Generally speaking, discoloration and staining are bad things – just ask anyone who does the laundry. But sometimes, nature has a way of turning a disadvantage into an asset.

By Udo Schmidt

**DISCOLORATIONS IN WOOD**

Non-typical coloring in wood can be good or bad – depending on your point of view and the project at hand. We all associate certain colors with various wood species: light brown with oak, burgundy red with aged cherry and mahogany, or tan with maple. After several years of growth, the wood cells become inactive and increase extractive content like resin, gum and tannin to become heartwood. Heartwood is usually darker in color than sapwood because of a higher level of extractives that give heartwood its color attributes and odor. Major color variations are discolorations, changed by nature or man, on purpose or by neglect. These stains in wood can be classified into three groups: fungal, mineral and chemical.

**Fungal Stain**

This group of stains is caused by minute parasitic organisms that need water, warm temperatures and oxygen to grow. Fungi feed on sugar in the sapwood of logs and lumber with a moisture content of more than 22 percent, or when the relative humidity is more than 92 percent. The affected wood is then said to be “sap-stained.” The discoloration varies depending on the infecting organism, wood species and moisture situation, but a blue stain is the most common type. Blue stain shows as bluish to bluish-black, or gray to brown. The affected areas can be spotty or streaky. In severe cases, the entire sapwood is evenly discolored.

Even though sap stain seldom changes the strength properties of wood, heavy sap stain reduces wood’s toughness and its ability to withstand shock. Stained areas also have a higher water absorption capacity, and therefore are more susceptible to other organisms such as decay fungi.

Mold is another type of stain caused by fungi. Basically, the difference between mold and sap stain is the penetration into
the wood. Mold is usually a surface growth, but it can stain the wood deep below the surface. Areas affected by mold show stain even if planed to nominal thickness – especially hardwoods such as oak. On softwood, the discoloration is shallow and can be removed by planing the lumber. Sap stain can affect the entire sapwood of a tree, which in some species is more than half of its volume, or entire boards cut from a log.

A third kind of organism is decay fungi, more commonly referred to simply as rot. Even though decay fungi aren’t stains, they should be mentioned here because they live and thrive under the same conditions as mold and sap stain. Spalted wood is a good example of decay fungi. The blue-black zone lines are boundary markers of fungi colonies coming into contact with each other. Unlike wood with other fungal

Mineral Stain

Mineral stains occur in living trees and should not be confused with fungal or chemical stains, which occur in cut logs or lumber. Mineral stains are mostly the result of an injury or biological attack on the tree and no treatment is known. Typical discoloration in oak shows as dark-brown streaks, in maple as green or brown, and in poplar as purple to dark-red. Mineral stains do not affect the strength properties of the lumber.

While some see mineral streaks in lumber as a defect, others see them as aesthetically pleasing. However, one should keep in mind that the brilliant colors will fade to a light-brown or medium-brown over time.

Mineral Stain

stains, spalted wood is rare, high-priced and in high demand. The reason is that the timing has to be just right to harvest spalted wood. If a spalting log is cut into lumber too soon, the color characteristics are less pronounced. When the log is cut too late, the wood is too decayed and the lumber is useless.

Organisms like fungi need food, water, oxygen and warm temperatures to live and grow. Temperatures of 75-85 degrees are optimal for fungal growth. But the growth rate slows to half the optimal rate at temperatures of 32-50. The organisms are killed at temperatures over 130. Another characteristic of fungi is that they can go dormant for long periods of time. Only high temperatures and chemical treatment kills the organisms. Any fungal stain is permanent and cannot be removed or lightened by chemicals like bleach or oxalic acid.

ON LOGS WITH PREDOMINANT SAPWOOD, sap stains can almost encompass an entire log.
Chemical Stain

Chemical stains result from the oxidation of naturally occurring chemicals in the wood cells of the hardwood. This is especially true with species with the highest proportion of sapwood. The discolorations vary and can be yellow, pinkish-brown, blue, or shades of gray.

