TechLine

Forest Products Laboratory

What's in That Pressure-Treated Wood?

Wood in contact with the ground, or above ground that often gets wet, will eventually be attacked by decay fungi and insects. With the exception of naturally durable species, such as redwood and cedar, wood used in these applications should be pressure treated with preservatives if it is expected to last more than a few years. Several new wood preservatives developed in recent years have added to the variety of preservatives available.

The following descriptions are intended to help the consumer understand what is in the pressure-treated wood or what type of pressure-treated wood they should choose. Wood preservatives are broadly classified as either water based or oil type, depending on the chemical composition of the preservative and the carrier used during the treating process. Several preservatives that are not currently available, but were previously in use or discussed in the literature are also described.

Water-Based Wood Preservatives

Water-based preservatives react with or precipitate in the wood substrate, thus becoming fixed and resistant to leaching. Water-based preservatives leave a dry, paintable surface; therefore, they are commonly used to treat wood for residential applications such as decks and fences. They are primarily used to treat softwoods because hardwoods treated with these preservatives may not be well protected from soft-rot attack. Water-based wood preservatives can increase susceptibility to corrosion, so all metal fasteners used with the treated wood should be hot-dipped galvanized or made of stainless steel. Borates, another type of water-based preservative, do not become fixed in the wood and readily leach if exposed to rain or wet soil.

Chromated copper arsenate contains chromium, copper, and arsenic. Wood treated with CCA, commonly called "green-treated" wood, dominated the residential market for several decades and was sold at

lumberyards under a variety of trade names. However, as the result of the voluntary label changes submitted by CCA registrants, labeling of CCA by the Environmental Protection Agency (EPA) now permits the product to be used primarily for industrial applications. Use of CCA-treated wood prior to 2004 is not affected by this change. CCA protects against attack by decay fungi, insects, and most types of marine borers. CCA-treated wood is now primarily used in poles, piling, and bridge timbers.[1] Obtaining adequate treatment with CCA can be a problem with difficult-to-treat species such as Douglas-fir. Wood treated with CCA has no odor and is typically light green in color. It can be readily painted or stained.

Ammoniacal copper zinc arsenate (ACZA) contains copper, zinc, and arsenic and is a refinement of the original formulation ammoniacal copper arsenate (ACA). ACZA protects against attack by decay fungi, insects, and most types of marine borers. It is used to treat poles, piling, and timbers. Because of its ability to penetrate Douglas-fir and other difficult-to-treat wood species, it is most widely used on the West

[1] For a detailed explanation of allowable uses of CCA see the article "Treated Wood in Transition" at http://www.fpl.fs.fed.us/documnts/pdf2004/fpl_2004_lebow005.pdf

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Coast. The color of the treated wood is olive to bluish-green. The wood initially has a slight ammonia odor, but this dissipates soon after treatment. ACZA-treated wood can be painted or stained.

Alkaline copper quat (ACQ) is one of several recently developed wood preservatives. It contains copper and a quaternary ammonium compound. ACQ protects against decay fungi and insects but has not been standardized for use in marine applications. Multiple variations of ACQ have been or are in the process of being standardized.

ACQ-B is an ammoniacal copper quat formulation; ACQ-D is an amine copper quat formulation; and ACQ-C is formulated with either ammonia or amine and a slightly different quat compound. Currently ACQ-D is the most commonly used formulation. Like ACZA, ACQ-B is able to penetrate Douglas-fir and other difficult-to-treat wood species and is used primarily on the West Coast. Wood treated with ACQ-B has a dark greenish-brown color. ACQ-D is manufactured with amine copper, which gives the treated wood a light brown color. ACQ-D is not as effective as ACQ-B in penetrating difficult-to-treat woods. Both ACQ-B- and ACQ-D-treated wood can be painted or stained.

Copper azole (CBA) is another recently developed preservative formulation that relies on amine copper, with co-biocides, to protect wood from decay and insect attack. The first copper azole formulation developed was CBA-A, which contains copper, boric acid, and tebuconazole. Recently the CA-B formulation was standardized and has largely replaced CBA-A. CA-B does not contain boric acid, but contains more copper and tebuconazole. Copper azole formulations can be used to treat a wide range of wood species used in aboveground or ground-contact applications but are not standardized for use in seawater. In some cases, additional ammonia may be added to the treating solution to improve penetration of difficult-to-treat species such as Douglas-fir. Wood treated with either copper azole formulation has a light brown color and little or no odor. The treated wood can be painted or stained.

Borate preservatives are salts such as sodium octaborate, sodium tetraborate, and sodium pentaborate that are dissolved in water. Borates are effective preservatives against decay fungi and insects. Borate preservatives are diffusible, and with appropriate treating practices, can achieve excellent penetration in species that are difficult to treat with other preservatives. However, the borate in the wood remains water soluble and readily leaches out in soil or rainwater. *Borate-treated wood should be used only in applications where the wood is kept free from rainwater, standing water, and ground contact.* An example of such a use is in the construction of wooden buildings in areas of high termite hazard. Borate-treated wood is odorless and colorless and can be painted or stained.

