

Technology Profile

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Water-based Finishing for Cabinet & Millwork Shops

The technology for making water-based finishes has existed for more than half a century and is based on the same technology that is used in making common latex paint. Until recently, there has been little demand for water-based finishes because they were more expensive to produce than other finishes and were more difficult to use. However, with society's growing concern over air pollution and its desire for eco-friendly products, the demand for water-based finishes has increased. This article explains the advantages of water-based finishes over solvent-based finishes and is intended to demonstrate techniques for the cost-effective and problem-free use of water-based finishes.

What Is a Water-based Finish?

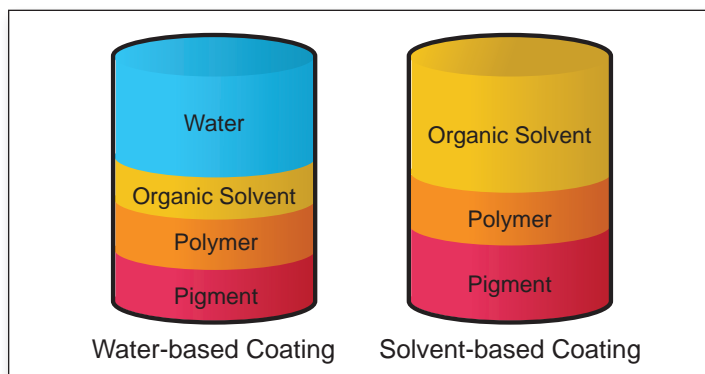
"Water-based" is a generic term that applies to finishes that use water as a primary thinning agent. What is commonly called a water-based or "water borne" finish is really a solvent-based finish made with resins that are dispersed in water. Calling the finish "water-based" distinguishes it from solvent-based finishes (e.g. lacquer, shellac, varnish, polyurethane) that do not use water as a primary thinning agent.

Composition of Water-based Finishes

Just like solvent-based finishes, water-based finishes are composed of resins, solvents, and additives.

The specific composition of a given water-based product determines its clarity, warmth and colour, as well as its grain raising and flow-out properties.

Acrylics and urethanes are the two primary resins used in water-based finishes. They both provide good clarity, gloss, and adhesion, and most of them are non-yellowing. These resins can cure either through a reactive or evaporative process. The reactive curing acrylics and urethanes are sometimes referred to as "self cross-linking" and use oxygen



to establish cross-links between molecules, yielding a tougher finish. Both types of resins possess many of the same scratch, mar, heat and solvent resistant properties as the solvent-based versions, and manufacturers blend the two resins to enhance certain characteristics. Some of the newer-generation resins used in water-based finishes are actually produced as acrylic-urethane molecules to further improve their clarity, adhesion and rub through properties.

Water-based finish technologies start with mono-component finishes then progress to two component catalyzed coatings and further progress to Ultra Violet (UV) cured materials that after flash off, dry instantly upon exposure to UV lighting.

Advantages of Water-based Finishes



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Typical water-based finishes have higher solids content which helps the finish build faster, thus requiring fewer coats. When applied to cabinets, water-based finishes are very resistant to scuffs and produce hard, tough finishes. Water-based finishes have exceptional clarity making them ideal for white or “pickling” finishes as they avoid the typical amber cast that often results when using solvent-based finishes.

Water-based finishes are non-flammable and contain fewer environmentally hazardous materials, resulting in a product that is safer to apply, much less harmful to the environment and more appealing to the consumer. As the finish is water-based, lighting and electrical fixtures in and around the finishing area do not have to be explosion proof.

Cleanup before the finish cures is easy using warm soapy water, while clean up after curing will require an aggressive solvent.

As there are fewer solvent fumes than from solvent-based finishes, final finishing and or touch up with water-based finishes can be done in the end users home or office without releasing volatile organic compounds (VOC's) into the environment.

Water-based Finishes	
Advantages	Disadvantages
Higher solid content, finishes build fast, requiring fewer coats.	Sensitive to temperature and humidity.
Non flammable	Grain raise (largely reduced with newer finishes)
Safer for user and the environment	Attention must be paid to spray equipment
Film is clear, durable and water resistant	Potential compatibility problems when used over solvent-based material.
Easier clean up	Restoring and refinishing over solvent-based presents adhesion problem.

Whether you are a one-man finishing shop or a large manufacturer, there are new water-based finishes that meet the most demanding finishing requirements.

The key ingredient in any finish is the resin, or “solid”, that dries to form the final film. The more solids the finish contains, the thicker the dry film will be.

Getting the Most out of Water-based Finishes

High humidity and cold temperatures are the two of the worst weather conditions to have when using water-based finishes. Under these conditions finishes can take longer to dry, which slows down production and allows more time for dust and other contaminants to settle on the wet finish.

