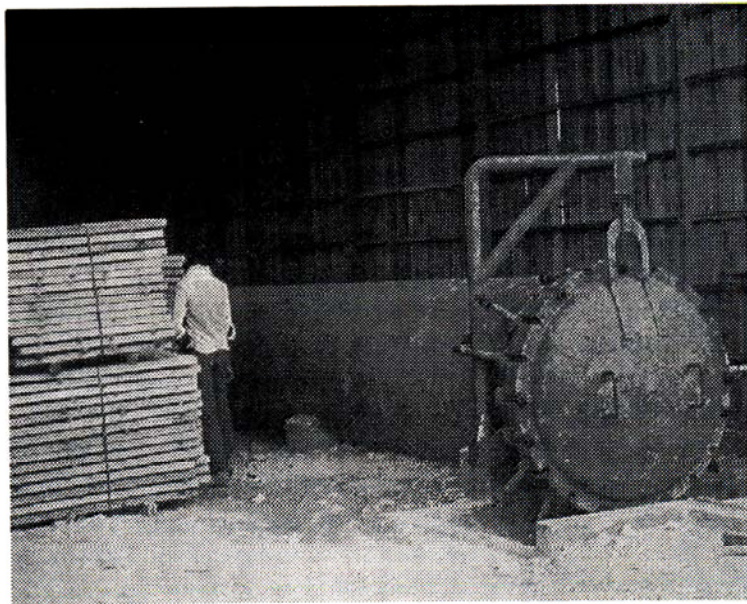


Cift Technology Advisory Series - 6

WOOD PRESERVATION FOR MARINE APPLICATION

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Introduction

Wood, perhaps, is the oldest and most popular material used for construction of traditional fishing craft. Wood has excellent properties with respect to buoyancy, workability, treatability, nail-holding power, strength to weight ratio and poor transmission of heat. These factors, together with its abundance, might have contributed to its popularity in marine applications. However, dimensional instability and susceptibility to biodeterioration stand out as the major impediments against the use of wood as a construction material for fishing craft. Among these, the former, i.e., the dimensional instability, can be contained if the wood is appropriately seasoned before use for such purposes.

Timber easily deteriorates due to mechanical wear and tear and is most easily destroyed by fire. Two major threats responsible for the biodeterioration of wood are decay by the action of fungi and damage by insects. In contact with seawater, timber is grossly attacked by marine boring and fouling organisms. All these factors cumulatively reduce the service life and efficiency of operation of wooden fishing craft. Therefore, necessary protective measures have to be taken to increase the service life and derive maximum advantage during its service period.

Teak (*Tectona grandis*) is an ideal material for construction of fishing craft. However, it is a very expensive species and is also scarce. Several low cost species of wood such as jungle jack (*Artocarpus hirsuta*), mango (*Mangifera indica*), karimarudu (*Terminalia tomentosa*) and chini (*Antiaris toxicaria*) have been proved to be useful in construction of fishing craft if they are seasoned and treated with wood preservatives of the appropriate type. Preservative treatments applied to improve the quality of such species of wood to make them suitable for marine applications are discussed in this note.

Wood preservation - traditional vs modern

Preservation of wood against the ravages of natural forces is a vital economic problem, which requires proper attention. Generally, the traditional fishermen do not adopt any method of preservation employing chemical preservatives for their craft. Traditionally, they have been using various indigenous materials for preservation of their craft. These include sardine oil, shark liver oil, poon seed (*Callophyllum* sp.) oil, cashew (*Anacardium occidentale*) nut shell liquid, various vegetable oils and animal fats and also a natural resin called damar batu. These are all easy to apply and easily available; however, their performance as an effective preservative against deterioration of timber remains far from satis-

factory. They are often effective only for very short periods and hence necessitate frequent repeated application, the frequency varying from one month to one year. These indigenous preservatives practically have no toxic effect on the organisms responsible for biodeterioration of timber. Their preservative action is limited to providing the timber with a water repellent surface. In this context, application of preservatives having proven toxicity against the organisms responsible for biodeterioration of timber becomes very important. With the increasing knowledge on the causes of biodeterioration under marine conditions, it has been possible to develop chemical wood preservatives, which are several times more effective than the traditional preservatives in use. Chemical wood preservatives contain toxic ingredients that protect the timber against the action of organisms that are responsible for the deterioration of timber.

