

ON THE CHARACTERISTICS OF SOME OF THE INDIAN TIMBERS FOR BOAT BUILDING

Part III - WOOD SEASONING AND PRESERVATION

R. Balasubramanyan,

*Central Institute of Fisheries Technology
(Craft & Gear Division), Cochin-5*



Many of the unknown and less known secondary species of timbers other than the conventional ones can be brought under profitable use after careful seasoning and proper preservative treatment. The extensive use of well seasoned and adequately treated timbers in boat building will reduce the present high cost of wooden fishing boats to a great extent. The present paper describes the salient features of wood seasoning and preservation with a view to suggesting cheaper alternative substitutes for Teak, Aini, Ventek and the like for boat building purposes.

Water is the primary life source of the timber yielding tree. Wood obtained from just felled trees will contain appreciable amount of water, sometimes as high as 100 to 200 percent in terms of its oven-dry weight. Water is also the primary cause of instability, deficiency, and decay in wood products, unless removed exactly and evenly to specified levels. When green wood is exposed to natural atmospheric

conditions, it dries and the free moisture from the cavities of wood cells are expelled. In this process of drying, no normal dimensional changes take place but when further drying is continued below the fibre saturation point (the point at which there is no free moisture within the cell but before the water in the cell walls begin to leave) shrinkage takes place. This results in a change in the dimensions of the wood and the shrinkage is not uniform and equal in all directions. The shrinkage of wood along the grain is normally negligible but across the grain it shrinks about twice as much in the tangential direction as radially. This inequality in shrinkage in three directions at right angles sets up strains causing checks, splits, warping and loosening of knots. Thus it is seen that even the simple removal of moisture from wood requires certain amount of care and technique so that the wood is free from defects in drying. Unseasoned wood is susceptible for quick decay.

Seasoning is the removal of moisture to a desired extent from

green wood without any degradation in order to improve its serviceability. Air seasoning is the exposure of lumber to the air usually stacked in a yard without external influences. Air seasoning is subject to the vagaries of the weather conditions which in turn limit both the degree to which the drying rate can be controlled and the final moisture content attainable. If drying temperature and relative humidity are precisely controlled during shrinkage, instability, the usual deficiencies and other harmful effects in the drying processes are naturally eliminated. This is possible only under expert and scientific Kiln-drying. In standard Kiln-drying in a specially heated chamber, green lumber can be dried under controlled heat, humidity and air circulation which will hasten the process of seasoning besides controlling the rate of drying until the desired moisture content is attained. Lumber upto 2 to 3 inches in thickness can be dried in a shorter period and with few drying defects in a Kiln than by air seasoning. Though quite expensive "chemical

seasoning", — the use of hygroscopic chemicals in the seasoning of lumber is also known. While ordinary air-seasoning and kiln-seasoning are suitable for smaller dimensions, chemical seasoning is applicable to larger dimensions for keel, stern, stem structures, bearer timbers, and other deck beams etc. in a fishing boat. Though it has not been commercially adopted to any appreciable extent, High Frequency Dielectric Heating and Infra-red Drying are the two advanced methods of timber drying. However, combined air and kiln drying is more economical. Thoroughly air dried lumber will have a moisture content ranging between 10 to 15% (average 12%). Excessively dry wood will be very stiff and will be difficult to handle in boat construction.

Wood differing in species, thickness, character of grain, moisture content and the type of end use require different drying conditions. All wood used in boat building should have a moisture content definitely higher than that for most other commercial uses. Even for those parts that are always under water in service some pre-seasoning is desirable. Logs should be converted as soon as possible into planks or scantlings which should then be seasoned as per requirements either by air seasoning or kiln drying. One inch boards of Teak wood which require 3 to 4 months for air drying will take only 8 to 10 days for complete kiln seasoning. A standard schedule (Table - I) is available as a guide line indicating the permissible moisture content for various parts in wooden boat construction for the different climatic zones of India.

Table I - Showing the minimum moisture permissible in wooden structures in ship and boat-building.

STRUCTURAL MEMBER	ZONE I	ZONE II	ZONE III	ZONE IV
	Annual Rain fall less than 20" Dry area	Annual Rain fall 20" to 40" Moderately Dry	Annual Rain fall 40" - 75" moderately humid area	Annual Rain fall above 75" Humid area*
DECK	10%	12%	12%	14%
FRAMES	12%	14%	16%	18%
PLANKING	12%	14%	14%	16%

*Applicable to Kerala.

