For Vibrant Color, Use Wood Dyes

Aniline dyes enhance figure, even out tones

by Chris A. Minick

Getting consistent colors—*Exact measurements and careful record keeping are important for duplicating colors. Wood dyes usually are a blend of colors, visible as dye powder dissolves in water (above) and in filter paper (right).*

Aniline dyes are a good product with a bad name. Their nasty reputation is a holdover from the days when these versatile coloring agents were highly toxic. It's a misnomer not much different from golfers still calling their drivers "woods," even though many modern golf clubs are made of metal. Woodworkers still know dyes by the name "aniline," even though modern wood dyes no longer contain the chemical.

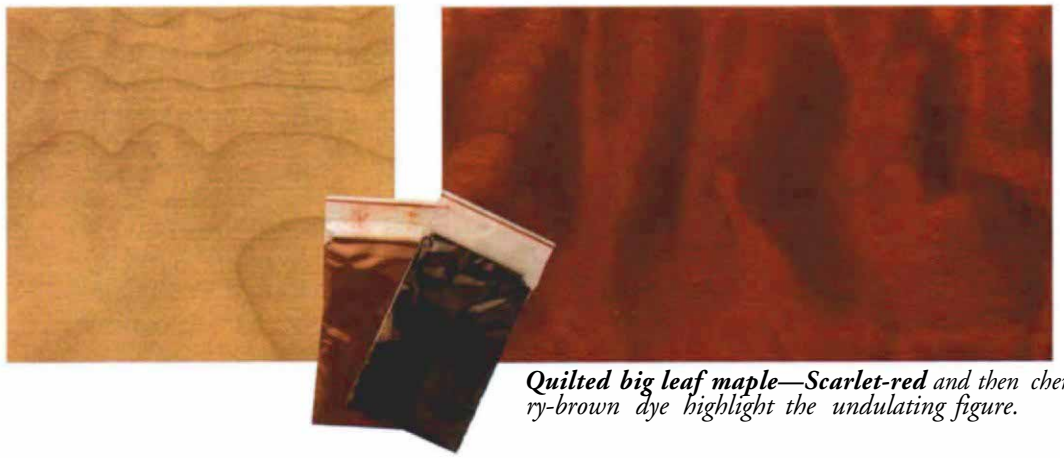
First used in the textile industry in the mid-1800s as a substitute for natural dyes, aniline-derived dyes worked fine, but they faded quickly and were soon replaced by more light-fast synthetic colorants. Unfortunately, the term *aniline dye* stuck. It is still used to distinguish transparent wood stains from their pigmented cousins.

Dyes are useful for special finishing effects, like layering (adding depth) and toning (applying tinted finish). Probably the best use for dyes is evening out differences in color, like those between sapwood and heartwood.

Dyes can work miracles on figured wood (see the photos on the facing page), but they aren't magic. For example, when an uninteresting piece of wood is dyed, it will just become an uninteresting, colored piece of wood.

You can buy premixed-liquid or gel wood dyes or mix-it-yourself powdered dyes. I mostly use powdered dyes, which have an indefinite shelf life. Dye is classified by the solvent that dissolves it. The three classes are water-soluble, oil-soluble and alcohol-soluble dyes (see the sources of supply box on p. 76). Each type has finishing advantages.

***Quartersawn** lacewood—Burnt-sienna and then light-walnut dye bring out the ray-fleck figure.*



***Quilted big leaf maple—Scarlet-red** and then cherry-brown dye highlight the undulating figure.*

***Mottled** mahogany—Yellow and then rosewood dye emphasize the chatoyance.*

You can even use ordinary fabric dyes. Brands like Rit can be found at department stores, but you'll have to mix or layer several colors to get more natural wood tones. Powdered fabric dyes sometimes have fillers, so I buy the premixed-liquid type. They're fairly inexpensive, so they're good for experimenting.

Dyes are less hazardous than many household cleaners, but you will still need to handle dyes carefully:

- Use a paper mask when mixing the dye.
- Wear rubber gloves, so you don't absorb the dye through your skin.
- Keep dye powders and solutions away from children and pets.
- When a dye is mixed with a flammable solvent, store it properly.
- If you get dye on your clothes, wash them separately.