What are the requirements of an effective wood preservative?

A preservative to be very effective against biodeterioration under marine condition shall

- be highly toxic against boring and fouling organisms responsible for deterioration of timber
- penetrate deeply into the wood and remain permanently there
- be non-corrosive to metals and have no deleterious effect on timber

Types of wood preservatives – their advantages and disadvantages

Three types of preservatives are commonly used. The basic difference between them is the medium in which the active ingredients are maintained. On this basis, the preservatives are classified as water-borne, oil-borne and, solvent type.

Water-borne preservatives

Water-borne implies that the preservatives are borne-on, or carried into the wood as aqueous solution. Several water-soluble chemicals have been used for wood preservation, either singly or in combination. Of these, the most common is copper–chrome–arsenic (CCA) commonly known as ASCU. ASCU as a preservative for timber under marine conditions has been tested extensively on different species of wood such as *Artocarpus hirsuta* (jungle jack), *Mangifera indica* (mango), *Terminalia tomentosa* (karimarudu) and *Antiaris toxicaria* (chini). The results indicated that it is a very effective preservative against deterioration of timber under the test conditions. 16-32 kg/m³ of ASCU in 7.5% aqueous solution is needed to provide protection against the heavy rate of

biodeterioration experienced in our tropical waters.

The main advantages of water-borne preservatives are that they

- are easy to transport
- are effective against fungi and insects
- are easy to handle
- can be painted upon
- are odourless

The main disadvantages, however, are:

- impregnation with the preservative causes a slight reduction in the mechanical strength properties
- the dimensional stability of the treated timber is adversely affected as the water in the preservative causes the wood to swell

Oil-borne preservatives

The most popular among the oil-borne preservatives is creosote. Creosote is the fraction of distillate from coal tar that boils between 200 and 400°C. The distillate contains tar acids, tar bases and neutral oils. These are effective against decay due to fungi and insect attack and reduce the risk of splitting and surface cracking of the wood. They are also non-corrosive to metals. Therefore, creosote is widely recommended for preservation of timber involved in marine applications.

The main disadvantages of oil borne preservatives are that they

- are bulky to transport
- give off pungent odour
- tend to bleed from impregnated timber, and
- timber treated with creosote cannot be painted

Solvent type preservatives

This is yet another type of preservative consisting of a toxic substance dissolved in a solvent other than water. Pentachlorophenols, naphthanates of zinc and copper, tributyl tin oxide etc are some of the solvent type preservatives. They do not affect the strength of wood and do not leach out from the timber, once applied.

Treatment of wood for boat construction

The reduced availability and disproportionate increase in the cost of naturally resistant timbers traditionally used for construction of fishing craft, leaves no choice but to turn to alternate low cost species of wood which necessarily should be treated with chemical preservatives before use in boat construction. Application of the preservatives on the surface is the easiest method. But it affords little protection unless applied repeatedly. The diffusion process or dip treatment involves the immersion of the timber in the preservative until the desired retention is obtained. The period of immersion depends on the thickness of the wood. Planks can be treated prior to their use in boat building using water borne preservative. The most successful treatment method for marine purposes is the vacuum-pressure impregnation treatment that results in filling the cells of the wood with the preservative. This ensures proper penetration of the liquid, which results in high durability of timber under field conditions. Multiple preservative treatments have been found to be very effective in high hazard situations. The dual preservative treatment technology involves impregnation of the plank with CCA followed by pressure treatment with creosote. The equipment for treatment consists essentially of a steel cylinder that can be hermetically sealed, a vacuum pump and an air compressor. The treatment process is illustrated in the flow chart (Fig 1).

Protection of Kattumaram

Kattumarams are log rafts commonly operated from the surf beaten eastern Indian Coast and the southern tip of the West Coast. Their popularity and extensive employment for fishing can be gauged from the fact that about 73400 kattumarams are operated from the Indian coast of which 31850 are in Tamil Nadu. Kattumaram is a type of sailing and paddling raft. In a kattumaram, three or more similar or identical logs are joined parallel to each other at some distance apart by beams. Great stability combined with lightness and low resistance in water are the major advantages of kattumaram as a fishing craft. These are made of light wood species and are operated mostly by the economically weaker section of the Indian fishermen.