Chemical stain develops just below the surface and can penetrate deep into the wood if conditions are favorable. Requirements for the development of chemical staining are similar to that of fungal staining – temperatures above 50 degrees and a moisture content above 20 percent. Since chemical stain is an oxidation process, oxygen must be present in the wood cells. That means the wood needs to be partially dry. And then, of course, chemicals have to be present.

The problem with most chemical stains is that they don't show on the surface of the lumber. Only when the lumber is planed does the discoloration become visible. And even then, it's sometimes hard to detect unless a piece of wood without stain is used as a comparison. This is common on white maple. The stain may be so even throughout the wood that it isn't noticed, but when a finish is applied to the wood, the stain becomes magnified, giving greater contrast between stained and unstained wood.

One common type of chemical stain is iron stain. These are unsightly blue-black or dark-gray discolorations mostly in oak, redwood, cedar and cypress. The heartwood of these species has a high content of tannin and tannin-like extractives. When iron or steel comes into contact with the wood, a chemical reaction takes place, resulting in discoloration. This contact can be as simple as rubbing out a finish on a project with steel wool, or driving a nail into a living tree.

There is one characteristic that all chemical stains have in common: The chemical reaction can be reversed. Many times the discoloration can be softened with household bleach. A more powerful bleach is oxalic acid, available in pharmacies and paint stores. Oxalic acid is a good spot remover for small areas of iron stain. However, the treatment isn't permanent unless all the iron is removed from the wood. If not, the acid will break down over time and the staining will continue. Use extreme caution when using oxalic acid, as it causes irritation of the skin, eyes and mucous membranes. Ingesting just a few grams can be fatal.

In contrast, fungal stains cannot be bleached out. An application of bleach may lighten the stained area temporarily, but it will return to its original color after a short time.

Aging of Wood

All wood darkens with age. No treatment with colored stains or dyes can duplicate the beauty of naturally aged wood. Some species, like cherry, darken very fast and care should be used when working with them on large-scale projects. Finished parts of the project should be kept in dark rooms or covered to prevent light from prematurely aging the wood.

Weathering is another change in wood color through photo-oxidation caused by ultraviolet radiation of sunlight. Add this to the effect of the elements, and weathered wood turns grayish regardless of the species' original color. Exterior projects should always be protected with a finish containing UV blocking. Luckily, the color of aged or weathered wood is only skin deep and can be sanded or planed out.

Born and educated in Germany, Udo Schmidt came to the United States in 1979. After 12 years in the lumber-export industry, he started his own cabinet shop. Schmidt has written numerous magazine articles and is the author of "Building Kitchen Cabinets" (Taunton Press, 2003).
DO-IT-YOURSELF SPALTING

While spalting is a natural process, there are several methods of spalting your own wood. Some are more controllable than others, but none have a guaranteed stage of optimal color characteristic before rot destroys the wood fiber. The spalting process depends on climate and environmental conditions and can take from several weeks to a few months. The wood has to be kept at a moisture content above fiber-saturation point (about 30 percent), with a temperature ranging from 70-90 degrees. Decay fungi are plentiful in the atmosphere and do not need to be induced.

All hardwoods with light-colored wood and a heartwood that’s nonresistant to decay will spalt easily under favorable conditions. Such species include birch, beech, and maple, buckeye, elm and sycamore. Creating spalting in a species with decay-resistant heartwood, like oak, is almost unheard of.

The easiest – but least controllable – way to spalt wood is to cut a tree and leave it in the shaded forest for some time. Covering the log in leaves retains moisture. Cutting the log into lumber before decay sets in is a hit-or-miss situation.

A more controllable way to spalt is to stack a pile of freshly cut lumber in a well-shaded area and keep it moist by occasionally sprinkling it with water. When the desired stage of spalting is obtained, quickly restack the lumber in a well-ventilated area with 1” sticks between the layers to encourage airflow. Kiln-drying the lumber at this point is a guaranteed way to stop...
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