UTILIZATION OF RUBBER WOOD : A TIMBER FROM NON-CONVENTIONAL SOURCE

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ABSTRACT

The paper examines the suitability of utilization of rubber wood (*Hevea brasiliensis*) as an alternative to traditional wood. To this end its different properties have been determined and appropriate processing techniques have been developed. The results reveal that, inspite of some limitations, rubber wood may be used for a variety of purposes.

সারসংক্ষেপ

প্রচলিত কাঠের বিকল্প হিসাবে রাবার কাঠ ব্যবহারের উপযোগিতা এই প্রবন্ধে পরীক্ষা করা হয়। এই লক্ষ্যে ইহার বিভিন্ন গুণাগুণ নির্ধারণ করা হয় এবং সঠিক প্রসেসিং পদ্ধতি বাহির করা হয়। ফলাফলে দেখা যায় যে, কিছু অসুবিধা সত্ত্বেও রাবার কাঠ বিভিন্ন কাজে ব্যবহার করা যায়।

Key words : Rubber wood, properties, processing techniques, uses.

INTRODUCTION

There is an acute shortage of timber in Bangladesh. The total roundwood supply was estimated at 7.9 million m^3 against the demand of 13.6 million m^3 in 1993 (Anon 1993). It is reflected in the per capita consumption of only 0.07 m^3 of sawnwood and 0.07 m^3 of fuelwood which are the lowest figures compared to even the neighbouring developing countries. With the increase of population the requirement of timber will increase resulting in more deficit.

Inspite of the low per capita consumption there has been over exploitation of forest products beyond the sustainable yield. This has caused depletion of the tree resource. In order to arrest this situation, the government imposed a moratorium on the felling of forest trees in 1989. However, the extraction of raw materials for the newsprint and paper mills of the Bangladesh Chemical Industries Corporation (BCIC) are allowed. A limited exploitation of forest produces has also been extended to Bangladesh Forest Industries Development Corporation (BFIDC) since 1992.

At present, the homestead forest is the prime source of timber for furniture, construction and other utility purposes. A large amount of timber is being imported to meet the demand of some products like railway sleepers, transmission poles, etc. It is thus high time to augment the tree resource by intensifying the plantation programmes as well as management of the existing forests. At the same time, alternative source of timber should be looked to ease the pressure on conventional source. Rubber (*Hevea brasiliensis*) plantation may be considered as such a non-conventional source.

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NON - CONVENTIONAL SOURCE

Rubber (*Hevea brasiliensis*) was first planted by the BFIDC in 1961 in the south-eastern part of the country. Thereafter, its plantation was continued almost every year in this area. It was extended to other two areas in the greater Sylhet and Dhaka districts. The Chittagong Hill Tract CHT Development Board and some private enterprises initiated also rubber plantation. The area of plantation with their location and number of trees are shown in Table 1 (Anon 1995).

The present area of rubber plantation is small which can meet a fraction of the demand of raw rubber. There exists a good prospects for planting rubber trees in different hilly areas particularly in the unclassified state forests (USF). The USF totals 0.73 million ha land in the hill tract districts consisting of 5% of the total forest area of the country. It is a scrub forest and is almost denuded. This large tract of land may be reforested with rubber trees.

The production of latex becomes uneconomic when the rubber trees are about 30 years old. The trees are then clearfelled and the area is replanted. Timber from the over mature trees is a by-product from the rubber plantation. The plantations of BFIDC in 1961-65 have already reached this period of over maturity. These trees and trees from subsequent plantations may provide a substantial amount of timber on a sustained basis. However, the information on technological properties is required before the rubber wood is used economically. At the request of BFIDC, an investigation was undertaken to evaluate its pertinent properties and to develop appropriate processing techniques. This paper summarises the results of this investigation.

TECHNOLOGICAL PROPERTIES

Anatomical characteristics

Rubber wood is light yellowish white on fresh cut, but turns into reddish brown on exposure. The sapwood and heartwood are indistinguishable by colour. It has straight to shallowly interlocked grain with attractive figures in the longitudinal surface (Mohiuddin 1993).

Table 1. Rubber plantations in Bangladesh

		Organization			
		BFIDC	CHT Dev. Board	Private enterprise	Total
i)	Area of plantation (ha)	12,146	3,239	7,287	22,672
ii)	Location of plantation	Raojan, Ramu, Fatikchari, Habigonj & Modhupur	Khagrachari	Bandarbans and some tea-gardens in Sylhet & Chittagong	
iii)	No. of trees (approx.)	22,50,000	12,00,000	20,00,000	54,50,000

Physical properties

Rubber wood possesses specific gravity of 0.51 to 0.54 based on green and airdry volumes respectively (Table 2). It thus falls under the medium dense timber group (Sattar *et al* 1992). Compared to Indian and Malaysian rubber wood, Bangladeshi rubber wood is less dense (Anon 1991, Shukraj 1983).

The radial and tangential shrinkage of rubber wood seems to be low. The volumetric shrinkage is, however, higher than that of Malaysian wood (Shukraj 1983).

Seasoning property

Rubber wood can be seasoned easily by following the conventional steamheated kiln and air drying methods. Planks of 2.5 cm thickness may take 6 days from the initial moisture content (mc) of 102% to a final mc of 12% in kiln drying. Airdrying may take 45-60 days depending on the season of the year (Table 2). Timber, however, needs to be protected from biodeterioration with a prophylactic preservation treatment during the initial stage of airdrying (Sattar *et al* 1992). One way to protect timber from sap-staining fungus attack is to convert the timber into planks and then dry them quickly.

Table 2. Comparative physical and mechanical properties of rubber wood and teak.

