a closer look

Pros and cons of oil finishes

BY CHRIS A. MINICK

In a recent poll on the *Fine Woodworking* Web site, more than half of readers chose either pure oil or an oil/varnish mix as their favorite finish. This is not surprising, given that oil finishes are easy to use, easy to renew, and above all, hard to mess up.

But there still is a lot of confusion about oil finishes: What are the merits of different types of oil? What can oil finishes do and not do? What are the differences between pure-oil finishes and oil/varnish mixtures?

Not all oils are suitable for finishing

Vegetable oils form the largest family of natural resins used for finishing wood. These oils are divided somewhat arbitrarily into three classes: drying oils, semidrying oils, and nondrying oils.

Only the drying oils, primarily linseed oil and tung oil, can form a cohesive, hard film when used as a wood finish. Linseed oil is derived from flaxseed, while tung oil, also known as China wood oil, is obtained from the nuts of the tung tree. Semidrying oils like soybean, safflower, or sunflower are used in the manufacture of oil-based varnish. Nondrying oils such as corn, cottonseed, coconut, and olive are better used as salad dressing than as wood finish.

Your doctor may have advised you to switch from saturated to polyunsaturated fats, and as it turns out, what is good for your health is good for your finishing, too. Polyunsaturated oils have a greater number of double bonds in each fatty-acid segment, making them more chemically reactive. Not only can your body digest them more easily, but when applied to wood, they have better drying characteristics. For instance, raw linseed oil dries when applied to wood, but soybean oil does not. That's because more than half (52%) of the fatty-acid segments in linseed oil contain three double bonds, whereas only 9% of the segments in soybean oil have

The right oil for the job

When applied in their pure state, three types of oil are suitable for finishing wood. Linseed, tung, and walnut oils have characteristics that make them suitable for different woods and projects.

BOILED LINSEED OIL
This the cheapest and most widely available of the pure-oil finishes. It will darken the wood as it ages, so if you want an antique look or if you find the appearance of freshly sawn cherry too pale, linseed oil is the right choice.

TUNG OIL
Pure tung oil is harder to find than linseed oil. It produces a slightly more durable finish and doesn't darken the wood as much. This makes tung oil a good choice to use on woods that you wish to remain pale, such as curly maple (left), or on woods already sufficiently dark, such as walnut (right).

WALNUT OIL
This oil is expensive and dries slowly, but it has exceptional nonyellowing properties and in its pure form is completely nontoxic. To make sure it contains no metallic driers or other harmful chemicals, buy it in the salad-dressing aisle at the supermarket. Apply three coats to cutting boards, wooden utensils, and bowls. Wait two days between applications to let each coat cure.

Photos: Mark Schofield

Why oily rags can combust

Heating up fast. *In seven minutes, the internal temperature of this wadded-up cloth soaked in linseed oil rose from less than 100°F to 350°F and started to smoke (above). Less than five minutes later, the temperature rose from 350°F to almost 500°F, and the cloth caught fire (right).*

Uncontrolled combustion, spontaneous or otherwise, is not a good thing in any shop. I'm aware of two fires near where I live that have been attributed to the spontaneous combustion of oily rags.

Wadded-up, oil-soaked rags contain the three ingredients needed for spontaneous combustion: an ignition source, fuel, and oxygen.

The same process that causes an oil finish to dry can cause an oily rag to ignite. To begin with, the liquid oil absorbs oxygen from the atmosphere, a phase that continues for several hours. Once sufficient oxygen has been absorbed, a chemical reaction starts, producing heat as a by-product.

When trapped inside a wadded-up oily rag, the heat feeds on itself. A fundamental rule in chemistry states that the higher the temperature of a chemical reaction, the faster the chemical reaction proceeds. The heat trapped inside the rag causes the reaction rate to increase, producing more heat, which increases the reaction rate, which produces more heat, and so on. Within 15 minutes, the heat can ignite the rag.

Avoiding disaster is easy if you dispose of rags correctly. Spread them on your shop floor to dry, or hang them over a rack outside. Once dry, the rags can be tossed into the trash safely.

Hung out to dry. *To prevent the chance of spontaneous combustion, oil-soaked cloths should be spread out and allowed to dry before being discarded.*

three double bonds. Tung oil dries even faster because 80% of its molecules contain three double bonds.

