

Hardboard Making Characteristics of Fifteen Lesser Used/Unused Medium Density Hardwood Species of Bangladesh

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Abstract

A study was conducted with 15 lesser used/unused medium density (0.52-0.68) wood species of Bangladesh to determine their hardboard making characteristics. The species tested were barta (*Artocarpus lakoocha*), chalta (*Dillenia indica*), dakroom (*Mitragyna rotundifolia*), gab (*Diospyros peregrina*), hargaza (*Dillenia pentagyna*), jhumka bhadi (*Engelhardtia spicata*), kamdev (*Calophyllum polyanthum*), kao (*Garcinia cowa*), kasturi (*Cinnamomum cecidodaphne*), kerung (*Pongamia pinnata*), moos (*Pterospermum acerifolium*), pairag (*Canarium risiniferum*), rata (*Aphanamixis polystachya*), tali (*Palaguium polyanthum*) and uriam (*Mangifera sylvatica*). It was found that all the species except barta, kasturi and uriam produced good or even better quality hardboard than that of sundri (*Heritiera fomes*) a widely used wood species in Khulna Hardboard Mills.

সারসংক্ষেপ

বাংলাদেশের বনাঞ্চলে পাওয়া যায় এমন ১৫টি কম ব্যবহৃত/অব্যবহৃত মধ্যম ঘনত্ববিশিষ্ট (০.৫২-০.৬৮) বৃক্ষপ্রজাতির উপর হার্ডবোর্ড তৈরির উপযুক্ততা নির্ণয়ের জন্য পরীক্ষা চালানো হয়েছে। প্রজাতিগুলো ছিল বরতা, চালতা, ডাকরুম, গাব, হাড়গাজা, জুমকা ভাদি, কামদেব, কাও, কস্তুরী, কেরাং, মুছ, পৈরাগ, রাতা, তালি ও উড়িআম। পরীক্ষায় দেখা যায়, কস্তুরী, বরতা ও উড়িআম ব্যতিত অন্য সকল বৃক্ষপ্রজাতি থেকে খুলনা হার্ডবোর্ড মিলস্‌ উৎপাদিত সুন্দরী বৃক্ষের সমমান বা এর চেয়ে উৎকৃষ্টমানের হার্ডবোর্ড তৈরি করা সম্ভব।

Key words : Bangladesh, hardboard, lesser used/unused wood

Introduction

There are about 600 tropical hardwood species in the forests of Bangladesh (Das 1991). About 40 of these species are being extracted for their commercial use (Bose 1995). The rest are being used as fuel wood or under-utilized because of their less known end-use characteristics. On the other hand, there is an acute scarcity of fibrous raw material (FRM) for industrial utilization. The Khulna Hardboard Mills, the only hardboard mill

in Bangladesh, uses sundri (*Heritiera fomes*) as the singular FRM. This mill is now facing a serious FRM crisis. With a view to ameliorating such problem a study on 15 lesser used/unused medium density (0.52-0.68) wood species has been undertaken to determine their hardboard making characteristics. Knowledge on the hardboard making characteristics of these species will help select the species in supplementing sundri for hardboard making.

Materials and method

Pulping

Logs of 15 lesser used/unused medium density wood species, namely, barta (*Artocarpus lakoocha*), chalta (*Dillenia indica*), darkroom (*Mitragyna rotundifolia*), gab (*Diospyros peregrina*), hargaza (*Dillenia pentagyna*), jhumka bhadi (*Engelhardtia spicata*), kamdev (*Calophyllum polyanthum*), kao (*Garcinia cowa*), kasturi (*Cinnamomum cecidodaphne*), kerung (*Pongamia pinnata*), moos (*Pterospermum acerifolium*), pairag (*Canarium risiniferum*), rata (*Aphanamixis polystachya*), tali (*Palaguium polyanthum*) and uriam (*Mangifera sylvatica*) were sawn and chipped in a Murray chipper. The chips were air-dried and steamed for one hour in laboratory model rotary digesters at 10 kg/cm² pressure. The steamed chips were then defiberized in a single rotating disc attrition mill using a stream of water at room temperature. Pulp were made at different freenesses from each species by varying the plate clearance of the attrition mill.

Hardboard making

Hardboard mats were formed in a mat former-cum-freeness tester from 10 litres of pulp slurries. The freeness (AB defibrator freeness) of each pulp was recorded. The consistency of the pulp slurry was such that the mat would ultimately make a hardboard disc of about 21.6 cm diameter, 3.175 mm nominal thickness and nearly 1000 kg/m³ density.

The mats were cold pressed to remove excess water prior to hot pressing. The prepressed mats were finally consolidated between the cauls of a hydraulic hotpress at about 190°C temperature and 35 kg/cm² pressure. Hot pressing was done for six minutes including a one minute breathing time at a low pressure of 7 kg/cm² after the first two minutes to allow the entrapped steam to escape from inside the mat. Also a 20-mesh wire net was placed underneath the mat to ease water

removal during pressing. Thus wet felted smooth one side (S-l-S) hardboard discs were made with all the species.

