ANATOMICAL PROPERTIES AND WOOD QUALITY IMPROVEMENT OF SOME LOW VALUE TIMBERS GROWN IN AJK

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ABSTRACT

Basic wood structure of seven low value wood species grown in AJK, was studied for the assessment of their technological properties helpful to improve quality of wood before utilization. Permanent slides of cross, radial and tangential sections of each wood species were prepared and data were collected for the frequency and dimensional measurements of various wood elements/structures in each species. Results showed that Lasura, Shreen, Dhak, Ritha and Tun wood may be better in strength due to longer and thick-walled fibers and Kao and Anjir wood may be medium in strength as the fibers are comparatively thin-walled. In order to increase service life, preservative treatment of wood before utilization may be necessary for all the studied species because of larger size or higher frequency of wood rays. Lasura, Shreen, Dhak, Tun and Ritha wood can be easily treated with chemicals and seasoned as the vessels are sufficient large in diameter whereas, Kao and Anjir wood may be somewhat difficult because of smaller diameter of vessels. Further, on the basis of fiber morphological characteristics, the wood of all the studied species may also be suitable for pulp and paper manufacture.

INTRODUCTION

Less production and increase in demand of valuable commercial timbers creating shortage of wood resource in the country to fulfill the requirements. Therefore, It is important to pay attention on the other wood species which are growing successfully but are being used for common ordinary/ conventional uses or as firewood because of lack of information about their properties.

In this study, anatomical characteristics of some low value timbers grown in AJK have been studied in order to assess their technological properties helpful to improve quality of wood and increase their utilization. Seasoning and preservation behavior of wood is related to vessel wood elements as moisture can pass through them lengthwise as well as sidewise (Findlay, 1962) and these are main route for the flow of preservative (Wilkinson, 1979). Larger the size and higher the frequency of vessels, more the wood can be easily seasoned and preserved with chemicals to reduce the defects and increase its service life.

Durability of wood is related to frequency and size of wood rays. Larger the size and higher the frequency of wood rays, more the wood may be non-durable as the wood rays are composed of food cells (parenchynmatous) susceptible to insects and fungi (Kolman & Cote, 1968) and chemical treatment of wood may be necessary before its utilization.

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Strength of wood is related to wood fibers as they constitute the mechanical tissue. Thickness of fiber walls is one of the important factors in determining the strength of wood (Dinwoodie, 1983). Higher the fiber wall thickness and narrow the lumen width, better may be the density and strength of wood and it can be used for manufacturing of various forest products. Low density woods preferably and medium density woods if available at good prices, are used for particleboard manufacturing as a general rule (John and Jim, 1989)

On the other hand, fiber morphological characteristics also help to predict suitability of any wood species for pulp and paper manufacture. Fiber length generally influences the tearing strength of paper. Fiber diameter and wall thickness governs the fiber flexibility (Watson, 1967). Thick-walled and narrow lumened fibers have high value of Runkel ratio than thin-walled and wide lumened fibers. High Runkel ratio fibers are stiffer, less flexible and form bulkier paper of low bonded area than the low Runkel ratio fibers (James, 1980). Favourable paper strength properties are usually obtained when the value of Runkel ratio is below 1.

MATERIAL AND METHODS

The wood material of Kao (*Olea cuspidate*), Lasura (*Cordia myxa*), Shreen (*Albizzia lebbek*), Anjir (*Ficus palmata*), Dhak (*Butea frondosa*), Tun (*Cedrela toona*) and Ritha (*Sapindus mukrossi*) was procured in log form AJK and transported to PFI. For the study of anatomical properties, the wood samples were collected in the form of disc from the end face of but log of each species. Then the sample blocks of size about 1cm x 1cm x 3cm were removed from each disc and prepared for section cutting by softening. Cross, radial and tangential sections were prepared by standard laboratory techniques (Anon, 1971) and observed under the microscope for the following features in each species.

Frequency of vessels per unit area.
Diameter of vessels
Frequency of rays per mm in cross section.
Frequency of rays per mm square in tangential section.
Number of cells along ray height.
Number of cells along ray width.
Height of ray in microns.
Width of ray in microns.
Fiber diameter.
Fiber wall thickness.

Small portion of wood from each species was macerated in 20% Nitric acid and Potassium chlorate to separate the fibers and measure the fiber length by the process of micrometry. The data collected were analyzed for statistical

variables such as mean value, standard deviation and coefficient of variation for each microscopic feature in each species.

In order to assess suitability of the studied wood species for pulp and paper manufacture, Runkel ratio (2X cell wall thickness/ lumen width) was also calculated in each species.

