

# Particle Board from Cotton Plant Stalk

## — A Timber Substitute



**Strong and Durable**



**Moisture and Weather  
Resistant**



**Fire Resistant**



**Termite and Decay  
Resistant**



**Heat Resistant  
and Sound Proof**



**Low Cost Technology**

**Central Institute for Research on Cotton Technology**

(Indian Council of Agricultural Research)

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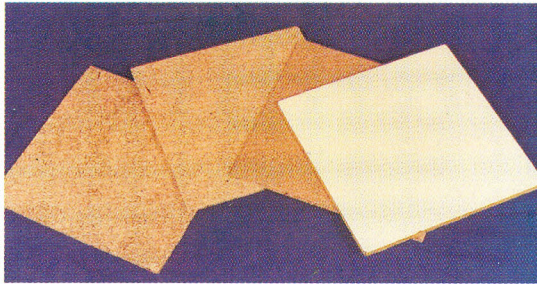
## Introduction

India is one of the leading cotton growing countries in the world. The total area under cotton cultivation is about 8.2 million hectares, which annually generates about 16 million tonnes of cotton stalks. If this crop residue is put to better use, it will not only solve its disposal problem but also fetch additional returns to the farming community and generate self employment among rural people. The introduction of particle board as a substitute for plywood and block board has been the most innovative contribution of modern technology to the world. It was the Germans who introduced particle board as a



*Cotton Stalk and heaped chips*

substitute for timber to mitigate its shortage during World War II. In advanced countries particle boards are the most popular panel material put to various end uses by the building and furniture industries.



*Particle boards with different surface finishes*

Cotton plant stalk contains about 60% holocellulose, 27% lignin and 7% ash. Cotton stalk is comparable to the most common species of hardwood in respect of fibrous structure unlike other agricultural crop residues.



*Cotton stalk chips and particles of different sizes*

CIRCOT has developed a process for preparing different types of particle boards from cotton plant stalk.

### **The Process**

On the laboratory scale, the stalks are chopped and chipped and classified as coarse and fine particles. They are separately coated with synthetic resin adhesives and blended in specially designed mechanical mixers by



*Mat formation of particles coated with resin*

adjusting the required moisture level. The coated particles are formed into mats which are subsequently consolidated under heat and pressure in a preheated hydraulic press. The hot pressed panels are cooled and trimmed to desired dimensions and are sanded for smoothness and uniform thickness.

In the commercial level manufacture also, while the basic sequence of processes remain the same, each of these activities are taken care of more or less automatically.

The particle board, thus prepared, is strong, durable and easily workable. The properties such as fire resistance, termite resistance, water repellency, thermal resistance and acoustic insulation can be imparted through suitable additives at the mixing stage. Further, the particle boards can have different surface finishes like veneer, plain, bamboo mat and



*Mat formation*



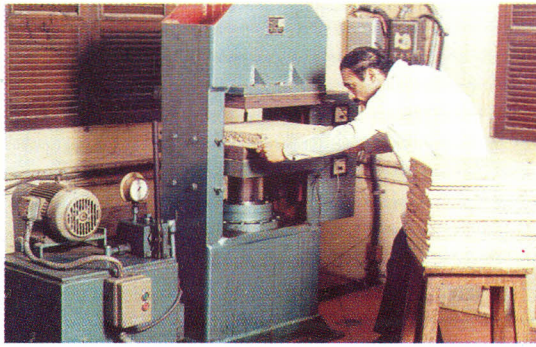
*Three layered mat of different particles*

laminated. These boards can be directly painted or varnished.

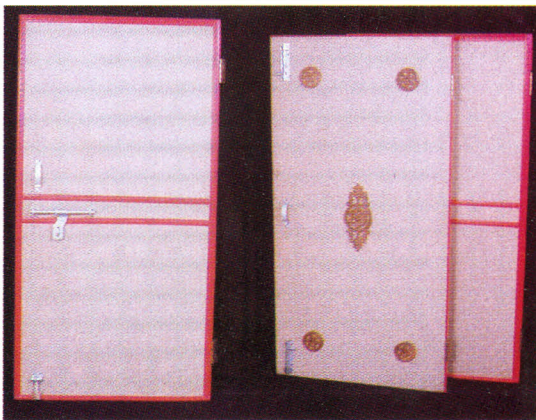
### Applications

Cotton stalk particle boards possessing different densities, thickness and types are manufactured to suit a wide range of applications such as :

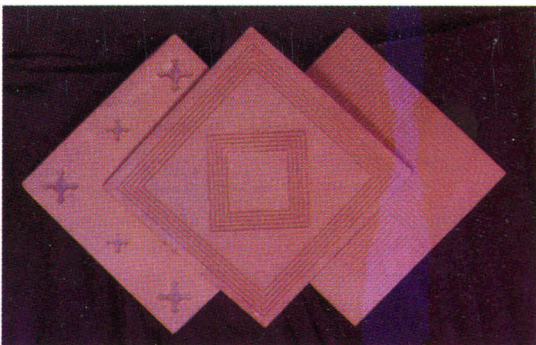
- 🔩 *Wall paneling*
- 🔩 *Window paneling insert*
- 🔩 *Table top*
- 🔩 *Doors and furniture*
- 🔩 *False ceiling*
- 🔩 *Roof paneling*
- 🔩 *Partitioning*
- 🔩 *Insulating material*
- 🔩 *Industrial & domestic floorings*