Oil-Type Wood Preservatives

The most common oil-type preservatives are creosote, pentachlorophenol, and copper naphthenate. The oil-type preservatives are commonly used for applications such as utility poles, railroad ties, piling, and laminated beams. Wood treated with oil-type preservatives is not usually used for applications that involve frequent human skin contact or inside dwellings because they can be visually oily, oily to touch, or have a strong odor. Because of their oily nature, these preservatives also act as water repellants and can help to prevent checking and splitting.

Creosote is made from coal tar, which is a byproduct of the carbonization of coal during steel production. Unlike other oil-type preservatives, creosote is not dissolved in oil, but it does have properties that make it look and feel oily. Creosote contains a chemically complex mixture of organic molecules, most of which are polycyclic aromatic hydrocarbons (PAHs). Creosote is effective in preventing attack by decay fungi, insects, and most marine borers. Creosote is widely used in railroad ties, utility poles, bridge timbers, and piling. Creosote-treated wood has a dark brown-black color with an oily surface and strong odor. It is very difficult to paint, stain, or seal. It is not recommended for use inside dwellings or areas where it could come into frequent contact with human hands, such as handrails.

Pentachlorophenol is a crystalline solid that can be dissolved in different types of oils. Pentachlorophenol is very effective against fungi and insects but does not protect well against ocean marine borers. It is widely used to treat utility poles, bridge timbers, laminated beams, and foundation and fresh-water piling. The appearance of pentachlorophenol-treated wood depends greatly on the type of oil in which it is dissolved. The wood may have a very light brown color and dry surface if a light oil is used, or a dark brown

color and somewhat oily surface if a heavy oil is used. Pentachlorophenol-treated wood is generally more durable if a heavy oil is used, so light oil is most often used for aboveground applications.

Pentachlorophenol is odorless, but the odor of the oil in which it is dissolved may be noticeable near the treated wood. Pentachlorophenol-treated wood should not be used inside dwellings, and it is not recommended for areas where it could come into frequent contact with human hands, such as handrails. Pentachlorophenol-treated wood is difficult to paint or stain unless it was pressure treated using a light oil.

Copper naphthenate is a mixture of napthenic acids and copper salts dissolved in oil. It is effective against decay fungi and insects but is not recommended for use in marine applications. Copper naphthenate is not as widely used as creosote or pentachlorophenol, but it is used for the treatment of utility poles and in highway construction. As with pentachlorophenol, the properties of copper naphthenate are dependent on the type of oil in which it is dissolved. The most commonly used oils are fuel oil and mineral spirits. The color of the treated wood varies from light brown to dark green, depending on the type of oil and treating process. The odor of the oil may be noticeable near the treated wood. The treated wood is difficult to paint or stain unless pressure treated using a light oil. Copper naphthenate is not a restricted-use pesticide, and the liquid preservative can be purchased at retail lumberyards and hardware stores. It is widely used to treat field cuts of pressure-treated wood that are made during construction.

Preservatives Not Commercially Available

Several preservative formulations that have been used in the past or were discussed in previous publications are not currently available. These preservatives are included here to inform the reader that they are not currently available or because they may become available in the future.

Ammoniacal copper arsenate (ACA) is an older formulation of ACZA that does not contain zinc. It has not been available in the United States for many years and is not likely to be produced again in the future. ACA wording should be replaced with ACZA in older guideline and specification literature.

Acid copper chromate (ACC) has been used as a wood preservative in Europe and the United States since the 1920s. ACC contains copper oxide and chromium trioxide. The treated wood has a light greenish-brown color and little noticeable odor. Tests on stakes and posts exposed to decay and termite attack indicate that wood well-impregnated with ACC gives acceptable service, although it may be susceptible to attack by some species of copper-tolerant fungi. As with CCA, it may be difficult to obtain adequate ACC penetration in some of the more refractory wood species such as white oak or Douglas-fir. However, the high chromium content of ACC has the benefit of preventing much of the corrosion that might otherwise occur with an acidic copper preservative.

Ammoniacal copper citrate uses copper oxide as the fungicide and insecticide and citric acid to aid in the distribution of copper within the wood structure. In 2004, ammoniacal copper citrate was withdrawn from the American Wood Preservers' Association standards due to lack of use.

Copper dimethyldithiocarbamate (CDDC) is a reaction product formed within the wood after treatment with two different treating solutions. It contains copper and sulfur compounds. CDDC protects against decay fungi and insects but has not been standardized for use in seawater. CDDC-treated wood has a light brown color and little or no odor.

Availability

Suppliers of treated wood can be found by contacting local lumberyards or trade associations that work with treated wood manufacturers. A few such trade associations include the following:

American Wood Preservers' Association; P.O. Box 388
Selma; AL 36702-0388; (334) 874-9800;
fax (334) 874-9008; www.awpa.com

Western Wood Preservers Institute; 7017 NE Highway 99;
Suite 108; Vancouver, WA 98665
(360) 693-9958; Fax (360) 693-9967;
www.wwpinstitute.org

Southern Pressure Treaters Association;
P.O. Box 3219; Pineville, LA 71361-3219
(318) 619-8589; fax 318-767-1388; www.spta.org

Southern Pine Council; 2900 Indiana Avenue;
Kenner, LA 70065-4605
(504) 443-4464; fax: (504) 443-6612;
www.southernpine.com