SOME WOOD SPECIES OF PAKISTAN AND THEIR MOVEMENT

Iqbal Mahmood[1] and Tanvir Ahmad Qureshi[2]

Abstract

Sixteen indigenous/naturalized wood species were tested for tangential and radial movement. Results revealed that eucalyptus (*Eucalyptus camaldulensis*) and chir (*Pinus roxburghii*) had large movement values (>4.5 %). Fir (*Abies pindrow*), kail (*Pinus wallichiana*), mulberry (*Morus alba*), bhan (*Populus euphratica*), walnut (*Juglans regia*) , toon (*Cedrela toona*), Jaman (*Eugenia jambolana*) and semul (*Bombax ceiba*) were of medium movement (3 – 4.5 %) while deodar (*Cedrus deodara*), babul (*Acacia nilotica*), shisham (*Dalbergia sisso*), black siris (*Albizzia lebbek*), white siris (*Albizzia procera*) and mango (*Mangifera indica*) displayed small movement (< 3.0 %).

Key words: Wood species, Tangential Movement, Radial Movement

Introduction

Loss in water below the fibre saturation point, i.e bound water is associated with certain dimensional changes. The changes that occur as a result of initial drying down from green to dry conditions are referred to as shrinkage and that of daily or seasonal changes in relative humidity of the atmosphere are termed as movement. It is noted that the shrinkage varies considerably from species to species. Those timbers which have high shrinkage values have also large values of corresponding movement (.Desch and Dinwoodie, 1983). If humidity changes are small, these dimensional changes will not be noticed and will have no impact on satisfactory use. Even large fluctuations in humidity may have little effect if these conditions last for only short periods and the wood does not attain new equilibrium moisture content (.Haygreen and Bowyer, 1985). Panel products like plywood boards, block boards and all forms of laminated constructions have small movement in the large dimensions but are very prone to warp unless suitably braced . Movement of timbers with higher values results in the loosening of joints and in the development of gaps. Timber designed for indoor use should be seasoned to twelve percent moisture content and it may fluctuate by plus or minus two percent. Thus, it has been seen that seasoned timber tends to move about one third to one quarter of its total shrinkage every year of its life (Bateson, 1946).

No work has been carried out about the movement of local wood species. Therefore, sixteen important indigenous wood species have been selected for determination of their movement.

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1 Wood Seasoning and Preservation Officer, PFI.
2 Forest Chemist, PFI

Materials and Methods

For determination of timber movement , samples of four softwoods viz. fir, deodar, chir, kail and twelve hardwoods namely babul, semul, shisham, poplar, eucalyptus, walnut, toon, black siris, white siris, jaman , mulberry and mango were obtained from Forest Products Research Division, Pakistan Forest Institute, Peshawar.

Plain sawn representative samples of good quality material were employed for determining radial and tangential movement of each species. The samples were prepared from wood, first seasoned to equilibrium moisture content (12±2 %). Each sample was planed to thickness of 1/4 inch and cut to a length of 2 inches. The width along or normal to the growth rings was of order of 9 inches. All samples were first conditioned in air at 25°C and 90 percent relative humidity until they attained constant weight. The width of each sample across the grain was then accurately measured on both faces by means of a flexible steel rule with vernier scale measuring to 0.1 cm. Then they were conditioned in air at 25°C and 60 % R. H. , and measured again as before. The difference between two measurements was finally computed as percentage of the width in the 60 percent humidity conditions. After the final measurement was made, each sample was oven dried so that the moisture content values attained in each environment might be estimated from the recorded weights (Anon., 1959) .

The radial and tangential shrinkage values, given in Table 1, were used to convert them into dimensional changes in inches following Raymond and Rufus (1971) formula:

$$S = \frac{(M_i - M_f)\, D}{\left[\frac{30}{S_t \text{ or } S_r} - 30 \right] + M_i}$$

Where S is shrinkage in inches; M_i is initial moisture content in percent; M_f is final % moisture content. D is dimension at initial moisture content in inches; 30 is fibre saturation point in percent; S_t is total tangential shrinkage in percent, divided by 100; and S_r is total radial shrinkage in percent, divided by 100.

The movement values of different wood species were calculated and were grouped into three classes in accordance with standard requirement (Anon, 1959).

Results and Discussion

For comparison sixteen wood species were grouped into three classes according to their movement values. The wood species with less than 3 % sum values of radial and tangential movement were categorized as first class . Whereas ,those wood species with 3 – 4.5% and greater than 4.5 % sum values of radial and tangential movement were grouped as second and third class, respectively .

In this study woods of chir (*Pinus roxburghii*), and Eucalyptus (*E. camaldulensis*) gave relatively more shrinkage as compared to other under trial species and consequently had large movement. These wood species have sum of radial and tangential movement values of 4.58% and 4.84%, respectively (Table 2). This means the timbers are refractory therefore, mild drying conditions of temperature and relative humidity are suggested particularly in early stage of drying.

In contrast woods of dedar (*Cedrus deodara*), babul (*Acacia nilotica*), shisham (*Dalbergia sissoo*), black siris (*Albizzia lebbek*), white siris (*Albizzia procera*) and mango (*Mangifera indica*) showed small movement. Hence, relatively severe conditions of temperature and relative humidity can be maintained for drying of these wood species.