*Mat pressing and finished boards*



*Panel doors made from particle board*



*False ceiling tiles*

**Properties of Three Layered Particle Board Prepared from Cotton Plant Stalks**

Sr. No.	Parameters/ Properties	Unit	CIRCOT Board	Values Prescribed in BIS:3088-1985 for Flat Pressed Three Layer, Multi Layer and Graded Boards	
				Type I	Type II
1	Density	Kg/m <sup>3</sup>	700	500-900	--
2	Moisture Content	%	10	5-15	--
3	Water Absorption				
	- 2 h soaking	%	20	10	40
	- 24 h soaking	%	40	20	80
4	Thickness Swelling (2 h soaking)	%	10	8	12
5	Swelling due to Surface Adsorption	%	7	6	9
6	Modulus of Rupture (Upto 20 mm)	N/mm <sup>2</sup>	16.5	15	11
7	Tensile Strength Perpendicular to Surface (Upto 20 mm)	N/mm <sup>2</sup>	0.50	0.45	0.3
8	Screw Withdrawal Strength				
	Face	N	1600	1250	1250
	Edge	N	850	850	700
9	Nail Withdrawal Strength	N	1300	1250	-----

*The quality of particle boards prepared from cotton plant stalks is on par with those from conventional timber material and meet all the specifications set by Bureau of Indian Standard (BIS:3087-1985). The three layered particle boards possess good bending strength and internal bond strength. The density profile across the board is engineered to suit various constructional features as required for different end uses.*

## Cost Estimation and Profitability

### Capacity

10 TPD (360 boards of  
8'×4'×12 mm)

### Capital Investment

Rs.222.00 lakhs

### Cost of Production

Rs.172.00 lakhs

### Cost of Production

Rs.12.60 per sq.ft.

### Sale Price

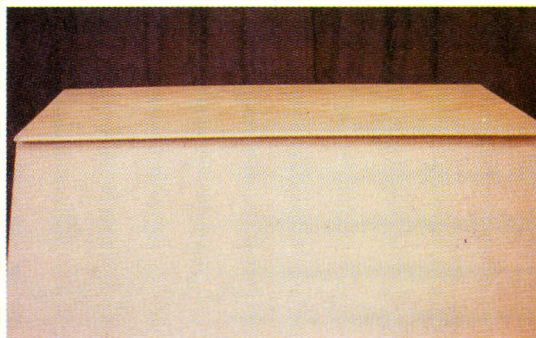
Rs.17.50 per sq.ft.

### Return on Investment

34%



*Telephone stand from particle board*

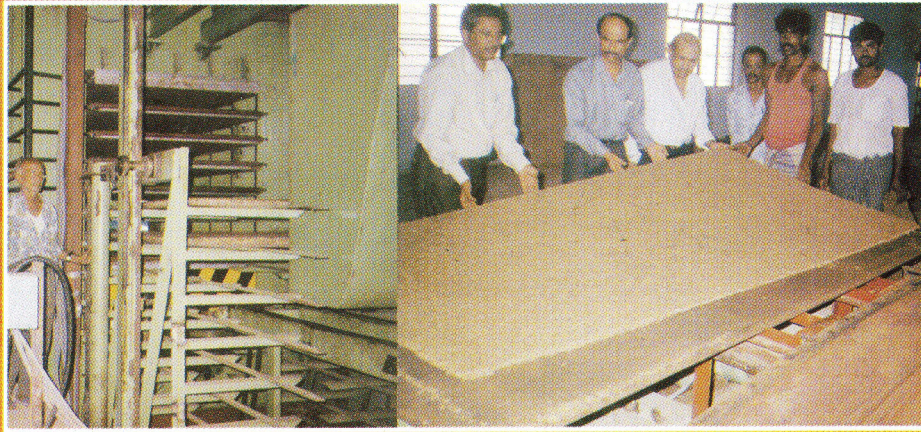


*Table top made from particle board*

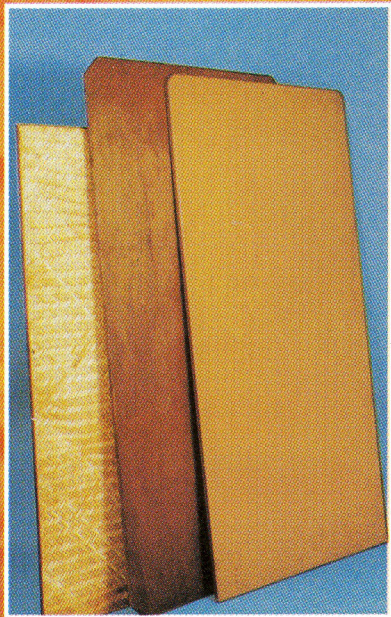
The Technology developed by CIRCOT for preparation of particle boards from cotton plant stalks was transferred to a co-operative society situated at Chikkanaragund in Dharwad district of Karnataka State. The automatic plant of 20 TPD capacity was inaugurated by Shri S.M. Krishna, the Hon. Chief Minister of Karnataka State.



*Shri S.M. Krishna, Hon. Chief Minister, Karnataka State, inaugurating the particle board factory at Chikkanaragund, Dharwad*



*Particle board from the commercial plant at Chikkanarogund, Dharwad*



*Particle boards of different finishes prepared from the commercial plant*



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