ROLE OF SEASONING AND PRESERVATION IN IMPROVING THE QUALITY OF WOOD

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With increasing use of wood it is becoming scarce and it is expected that by the end of this century the requirement of wood for building construction in India would be about 2 lac cubic metres while supply would be less than 1 lac cubic metres. To overcome this scarcity, it is very necessary to start the use of non-conventional secondary species of wood for this purpose. It has been found that many species of wood are rejected as they are liable to warp, crack, shrink or swell and/or they are liable to be attacked under appropriate conditions by certain biological agencies. But if they are properly seasoned and treated with preservatives, they can be used safely. In this paper various methods of seasoning along with recent researches carried out in this direction are discussed. A brief review of various types of organisms which may attack the wood and types of preservatives used for protection has also been given.

SEASONING

In a newly felled tree the moisture content is relatively high due to presence of 'free-water' in the cell-cavities. The removal of 'free-water' will leave the 'bound-moisture' held in the wood-tissues. When this condition is reached, it is known as 'fibre saturation point'. When 'bound-moisture' starts to dry out of the wood-tissues the plasticity of the cellulose content of the wood is reduced, shrinkage starts and wood exhibits a general improvement in the strength properties. Most woods shrink or swell only about 1/100 to 1/50 as much in the fibre direction as across the fibres. However, during seasoning mostly the shrinkage-moisture content relationship is linear but in the final stages the shrinkage is slightly more. When wood is required for structural purpose care is taken in seasoning so that the structure of the wood is not adversely affected. In addition to better strength properties, the seasoned wood has better dimensional stability. Moreover most wood-rotting insects grow if the moisture of wood is above 20 per cent.

Air Seasoning

The moisture is removed in air-seasoning with the help of air and sun while protecting the timber from rains. The air inside the seasoning shed gets saturated with the moisture removed from the timber and is continuously replaced by the post air due to its natural circulation.

In its simplest form a seasoning shed can be a large Dutch barn having roof. But the best shed to meet the necessary requirements is a long narrow building. It should have openings in the walls at the top and the bottom for free circulation of air through the piles of timber. However the method is very time consuming and some times losses are also high and this method becomes uneconomical.

Kiln Seasoning

The main advantages of steam heated kilns, which are normally used for seasoning purpose, are their rapidity, adoptability and precision. In properly operated kilns every piece of timber can be dried to a uniform moisture content. The humidity and moisture at which wood is seasoned have also injurious effect on the insects or fungus present in the wood.

Kiln-seasoning some times is found costly and time consuming. Therefore, it is usually recommended to season firstly the wood upto 30 per cent moisture content in air followed by kiln-seasoning. The extra advantage of such 'pre-seasoning' is that it helps in getting uniform moisture distribution at the time of kiln-seasoning.

Solar Seasoning

Solar energy is also used in air-seasoning. Much heat is however lost by radiation from the surface that absorbs it. It could be utilised more effectively if the heat energy could be entrapped inside a chamber. In this way, continuously transmitted heat is directed to the seasoning process than in normal air-seasoning. In C.B.R.I. this condition is achieved by preparing a chamber in which three sides (E, W & S) are constructed with transparent glass. The walls are made double to have more thermal insulation. A solar energy collector is fitted at an angle of 30° in the bottom of south wall at the entrance of fresh air. To provide stock-effect inside the chamber a chimney is fixed vertically and a hole provided in the roof which is made of corrugated G.I. sheets.

Performance of the Kiln

Performance of the solar kiln studied from November 1977 to March 1978 by seasoning of Mango (Mangifera indica), Jamun (Eugenia Jambolera) and Sal (Shorea robusta) woods. The planks of Mango and Jamun woods are taken in the size 300 x 25 x 50 cm. The Sal wood is studied in the form of scantlings in the sizes 300 x 10 x 10 cm. and 300 x 7.5 x 5.0 cm. Initial

moisture content of the three woods were 41, 37 and 32 per cent respectively.

Mango wood being non-refractory in nature was seasoned much quicker than other species. The moisture content of the mango wood planks stocked in the kiln was reduced from 41 to 32 per cent within three days. However, in the shed it could come down only to 36 per cent within this period. The wood was seasoned upto 10 per cent moisture content inside the kiln on the 35th day while in the shed it reached upto 20 per cent moisture content on this day.