How oil finishes dry

Tung oil and linseed oil dry to a usable finish in a two-step process: Oxygen is absorbed into the wet oil around a molecule's double bonds to form peroxide. This oxygen absorption takes a surprisingly long time, ranging from eight hours for boiled linseed oil to about five days for raw linseed oil. Next, the peroxide decomposes to produce very reactive free radicals, which attack the unsaturated fatty-acid segments of another oil molecule. This forms a stable chemical bond between the two molecules, at the same time producing another free radical to carry on the reaction. Eventually, all of the oil molecules are linked by a network of stable chemical bonds known as a polymer—the dry finish we see on our masterpieces.

The main reason that boiled linseed oil dries so much faster than raw linseed oil is the addition of metallic driers. The driers in boiled linseed oil catalyze the uptake of oxygen, decreasing the wet time and initiating a rapid decomposition of the peroxides to speed up the polymerization process. More important, metallic driers produce a greater concentration of free radicals in the oil, which leads to a tightly bonded finish. Thus, not only does boiled linseed oil dry faster than raw linseed oil, but it also produces a longer-lasting, more protective finish.

Tips for using oil finishes

Oil finishes may be easy to apply, but they are not foolproof. Good surface preparation and thin coats

are the keys to success. When preparing the surface of the workpiece, don't skimp on the sanding. Oil finishes don't cover stray sanding scratches or other defects very well because applications are much thinner than most brushed-on finishes.

I power-sand most wood species to P180 grit with aluminum-oxide sanding disks and then hand-sand with 180- and 220-grit (CAMI) garnet paper. Hand-sanding eliminates machine-made swirl marks and generally improves the appearance of the wood. Garnet sandpaper leaves a softer, less noticeable scratch pattern than other sandpapers. This sanding sequence is not written in stone; if you have a cherry board that appears likely to blotch, you may want to sand up to 400 or even 600 grit (CAMI) to burnish the wood and make the oil absorption more even.

Allow the wood to absorb as much oil as it can. Flood the surface by applying the oil with a brush, or simply pour it on and wipe it around with a cotton cloth. Reapply oil to the dry spots as they show up, keeping the wood thoroughly wet. After 30 minutes or so, wipe away any excess oil and allow the wood to dry overnight. Buff the dry surface with a fine, gray nonwoven abrasive pad, then repeat the procedure until you have applied at least four coats.

Wet-sanding (with the oil, not water) the second and third coats with 400- or 600-grit (CAMI) wet-or-dry sandpaper creates a slurry of oil and sanding dust that fills the wood's pores to produce a smooth surface. It's not a good idea to wet-sand a project if it contains contrasting woods because the slurry from the dark wood will discolor the lighter wood.

When finishing open-pore woods such as oak, ash, and walnut, oil may bleed back, or ooze, out of the pores. If this ooze dries on the surface, shiny patches of polymerized oil will result. To avoid this problem, apply the oil early in the day and recheck the piece every 30 minutes to wipe away any ooze. The oozing should stop after four or five hours.

The good and bad about oil finishes

Oil finishes excel at bringing out the figure in a piece of wood, increasing the depth and natural beauty of the piece. But they offer minimal protection from food or water stains. Nor can you expect to get even a semigloss appearance. If you want a shiny, waterproof tabletop, use a different finish.

Easy repairability is the biggest advantage of an oil finish. If the piece is scratched sometime in the future, just sand out the ding and reapply another coat of oil. A periodic reapplication of the same oil keeps the piece looking new. □

Not all oil finishes are pure oil

Danish oils and other wipe-on oil varnishes often are lumped in with pure-oil finishes like tung oil and linseed oil because the application technique is the same and the appearance of the finished wood is similar. However, Danish oil is chemically quite different from pure oil: An additional processing step is taken by manufacturers to convert part of the raw oil to an alkyd varnish. Thus, wipe-on oils such as Minwax Antique Oil and Waterlox share the convenient application method of traditional oil finishes and have the added protection of varnish.

There are two ways to tell if a finish is pure oil or an oil/varnish mix. Check the can's label to see whether the contents include resins, mineral spirits, or hydrocarbons, none of which should be part of a pure-oil finish. Or, pour a little finish onto a nonporous surface such as glass or laminate. Because oil absorbs oxygen and expands as it dries, a pure-oil finish will dry severely wrinkled. Varnish will dry very smooth, while Danish oil, being a combination of the two, will be somewhat wrinkled when it dries.

PURE OIL WRINKLES

Pure-oil finishes will wrinkle on an impermeable surface because they absorb oxygen and expand as they dry.

OIL/VARNISH MIX DRIES SMOOTH

An oil-based varnish does not expand as it dries and therefore does not wrinkle.

DANISH OIL WRINKLES SLIGHTLY

Because Danish oil contains both oil and resin, the dry surface texture is a combination of pure oil's wrinkles and varnish's smoothness.