The solution on a cold day is to ensure that the finishing room and the piece being finished are as warm as possible. Most importantly, make sure that the coating is warm so it will flow level and will dry better. It is advisable to use a thermometer to determine the temperature of the coating and a viscosity cup to measure how well the finish will flow. It is also good practice to keep warm, clean (dust free) air moving over the work pieces after they have been sprayed.

It can be difficult to control the humidity in the finishing area, so increased air flow is essential here as well. Keeping a large amount of fresh warm air circulating through the room should help lower drying times to levels that meet production schedules.

Grain raising is a major complaint of water-based finish users. The newer finishes have largely eliminated or at least reduced this issue to acceptable levels. Attention to the first sanding step will help eliminate grain raising. Staining the wood before finishing also helps, and staining dark wood (mahogany or walnut, for instance) before finishing can also help maintain a warm look to your finish.

To avoid the fluid passages of spray equipment being aggressively eroded from the effects of spraying any water-based material, stainless steel fluid passages are highly recommended.

Substrate Surface Preparation

Proper surface preparation depends on various factors primarily determined by the species of wood being finished. But no matter what finish or type of wood is used, all surface preparation begins with sanding.

Water-based coating materials will cause the wood fibers to swell and they will penetrate deeper into the pores. This will allow final white wood sanding to a finer grit. This in turn will help to minimize stain blotching.

If grain raise is an issue, try pre-wetting the wood prior to application of the first coat of sealer or use paste fillers when working with open-grained woods to create a surface that is like glass.

Water-based Stains

New technology has greatly increased the ease of using water-based stains and excellent finishing effects can be achieved. Water-based stains have a longer “open” time to allow for wiping or brushing the stain. While the effects achieved using a water-based stain can be very pleasing, they will not quite match the look of a solvent-based stain.

Water-based stains can be used under any finish. Stains can be applied with brushes, rags, sponges, or spray equipment, and the particular technique used is determined by the look one wants to achieve. Stains can affect the adhesion of the top coats so always check with your coatings supplier before applying the stain. Unless otherwise instructed by your coatings supplier, when applying the stain make sure to cover the wood surface consistently and let the stain dry thoroughly before applying the top coats.

Wipe or Spray Only?

As a general rule, wipe the stain if you want to accentuate the grain, spray the stain (no wipe) if you want the stain to colour evenly.

Wet Rags

Never throw any (solvent or water based) wet rags in a garbage can as they can spontaneously combust. Let them dry on a flat surface.

Sealers

The primary purpose of a sealer is to prepare the surface of the wood for future coats of finish. The sealer can promote adhesion, minimize grain raising, and prevent the migration of underlying substances. Sealers can also be used as barrier coats to seal-in surface impurities and prevent them from leaking out of the wood through the finish. They can also act as bonding agents between two materials that would not normally bond to each other.

Individual sealers are typically designed to work with their own topcoats. Sealers tend to be applied in thinner coats than top coats and one should never need to add a thinner to a clear (water-based) sealer. When sanding fully dried sealers, the raised grain should disappear effortlessly and the sealer should form a dry powdery substance. Be sure to wipe all sanding residue away before continuing with the next coat.

Water-based Top Coat Systems

Water-based clear coat and paint materials may have significantly different physical properties than solvent-based coating materials, for example many water-based coatings can be thicker and have a higher viscosity than solvent-based coatings. When these materials are agitated and sprayed, they become much less viscous, so there is no problem when spraying heavy water-based materials. They will perform differently than solvent-based materials at the same viscosity and this is what gives these products better build.

If the coating does need to be reduced to atomize effectively or flow evenly, the spray operator may need to add a small amount of water to the coating. Water is a much more effective “solvent” for reducing the viscosity of water-based coatings than a petroleum solvent is with solvent-based materials. A very small amount of water will cut the coating viscosity very quickly. As a general guideline adding no more than 2 percent of water by volume to the coating will be sufficient to reduce viscosity. When spraying in high ambient temperatures, one may need to add a flow enhancer to the material to achieve a nice smooth finish. Ask your coating supplier for recommendations on the type and quantity of additive for your coating material.

Some water-based finishes are cross-linked. Research has proven that a cross-linked system of coatings will generally provide a harder finish that may equal or exceed the performance of many solvent-based systems.

Although some water-based finishes do not sand easily and, as a result, are not good as sealing coats, most water-based finishes sand out so well that a special sealer is not required

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The purpose of this introduction to water-based coatings was to present alternative ways to improve the quality and durability of finishes while maximizing production schedules and minimizing environmental impact. While solvent-based finishes are not going to disappear any time soon, the use of water-based finishes as a viable alternative is gaining momentum. Few manufacturers and finishers will go back to solvent-based coatings once they have experienced the ease of use and the consumer-friendly attitude towards the “green technology” of water-based finishes.



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