The higher temperature of the kiln helped in lowering its relative humidity. Maximum difference between inside and outside the kiln is measured upto 15°C. Jamun wood was seasoned in the kiln within 2 months and 20 days while in the in the shed it took 3 months 17 days. Between 27th to 29th Dec. 1977 when the rainfall was 45 mm. the moisture content of the planks in the shed was slightly increased while in the kiln it remained the same as the entry of fresh air in the kiln was prevented.

The scanttings of sal wood of the thickness 7.5 x 5.0 cm. were fully seasoned in the kiln within 67 days while in the shed they were dried upto 27 per cent moisture content within this time. The scantlings of the thickness 10 x 10 cm. were seasoned within 85 days while under shed even after 4 months they were seasoned upto 17 per cent moisture content.

Capacity and Cost of Solar Kiln

The solar seasoning kiln whose performance is discussed above can season about 3 cubic metres of wood at a time and cost of construction is about Rs. 10,000/-. However, with some modifications the kiln is designed to season upto 15 cubic metres of wood and its cost of construction is estimated as Rs. 24,000/-.

PRESERVATION OF WOOD

Fungal Attack

The decay of wood by fungal attack only takes place when the wood has high moisture and access to air. The limiting moisture content below which no appreciable decay takes place is about 20 per cent. However, the optimum temperature for fungal growth varies with different fungi.

The most important fungi which may attack the wood are brown rot and white rot fungi. In timbers submerged in water soft rot fungi are also visible. Brown rot fungi decompose primarily the polysaccharides by the process of hydrolysis while the white rots are able to decompose polysaccharides and also lignin.

Termite Attack

In tropical countries the termites cause much destruction to wood. Protozoa which is present in their intestine is responsible for breaking the cellulose and hemicellulose into products having small chains of carbon atoms. Thus the cellulose content of the wood is reduced and in advanced stages the wood is left as brown powdery substance consisting of lignin.

Beetles

In addition to termites a few wood boring insects may also attack the wood. The larvae of these beetles bore tunnels in wood and pass the bored material through intestines. However, it is not necessary that the insect may use the material as food.

PRESERVATIVES

The preservatives which are generally used to protect the wood from fungus and insect attack may be divided into four types.

(i) *Oil Type*

The most common preservative of this type is creosote. The advantages of using it are that it is in indigenous product with high toxicity and non-corrosiveness. However, creosote has unpleasant odour and the timber treated with it is difficult to paint.

(ii) *Organic Solvent Types*

These preservatives are used after dissolving them in suitable organic solvents. The preservatives are clean to handle and are permanent. The wood treated with such preservatives can also be painted. The common examples of such preservatives are copper and zinc naphthenrates, pentachlorophenol, DDT etc.

(iii) *Water-soluble (Leachable) Type*

The preservatives such as Zinc chloride, boric acid and sodium fluoride etc. may gradually be depleted owing to the dissolving effect of water. However, the leaking effect can be reduced if a coating of waterproof paint is applied on the treated timber.

(iv) *Water-soluble (fixed) Type*

Such type of preservatives can be prepared by mixing various toxic chemicals and fixative salt. Usually sodium or potassium dichromate is used as fixative salt in which the effect of chromium is to fix the toxic element such as arsenic, copper or zinc etc. in the wood and thus it does not leach by the action of water. The timber treated with such types of preservatives may be used for outside locations and can also be painted. The common preservative of this type is a mixture of copper sulphate, potassium dichromate and arsenic pentoxide in the proportions 37.5, 50.00 and 12.5 by weight respectively.

Conclusions

The foregoing discussion gives an exhaustive review of the importance of seasoning in wood and various seasoning methods adopted for this purpose. Advantages of solar kiln developed in this institute have also been briefly discussed. Further, an account of mode of attack of different biological agencies and preservatives used for this purpose are described.

Acknowledgement

The paper is being published with the kind permission of the Director, C.B.R.I. It was originally presented at the Seminar on "Wood Science and Technology" 14–15 March, 1980 at I.I.T. Madras.