Differences between pigments and dyes

What distinguishes dye stains from pigment stains is the size of the particle that's doing the coloring. Individual colorant particles in a dye solution are exceedingly small—there are more than 10 million trillion per quart. In comparison, the particles in pigment stains would look like boulders.

Pigments are suspended when in solution; dyes dissolve totally in solvent. The tiny size of dye particles explains why dye stains are so transparent and why they penetrate wood so deeply. Pigments stay near the surface of wood where they lodge in wood pores, which emphasizes the pores and any blemishes like sanding scratches. Dyes color everything similarly. Even end grain can be dyed so that it looks like the rest of the wood.

Water-soluble dyes have lasting color and clarity

Water-soluble dyes are the most versatile of the three wood-finishing dyes. Water-soluble dyes are easier to use, easier to repair and are more light-fast than the other two types. The exceptional clarity and penetration of water-soluble dyes help make figure come alive. Laboratory experiments confirm that water-soluble dyes penetrate the wood about five times deeper than alcohol-soluble dyes. The deep penetration and chemical structure of water-soluble dyes account for their superior fade resistance. (The story on p. 74 gives a general explanation of how fading occurs.)

To mix water-soluble dyes, I use a gram scale to weigh the water and dye powder (see the photo on the facing page). Keep track of dye brands, colors and concentrations every time you use them. If you ever have to match a color, a mixing logbook will save you hours of making up sample stain boards. Once the dye is mixed, sponge the wood with the solution until the wood is thoroughly wet. Wipe off the excess before it dries. (Leaving wet dye stain on wood for a long time will not darken the color any further.)

Because water raises wood grain and makes the surface fuzzy, water-soluble dyes do the same. Fortunately, there is a simple solution to this. I flood the wood with clear water after I have sanded to 180-grit. After the wood dries

overnight, I knock down the raised grain with 220-grit sandpaper. Once the grain has been sanded flat, the dye stain will not raise the grain *again.*

Blotch-prone woods like cherry and pine don't fair any better with water-soluble dyes than they do with solvent-based pigment stains. To minimize blotchiness, I substitute a hide-glue size for the initial coat of clear water. Make the glue size fairly dilute (by weight, I use one-part hide glue granules to nine-parts water). If you use premixed hide glue, you'll have to dilute it as well. Once dry, the size accepts the dye stain evenly. This only works with hide glue, though. I once ruined a butternut desk by trying white-glue size.

Oil-soluble dyes can customize stain color

Most woodworkers have used gallons of oil-soluble dye over the years and don't even know it. Pigment-stain manufacturers often include oil-soluble aniline dyes in their stain formulations to add a little life to an otherwise dull stain. (To learn more about the uses of pigment and dye in stains, see *FWW #101,* p. 66-69.) Oil-soluble dyes will dissolve in common shop solvents, like mineral spirits or VM&P naphtha, but they dissolve most completely in lacquer thinner.

Once dissolved in solvent, oil-soluble dye can be added to linseed oil, Danish oil or varnish to make a custom color. In solution, oil-soluble dyes can also be added to a can of pigment stain to modify the color. One problem with oil-soluble dyes is their lack of clarity. Because of their muddy look, I don't like to use oil-soluble dyes on raw wood. But I still keep a full array of colors in my shop for tinting varnishes when I'm toning areas of furniture.

Alcohol-soluble dyes tint shellac, lacquer

Comedian George Burns once asked a clothing-store clerk what the shrink-resistant label on socks meant. She replied, "The socks will shrink, but they really don't want to." The latest alcohol-soluble dyes, touted as "fade-resistant," are somewhat analogous to this. I've found that most of these alcohol-soluble dyes will fade, but they really don't want to. They do have a place, though. Furniture restorers like them for tinting shellacs and solvent-based lacquers in touch-up work.

Alcohol-soluble dyes can be dissolved in methanol (wood alcohol) or ethanol (grain alcohol). I like ethanol because it's the least toxic of the two. Alcohol-soluble dyes dry very rapidly, so they can leave lap marks when brushed or wiped on. Spraying is really the only acceptable way to apply them to large surfaces. Because most alcohol-soluble dyes fade quickly, I find little use for them in my shop.