On the other hand, fir (*Abies pindrow*), kail (*Pinus wallichiana*), mulberry (*Morus alba*), poplar (*Populus euphratica*), walnut (*Juglans regia*), toon(*Cedrela toona*), jaman (*Eugenia jambolana*) and semul (*Bombax ceiba*) showed medium movement. Therefore, these wood species need moderate conditions of temperature and relative humidity for drying. The woods are also moderately lialble to split and warp during their processing.

In addition to other factors, shrinkage of a particular species plays an important part for calculating its movement. Generally, the woods which have tendency to exhibit more shrinkage show large movement (Desch and Dinwoodie,1983). Present results have been found in corroboration with as cited above.

Similarly during the preservation of timbers of medium or large movement, careful handling is suggested to attain appreciable retention of preservatives and to avoid degradation.

Conclusion

The results of the study can be applied to the wood species while processing them based on tangential and radial movement. Chir (*Pinus roxburghii*) and eucalyptus(*E. camaldulensis*) woods had large movement and needed care during their storage, sawing, working with tools and treatment with preservatives. Fir (*Abies pindrow*), kail (*Pinus wallichiana*), mulberry (*Morus alba*), walnut (*Juglans regia*) , jaman (*Eugenia jambolana*), semul (*Bombax ceiba*) and toon (*Cedrela toona*) have shown medium movement. These woods are moderately liable to split and warp during their processing. However, deodar (*Cedrus deodara*), babul (*Acacia nilotica*) black siris (*Albizzia lebbek*), white siris (*Albizzia procera*), shisham (*Dalbergia sissoo*) and mango (*Mangifera indica*) have small movement and can be worked and processed without any difficulty.

Table 1. Radial and tangential shrinkage of some local wood species

Wood species	Radial shrinkage (Sr) %	Tangential shrinkage (St) %
Fir (*Abies pindrow*)	3.6	8.0
Deodar (*Cedrus deodara*)	3.6	5.2
Kail (*Pinus wallichiana*)	2.8	7.0
Chir (*Pinus roxburghii*)	6.5	8.2
Babul (*Acacia nilotica*)	2.7	6.7
Semul (*Bombax ceiba*)	4.0	6.4
Shisham (*Dalbergia sissoo*)	2.7	5.5
Mulberry (*Morus alba*)	3.3	7.5
Poplar (*Populus euphratica*)	3.6	7.7
Eucalyptus (*E. camaldulensis*)	6.8	9.0
Walnut (*Juglans regia*)	4.7	7.0
Toon (*Cedrela toona*)	3.4	7.3
Black siris (*Albizzia lebbek*)	2.9	5.8
White siris (*Albizzia procera*)	3.1	6.9
*Jaman (*Eugenia jambolana*)*	4.5	7.8
Mango (*Mangifera indica*)	3.0	4.9

Table 2. Timber movement of some indigenous wood species.

Species	EMC at 90% humidity (%)	EMC at 60% humidity (%)	Correspondin - g tangential movement		Corresponding radial movement	
			Per cent	inch per foot	Per cent	Inch per foot
Fir (*Abies pindrow*)	21	12	2.46	0.29	1.13	0.10
Deodar (*Cedrus deodara*)	20	12	1.41	0.17	0.97	0.12
Kail (*Pinus wallichiana*)	20	12	1.91	0.23	0.80	0.97
Chir (*Pinus roxburghii*)	21	12	2.58	0.31	2.0	0.24
Babul (*Acacia nilotica*)	20	12	1.83	0.22	0.73	0.09
Semul (*Bombax ceiba*)	21	12	2.0	0.24	2.58	0.31
Shisham(*Dalbergia sissco*)	20	12	1.13	0.18	1.09	0.13
Mulberry (*Morus alba*)	21	12	2.30	0.28	0.67	0.11
Poplar(*Populus euphratica*)	21	12	2.10	0.25	0.98	0.12
Eucalyptus(*E. camaldulensis*)	21	12	2.75	0.33	2.09	0.25
Walnut (*Juglans regia*)	20	12	1.93	0.23	1.23	0.15
Toon (*Cedrela toona*)	20	12	2.00	0.24	0.93	0.11
Black Siris (*Albizzia lebbek*)	20	12	1.58	0.19	0.78	0.10
White Siris (*Albizzia procera*)	20	12	1.42	0.17	0.83	0.10
*Jaman (*Eugenia jambolana)	21	12	2.40	0.29	1.23	0.15
Mango (*Mangifera indica*)	20	12	1.33	0.16	0.81	0.10

Table 3: Classification of different wood species according to their movement

Small Movement < 3.0%	Medium Movement 3.0 % to 4.5%	Large Movement .> 4.5%
Deodar (*Cedrus deodara*) Babul (*Acacia nilotica*) Shisham (*Dalbergia sissoo)* Black siris (*Albizzia lebbek*) White siris (*Albizzia procera*) Mango (*Mangifera indica*)	Fir (*Abies pindrow*) Mulberry (*Morus alba*) Poplar (*P. euphratica*) Walnut (*Juglans regia*) Toon (*Cedrela toona*) Jaman(*Eugenia ambolana*) Semul (*Bombax ceiba*)	Chir (*Pinus roxburghii*) Eucalyptus (*E. camaldulensis*)

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