Old-Fashioned Wood-Coloring

Reviving the dyes of yore

by George Frank

There can't be much doubt about the advantages of using modern ready-mixed stains or dyes for coloring wood. They're readily available, easy to apply, reasonably fade-resistant and they yield consistent results. But if you're a one-piece-at-a-time wood artisan interested in obtaining a quality of color you can't get directly out of a can, there are great thrills and advantages to making your own homemade wood-coloring mixtures by following some of the old-fashioned, bygone ways of preparing natural and chemical dyes. I learned about various natural extractive dyes and chemical mordants in Paris in the days following World War I. Although the old woodworking section of Paris has undergone many changes since the unforgettably charming days of the 1920s, and while the old ways of dyeing wood are slowly disappearing, I haven't forgotten what I learned and still depend on many of these techniques today.

Why go to all the trouble of making your own coloring concoctions when you can get reliable, ready-made stains at the corner paint store? First of all, using a dye instead of a stain allows you to color the wood without adding a cloudy layer of pigment that can conceal the grain and cover up the wood's natural beauty. Unlike paint or stain, a dye consists of a liquid medium—usually water or alcohol—in which pigment particles are dissolved, not merely suspended. Thus, the pigment can't settle out. And since these dissolved pigments are less opaque than suspended particles, a dye solution is more transparent than a stain.

Furthermore, many of the techniques I'll describe produce their color by chemical reaction with the wood itself. The effect they achieve has a clarity and vibrant *quality* of color that, in my opinion, far exceeds that of their modern equivalents, such as aniline dyes. The old-fashioned dyes can also be the right way to get an authentic color when refinishing certain antiques.

The use of dyes to change the natural color of a material goes back to textile dyeing—a craft that evolved well before recorded history. Woodworkers undoubtedly gleaned the experience of these textile artisans in developing their own methods for dyeing wood, often to make light, inexpensive woods resemble the darker, more coveted varieties.

The palette of color-creating substances compatible with yarn and fabric is vast, yet relatively few of these materials have been adapted to the wood-dyeing craft. One of the most useful and well-known of these dyestuffs is brewed from the hulls of walnut shells by so simple a means as a pot simmered on the kitchen stove or by extracting the dyestuff with ammonia. This venerable *brou de noix,* which Jon Arno wrote about in *FWW* #59, produces very handsome rich-brown colors when applied to wood.

But allow me to introduce you to the two most versatile stars for natural wood-dyeing, derived from various species of South American hardwoods: logwood (also known as "campeachy wood"), so called because it is imported from Central America in heavy, dense logs; and brazilwood, frequently referred to simply as "brazil." In the old days, these logs were reduced to chips or sawdust and marketed as dyestuffs. The product was boiled down, strained, bottled and stored for future use. Since these exotic chips are far from easy to come by these days, we must buy extracts of them (available as powders—see "Sources of supply," p. 55), ready to be dissolved in water. Yellowwood and catechu are also available as extracts, but they're far less versatile than logwood and brazilwood.

Applied by themselves, these extractive dyes will produce pleasant yellowish and reddish-brown tones. But combine them with chemical mordants and you open the door to a multitude of superb colors (see facing page). Mordants like sodium sulfate also help increase the fade resistance of brazilwood and logwood dyes. Before I provide a how-to on combining dyes and mordants, however, allow me to explain what a mordant is and how it works.

The word "mordant" comes from the French verb, *mordre*—"to bite." The mordant helps the dye penetrate into the fibers of the wood and bind there. Quite frequently, the chemical combination of dyes and mordants also gives birth to deep, rich, vibrant colors impossible to obtain in any other way. The reason is this: While a dye creates color with dissolved pigment, mordants create or change color by chemically reacting with dyes or other substances found in the wood itself.