Non-grain-raising dye stains save sanding

Dye stains that do not raise wood grain are called NGR (non-grain raising) stains. Although NGR stains are technically not a separate class of dye stains, many woodworkers view them as such. But here's the rub: Some brands (the bad ones) are just oil-soluble dyes dissolved in solvent. They give wood the bland look of oil-soluble dyes. Good brands of NGR stains, like Behlen's Solar-Lux (see the sources of supply box on p. 76), are water-solu-

Dyes go deep but still fade

Pigments tend to obscure wood's fine details. By contrast, dyes are more transparent, which lets the wood show through. Instead of muddying subtleties in figure, dyes enhance them, as shown in the photo at right.

Even though dyes penetrate more than pigments, dyes fade more. Fading is a form of photochemical degradation. Though ultraviolet light plays a part in fading, intense visible light is mainly responsible.

Visible light is composed of seven colors: red, orange, yellow, green, blue, indigo and violet. White light is a blend of all these colors. A red dye stain looks red because the dye absorbs the other colors and reflects only the red.

Dyes are large, organic molecules primarily composed of atoms of carbon, hydrogen, nitrogen and oxygen. The arrangement of these atoms within each molecule dictates how a dye responds to light.

Quite often, enough light energy is absorbed by a dye molecule to initiate a photochemical reaction, which changes the arrangement of its atoms. Photochemically changed molecules usually are colorless. Because of this, the color becomes more dilute; therefore, the dyed wood appears lighter—faded. Pigments produce color the same way as dyes, but they are more immune to fading.

Alcohol-soluble dyes fade the fastest. The alcohol-dyed half of the sample shown in the photo at right faded from a nice walnut color to swamp-green in less than two months under fluorescent lighting. Water-soluble dyes fade the least (see the unfaded portion of the photo at right). Oil-soluble dyes fall somewhere in between.

Even though the fading of dyes is inevitable, don't let it prevent you from using them. If you use a fade-resistant dye, your project should remain the same color for decades. —*C.M.*

Pigment (top) vs. dye stain

Faded (top) vs. unfaded

ble or organic dyes that, through a chemical sleight of hand, offer decent clarity and penetration without making the wood fuzzy. If you drop some NGR stain in clear water and it dissolves, it's a good one.

NGR stains made with water-soluble dye still lack the depth of penetration of water-dissolved dyes, so they look a little flat by comparison. There are rare occasions, though, when a water-soluble dye is impractical. Intricately carved areas, for example, can't be sanded easily after a water-soluble dye has raised the grain. For these situations, I'll use an NGR stain. I make my own by mixing concentrated powdered dye with hot water and then diluting the solution with lacquer retarder from James B. Day & Co. (1 Day Lane, Carpentersville, IL 60110; 708-428-2651). A volume ratio of one-part dye solution to three-parts retarder is about right.

Adjusting dye color to suit the wood

Customizing the color of a dye stain is easy. All dyes within a solvent class can be intermixed. For instance, any two water-soluble dyes can be mixed or layered to produce a third color (see the top photo at right). Likewise, colors within the alcohol-soluble and oil-soluble families of dyes can be blended.

Dye colors are not always consistent from one supplier to the next or even from one batch to another from the same company. Luckily, you can modify the color slightly by adding small amounts of liquid dye-tinting colors. I use Dayco brand (carried by James B. Day & Co. and most professional paint-supply stores).

You can also tint dye to get that special color you want. A dull-looking walnut can be livened up, for example, by adding a bit of red tint. Adding green to a cherry dye stain (which is often too red) will cool the overall color to a more natural cherry tone. Conversely, dyes that are too blue can be warmed by adding orange dye.

Color intensity (how light or dark a dye stain is) is controlled by the amount of solvent in the dye solution. So if your dye stain is too light, just add more dye powder. I add a little black India ink to my dye stains when the standard color is a little too bright and needs to be toned down a shade or two. India ink is not a dye, but rather a dispersion of very fine lampblack pigment that imparts a neutral gray tone to dye solutions. Incidentally, quartersawn walnut stained with India ink makes a decent substitute for ebony.

Special effects: layering, shading and toning

Woods with large, open pores like oak look a little strange when stained with dye. The areas between the grain lines color evenly, but the open pores do not. Dyed oak usually lacks contrast between the earlywood and latewood bands.

