An Introduction to Wood Preservative

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1.0 Introduction:

Etymologically, the term wood preservatives defines that the wood preservation is the process of preserving wood from the wood destroying agents like insects or fungus so that the life span of the wood can be extended. It refers to the treatment of wood with chemicals to impart resistance to degradation and deterioration by living organisms. The proper application of chemical preservatives can protect wood from decay, and stain fungi, insects and marine borers, thus prolonging the service life of woods for many years.

The wood contents celluloses, hemicelluloses, starches and other susceptible materials that attract the fungi and insects to be degraded and eaten. After the preservative treatments, the fungi and insects cannot decompose and feed on these substances, hence the durability of wood is to be increased.

Wood preservative chemicals are toxic and hazardous. Preservative treatments provide long term resistance to organisms that cause deterioration. If it is applied correctly, it extends the productive life of timber by 5-10 times **(Wikipedia, 2007).** If left untreated, wood that is exposed to moisture or soil for sustained period of time will become weakened by various types of fungi, bacteria and insects.

In Nepal, the wood preservative treatment is the common practice for wooden transmission poles, and telephone poles. The treatments have been done for the poles of *Eucalyptus camaldulensis*. It has increased the value of Eucalyptus, and farmers have been getting good amount of money from the sale of Eucalyptus poles and this method has made possible to electrify the rural parts of Nepal, since the treated poles last longer period and it cost less in transportation than other metal poles.

2.0 Objectives of Wood Preservative Treatment:

- To increase the wood durability by decreasing the risks of wood destroying agents like fungi, bacterial and insects. It aims in prolonging the life of non durable wood.
- To lessen the maintenance and replacement cost of wood after use.

3.0 Pests and Disease of Wood: There are several pests and diseases that destroy the woods even after the use. They are:

3.1 Wood Inhabiting Fungi: Wood decay, Mold and most sapwood stains are caused by fungi. There are two types of fungi:

3.1.1 Wood Destroying Fungi: these are decay fungi that cause Brown rots, White rots and Soft rots.

3.1.2 Wood Staining Fungi: discoloration of wood, it has little or no effects on its strength. They are sap staining fungi, mold fungi etc.

3.2 Insects: Several kinds of insects attack wood for shelter and foods. The most important are Termites, Carpenter ants and various Beetles (for example Powdery post beetle, Anobiid beetles), Marine borers etc.

4.0 Types of Wood Preservatives:

There are several commercial chemical preservatives available in the markets. They can be grouped in two broad categories:

4.1 Water Borne Preservatives:

The water borne preservatives solute with water and it can be impregnated with the help of water. These preservatives are used in aqueous solution, but then undergo fixation so that they are not soluble after impregnation.

Waterborne preservatives leave the wood surface comparatively clean, paintable, and free from objectionable odor. Several formulations involving combinations of copper, chromium, and arsenic have shown high resistance to leaching and very good performance in service.

There are some disadvantages of water borne preservatives. This can cause swelling and hence increases the twisting, splitting and checks.

Standard wood preservatives used in water solution include:

A) Acid Copper Chromate (ACC):

Acid copper chromate (ACC) contains 31.8% copper oxide and 68.2% chromium trioxide

B) Ammoniacal Copper Zinc Arsenate (ACZA):

ACZA should contain approximately 50% copper oxide, 25% zinc oxide, and 25% arsenic pentoxide dissolved in a solution of ammonia in water.

C) Chromated Copper Arsenate (CCA):

It is one of the oldest and commonest types of water borne preservatives. This is the compound of Copper, Arsenic and Chromium. In the treatment, Copper works as the primary fungicide, arsenic as a secondary fungicides and an insecticide. During the rainfall, arsenic might leach out and can harm the environment; therefore it is not wise to use CCA treated wood in residential and commercial constructions.

D) Borate Preservatives:

Borate preservatives are readily soluble in water, are highly leachable, and should only be used above ground where the wood is protected from wetting. Borates are odorless and can be sprayed, brushed, or injected.

Borate treated wood is of low toxicity to humans and does not contain Copper or other heavy metals. In this chemical, Boric acid, Oxides and Salts (Borate) are effective wood preservatives.

4.2 Oil Borne Preservatives:

This type of wood preservative consists of different forms of Creosote. Creosote and solutions with heavy, less volatile petroleum oils often help to protect wood from weathering, may adversely influence its cleanliness, odor, color, paintability and fire performances. The most common type of oil borne preservative is Coal tar Creosote.

A) Coal tar Creosote:

It is the residual product from the distillation and processing of coal tar which is normally black or brownish in colour. It is high toxic to wood destroying organisms, permanent, easy to apply and relatively cheap. This has been commonly used in utility poles such as electricity pole, telephone poles and railway sleepers.

B) Other Creosotes:

Creosotes distilled from tars other than coal tar are used to some extent for wood preservation. These include wood-tar creosote, oil-tar creosote, and water–gas-tar creosote. These creosotes protect wood from decay and insect attack but are generally less effective than coal-tar creosote.

C) Pentachlorophenol:

It is also being used commonly which is manufactured by the direct chlorination of phenol or a mixture of phenol and lower chlorinated phenols.