The ideal timber for kattumaram is light buoyant species of wood which will absorb only very little water. Such wood species should be dimensionally stable, durable and easily available. The most commonly used species of timber are *Melia dubia*, *Melia composita* and *Albizzi* sp. However, these species of wood are easily infected by wood rotting fungi that soften the entire structure making the log absorb high quantities of water. Therefore, kattumarams made of such

wood have a short service life as they are very soon deprived of the original strength and thereafter cannot function efficiently as floating rafts. These logs are also ravaged by their constant exposure to the scorching sun, sea, sand and wind. Alternate wetting and drying bring about surface splits, cracks and dimensional changes on the logs. Due to biodeterioration, the craft have to be repaired or replaced every 2nd to 7th year resulting in heavy expenditure. The life of kattumarams can be substantially increased by preservative treatment.

Immersion treatment

The preservative treatment shall involve two stages as indicated below.

1st Stage: Water-borne preservative (Copper-Chrome-Arsenic (ASCU)).

The logs for treatment are to be debarked thoroughly before immersion. The moisture content of the logs before treatment should be 20-30%. The ASCU solution should have a concentration of 5-7.5%. The recommended proportion is 1 kg of ASCU in 13 litres of water. The solution is filtered before use. Finished logs are kept fully immersed in the cold treatment solution in shallow cement tanks. 80% penetration of the preservative can be achieved by immersing the kattumaram logs for 15-20 days. The logs are then allowed to air dry for 7-8 days.

2nd stage: Oil-borne preservative treatment

The second stage of treatment involves full immersion in creosote. For this, light creosote oil of specific gravity 1.01 is used. A dip diffusion period of two to three weeks provides for deep penetration of the preservative into the logs. The logs are then allowed to dry for at least one week before use.

Equipment and machinery

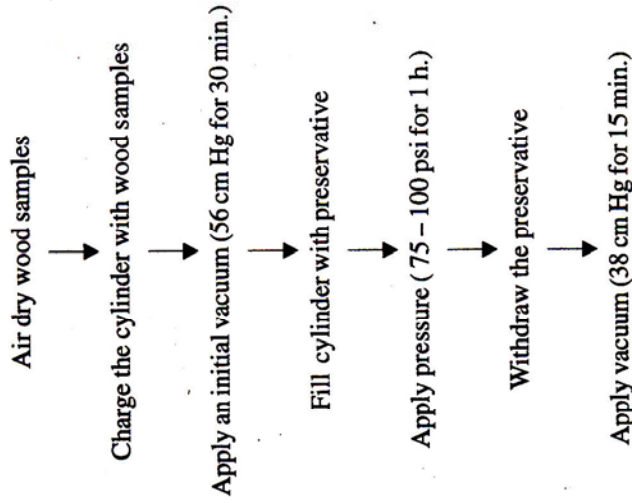
Cement tanks of specified size- 4 nos.

Cement platform for keeping freshly treated logs for drying, material handling device, workers' retiring room etc.

Conclusion

As the indigenous preservation practices do not impart any toxicity to the wood they are not very effective in preventing biodeterioration. Preservation of wood using chemical preservatives is much cheaper. This also imparts long lasting preservation compared to the indigenous preservative and helps to avoid frequent maintenance of fishing craft, thereby preventing loss of fishing days. Installation of a treatment plant in every fishing village or introduction of mobile treatment plants to cater to a group of fishing villages is a suitable proposition in this context.

Fig. 1. TREATMENT PROCESS



Suppliers of chemical preservatives

ASCU

M/s ASCU India Limited
7A, Elgin Road
Calcutta-700020
Phone: 2470509/0598, 2401174
Fax: (033)2470598
E-mail: ascuhickson@hotmail.com

Creosote

M/s Shalimar Tar Products Limited
570 Udyog Vihar
Phase V
Gurgaon
Haryana State
Phone: No. 0124-343204

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