

Some Finishes for Woodturning

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CAVEAT. The following is what I have found and reflects what I think I've learned in using wood finishes over the last 50 some years. It is what has worked for me, and I have had success with. Other finishes may be as good or better in other hands, but I've tried to keep it simple for me, and this is the result (so far). I've tried to do my homework, but I offer no guarantee all is 100% correct.

Purposes. At the outset of any consideration of finishes for turned wooden items, it is appropriate to consider one's expectations about the use to which the item will be put. Broadly, turned wooden items are going to be employed in three different manners

- As a utility piece, designed to hold items, often food including wet items. As a consequence of this usage, frequent handling, and cleaning/washing can be anticipated. Food bowls, rolling pins, etc. fall into this category
- As a largely decorative piece that will be displayed and see limited handling.
- As a utility piece that will see extensive physical contact with human hands and the oils and dirt that may come with that. Examples being pens and to a bit less degree, bottle stoppers.

In each case, the usage needs to drive the choice of finishes, with regard to durability, repairability, maintenance, appearance, and safety.

1) **Food Safe Finishes.**

- a) All finishes are ultimately safe for contact with food ONCE the volatiles have volatilized, and once the finish has fully cured or polymerized. The period between application and "food safe" status, could be anywhere from nearly instantly to 6 months or more. It depends on the finish selected, how it is applied, and what the wood is.
- b) An overlooked consideration is that wood that is used for food service needs to be washed and cleaned after use. In general, any surface film class of finish, if scratched or otherwise penetrated can allow water to get beneath the finish and cause peeling or lifting.
- c) Broadly speaking, for items considered for use for food service should avoid surface film finishing and use an oil based finish, and in particular avoid hybrid finishes as described below.
- d) Specifically, three finishes mentioned here are considered food safe immediately upon application, Mahoney's Walnut Oil, Mahoney's Walnut Oil & Wax Blend, and Mineral Oil. All others have drying agents as a part of their composition and will become "food safe" only over an extended period of time.

2) **Sanding.** No finish can be satisfactory, unless you have first sanded appropriately. In general, all tool marks should be removed by the first grade of sanding. Generally that is going to be 80 grit, but sometimes 120 grit or 220 with softer woods and good tool control. REGARDLESS, sanding out all tool marks and significant sanding grit marks is ABSOLUTELY NECESSARY.

- a) For food service utility bowls, sanding to 220 grit is usually adequate. 320 if you want to push it, but more than that is unneeded.
- b) For art pieces, generally sand to 440 grit. If you are going for a high gloss, plastic/glass finish on dense woods, then 600 or 800 grit may be appropriate.

3) **Finishes can broadly be divided into three groups:**

- a) **Oil based penetrating finishes** ... most common are those with linseed or Tung oil as a base, and a little less common also walnut oil. In each case, oils penetrate into the wood at varying depths, depending on the cell structure of the wood, and ultimately with time they harden into a solid within the wood cells in a process called polymerization. Most (not all) oil finishes have chemical accelerators (heavy metal

driers, e.g. Japan Dryer) added that speed the process of polymerization, changing the time period from many months to weeks to few months.

- i) In a broad generalization, penetrating oil finishes
 - (1) slightly darken the ultimate appearance of the piece, and
 - (2) create more contrast or cause interesting grain patterns to stand out or “pop” as they are absorbed in varying amount within grain structures (summer v. winter growth rings, end grain v. side grain, curly, burls, etc.)
 - (3) Take more time to work with than surface films.
 - ii) Without the hybrid additive of a surface film they do little to provide a gloss or sheen to the surface.
- b) **Surface film finishes.** Varnishes, polyurethane, lacquer, shellac are examples. In common they all deposit a coating on the surface of the wood, bond onto it, harden and provide a protective shield.
- c) **Waxes.** In general all waxes provide a thin one cell deep slick finish that can be polished but they do not provide any significant long time protection. They neither penetrate as oil finishes do, nor do they harden into a permanent film.
- 4) **Hybrids.** Many commercial finishes available combine an oil with a surface film so you get a bit of both. Unfortunately for woodworkers there are no requirements to disclose what the contents are within any particular finish you can purchase. Examples: any of the Danish Oil Finishes, Waterlox, etc.
- 5) **“Wiping” finishes.** Generally these are the same that could otherwise be applied by other means, except they have been thinned with mineral spirits to allow application by a rag or paper towel. Examples are wiping poly, sanding sealer (lacquer thinned with mineral spirits).
- 6) **Friction finishes.** Generally these are finishes that are unique to use on lathes, wherein the heat that is generated by the friction between the turning wood and the applying cloth/paper towel rapidly heats the volatile components of the finish and causes it to very rapidly cure and harden.