5.0 Essential Characteristics of Wood Preservatives:

Preservative must perform their function throughout the service life of the product under the variety of exposure conditions. Hence it should have following characteristics:

- High toxicity against fungi and or insect attack
- High level of permanency under all service condition.
- High degree of stability during treatment i.e. resistance to decomposition at normal treatment temperatures.
- High level of penetrability.
- It should not add to the inflammability of the wood; should rather increase the natural resistance of timber against fire.
- It should not be harmful to human beings and other livestock. They must be relatively free from objectionable qualities in handling and use.
- The environmental damage should be a minimum.

It is very hard to find all the desired characteristics in one preservative chemical but while selecting the appropriate chemicals these characteristics must be taken into account.

6.0 Treatment Process: There are two types of preservative application process:

6.1 Non Pressure Methods:

In this method, the preservative is inserted into woods without application of any pressure. This process is economical and saves lots of preservatives; however it is not as effective as pressure process. The principal advantage of non pressure treatment is that it can be performed with simple equipments.

There are several non pressure processes of treating woods. The most common are the application of preservative by means of brushing, spraying, dipping, soaking, steeping or by means of hot and cold bath.

6.2 Pressure Methods:

About 90 percent of commercially treated wood is pressure impregnated (Iowa, 1994). It is by far the most effective method of protecting wood against attack by decay, insects, fires and other wood destroying agent (Nicholas D. D. 1973). It is a process that forces chemical preservatives into the wood.

Through the pressure treatment, deeper and more uniform penetration of preservatives can be obtained and retention of preservatives can be more controlled. Also, through use of pressure process, many unseasoned wood can be treated.

6.3 Treating Process:

Before treatment start, it is necessary to debarking, conditioning and sometimes incising of wood for the better impregnation of preservatives. There are two type of pressure treatment method. They are:

6.3.1 Full Cell Process:

The object of full cell process is to fill the cells of wood to its maximum capacity. Full cell processes are mostly employed with aqueous solutions.
After the cylinder is filled with wood, a preliminary vacuum is applied. This removes air from the wood cells. While the vacuum is maintained, preservative solution is introduced into the cylinder until the cylinder is completely filled with and the wood is totally immersed. When the cylinder is completely filled with preservatives solution, pressure is applied to force solutions into the wood. The application of pressure is continued until the wood starts refusal.

When the pressure is finished, pressure is releasing slowly to atmospheric conditions and treating solution is taken back to the storage tanks. It will take around three hours to complete the process at our institute's laboratory **(source: informal discussion).**

6.3.2 Empty Cell Process:

Other systems are similar with full cell process, except the vacuum created at the end instead of beginning, so that excess preservatives come out from wood.

6.4 Preservative Effectiveness:

Preservative effectiveness is influenced not only by the protective value of the preservative chemical, but also by the method of application and extent of penetration and retention of the preservative in the treated wood. Even with an effective preservative, good protection cannot be expected with poor penetration or substandard retention levels.

The species of wood, proportion of heartwood and sapwood, heartwood penetrability, and moisture content are among the important variables that influence the results of treatment.

6.5 Post Treatment Management:

- Treated timber should be handled with sufficient care to avoid health hazard, unnecessary waste of preservatives and breaking through the treated areas.

- Long unsheltered exterior storage of treated wood before installation should be avoided because such storage encourages deep and detrimental checking and can also result in significant loss of some preservatives. Treated wood that must be stored before use should be covered for protection from the sun and weather.

- During and after the treatment the safety mechanisms and rules should be strongly followed, since it might be hazardous to health and environment. Use of Masks, goggles, gloves, apron could minimize the risks.
- Treated wood and its scraps should not be burn in open places.
- With waterborne preservatives, seasoning after treatment is important hence should be done properly.

7.0 Conclusions:

From the environmental point of view, wood treated with a preservative should be used only when untreated material will not perform satisfactorily. If ordinary dry lumber will provide the required durability, the extra expense of treated wood is not recommended.

Generally in case of interior use, if the wood itself is highly durable and well seasoned then even the untreated wood could work longer.

But, in case of exterior use, it is almost compulsory to use wood preservative treatments. Without treatment, the wood cannot last longer. This wood starts degradation and decomposition with the contacts and reactions of external environments such as moisture, weathering, biotic organisms such as fungi and insects. Since the resources are limiting, only the preservative treated wood can provide service for longer periods with intended quality without any maintenance and replacement, therefore the treatment should made compulsory for exterior uses such as poles, post, beams, roof shingles, park furniture and so on.

Even the less durable species can be utilized with the preservatives treatment for longer periods. Therefore, the wood treatment should be encouraged and promoted.

Selection of the right preservative and treatment methods depends on the objectives, budgets, availability and specific use requirements of work place and it is quite an important decision regarding the wood preservative.

Handling of preservatives should be wisely managed so that it could not be hazardous to people and society. Treated wood should not be used where it may come into direct or indirect contact with public drinking water.

Treated wood should not be used under circumstances where the preservative may come in contact with food or animal feed, like food containers. It can be hazardous to health.

8.0 References:

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