Sometimes mordants are used without dyes to create color. For example, untreated oak becomes darker after being exposed to fumes from a heated ammonia solution. By "fuming" the oak in this manner (caution: the use of a vapor respirator with an ammonia cartridge is essential during this process), the natural tannin present in the wood reacts with the ammonia mordant to cause a color change. This effect can also be achieved on other woods lacking tannin by simply applying a tannic acid solution before fuming (see bottom right, facing page).

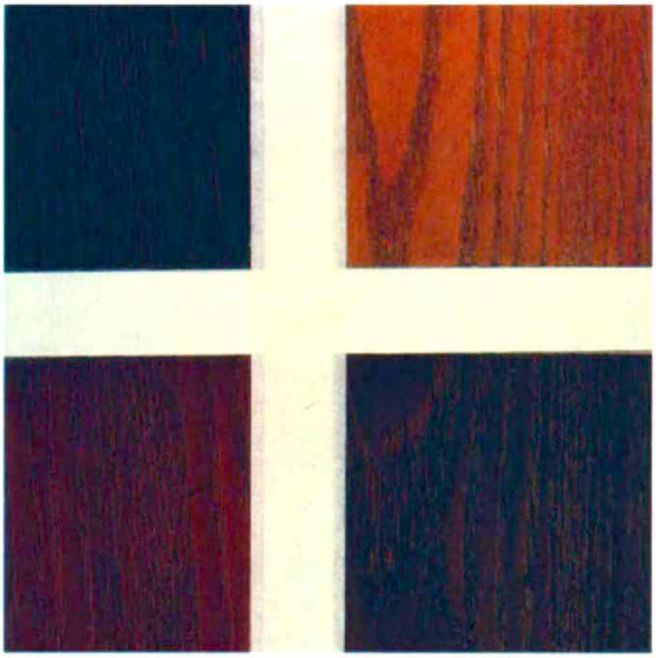
There are no hard-and-fast rules on how best to combine dyes and mordants. Typically, the dye is applied first, then the mordant when the dye is dry. Sometimes the mordant comes first and the dye follows, but rarely are the two mixed. In some instances, it's unknown which component—dye or mordant—actually creates the color change.

There are countless possible combinations of mordants and dyes, and the key to discovering the magic of brilliant color is experimentation. Experimenting is like creating a play on the stage: The actors are the ingredients; the plot is how you make

Sample results using various dyes and mordants

This white ash sample shows some of the colors obtainable with logwood dye and various chemical mordants. All solutions were mixed in a 15% concentration.

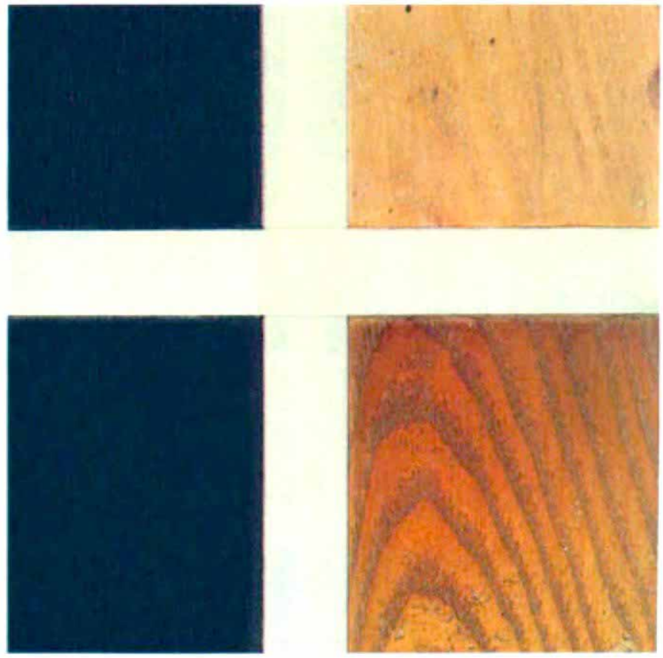
Ferrous sulfate over logwood dye | Logwood dye alone



Alum over logwood dye | Potassium dichromate over logwood dye

An interesting range of colors can be created by using mordants in combination—with or without dyes. This entire white ash sample was first coated with tannic acid. Then, various second coats were applied, as indicated.