Part II – Oil Finishes

Drying Oils. A **drying oil** is an oil that hardens to a tough, solid film after a period of exposure to air. The oil hardens through a chemical reaction in which the components crosslink (and hence, polymerize) by the action of oxygen (not through the evaporation of water or other solvents). Drying oils are a key component of oil paint and some varnishes. Some commonly used drying oils include linseed oil, Tung oil and walnut oil. Oils that penetrate into the wood, then polymerize within the wood to partially seal and make the wood harder.

CAUTION: *Since oxidation is the key to curing in these oils, rags, cloth, and paper saturated with drying oils may combust spontaneously (ignite) in a few hours as heat is released during the oxidation process. The simplest safety precaution to employ, is that rags used for applying drying oils should be taken out of doors or to an open area and spread out to dry rather than left in clumps in an area where they could cause fire.*

Linseed Oil. **Linseed oil**, is a colorless to yellowish oil obtained from the dried, ripened seeds of the flax plant. Linseed oil is a *drying oil*, meaning it can polymerize into a solid form. Due to its polymer-forming properties, linseed oil can be used on its own or blended with combinations of other oils, resins or solvents as an impregnator, drying oil finish or varnish in wood finishing.

Boiled Linseed Oil. Today, "boiled linseed oil" refers to a combination of raw linseed oil, and metallic dryers (catalysts to accelerate drying), Note that the dryers are toxic, unsuitable for contact with foods, until such time as the oil and drying agent have fully become a solid, i.e. polymerized.

Tung Oil. --a drying oil obtained by pressing the seed from the nut of the Tung tree. As a drying oil, Tung oil hardens (dries) upon exposure to air. The resulting coating is transparent and plastic-like; a property which is exploited in most of its applications such as wood finishing. The name is often used by paint and varnish manufacturers as a generic name for any wood finishing product that contains the real Tung oil and/or provides a finish that resembles that obtained with it.

Tung oil slowly cures to a satin "wetted wood" look with slight golden tint. It resists liquid water better than any other pure oil finish, though it still provides little protection against water vapor exchange or scratches. Tung oil does not darken noticeably with age.

It should be noted that many products labelled as "Tung oil finishes" are deceptively labelled: polymerized oils, wiping varnishes, and oil/varnish blends have all been known to be sold as Tung oil finishes (sometimes containing no Tung oil at all), and all the above contain solvents and/or chemical driers.

Walnut Oil. Like Linseed and Tung oil, walnut oil is a drying or polymerizing oil in wood. Food use walnut oil tends to be "cold-pressed" which retains flavor and desirable characteristics for use in cooking. While it will ultimately polymerize, it does so slower than heat treated walnut Oil. Mike Mahoney Walnut Oil is the predominant walnut oil for woodworking, and he heat treats the oil to make it oxidize faster. This combined with the high linoleic acid makes Mike's oil unique. It penetrates deeply into the wood and then hardens, leaving an excellent utility finish that will not evaporate like mineral oil finishes.

Mahoney offers also a walnut oil/wax blend that can be applied over the walnut oil to add a slight surface protectant to the wood. In Mikes' words: "*Mahoney's Oil Wax Finish is my own unique blend of pure walnut oil, beeswax, and carnauba wax. Use this when you need a little luster on your work. This fine paste wax is superior to mineral oil based waxes; the walnut oil penetrates the wood while the beeswax and carnauba blend to create a harder surface with more luster. All my finishes are high-quality, non-toxic, and food-safe products.*")

Mineral Oil. Because of its properties that prevent water absorption, combined with its lack of flavor and odor, food grade mineral oil is a popular preservative for wooden cutting boards, salad bowls and utensils. Rubbing a small amount of mineral oil into a wooden kitchen item periodically will prevent absorption of food odors and ease cleaning, as well as maintain the integrity of the wood, which is otherwise subjected to repeated wetting and drying in the course of use. The oil fills small surface cracks that may otherwise harbor bacteria. Mineral oil is not a polymerizing oil and never hardens within the wood, and can evaporate slowly over time.

"Danish Oil" finishes. These finishes gained recognition with the introduction of Danish Modern Furniture using mostly teakwood that became popular worldwide in the 40's, 50's and 60's.. The characteristic of a so called Danish Oil finish is a finish with a penetration of oil into the wood, with a soft satin surface finish when done. Left without buffing, it has a low luster. The most common of the "Danish Oil" finishes in the U.S. is Watco Danish Oil™, used by woodturners in the Natural variety (no stain). (*In general stains in wood turning rarely are successful as the most common side grain turned pieces have side grain exposed on half the piece and end grain on the other half, and any stain will be absorbed differently leaving a blotchy appearance.*)

Composition. Roughly speaking it appears that Watco Danish Oil and its similar cousins are a blend of

- Boiled Linseed Oil (50-60%)
- Mineral spirit thinner
- A chemical drying agent ("Japan Drier") (3-5%) that accelerates the polymerization of the oil
- A small amount (~10%) of polyurethane or other surface film finish.