RESULTS AND DISCUSSION

Anatomical Properties of the woods:

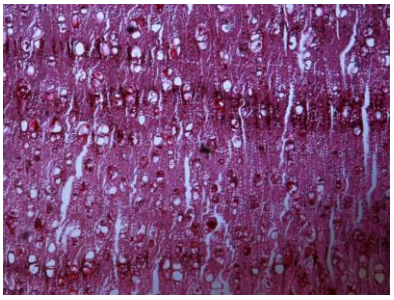
On the basis average values as given in Table 1, it was observed that in Kao (*Olea cuspidate*) wood, the vessels were very small but higher in frequency than all the other studied species. Frequency of wood rays was also highest among the studied species but their size was small. The fibers were short, thin-walled and medium in diameter.

In Lasura (*Cordia myxa*) wood, the vessels were medium sized and lower in frequency. The wood rays were also lower in frequency both in tangential and cross section but larger in size. The fibers were long, thick-walled and narrow lumened than all the other studied species.

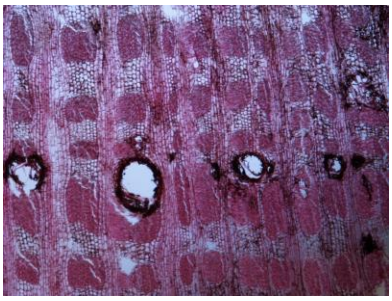
In Shreen (*Albezzia lebbek*) wood, the vessels were medium in size and lower in frequency. The wood rays were medium in frequency in tang section, lower in cross section and medium in size. The fibers were long, thick-walled, comparatively larger in diameter and wide lumened.

Tun (*Cedrela toona*)

Anjir (*Ficus palmata*)



Kao (*Olea cuspidata*)



Dhak (*Butea frondosa*)

Lasura (*Cordia myxa*)

Ritha (*Sapidus mukrossi*)

Shreen (*Albizzia lebbek*)

Fig.1 Photomicrographs showing the wood structure of some low value timbers grown in AJK

In Anjir (*Ficus palmata*) wood, the vessels were smaller in diameter and lower in frequency. The wood rays were medium in frequency but larger in size. The fibers were short, thin-walled and medium sized.

In Dhak (*Butea frondosa*) wood, the vessels were the largest in diameter than all the other studied species but lower in frequency. The wood rays were lowest in frequency in tangential section and the largest in size among the studied species. The fibers were long, somewhat thick-walled, larger in diameter and widest in lumen width in comparison to other studied species.

In Tun (*Cedrela toona*) wood, the vessels were of two sorts. The earlywood vessels were medium in size whereas, the latewood vessels were small and lower in frequency. The wood rays were medium in frequency in tangential section, lower in cross section and medium in size. The fibers were long, thick-walled, the largest in diameter among the studied species and wide lumened.

In Ritha (*Sapindus mukrossi*) wood, the vessels were also of two sorts. The earlywood vessels were medium in diameter but the latewood vessels were very small and lower in frequency. The wood rays were higher in frequency and medium in size. The fibers were long, comparatively thick-walled and medium in diameter.

Assessment of Technological Properties

Kao (*Olea cuspidata*) wood may be medium in strength due to thin-walled and shorter fibers. It may be less durable because of higher frequency of wood rays and need preservation before utilization to increase the service life. Chemical treatment of the wood may be somewhat difficult as the vessels are smaller in diameter. However, their frequency is higher which may ease the process. Similarly seasoning process of the wood may also be slow.

Lasura (*Cordia myxa*) wood may be better in strength due to longer and thick-walled fibers. It may be moderately non-durable because of somewhat larger size of wood rays. However, the wood can be treated with chemicals and seasoned without difficulty due to sufficient large diameter of vessels.

Shreen (*Albezzia lebbek*) wood may be better in strength due to longer and thick-walled fibers. It may be more or less non-durable because of a bit larger size and higher frequency of wood rays and require preservative treatment. The wood may be easy to preserve and dry for the reason that the vessels are medium sized.

Anjir (*Ficus palmata*) wood may be medium in strength due to thin-walled and shorter fibers. The wood may be less durable because of larger size and somewhat higher frequency of wood rays therefore, chemical treatment of the wood may be necessary before utilization as solid wood. Seasoning and preservation of the wood may be slow because of smaller diameter of vessels.

The wood can also be used for composite wood products such as particleboard etc.

Dhak (*Butea frondosa*) wood may be better in strength due to longer and somewhat thick-walled fibers. It may be non-durable because of larger size of wood rays and need chemical treatment before utilization. The wood can be preserved and seasoned with no trouble as the vessels are fairly large in diameter.

Tun (*Cedrela toona*) wood may be better in strength due to longer and thick-walled fibers. It may be less durable because of a bit higher frequency and larger size of wood rays. However, the wood can be treated with chemicals and seasoned without problems due to sufficient large diameter of earlywood vessels.