Board testing

At least 15 boards, taking five boards from each of the three pulps made with a species, were tested. Test samples of 12.7 cm x 5.08 cm size from each board were prepared and conditioned for 72 hours at 50 ± 1% relative humidity and 23 ± 2°C temperature in a humidity control room. Strength and water absorption tests were done with the samples according to ASTM procedures (Anon. 1954).

Results and discussion

Two important properties, for example, strength and water resistance of hardboard made with the species were evaluated. The strength of the hardboards determined by static bending process was expressed in terms of modulus of rupture (MOR), and the water resistance properties were reported as percent changes in weight and thickness of the boards after 24 hours' of water soaking. The properties are shown against the pulp freeness (Table 1). It may be mentioned that pulp freeness is an important consideration in the manufacturing process, and a freeness value exceeding 40 seconds (defibrator freeness) is ordinarily unacceptable for industrial purpose (Lyll 1969). For the convenience of comparison, MOR and the percent changes in weight and thickness of the boards made from both the free pulps like those of darkroom, hargaza, etc. and the slow draining pulps like those of kerung, uriam, etc. were calculated at a standard freeness value of 25 seconds. The results of earlier works (Khan and Shafi 1988) on sundri hardboard by the same process and tested in identical conditions were also referred to in Table 1 because of the species being the principal raw material source of the hardboard industry in the country. Board properties of all the species including sundri thus evaluated were graded following a grading schedule shown below the Table 1.

Table 1. Strength and water resistance properties of hardboards made from lesser used/unused wood species.

Species	Freeness	Modulus of rupture (MOR) kg/cm ²	MOR at 25 sec. freeness	Grade according to strength	Water absorption		
					Change in weight %	Change in thickness %	Grade according to water resistance
Barta	20	77	103	C	56	28	A
	26	103					
	30	123					
Chalta	24	342	345	A	46	20	A
	32	358					
	60	398					
Dakroom	14	112	184	A	38	15	A
	15	128					
	17	184					
Gab	34	205	205 (at 34 sec.)	A	31	13	A
	53	213					
	56	222					
Hargaza	16	242	301 (at 21 sec.)	A	43	24	A
	17	266					
	21	301					
Jhumka bhadi	20	144	208	A	46	20	A
	22	160					
	25	208					
Kamdev	17	148	240	A	42	17	A
	20	202					
	57	365					
Kao	25	172	172	A	31	16	A
	32	181					
	35	227					
Kasturi	14	23	63 (at 22 sec.)	C	22	18	A
	18	48					
	22	65					
Kerung	30	151	151 (at 30 sec.)	A	33	14	A
	35	160					
	38	185					
Moos	18	159	235	A	60	30	B
	27	245					
	59	292					
Pairag	14	60	148	A	49	28	A
	19	78					
	26	148					

Table 1. Contd.

Species	Freeness	Modulus of rupture (MOR) kg/cm ²	MOR at 25 sec. freeness	Grade according to strength	Water absorption		
					Change in weight %	Change in thickness %	Grade according to water resistance
Rata	20	160	201	A	41	19	A
	25	201					
	26	210					
Tali	13	131	225 (at 18 sec.)	A	46	21	A
	15	175					
	18	225					
Uriam	33	153	125	B	30	14	A
	44	171					
	50	176					
Sundri	18	108	150	A	60	27	A
	23	142					
	49	186					

Garding index :

Strength	Water absorption	
	Change in weight	Change in thickness
A => 150 kg/cm ²	A = <60%	A = <30%
B = 125 - 149 kg/cm ²	B = 61-70%	B = 30-40%
C = 60 - 124 kg/cm ²	C = 71-80%	C = 40-50%
D = <60 kg/cm ²	D = >80%	D = >50%

The following is a short description of the characteristics of the individual species with reference to sundri.

Barta : The pulps are fairly free giving weak hardboards but with fair water resistance properties.

Chalta : The pulps are slow draining capable of making sufficiently strong and water resistant hardboards.

Dakroom : The pulps are quite free giving fairly strong and good water resistant hardboards.

Gab : The pulps are slow draining capable of producing strong and good water resistant properties.

Hargaza : The pulps are quite free. Hardboards are very strong and fairly water resistant.

Jhumka bhadi : The pulps are somewhat slow draining giving strong and fairly water resistant hardboards.

Kamdev : The pulps are moderately free. Hardboards are very strong and fairly water resistant.

Kao : The pulps are a bit slow draining giving strong hardboard and good water resistance properties.

Kasturi : The pulps are quite free but giving weak hardboard with fair water resistance properties.

Kerung : The pulps are very slow draining. Hardboards made are strong with fair water resistance properties.

Moos: The pulps are moderately free giving strong hardboards but with poor water resistance properties.

Pairag : The pulps are free producing weak and fairly water resistant hardboards.

Rata : The pulps are fairly free. Hardboards are strong and fairly water resistant.

Tali : The pulps are quite free giving strong and water resistant hardboards.

Uriam : The pulps are slow draining producing weak and fairly water resistant hardboards.

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