Danish Oil Application.

On **work turned between centers**, a Danish Oil finish can be wiped on while the lathe is stopped or turning slowly, and then with the speed turned up, the drying process can be accelerated by the friction of the applying cloth. With a bit of time and pressure, the work can essentially be dried at least to the touch on the surface with application of the finish as a friction finish this way.

For **bowls or hollow vessels**, there is little purpose to apply the finish on the lathe. Generally you can't get enough friction heat to speed the drying process. Once completely sanded, the oil finish can be liberally applied with a brush, rag/paper towel or by hand. (*For maximum grain contrast, particularly on burls, or curly grain, submerging the bowl or vessel in the Danish Oil for a few minutes will increase the oil penetration, often deepening the color and darkening the piece while accenting the grain structure.*) With the wet oil finish applied turn the bowl or vessel upside down on a suitable surface, so that any excess oil runs off the edges, rather than collecting as a dark spot on the bottom. In all cases, then after half an hour or so, use a clean paper towel or cloth rag, and wipe all the excess finish off the item. Then let dry. I find that setting the item in strong sunlight that heats the bowl relatively moderately hastens the curing (polymerization) process.

It is worthwhile noting that in the case of Danish Oil finishes, there are two parts to "curing" of the finish. The first is the surface coating (poly, varnish, etc.) and the second is the oil that penetrated into the wood. The surface finish can be completely dried in a few hours to a few days depending on the finish. Exposing the item to sunlight and heat appears to hasten that. The oil *within the wood* will polymerize with time, but that is difficult to say how long that will take, and could well be several months, depending on the product used, the application method, and the species of wood.

A **downside** is that Danish Oils take time to polymerize and can bleed excess oil for some time after application. This is particularly true of burls where much end grain and small cracks and voids are exposed. Oil that bleeds out after, can be wiped with mineral spirits sometimes to remove the excess. Another technique with burls is after allowing the oiled piece to sit for a few hours, use compressed air to blow out any excess oil that has accumulated in the cracks, crevices and bark.

Virtually any of the oils will tend to yellow or darken the wood. For woods where this is not desirable, other surface film finishes may be more appropriate.

Generally, one generous coat of Watco is adequate. Once the surface is cured and dried, items finished with a Danish Oil can be polished and buffed to either a low luster or high gloss. What is being polished, is the surface film component of the blended finish. If a higher gloss finish is desired, I have been successful with applying a thin coat of wiping Poly on the top after allowing several days of drying.

Watco Danish Oil is stable when stored, even with partially opened cans. It can be stored for many months or years without polymerizing in the can.

Other companies manufacture similar "Danish Oil" finishes. Notably the ***Tried and True Danish Oil*** finish states that they use no metallic dryers, and no solvents in their finish, thus they are food safe. It appears that Tried and True uses the old method without metallic dryers, to speed polymerization. I have yet to use their finish on turned bowls so while I've heard good things, I have no experience of consequence to share.

WATERLOX™ finish -- A Tung Oil based finish, widely used by woodturners. Virtually all of the comments regarding the Danish Oil finish apply to Waterlox with a few exceptions:

- Waterlox categorizes itself a varnish based on Tung Oil. While it penetrates like a Danish Oil finish, it is thicker and provides a denser surface film
- Waterlox dries quicker on the surface
- It appears to polymerize faster within the wood

- Multiple coats may be desired
- A downside is that Waterlox doesn't store well. Once a can is opened and used, the oxygen that gets in causes the liquid to become first a skin and ultimately a solid in as little as a few weeks. This can be controlled in several ways, including purchasing multiple small bottles and decanting the larger Waterlox bottle into the smaller bottles that are full, purchasing an aerosol can of Bloxygen (pure Argon, an inert gas) that is used to replace the oxygen before resealing the can, or buying a bag of marbles, and dropping them into the Waterlox can to replace the liquid removed.
- *Note: David Ellsworth, arguably the most famous woodturner doing hollow vessels, uses Waterlox exclusively for the finish on his vessels, most selling for \$2,000 to 5,000.*

Part III -- Other Finishes

- **Lacquer**
- **Shellac**
- **Wiping Polyurethane**
- **Friction Polishes**
- **Cyanoacrylate ("CA") finishes.**
- **Plastic Finishes**
- **Waxes**