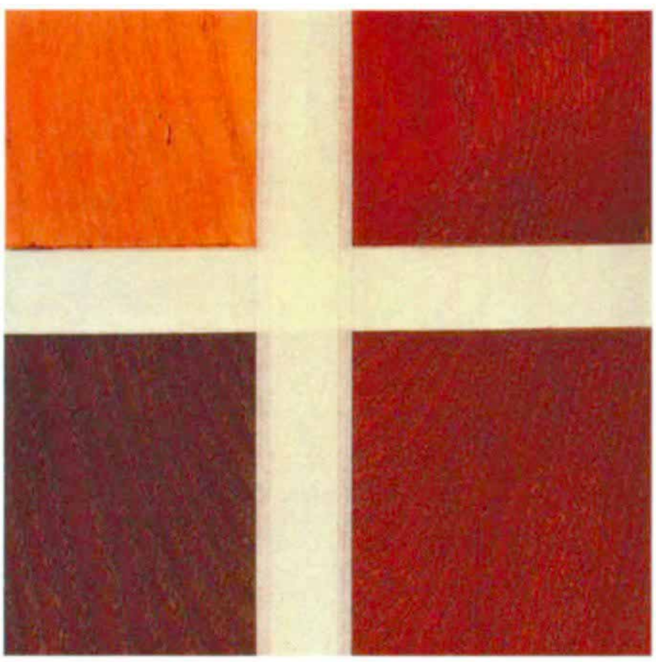
Ferrous sulfate over tannic acid | Alum over tannic acid



Ferrous sulfate over tannic acid with logwood dye topcoat | Potassium dichromate over tannic acid

After topcoating this white ash sample with brazilwood dye, different shades and tones were created by varying the concentration of potassium dichromate mordant used.

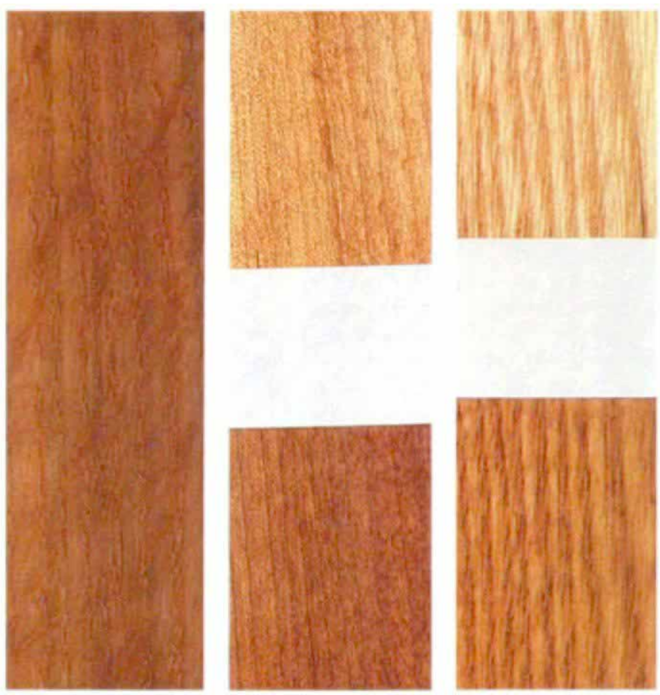
Brazilwood dye only | 5% solution



20% solution | 10% solution

You can darken woods that have a natural tannin content (such as oak) by exposing them to ammonia fumes. Furthermore, non-tannin woods such as birch and ash can be fume-darkened by first topcoating the wood with a tannin solution.