As a result of proper seasoning a number of changes take place in the wooden member like :

1. reduction in weight,
2. increased strength,
3. reduction in shock resistance,
4. increase in stability,
5. enhanced service life,
6. improved nail holding power,
7. less of conductivity of heat and electricity,
8. more permeability,
9. increased inflammability,
10. more of surface smoothness and
11. good paintability.

Indian timbers are classified under three main categories viz. Highly refractory, Moderately refractory and Least refractory depending upon their behaviour with respect to cracking and splitting during normal air seasoning (Refer IS: 399/1952 of Indian Standards Institution). To get the best service out of timber structures season them well before use.

Even though seasoning of wood improves many of its properties, seasoned wood does not necessarily acquire any special

resistance or immunity against its biological deterioration which is quite common in all organic materials. Biological degradation of wood is caused by wood-inhibiting fungi both on land and in water; wood (cellulose) consuming insects like Termites (white-ants) and beetles (powder post beetle) and wood boring marine organisms.

Wood, decaying due to fungus infection (Dry rot or wet rot decay) will gradually become soft, light, spongy, inflammable and will emit a mucky odour. Fungal attack is highly infectious and in no time sound timbers also are likely to be affected. Damages by insects may occur even in standing trees, green logs, unseasoned lumber, and in seasoned material both under storage and in use. Termites are the outstanding wood-destroying insects. Though in a wooden fishing boat both fungus infection as well as white-ant attack are confined to internal timber structures like frames, deck-beams, shelves, bulkheads, fish-holds, floor-boards, deck planks etc., destruction due to marine wood borers are restricted to the wooden hull below the water-line. In the case of marine borers the timber is more or less completely riddled in the interior (ship worms and paddocks) with

the protective outer surface remaining in tact, unless broken down by other external agency. Thus biological deterioration of timber structures result ultimately in the loss of their strength and all their mechanical properties rendering them unfit for any farther use. Many timber species which are otherwise more suitable for construction purposes suffer much due to this handicap.

Biological deterioration of timber structures can be eliminated or its adverse effect greatly reduced by selection of the right materials, by taking adequate precautions during construction and by regular and thorough maintenance thereafter with suitable wood preservatives. Excess moisture as is in unseasoned wood, is mostly responsible for all fungal infection and if the moisture content is kept below 20%, decay due to fungii is under control but not completely. Certain species of timbers like Teak, Padauk, Sal etc. are naturally resistant to decay (except to marine borers) because of certain chemical extractives they possess within their structure. Timbers devoid of all these protective extractives are susceptible to decay and does not last longer in service. This deficiency of natural resistance in wood can however be artificially enhanced by fortifying the timber structures with chemicals which are toxic to all the destructive biological agencies responsible for their degradation. By this process the normal life of timber structures can be preserved free from deterioration for a considerable length of time, sometimes, several years more than their normal span of service life.

The physical and chemical characteristics of the different

woods may play an important role in determining their susceptibility to impregnation with toxic preservatives as mere surface coating will not give the desired level of protection. Treatment of wood with preservatives involves the penetration of a liquid into the capillary structure and its subsequent flow through the capillaries already filled. Though wood is porous in structure and appears to be easy to drive in the preservative, it is surprisingly resistant to treatment sometimes. Wood preservation methods may be broadly classified as (i) non-pressure processes and pressure processes. Brushing, spraying, cold dip, hot dip and hot and cold dip are the non-pressure processes though simple and less costlier, have their own limitations in their performance. Under pressure processes which is a costly and complicated method, a deeper, a more uniform penetration and a higher absorption of preservative can be obtained, thus providing the most effective and reliable protection to the treated structures.

Though almost all sap woods and soft woods could be easily treated, in certain species of hard heartwoods due to the presence of extractives, resin deposits, tylosus in the vessels, they are highly refractory and as such difficult to impregnate the preservative at all even at high pressure like Teak, Ventek, Poon etc. and hence they are not treatable. In view of the structure of wood, much better penetration of preservatives (10 to 25 times more) are obtained from the ends (with the grains) than from the sides (across the grains) during penetration. For purpose of treatment, timbers can

be classified as (1) easily treatable (100% penetration throughout e.g. *Mango & Haldu*); (2) treatable (75 to 100% penetration e.g. *Gurjan & laurel*); (3) partially treatable (50 to 75% penetration e.g. *Siris & Kindal*); (4) difficult to treatment (25 to 50% penetration e.g. *dhaman*) and (5) not treatable (0 to 25% penetration e.g. *Teak and Ventek*).

