

## The hows and whys of dyes

BY PETER GEDRYS

Dyes are an indispensable tool for a professional finisher: I use them to give mahogany that rich brown found on antiques, to enhance figured maple, and to brightly color a contemporary piece. However, many woodworkers have a deep fear of coloring wood. I'm reminded of Groucho Marx's witticism: "Die, my dear? Why that's the last thing I'll do!"

In part, this comes from confusion between dyes and pigment stains. Unlike stains, dyes never look muddy or hide the natural beauty of wood. With that in mind, let's take a closer look at what dyes are, where they come from, and how to use them.

### What is a dye and how is it made?

For centuries, dyes were obtained from natural products such as roots, berries, insects, and nut husks. Then in the mid-19th century, William Henry Perkin discovered how to make a synthetic purple dye from aniline, an organic compound derived from coal tar. This was a giant step forward: There was now an inexpensive method to mass-produce dyes. Today, most dyes are derived from crude oil but the term aniline is still widely used.

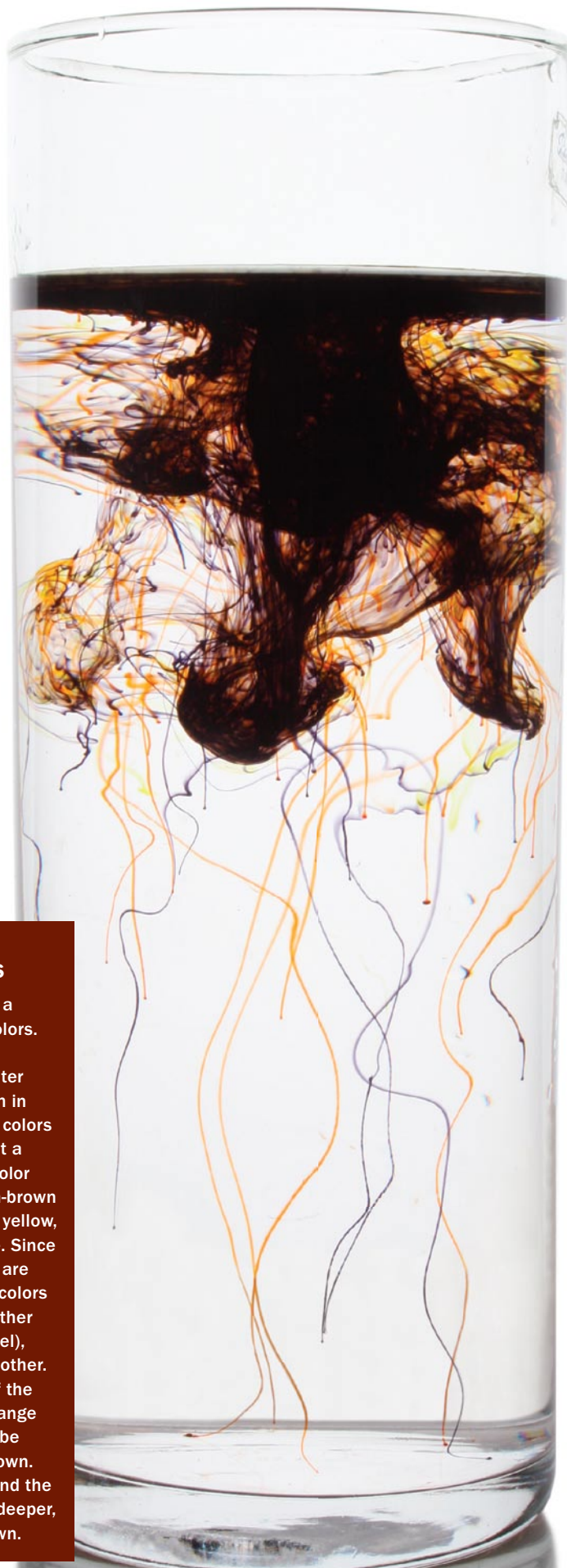
Many woodworkers think that dyes, like stains, are simply finely ground pigments, but this is not true (see facing page).

Although you can buy dyes already dissolved, powders offer the widest range of colors and are the most inexpensive option. You also have full control over the color strength by adding powder or diluting the solution.