Oak | Birch | Ash



Your wood-dyeing experimentation kit needn't make your workbench look like Dr. Frankenstein's laboratory. The most important tools include: disposable mixing cups, mixing sticks and applicators; masks, goggles, gloves and other protective devices; and an accurate scale.

them perform. Here's the chance for you to do for wood-coloring what Shakespeare did for the stage.

The basic tools you need to begin are shown in the photo above. They include: a reliable scale to measure the weight of the powdered dyes and chemicals (mine was made by Kodak—I paid $15 for it in 1941); a graduated cylinder or beaker to measure the water; disposable plastic cups to mix small sample batches (I use small urine sample cups available from any hospital-supply store); a few dozen Popsicle sticks for stirring each mixture separately; cotton swabs or scraps of old foam rubber for use as disposable applicators; and a notebook for taking notes on the various combinations of mixtures and the results they yield on different woods—so you can reproduce your best results in the future.

Before you do any mixing, however, a word of warning: Most of the chemicals described here are poisonous (see "Mordanting chemicals" below), so treat them with respect. Bottle the chemicals in safe containers, label them properly and store the containers in a locked cabinet or high out of reach. Keep kids and pets out of the shop while you're experimenting (mixed in solution, deadly potassium dichromate looks just like orange soft drink), and avoid all contact with these chemicals by wearing protective goggles, an organic-vapor/acid-gas particulate cartridge (available from MSA, P.O. Box 426, Pittsburgh, Pa. 15239), an apron and rubber gloves. And, most important, concentrate on what you're doing. Add the woodfinisher's most essential ingredient to every mixture: plain horse sense. In six decades of working with these chemicals, neither I nor any of my workers have had a serious mishap.

Start your experiments by cutting and smooth-sanding a number of thin sample boards or strips from whatever wood you plan to work with. Section off several separate areas on each one with masking tape. Now, fill the disposable cups with warm distilled water (or rainwater), and add small amounts of the various dyes and mordants. Use a separate Popsicle stick to stir each mixture (you can write the contents of each mixture on one end of the stick for quick identification). For most general experimenting, I mix dyes and mordants in about a 15% concentration. To speed the process of proportionally combining dry weight with liquid

Mordanting chemicals

The following is a list of common, readily obtainable chemicals that can serve as mordants in the wood-dyeing process. Please handle, store and use these substances with care.

Alum—Usually mined as a mixture of several metallic aluminum sulfates, alum is sold in drugstores as a white, astringent powder or crystal. Relatively non-toxic, it brings out purplish or dark-crimson tones when used over logwood and other dyes.

Potassium dichromate (potassium bichromate)—These orange crystals of chrome, available from darkroom-supply stores, are *extremely* poisonous (five grams can kill an adult) and are considered carcinogenic. Avoid all contact with the skin, and use them only in well-ventilated areas. Applied alone, they will darken the natural color of mahogany. When applied over logwood dye, they tend to create rich browns; applied over brazilwood dye, they produce deep reds and browns.

Copper sulfate—Also known as blue vitriol. Plumbers use large quantities of this turquoise crystal to kill the tree roots that clog sewer lines. Highly poisonous, copper sulfate can often be purchased at hardware or plumbing-supply stores. When used in conjunction with logwood, it produces dark gray and olive tones.

Ferrous sulfate—This toxic form of iron comes in tannish crystals that are poisonous in the amounts used for mordanting, although minute quantities of the chemical are used in iron-supplementing vitamins. Ferrous sulfate will produce an ebony-like black when applied over logwood, or a deep gray over tannic acid.

Stannous chloride—A white crystalline form of tin, Stannous chloride is moderately poisonous. Toxic fumes are generated when the chemical is mixed with water, so use maximum ventilation, or mix and apply it outdoors. Stannous chloride can be used in combination with alum, potassium dichromate or copper sulfate for color variations. It will produce a nice light red over brazilwood, and a deep yellow over yellowwood. When applied over madder dye (or alizarin, a synthetic replacement for madder), stannous chloride yields a pink color.

