STUDIES ON THE MANUFACTURE OF HARDBOARD FROM KEORA WOOD

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Keora wood was pulped by steaming the chips under 10 kg/cm^2 and 7 kg/cm^2 pressures each for half hour, one hour and one and half hour. The pulps were refined to two different freenesses in each case. Hardboards were made from these pulps without using any sizing materials or additives and tested for strength and water absorption properties. The boards were moderate in strength and water resistance.

INTRODUCTION

Keora (*Sonneratia apetala*, Ham) is a moderate sized tree growing in the mangrove forests, especially in the Sunderbans and similar other localities of Bangladesh. The wood is moderately hard with grey sapwood and light reddish-brown heartwood, suitable for making boat, packing case and rough furniture (Pearson and Brown 1932). Because of its rapid growth, it is regarded as an important mangrove species for coastal afforestation. In order to explore its new applications in wood-based industries of the country, a preliminary study was made in the Forest Research Institute to investigate into its suitability for hardboard making.

MATERIALS AND METHODS

Several Keora logs procured from the Sunderban forests were sawn to 9 cm x 9 cm x 200 cm size and then chipped in a laboratory model chipper machine to approximately 2.5 cm x 1.3 cm x 0.3 cm size chips.

Pulping : The chips were cooked by direct steaming in a stainless steel rotary digester of 0.02 m^3 capacity under 10 kg/cm^2 and 7 kg/cm^2 digester pressures for half hour, one hour and one and half hour in each case. They were then refined in a single-rotating disk attrition mill at two settings so as to obtain two pulps of different freenesses from each of the above cooks. A total of 12 pulps were thus made.

Board making : A mat was formed in the defibrator freeness tester-cum-mat former out of a 10-litre volume slurry of 128 gms O. D. pulp in water. Stock freeness was recorded. The mat was then cold-pressed to remove excess water, bringing down the moisture content to about 60% and reduce the thickness so that after final pressing, a nominal 0.32 cm thick hardboard disk was obtained.

The pre-pressed mat was then placed on a caul plate with a wire screen in between and hot-pressed in a single day-light hydraulic hotpress at 190°C to produce S-1-S boards. The pressing was carried out, first, for 2 minutes at 35 kg/cm^2 followed by a minute's breathing time at 3.5 kg/cm^2 and finally for another 3 minutes at 35 kg/cm^2 pressures. Five 24 cm diameter disks were made in this manner from each of the above pulps.

Testing : The boards were tested for modulus of rupture (MOR) and water absorption. From each disk, 3 specimens of 12.7 cm x 5.08 cm size were cut and their edges smoothed. One specimen was tested for physical strength by determining MOR by static bending process in a Universal Testing Machine using the formula (Anon. 1954),

$$MOR = \frac{3 P L}{2 bd^2}$$

where, P = Load in lbs to failure

L = Span

b = Width of the specimen

d = Thickness of the specimen

For determining water absorption and dimensional changes, another specimen was kept immersed horizontally 2.5 cm deep under water for 24 hours. The amount of water absorbed by the specimen was determined and reported as percent increase in weight. Thickness swelling was also measured and expressed as percent increase in thickness.

RESULTS AND DISCUSSIONS

Five boards made from each pulp were tested and the values obtained were averaged. The results together with the cooking conditions and stock freeness are given in Table 1. It is seen that pulps made by

Table 1. Pulping conditions of Keora wood and the hardboard properties

Cooking condition		Freeness (Seconds)	MOR (kg/cm^2)	24 hours' water immersion	
Steam pressure (kg/cm^2)	Cooking time (hour)			% change in weight	% change in thickness
10	1	76	317	38	20
	1	33	245	36	19
	½	32	293	50	27
	½	22	228	48	26
	1½	70	279	44	20
	1½	30	214	41	19
7	1	30	250	70	11
	1	20	192	78	22
	½	42	315	66	33
	½	28	174	57	29
	1½	43	162	43	20
	1½	56	192	43	21

cooking the chips under 10 kg/cm^2 digester pressure produced stronger boards with better water resisting property than those made under 7 kg/cm^2. The strongest board (MOR 317 kg/cm^2) was obtained under 10 kg/cm^2 pressure for one hour but the pulp was very slow draining. It also appears that at any given pressure, one hour's cooking produced the strongest boards. An inverse correlation between pulp freeness and strength of the boards is obvious.

In general, the boards were not strong enough to meet the requirements of U. S. or Japanese Standards for untreated Class I hardboard. They were also less water-resistant than required. The pulps were rather coarse and therefore free, except in two extreme cases. Since the board properties are usually dependant, among other factors, upon the degree of fineness of pulp upto a certain limit, finer pulps made under the above cooking conditions might produce better boards. Besides, there is scope for developing water-resisting property of the boards by using sizing materials. Both strength and water absorption properties can be greatly improved by using higher molding temperature (up to 240°C) during hot pressing (Schwartz and Baird 1950).

CONCLUSION

Hardboards made from Keora wood by the steaming process show deficiency in strength and water resistance properties. The pulps made by using higher cooking pressure (10 kg/cm^2), however, produced moderately strong boards. From the observation of pulp freeness, it would seem that more refined pulp could give better results. The use of sizing chemical is likely to raise the board properties to the standard level.

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