I solve this problem by layering a pigment stain over a dye stain. I start with a yellowish-brown, water-soluble dye, seal it with shellac (let it dry) and then wipe on walnut-colored pigment stain. The shellac prevents the walnut stain from coloring the areas between the grain lines. But the pigment does color the open pores. The result looks like antique oak.

The basic idea behind layer-

Use dyes for finish touch-ups. *The author stains a sand through on a mahogany tabletop. After he applies an orange-red dye, he'll seal the repair with shellac. Once that's dry, he'll wipe on the rosewood dye and seal it in preparation for a topcoat.*

Giving wood a new look- *To give butternut a rich, two-tone look, dye the earlywood and latewood separately. With ring-porous woods, coloring between grain lines is easy.*

Dyes are great for special color effects. *After building a case for his son's electric guitar, the author custom-finishes the lid. Successive bands of color create a sunburst effect.*

ing is to create distinct depths of color within the wood. Layering different dye stains produces an effect that cannot be achieved any other way. Dye-layered finishes look particularly stunning on wooden instruments.

One of my favorite layered finishes is for mahogany. I start by applying a bright yellow dye stain to all surfaces. This first layer, called a ground stain, highlights the figure deep in the wood and evens the color of the separate boards that make up a piece. The next layer is a coat of rosewood dye stain made by Clearwater Color Co. (Highland Hardware, 1045 N. Highland Ave. N.E., Atlanta, GA 30306; 800-241-6748). The rosewood dye gives the wood a rich, reddish-brown hue. The topcoat of finish can even be tinted to bring out other highlights. The timing of the dye applications is critical to getting distinct layers. For instance, I apply the second dye when the ground-stain looks dry but feels damp. The second dye does not penetrate as deeply as the first, so two layers of color are formed.

As I mentioned, certain dyes are soluble in finishes. Oil-soluble dyes can tint oil finishes and oil-based varnishes. Alcohol-soluble dyes can tint shellac and lacquer. Water-soluble dyes and NGR stains can tint waterborne finishes. Because all these dye-tinted finishes are transparent, two fancy techniques, toning and shading, are possible.

Toning is applying a tinted finish to an entire piece to alter the overall color slightly. Shading is more of a decorative effect that's achieved by selectively applying a tinted finish to highlight areas of a piece. Shading the center of a tabletop darker than the edges, for example, gives the table a worn, aged look.

You can improve your dyeing methods with different applicators. With small brushes, for example, you can color in areas of wood or add detail, as shown in the bottom photo on p. 75. With a spray gun, you can cover large areas or add zones of color (see the photo above).

But the best advice for using dyes, no matter how you apply them, is to experiment with a dye stain on scrap until you're happy with the color. If you absolutely hate the results, don't despair. You can sponge on full-strength chlorine bleach, and the color will disappear.

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Sources of supply

	 Water-soluble dyes	 Alcohol-soluble dyes	 Oil-soluble dyes	 NGR stain
H. Behlen & Bros., 4715 State Highway 30, Amsterdam, NY 12010; (518) 843-1380	✓	✓		✓
Furniture Care Supplies, 5505 Peachtree Road, Chamblee, GA 30341; (800) 451-0678	✓	✓	✓	✓
Garrett Wade Co., 161 Ave. of the Americas, New York, NY 10013; (800) 221-2942	✓	✓		✓
Homestead Finishing Products, 11929 Abbey Road, N. Royalton, OH 44133-2677; (216) 582-8929	✓	✓		
Lee Valley Tools, 1080 Morrison Drive, Ottawa, Ont., Canada, K2H-8K7; (800) 461-5053 (U.S.)	✓			✓
Olde Mill Cabinet Shoppe, 1660 Camp Betty Washington Road, York, PA 17402; (717) 755-8884	✓	✓	✓	✓
Woodcraft, 210 Wood County Industrial Park, Parkersburg, WV 26102; (800) 225-1153	✓			
The Woodworkers' Store, 4365 Willow Drive, Medina, MN 55340; (800) 279-4441	✓	✓		
Woodworker's Supply, 1108 N. Glenn Road, Casper, WY 82601; (800) 645-9292	✓	✓	✓	✓