Potassium bitartrate—The most common form of this white powder can be purchased at the grocery store as cream of tartar. Since it's used in cooking and saucemaking, potassium bitartrate is obviously non-toxic. It will sometimes brighten red or yellow when applied over dyes of those colors. Over logwood dye, it creates a gray-brown; over brazilwood, a reddish-yellow.

Sodium sulfate—Also known as Glauber's salt, sodium sulfate is a white or colorless crystal that is thought to assist other mordants and dyes in molecularly bonding colors to the fibers of wood, yielding better and brighter colors with improved light-fastness.

Ammonia—This is a clear liquid with powerful fumes. While the non-sudsing, household-grade ammonia sold in grocery stores will work, a 28% solution called aqueous ammonia (sold by industrial-supply companies) is most effective for darkening the color of oak with fuming. Ammonia will yield a dark violet-brown when applied over logwood dye, a light brown over brazilwood and a yellow-brown over yellowwood dye. It is hazardous to the eyes, skin and respiratory tract, so wear goggles, rubber gloves and an ammonia-cartridge-equipped vapor mask during use.

Tannic acid—This slightly toxic chemical can irritate sensitive skin. Tannic acid is naturally present in oak and is the "ingredient" that gives tea an astringent quality. It can be applied to the surface of non-tannic woods to make them susceptible to darkening by faming, or it can be used in combination with other mordants to produce color—with potassium dichromate, for example, it produces a yellowish-brown.

Calcium oxide—Also called quicklime, calcium oxide can be employed by itself to enrich mahogany, walnut or cherry. Slake calcium oxide with warm water and coat the wood with the freshly made paste. Let it dry overnight. The next day, brush off the lime and wash off the residue with rainwater. Neutralize with vinegar. *—G.F.*

volume, nothing beats the metric system. Since 1 cubic centimeter (cc) of water weighs 1 gram, 15 grams of powder dissolved in 100cc of water automatically yields a 15% solution. Try calculating *that* with liquid and dry ounces!

With a foam applicator, brush on the first coat of dye or mordant. Once dry, remove the raised grain with 400-grit sandpaper, sanding on a slight diagonal to shear the fibers off rather than just pushing them down. Next, brush on an even coating of the mordant solution (or dye, if you used mordant on the first coat). With some applications, the color changes will be rapid; others—ferrous sulfate over logwood dye, for instance—will continue to darken for several hours. If you like the color attained but want to darken it, you can either mix a higher concentration solution of the dye and/or mordant, or you can try a second application of either mixture—or both mixtures.

Once you're satisfied with the hue and intensity of the color, sand the piece lightly and top coat it with the finish of your choice—acknowledging that most finishes will add a slight yellow cast to the color and that some may not adhere to the dyed wood. Although natural-dye colors are reasonably light-fast (particularly when fixed with a mordant), everything in life eventually fades-even the natural color of most woods themselves. These old-timers' dyes, however, will age with dignity.

If you don't get quite the color qualities you're after with the substances I've described, feel free to experiment with others. There are many possible substitutions for the mordanting chemicals discussed here. If you're familiar with safe procedures for using diluted forms of nitric, sulfuric or hydrochloric acid, for example, you might try them in lieu of other mordants. These acids yield a whole range of deep reds, purples or yellows, depending on the dye over which they're applied. Don't be timid in your experiments, but *do* be careful using these materials. And *never* attempt to dilute a concentrated acid by pouring water into it; instead, add the acid to the water gradually, stirring constantly.

There are many other possible sources for dyestuffs. Antique restorers, for instance, achieve a very subtle faded-gold hue in their refinishing by applying final coats of a dye brewed from Chinese black tea (available in brick form from Chinese food and gift shops). In the old days, some finishing masters knew how to use the stone and iron sediment from the bottom of the water trough under a sandstone grinding wheel to make three different color dyes: green, brown and red. They'd boil the mud in vinegar and, over a period of days, skim off liquid at different intervals to produce the three colors. Although I've never tried this formula, I've had success making a grayish-color dye from the aluminum oxide dust and steel particles gathered from below my bench grinder.