Ritha (*Sapindus mukrossi*) wood may be better in strength due to longer and comparatively thick-walled fibers but, it may be non-durable because of higher frequency of wood rays and require preservative treatment to increase the service life which may be easy due to reasonable diameter of earlywood vessels. Similarly the wood could behave better during seasoning process.

Suitability for Pup and Paper

As shown in Figure 2, on the basis of Runkel ratio (2 X cell wall thickness/ lumen width) the wood of all the studied species may also be suitable for pulp and paper manufacture due to having the value of Runkel ratio below 1.

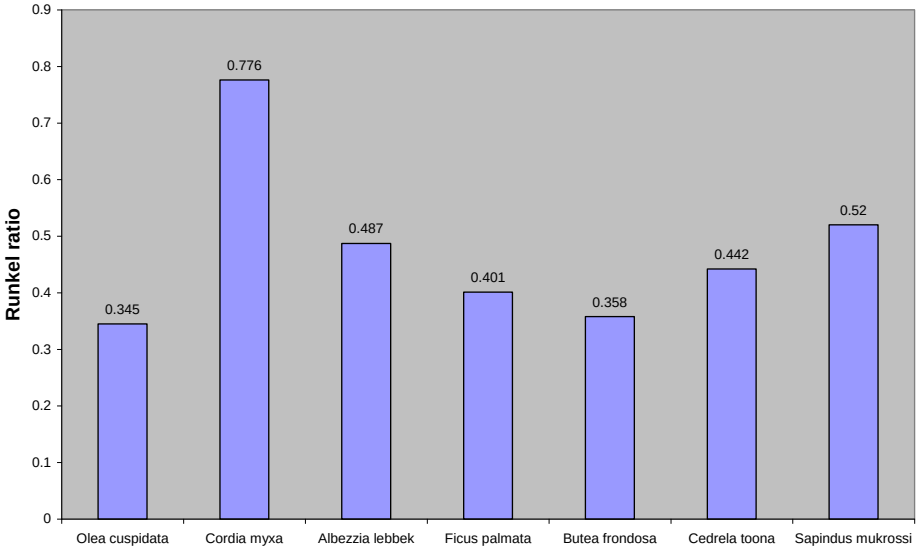


Fig.2. Runkel ratio in some wood species grown in AJK

Table 1. Frequency and dimensional measurement of various wood elements/ structures in some low value timbers grown in AJK (average values)

Microscopic features	Unit	Kao *(Olea cuspidata)*	Lasura *(Cordia myxa)*	Shreen *(Albizzia lebbek)*	Anjir *(Ficus palmata)*	Dhak *(Butea frondosa)*	Tun *(Cedrela toona)*	Ritha *(Sapindus mukrossi)*
Vessel diameter	Microns	70.82	171.20	168.22	108.03	205.88	E.W 160.53	E.W 177.26
							L.W 109.28	L.W 49.34
Vessel frequency	/mm^2	75.56	4.18	3.15	9.15	8.9	E.W 7.98	E.W 7.60
							L.W 5.38	L.W 3.46
Ray frequency in tangential section	/mm^2	48.24	4.45	16.80	17.92	3.58	19.73	30.63
Ray frequency in cross section	/mm	10.28	3.29	4.00	6.03	4.00	4.33	5.47
Ray width	Cells	1.75	4.6	2.56	3.43	7	3.16	3.00
	Microns	25.16	111.30	30.15	49.95	165.1	74.69	31.87
Ray height	Cells	8.67	19.2	19.05	46.32	25.32	11.27	13.27
	Microns	177.99	548.08	200.54	574.62	626.6	343.13	175.81
Fiber length	mm	0.859	1.81	1.08	0.92	1.405	1.08	1.09
Fiber diameter	Microns	19.96	22.29	22.69	18.78	23.71	24.31	19.80
Fiber wall thickness	Microns	2.56	4.87	3.72	2.69	3.13	3.73	3.39
Fiber lumen width	Microns	14.84	12.55	15.25	13.4	17.45	16.85	13.02

CONCLUSIONS

- Lasura, Shreen, Dhak, Ritha and Tun wood may be better in strength and can be used for manufacturing of various wood products.
- Kao and Anjir wood may be medium in strength and can be used for light wooden articles and composite wood products such as particleboard etc.
- Preservative treatment of wood may be necessary for all the studied species before utilization as solid wood in order to increase the service life.
- Lasura, Shreen, Dhak, Tun and Ritha wood can be easily seasoned and preserved with chemicals however, in Kao and Anjir wood, the process may be slow.
- The wood of all the species can also be used as raw material for pulp and paper manufacture.

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