The three main dye groups associated with woodworking are acid, basic, and solvent dyes. The water-soluble dyes are, for the most part, the acid group, and the alcohol dyes

### THE SUM OF ITS PARTS

Dyes are usually a blend of three colors. This can be seen clearly with a water dye. Drop a pinch in water, watch the colors separate, and get a lesson in basic color theory. A reddish-brown dye may contain yellow, orange, and blue. Since orange and blue are complementary colors (opposite each other on the color wheel), they offset each other. In other words, if the dye has more orange than blue, it will be a warmer red brown. Add more blue and the color shifts to a deeper, less reddish brown.



## DYES AND STAINS ARE TWO DIFFERENT PRODUCTS

A dye is generally an organic compound that is soluble in water, alcohol, or oil. This creates a color in solution that penetrates the wood. Conversely, a pigment remains in suspension and requires a binder to help affix it to the surface. Think of dyes as sugar and pigment as sand. Drop them into warm water and the sugar will dissolve; the sand will collect at the bottom. This is also what makes dyes transparent and stains cloudy.

### DYES POP THE FIGURE

On close-grained woods like maple, dyes add uniform color while magnifying any figure that is present. Stains muddy the figure.

DYE

STAIN

### STAINS POP THE GRAIN

On open-grained woods, the pigment particles lodge in the pores, highlighting the grain structure. Dyes give a more uniform color.

DYE

STAIN

are the basic group. The solvent dyes are soluble in a variety of oil solvents from mineral spirits and naphtha (aliphatics), to xylene and toluene (aromatics), to acetone and lacquer thinners (ketones).

So much for chemistry. Which dye is right for your project?

### Water-soluble dyes work for most needs

Water-soluble dyes account for roughly 70% of Lockwood's sales (see below) and there are good reasons for you to focus on them, too. They dissolve easily in warm water, have no odor whether dry or dissolved, and resist fading. They are best applied to new wood and are suitable on any species, but particularly dense-grained species such as maple, cherry, or poplar.

Water-soluble dyes are also easy to apply by hand. On large areas, you want to flood the surface (see next page); on smaller

areas, folded paper towels or a small brush work well. On very large areas, spraying is an option, and because the dye is water based, there is no need for an explosion-proof spray booth.

Don't be fooled by the dead look that dyes have when they dry. They come back to life when a clear finish is applied.

The problem of water-soluble dyes raising the grain is overblown. Some boards swell more than others (use a test sample), and for these, dampen the surface prior to final sanding. On all others, any raised-grain fuzziness disappears when you sand the first coat of clear finish. But what you don't want to do is sand the dye coat, as you will sand through the color in spots.

When preparing your test board, you may find that surface tension prevents these dyes from adding color to the pores of



**Pass it on.** Two generations of the Schiffrin family operate W.D. Lockwood, supplying dyes to the woodworking industry.

## The first family of colors

One of the oldest distributors of dyes in the United States is W.D. Lockwood & Co. in New York City ([wdlockwood.com](http://wdlockwood.com)). They have been providing their own line of colors to the furniture and instrument-making industry since the late 19th century. They also provide dyes to many companies that repackage them under their own name.

The current owners are the Schiffrin family: Herb, his wife Robin, and their son Jesse. They gave me a fascinating tour of their operation from the filing cabinets full of dye recipes, to the

underground vault where the drums of dye powder are stored, and to the mixing facility. Each time a color sells out, a new batch must be blended following the secret recipe. To ensure that the new and old colors are identical, white coffee filters are dipped in both solutions and then compared. Simple, yet effective.

—P.G.



**Family secrets.** Samples of all the colors Lockwood has made are filed away along with the recipe of how each was formulated.



## Plenty of dye yields an even color



**Flood the surface.** Don't skim when applying the dye. You get better penetration if you wet the surface thoroughly.



**Uneven application?** If you pause on a large surface, you can apply more dye as long as the surface is wet. At first the boundary will be obvious because the earlier dye had longer to penetrate.

woods like mahogany, oak, and walnut. To ease the surface tension, add a scant drop of dishwashing detergent to the dissolved dye. Don't add too much or you'll get a sudsy dye.

### Alcohol-soluble dyes dry fast

The biggest difference between water-soluble dyes and alcohol-soluble ones is that alcohol-soluble dyes dry much faster, generally in less than 15 minutes even when applied by hand. They are considered non-grain raising, which eliminates any need to raise the grain prior to dyeing and makes them excellent for quick touchups. Furniture finishers and restorers often have a plastic box with 18 compartments for a wide variety of alcohol-soluble dye powders. Mixing the dyes with a little shellac quickly rectifies finishing flaws such as sanding through color on edges.