	Properties			Rubber wood green	Rubber wood airdry	Teak green	Teak airdry
i)	Specific gravity			0.51	0.54	0.58	0.59
ii)	Shrinkage (%)	:	radial	1.99	-	-	-
	to OD condition	:	tangential	4.96	-	-	-
		:	volumetric	8.35	-	5.0	-
iii)	Seasoning (days)	:	kiln drying	6	-	8	-
		:	airdrying	45-60	-	28	-
		:	refractoriness	easy	-	moderate	-
iv)	Modulus of rupture (kg/cm^2)			457	610	867	1008
v)	Modulus of elasticity (kg/cm^2)			42,000	56,000	120,000	131,000
vi)	Compression parallel to grain (kg/cm^2)			206	344	583	513
vii)	Compression perp. to grain (kg/cm^2)			57	132	67	119
viii)	Hardness (kg)			361	601	503	538
ix)	Shear parallel to grain (kg/cm^2)			84	123	95	156
x)	Nail withdrawal (kg)			87	138	124	76
xi)	Cleavage (kg/cm of width)			54	86	73	73
xii)	Tension perp. to grain (kg/cm^2)			44	60	47	44
xiii)	Tension parallel to grain (kg/cm^2)			492	691	-	-
xiv)	Toughness (cm-kg/specimen)			338	212	403	324

Mechanical properties

Rubber wood is a moderately strong timber. Com-pared to teak (*Tectona grandis*), bending strength and compression parallel to grain are lower in both green and airdry conditions. The compression perpendicular to grain, hardness, cleavage and tension perpendicular to grain are found to be higher than those of teak in airdry condition, but these properties are lower in green condition (Table 2). Rubber wood is characterised with good nail holding capacity and has resistance to spliting during nailing (Sattar *et al.* 1992).

Chemical properties

The major chemical components and extractives of Bangladeshi rubber wood (Das *et al* 1995), Malaysian rubber wood (Choon and Bin 1982) and Indian teak (Tewari 1992) are shown in Table 3.

Bangladeshi rubber wood contains a higher percentage of holocellulose and alpha cellulose compared to Malaysian rubber wood and teak. It has comparable water soluble extractives. However, it contains less than a half alcohol-benzene soluble extractives of teak (Table 3). It may be noted that the wood, having a lower amount of alcohol-benzene soluble extractives, possesses a greater affinity for water and becomes less toxic to wood destroying agents. This is why rubber wood is easily perishable and teak is highly durable under the exposed condition.

Natural durability and treatability

Rubber wood is highly susceptible to fungi, insect and marine borers. Staining fungi and mould can attack the timber in 24 hours after the tree is felled, especially during the monsoon when the humidity is high (Gnanaharan and Mathew 1982). The natural durability of rubber wood is thus poor. It can withstand only 9 months in stake-yard test (Akhtar *et al* 1994). It calls for prophylactic measure for temporary protection. The cut ends of logs and all the exposed surfaces should be either brushed or sprayed with a preservative solution. A mixture of 3% sodium pentachlorophenate (NaPCP) and 2% borax may be used for this purpose (Akhtar *et al* 1994).

In case of storage for a processing industry for 3-6 months, the logs may be submerged under water. Even the sawn timbers may be stored under water. It can protect the timber from the attack of fungi and borer (Gnanaharan and Dhamodaram 1990).

Rubber wood can be treated with a non-pressure method like diffusion process. The diffusion

Table 3. Chemical constituents and extractives of rubber wood and teak.

Species	Holo cellulose (%)	Alpha cellulose (%)	Cold water solubility (%)	Hot water solubility (%)	Caustic soda solubility (%)	Alcohol benzene solubility
Bangladeshi rubber wood	76.6	42.7	4.07	5.13	18.8	2.80
Malaysian rubber wood	69.8	40.5	-	4.90	18.5	2.40
Indian teak	61.1	36.3	4.00	5.68	-	6.59

storage period may vary from 10 to 20 days for 2.5 and 5.0 cm thick planks respectively (Gnanaharan and Dhamodaram 1994). It can be easily treated with preservatives by the empty-cell pressure process. As it is highly permeable, even the partially dried timber can be treated with a copper-chrome-boron (CCB) by the full-cell method.

Working and finishing properties

Rubber wood is easy to work in sawing and machining. It has acceptable properties in the use of planing, shaping, boring, mortising and turning. Application of chalk powder and spirit as a surface preparation and subsequent coats of shellac and carpa give a good gloss attainment in rubber wood (Hannan and Khaleque 1992).

Peeling and particleboard making properties

Rubber wood yields smooth and decorative veneers in a lathe machine. The veneers can be dried easily in a roller conveyer drier. But the defects like warp and split along the grain and end weaviness may create some difficulty in handling the dried veneers. Plywood can be manufactured satisfactorily using urea formaldehyde glue. Medium density particleboards of good quality can be made with rubber wood (Hasnin *et al* 1992).

Pulping properties

Rubber wood can be used to make a fully cooked sulphate pulp with an yield of 45%. The physical strength properties of the pulp are moderate. It can be used for making average quality printing paper and moderate quality wrapping paper (Hossain *et al* 1977).

USES OF RUBBER WOOD WITH LIMITATIONS

Although rubber wood possesses several desirable qualities, it has certain limitations as well. It is non-resistant to decay fungi, insects and marine borers. Another factor which affects its quality is the presence of tension wood. Rubber trees are generally grown in hilly areas with a gradient. Reaction wood like tension wood is formed in these trees. Timber containing tension wood is prone to higher tangential and longitudinal shrinkages and has tendency to warping.

Inspite of the limitations, rubber wood may be used for the following purposes :

- Furniture like chair, table, sofa-set, cot, almirah and a variety of other products,
- Construction like door and window shutters with properly treated timber,
- Plywood and particleboard and
- Printing and wrapping paper.

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