PRESERVATIVE-TREATED WOOD IN THE LANDSCAPE

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Introduction

Wood is a valuable natural resource. It is widely available and relatively inexpensive in most areas. Wood has many uses because of its electrical and thermal conductivity, workability, beauty, density and strength. Unfortunately, wood is subject to attack by insects, bacteria, fungi and marine worms and if left unprotected in the landscape, wood deteriorates. Fortunately, some woods are naturally durable or resistant to deterioration. Inner heartwood is more resistant than outer, more porous sapwood of all species. Because wood is porous or permeable, it can be protected for many years with preservatives.

What Causes the Deterioration of Wood?

Anything that decreases the performance of wood is deterioration. The effect of deterioration on the value of the wood may depend upon the wood’s use. Although borer holes may make an attractive plywood veneer, the strength of the wood is greatly reduced for most uses. Fungal or bacterial straining may not weaken the wood, but it makes it unattractive for fine furniture.

Wood is attacked physically, chemically and biologically. Sun, wind, water, lightening, temperature, and wear from use or misuse eventually degrade wood’s useful life. Fire destroys wood and chemicals, cleaners, acids, bases, and strong oxidants, affect its beauty and strength. Bacteria, fungi, marine worms, and insects all deteriorate wood and wood products. Climatic conditions, particularly increased moisture and fluctuating temperatures, interact with biological organisms in deteriorating wood (Figures 1 and 2). Warm, moist environments hasten the breakdown of wood. Periodic treatment of exposed wood with simple water repellents that keep wood dry, helps prevent physical damage and reduces fungal and bacterial decay.

Marine worms attack wooden harbor piers and boats around the world, but in Nevada wooden docks, landings and boats must be protected from water-borne fungi and bacteria. In landscapes, wood in contact with soil deteriorates rapidly from the activity of fungi, bacteria and termites unless protected from moisture. Borers, subterranean termites and, in southern Nevada, nonsubterranean termites threaten wood used inside and out.

Bacteria only attack wet wood in water or wet soil. Five groups of fungi attack wood: brown rots, white rots, soft rots, stains and molds. The first three deteriorate wood and the last two discolor its surface. Wood that is intermittently moist is particularly susceptible to fungal attack.

Several insects infest wood. Some cause damage as adults, others as larvae. Several attack living trees, while many prefer sawed, seasoned wood. Some insects infest hardwoods, but not softwoods and visa versa. Worldwide, subterranean termites are most devastating economically. Powder post, anabiid and longhorn beetles are also very important destroyers of wood.

Figure 1. Potential wood decay in the United States based upon rainfall and temperature data. After Harris and Dines, 1988.

Figure 2. Subterranean termites are found as far north as line A-A, while the northern limit of nonsubterranean termites is line B-B. After Harris and Dines, 1988.
Strategies to Protect Wood from Deterioration

Several strategies may be used to eliminate or reduce deterioration of wood. First, use another material with a longer expected life where possible. However, wood and wood products may be the most available, economical, practical, or desirable choice at hand.

Secondly, reduce the moisture content of wood, which ranges from 30 percent to more than 200 percent to:

- reduce fungal growth
- work and finish wood
- reduce insect damage
- lighten the wood and increase the strength
- reduce shrinkage
- prepare wood for treatment with preservatives

Next, select naturally pest-resistant wood to reduce damage. Heartwood, as mentioned earlier, is generally less prone to attack than sapwood. Heartwood of such temperate zone species as cedar, juniper, redwood, locusts, bald cypress and post oak is resistant, but not immune to fungal and insect attack.

Lastly, apply chemical treatments to wood to reduce its deterioration. Some materials coat wood to keep moisture out, reduce the effects of sun, and reduce wear. These are not preservatives, but they do enhance the useful life of the wood. Preservatives impregnate the wood, protecting it from decay, insect attack, and in the case of borate-containing preservatives, fire. The effectiveness of chemicals to control biological attack on wood depends upon the wood, the chemical used, the pests that are present, and environmental conditions following treatment. Consider:

- the chemical and formulation selected,
- the preservative’s penetration, distribution and retention properties,
- the method of application and curing,
- the moisture content of the wood,
- the proportion of sapwood to heartwood, and
- the susceptibility of the organism to the chemical.

European wood treatment standards (EN 335-1) classify the hazard of biological attack by class and recommend treatment techniques for each to extend the service life of wood, Table 1.

Table 1. Hazard classes of biological attack by environmental service conditions with recommended treatments to extend the service life of wood.