Although the old ways of wood-dyeing are usually slower, less predictable and sometimes more dangerous than the modern practice of "finishing by the numbers," they can add valuable tricks to the repertoire of the artistic woodfinisher. □

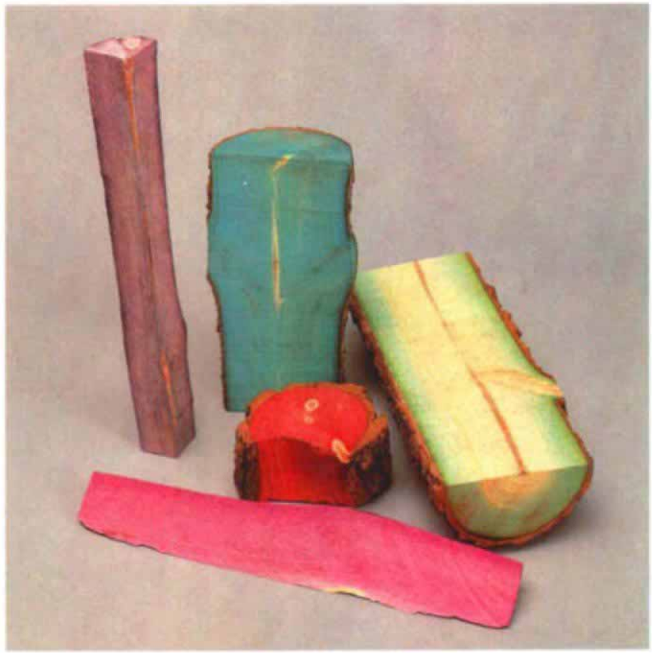
George Frank is a retired master woodfinisher living in South Venice, Fla., and is the author of Adventures in Wood Finishing *(The Taunton Press, 1981).*

Sources of supply

Dyeing materials and mordanting chemicals:

Olde Mill, R.D. #3, Box 547A, York, PA 17402 (also offers a kit of dyes and mordants).

Woodfinishing Enterprises, 1729 N. 68th St., Wauwatosa, WI 53213.



By letting a tree's natural circulation system absorb his pigmented solutions, LeRoy Frink is able to create a rainbow of unnaturally colored woods.

Dyed-in-the-wood pine

by Sander Nagyszalanczy

The next time you have trouble getting the stain off your clothing or fingertips, think of LeRoy Frink. About 30 years ago, Frink got the idea that it would be neater and more economical to color wood while it's still in the living tree. It took him 10,000 experiments to perfect his unorthodox method of dyeing: Frink bands each tree near its base with a probe consisting of multiple hollow needles. Through these needles, he pipes a water-based pigment solution (the exact nature of which he's understandably secretive about) fed by a ⅛-in.-dia. hose connected to an oil drum reservoir. The tree's active transport system, which normally circulates water and nutrients through the living portion of the plant, pumps the dye solution into every inch of sapwood and right out into the leaves or needles. A 16-in.-dia. to 20-in.-dia. tree takes about a month to assimilate the color, sucking dry an entire 55-gal. barrel.

Although the process works on all types of trees (including hardwoods), Frink prefers Ponderosa pine since it's fast-growing and consists mostly of sapwood. He once dyed 2,000 aspen trees simultaneously for a production run of colorful paneling, but he rarely colors more than 500 trees "intravenously" at the same time.

Semi-retired at 68, Frink runs a thriving craft business and uses thousands of small pieces of the unnatural-colored woods for making earrings and pendants, which he sells in his shop in Loveland, Colo. In addition to dyeing wood, Frink has explored other applications for his process. With the help and advice of several chemical companies, for example, he has introduced fire retardants, insect repellents and fertilizers into trees. □

Sandor Nagyszalanczy is an assistant editor at FWW.