Wood preservatives are specially formulated toxic chemicals which would give protection to wood against decaying organisms. They are generally classified as (i) Oils and oil-borne preservatives like Coal-tar and its derivatives (*Creosote* etc.), (ii) Oil solutions of toxic chemicals like *pentachlorophenol* and other chlorinated phenols, *copper naphthenate*, *Zinc naphthenate*, *phenyl mercury oleate*, *tributyltin oxide* etc. and (3) water-borne preservatives like *copper-chrome-Arsenic* compounds; *Zinc chloride*, *copper sulphate* etc. Whatever may be the type of preservative and the method of treatment followed, it is an important pre-requisite that wood preservatives should be highly toxic to fungi, termites, marine organisms and other injurious insects. Retention of preservative for a considerable length of time within the treated wood is yet another important factor for successful wood protection. Preservatives have to be non-corrosive to metals and should not adversely affect the strength of wood. They should be safe and easy to handle and be free from fire hazards. Many of the oil borne preservatives like *Creosote* increases the dead weight of the treated structures unlike the water-borne preservatives. Painting of timbers

treated with coal-tar and its derivatives is a problem so also the subsequent sheathing of such structures with fibre-glass reinforced plastic as is recommended for hull protection of wooden boats. It has been observed that Creosoted timbers with a dry surface can be given coatings of aluminium paint as a barrier without much discolouration. Certain oil borne preservatives like Creosote keeps the timber surface oily and thus tend to inhibit rapid moisture changes in the outer layers of the wood and stops the usual swelling and shrinkage. Oily preservatives should not be left bare in fish-holds and cooking cabins where its unpleasant odour will contaminate the fish and other food materials.

Water soluble preservatives are cheap and easy to handle. Treated wood will be light and dry and such surfaces can be painted and sheathed. These preservatives can also be fixed into wood by a chemical process without being leached out under wet exposure. However, preservatives like copper-chrome-arsenic compound cannot be heated as they react with the constituents of wood at high temperature and forms a precipitate. Preservative treatment and its resultant effect varies from wood to wood depending on the type and quantity of

the toxic chemicals involved more details of which are available in I. S. I. Standard 401/1961. Like converting timber logs into lumber before seasoning, all wood work and required shaping will have to be completed before the different members are put to preservative treatment. Where long storage periods of timber logs are involved, water storage offers a greater degree of protection than any other methods. Logs on land can be sprayed with a solution containing *benzene hexachloride* and *pentachlorophenol* in fuel oil as a protection against surface decay. Apart from preservatives, paints and other surface coatings applied to wood will offer protection against weathering and fire.

Efficient utilisation of the various timber species often depends upon the knowledge on the natural durability of the species involved. (Refer Part I and Part II of this series). The usage of wood preservatives throughout the World is continually increasing and with the appropriate choice of materials and processes the normal service life of timber can be extended even in the most severe environments. There are about 100 wood seasoning and 100 wood preservation plants in our country with a capacity to handle annually 4,00,000 cubic meters of timber, but un-

fortunately the boat-building industry is not making any use of these facilities at present. Even though fungus infection and termite attack can be controlled with preservatives, under tropical sea conditions in India, protection of timber structures in sea-water against marine wood boring organisms still appears to be an eluding problem. The best treating technique and an effective toxic preservative against all the marine borers have still to be worked out on account of certain practical limitations in their use in sea-water. At present wooden hulls of fishing boats are protected only with metallic (copper and Aluminium alloy) and non-metallic (Fibreglass) sheathing below their water-lines. Earnest attempts to bring more of the less durable timber species into free use for boat building purposes after their careful seasoning and proper preservative treatment, will be amply rewarded financially. Investigations in this line are being actively pursued at the Central Institute of Fisheries Technology, Cochin and useful findings are being disseminated from time to time for the benefit of the boat-building industry.

Note:- M/s. ASCU HICKSON LTD., Timber Engineers and wood processors of Calcutta (G. P. O. Box 2060) will be pleased to furnish greater details on wood seasoning and preservation plants.