On the other hand, while small areas can easily be dyed by hand with a quick-drying solvent like alcohol, it takes careful planning to avoid unsightly streaks when doing a large area. In these cases, spraying is more effective.

Dissolve the powder in denatured alcohol and stir the mixture occasionally for at least an hour. Once the powder is dissolved,



**Uniform color.** After a minute, the boundary will disappear and when the surplus dye is wiped away the surface will have an even color.

you can use the dye to tint finishes such as shellac and lacquer (when tinting lacquer, use a 3:1 mix of methanol and acetone).

All dyes will fade to some degree, but alcohol powders are not as lightfast as water ones. The most fade-resistant dyes are metal-acid complex types. In a sophisticated piece of chemical engineering, a metal such as chromium, copper, or cobalt is liquefied and attached to a molecule of dye in a 1:1 or 1:2 ratio. This creates a much stronger molecular bond and improves lightfastness. TransTints concentrated dye and Solar-Lux NGR dye contain this metal-complex dye, as do some of Lockwood's water-soluble powders.

## Preparing a dye

**Heat helps.** Dyes dissolve best in liquid that is around 160 °F. If you are heating anything but water, make sure you do it in a hot water bath and not directly over a heat source.



### Oil-soluble dyes are best for tinting

These are probably the dye powders you will use least, but they still have some niche uses. They are useful to add a hint of color in oil-based finishes. By tinting a clear finish, you create a toner that can slightly adjust a wood's color. This is also an easy way to shift a very amber-colored varnish to a more neutral brown. Oil-soluble dyes will dissolve in an aliphatic such as mineral spirits or turpentine, but are best dissolved in lacquer thinner, which mixes well with oil-based finishes. Add the dissolved dye in



## Alcohol dyes dry fast

**Great for touchups.** Alcohol-soluble dyes mixed with some dewaxed shellac are a great way to cover up mistakes such as over-sanded edges.



small increments and don't exceed 5% of the finish by volume, or you run the risk of a streaky surface. Less is more here.

### Success with dyes

There are a few simple safety precautions for working with dyes. Always wear gloves, and when handling dye powders wear a dust mask—you only get one pair of lungs.

When mixing a dye, it is best to work by weight vs. volume, but if you lack a sensitive scale, 1 oz. of dye as measured in a plastic medicine dispenser is just under 1 oz. in weight. As you gain experience, you'll get a feel for how much powder is needed to create your colors. The standard concentration is 1 oz. of powder per quart of liquid. However, I normally make a stock solution at twice that strength. If I want to dilute the color, I'll pour some of this stock into a measured amount of

clear solvent and test the result. Keep records of the ratios and you can re-create any color.

Dye powders dissolve best in solvents warmed to about 160°F. You can directly heat water (distilled is best), but if you warm up flammable solvent always use a hot-water bath as opposed to open flame or microwave. Failure to do so could ruin your day.

Dissolved water-based dyes are susceptible to bacteria, which can form a mold on the surface. However, I keep my dyes in glass or plastic containers out of sunlight and they last a year without problem. Alcohol or oil dyes are not as easily affected by bacteria, but can come out of solution over time and may require stirring and filtering.

If you've never used dyes, you'll be happily surprised at their versatility, brilliance, and clarity. Even though chemists have advanced their quality, some things stay the same. One example is Lockwood's walnut crystals, whose base color comes from a peat found in Germany. Once washed and filtered, it produces a lovely brown we associate with walnut.

Welcome to the wonderful world of dyes. □

*Peter Gedrys is a professional finisher in East Haddam, Conn.*

## Why I don't use chemical dyes

**I have deliberately not covered chemical dyes, though a few woodworkers still swear by them. Some, like the vinegar-and-steel-wool concoction, are relatively benign (if you let the hydrogen escape while it brews) but you can get the same color with dye powders with much less hassle. Avoid other chemical dyes at all costs. Potassium dichromate, used to darken cherry and mahogany, contains a heavy metallic salt, hexavalent chromium, which is very dangerous to humans and the environment.** —P.G.

## Oil-based dyes are best for tinting clear coats



**Sneak preview.** To see what tinting an oil-based finish will look like, put some finish on a white plate, sprinkle on some dye powder, and rub it around.



**Strain the solution.** Dissolve the oil-soluble dye in mineral spirits or lacquer thinner, then add it to the clear oil-based finish via a fine paint strainer.



**Apply normally.** Wipe or brush the tinted oil onto the surface and let it soak in. After waiting a few minutes, wipe up any excess with a clean, lint-free cloth.