing. A dryer for use during rainy season, when conventional practise of open sun drying is not possible, has been a long felt need. Copra being very susceptible to the infestation by microorganisms, cannot be dried even with intermittent supply of solar energy in the beginning and at the end of the monsoon season. The average land holding of 0.2 ha and about 90 percent farmers having less than 1ha of land makes the use of other indirect type dryers impractical and uneconomical proposition. The direct type dryers also cannot be used for copra drying due to inferior and non uniformly dried end product obtained from such dryers.

The indirect type small dryer with a provision to control the drying air temperature and using low cost easily available agricultural waste as fuel has been designed and developed at the Central Plantation Crops Research Institute, Kasaragod, 671024, Kerala (as shown in the drawing).

DESCRIPTION OF THE DRYER

OVER VIEW

TYPE: BATCH TYPE

HEATING MODE: INDIRECT

AIR CIRCULATION: NATURAL CONVECTION

The dryer is constructed from the materials such as asbetos, rope, asbestos cement sheet, G I sheet, MS angles, MS flats, wire mesh etc.

The components of the dryer are:

1. Drying chamber:- It is made of asbestos cement sheets on sides and wire mesh tray at the bottom. It is supported on MS angle frame.
2. Plenum chamber - It is made of asbestos cement sheets supported on MS angle frame. At the bottom of the chamber an adjustable opening is provided to regulate the entry of the fresh air for drying.

3. Burning cum heat changing unit - It is a 30 cm diameter cylinder made of 22 gauge G I sheet located in the centre of the plenum chamber. The bottom half is made of plain G I sheet whereas upper half is made of corrugated G I sheet to get more area for heat transfer. One end of the chamber is covered by the A C sheet lined with G I sheet damper with holes for entry of air required for combustion. Another end is connected to 10 cm diameter chimney which lets out the flue gases after combustion. The cylinder is placed inclined at 30° for smooth flow of gases. The fuel is burnt in the centre of the burning chamber in a welded wire mesh tray.

4. Chimney - Ten centimeter G I sheet chimney is provided with two butter fly valves to regulate the escape of flue gases. This in turn regulates the entry of air for combustion and thus controls the drying air temperature. The chimney is partially covered by asbestos rope with plastering by plaster of paris to avoid the danger during handling.

PRINCIPLE OF OPERATION

When the fuel is burnt in the burning chamber, due to higher temperature of the fuel gas the G I sheet cylinder is heated up. The heat from the cylinder is transferred to surrounding fresh air coming from bottom. The hot air being light in weight comes in contact with the wet material in the drying chamber. The hot air laden with moisture escapes to the atmosphere from the top of the drying chamber. This phenomenon also helps the natural convection of the air through the drying bed. The dial thermometer fixed just below the drying platform indicates when to regulate the valve position.

OPERATION OF THE DRYER FOR COPRA

The nuts are cut into two halves after dehusking and nut water is drained off. The cups are kept in inverted position for 15 min to remove the adhering moisture. In the drying chamber first two bottom layers are kept with cups facing up and the rest of the cups are kept facing down till the full capacity in brick fashion. The fuel is burnt in a wire mesh tray kept in the centre of the cylinder and fuel is fed as when required to keep the fire burning. The temperature of the drying air is kept at 70°C and if found more the valve position is adjusted to maintain the temperature.

OPERATION OF THE DRYER FOR COCOA

The fermented beans of about 40 Kg are accommodated in the drying chamber at 10 cm thickness. The surface moisture drying takes place for 8 hours and needs constant stirring at every half an hour. Then for seed coat drying time required is 3 hours and final cotyledon drying gets completed after 7 hours. Total drying time required is about 18 hours with 8 hours continuous drying and then intermittent drying with tempering for one hour after every three hours. The temperature of drying air is kept at 70-80°C.

ADVANTAGES

1. It needs only 2 m² area for housing. Temporary shade can serve as a cover during rainy season.

2. Two to three persons can lift and transport the dryer to short distances.
3. Temperature control ensures uniform and perfect drying and yields clean white copra.
4. Controlled combustion ensures economical use of fuel.
5. Any low quality but dry fuel can be used.
6. It is very simple in design and very safe to operate.
7. It can be used for drying other plantation crops also.
8. Maximum capacity of the dryer is 400 coconuts and drying time required is only 38 hours (four days)
9. Time required for drying about 40 Kg of fermented beans (cocoa) was 18 hours (two days).
10. Time required for about 150 Kg of fresh arecanuts per batch for drying is about 10 days (10 hours drying per day).

MATERIALS REQUIRED FOR FABRICATION

SL NO	MATERIAL	SIZE	QUANTITY
1	M S angle	38mm x 38mm x 3mm	20 mtr
2	M S flat	38mm x 3mm	22 mtr
3	M S flat	25mm x 6mm	5 mtr
4	G I sheet (corrugated)	22 gauge	1.5 m ²
5	G I sheet	22 gauge	1.5 m ²
6	Asbestos sheet	3mm	6 m ²
7	Asbestos rope	12.5mm Ø	1 Kg
8	G I bolts and washer	-	2 pkts
9	hinges	5cm	6 nos.

COST ANALYSIS OF DRAYING

1. Cost of the dryer: Rs. 1000.00
2. Expected life of the dryer in years: 10 years
3. Use of the dryer in a year: 200 days
4. Time required for drying per batch @ 10 hrs/day operation: 4 days

FIXED COST

Depreciation: Rs. 10.00

Interest @ 12% per annum on half initial cost: Rs. 60.00

Maintenance: Rs. 10.00

Total fixed cost: Rs. 170.00

VARIABLE COST

Dehusking charges/batch @ Rs. 20/1000 nuts: Rs. 8.00

Splitting and deshelling charges per batch: Rs. 8.00

Cost of fuel @ 10 paise/Kg: Rs. 3.00

Total variable cost: Rs. 19.00

COST OF OPERATION PER BATCH: RS. 22.40

COPRA OBTAINED PER BATCH: 64 Kg.

COST OF DRYING PER KG. OF DRIED COPRA: Rs. 0.35