<table>
<thead>
<tr>
<th>Hazard Class</th>
<th>Service Conditions</th>
<th>Recommended Treatments</th>
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<tbody>
<tr>
<td>1</td>
<td>Above ground, covered and permanently dry</td>
<td>Superficial treatments(^1) or impregnation</td>
</tr>
<tr>
<td>2</td>
<td>Above ground, partially covered, exposed to occasional wetting</td>
<td>Superficial treatments(^1) or impregnation</td>
</tr>
<tr>
<td>3</td>
<td>Above ground, not covered, exposed to frequent wetting</td>
<td>Superficial treatments(^1) or impregnation</td>
</tr>
<tr>
<td>4</td>
<td>Contacts ground or fresh water, permanently exposed to wetting</td>
<td>Impregnation</td>
</tr>
<tr>
<td>5</td>
<td>Permanently exposed to salt water</td>
<td>Impregnation</td>
</tr>
</tbody>
</table>

\(^1\) Methyl bromide fumigation, quick-dip, spraying or brushing.

Types of Wood Preservatives and Their Characteristics

Preservatives fall into three broad categories; waterborne, oilborne and coal tar creosote compounds.

**Waterborne** preservatives are organic or inorganic salts, mostly of arsenate, ammonium or boron. Originally, they leached out of wood with wetting. This is solved by adding chemicals that “fix” the preservative to the wood. From this class, CCA (copper/chrome/arsenate) is widely used in preserving wood. These products leave wood clean, odorless, slightly green, but paintable. They are not flammable or explosive and because they have a low volatility are safe for interior uses. Boron containing materials are fire retardants, reducing the spread of fire and the production of smoke. These products do not protect wood from weathering and after they are applied, the
wood must be carefully redried or it will warp. Waterborne preservatives are used to treat lumber, plywood, fence posts, poles, pilings and timbers.

**Oilborne** preservatives are insecticides and/or fungicides dissolved in an organic solvent or liquefied petroleum gas. They are easy to use and handle. They have a low solubility in water, are toxic to fungi and many insects, and treated wood may be glued. Unfortunately, they leave an oily residue behind making the wood unpaintable. Most darken the wood. Their fumes exclude their use indoors. They are toxic to plants, animals and humans, and they provide less protection then creosote. Most are used to treat poles, lumber, timbers, cross arms and fence posts.

**Creosote** products are distilled from coal tar. Although toxic to plants and humans, creosote is very effective in preserving wood in difficult sites such as marine environments. Creosote has an offensive, toxic odor, is flammable, and turns wood oily and black. It is not compatible with paints and wood finishes. It bleeds from wood surfaces, especially during hot weather. However, it is easily applied. Its toxicity is a two-edged sword. It protects wood for 30 to 60 years under extreme conditions from biological and physical attack, but its use is restricted as it is considered a public health risk in certain areas. Disposal of creosote-treated wood requires a permit and special treatment. It is used to treat large timbers, fence posts, and railroad ties.

**Application of Wood Preservatives**

Multiple objectives play on the choice of compound used and the method of its application. Considerations include:

- costs of the product and of applying it,
- efficient use of raw material,
- expected life of the treated wood according to its use and surrounding environmental conditions,
- potential for environmental contamination, and
- expected size of the effluent treatment facilities, if any.

Several methods of applying wood preservatives are employed. Full cell and empty cell processing use vacuum and pressure treatments to force the preservatives deep into the wood. Full cell treatment fills the cells with preservatives, while the empty cell treatment evacuates the cells of preservative in a final step. Nonpressure processes include the following treatments:

- Brushing, spraying or pouring the preservative on the wood. The treatment diffuses into the wood several millimeters, which is satisfactory for many uses.

- Dipping, soaking and steeping refer to increasingly longer times of submerging the wood in the treating solution. Dipping usually requires several seconds to minutes of treatment. Soaking takes less than a day, while steeping lasts longer than a day.

- Thermal processing achieves greater penetration of the preservative into the wood by immersing the wood in a hot solution of chemical followed by a cold (unheated) preservative bath.

It is important to match the wood preservative to the use of the wood and environmental conditions where the wood is used. This will ensure a longer, more useful life and is much cheaper than continually replacing unprotected wood. It is also important for the health of humans and household pets that the proper preservative be used indoors.
Appropriate Landscape Use of Preserved Wood

CAUTION AROUND PLANTS: Creosote-treated railroad ties are commonly used in landscapes. Foliage and roots that contact the creosote or its vapors are damaged or killed. Place sensitive plants back away from the ties and in raised bed gardens, line the soil side of the ties with sheet plastic to protect the roots of plants. Do not use creosote-treated wood in greenhouse construction or in a greenhouse as bench supports. The vapors may sicken sensitive people and damage plants.

Lumber treated with pentachlorophenol, another restricted-use chemical, damages plants that contact it. Do not use this product in greenhouses either. Boron preservatives are also toxic to plants.

RELATIVELY SAFE AROUND PLANTS: CCA, chromated, copper, arsenate, and CZA are commonly used to preserve wood. These are excellent preservatives against decay and termites and they last a long time, even in contact with soil. The chromium fixes the zinc, copper, and arsenic in the wood. Consequently, they do not vaporize or leach into the soil. This makes them safe for use around plants.

Copper and zinc compounds of naphthenate can be used to treat wood and do not damage plants. They are available at hardware stores and nurseries. Unfortunately, the wood is discolored and the treatment is less effective than the above when moisture is present or the wood contacts soil.

References


