

So You Want To Switch To Water-Based Finishes?

**By Erick Kasner, PhD
Hydrocote Company Inc.**

Though popularity of water-based finishes has increased significantly over the past few years due to tighter emission laws and more recently with using “green” finishes, you need to be aware of important facts before you make the switch.

Don’t misunderstand - I am proponent of water-based finishes - due to their VOC compliance, negligible fire risk and for health reasons. But facts are facts: water-based finishes are not suitable for everyone as it stands right now and will not be in the near future unless the government bans solvent-based finishes for wood coatings altogether, as it did for architectural coatings. All architectural paints for exterior application, such as the painting of bridges, etc., must be water-based.

Let me illustrate with the following true story. Three or four years ago, around August, I received a phone call from a long-time customer, a professional furniture refinisher based in New Jersey, and a long-time nitrocellulose lacquers user. He informed me that he tried our spray-on water-based lacquer and was sold on the product. Though I was thrilled for him and hated to burst his bubble, I had to lay some facts on him before it became very costly venture. I warned, “Take this slow and easy, because though our water-based lacquer may look nice to you right now, come winter months, this same finish will not look as good now because of your operating conditions. Your shop is cold in the winter, and, product performance and appeal will diminished by the fact that you refinish furniture.”

He ignored my suggestion and went full speed ahead with our water-based lacquer.

Sure enough, three months later, he called again. “You were absolutely right,” he said. “The finish looks lousy. I get orange peel and have to rub it out. I’m switching back to the old lacquer. But why can’t you guys make a water-based finish that is as easy to use as a solvent based?”

Here’s the reason for the lackluster advances in water-based lacquers:

Though clear water-based finishes for professional woodworkers have made significant progress since their inception back around 1985, marginal research and development has been expanded into it in the last ten years due to the government’s negligence in the matter. But California’s failure to ban solvent-based lacquer back in 2001 is also a significantly contributing factor. Back in the late 80’s through 1997, manufacturers of water-based finishes have spent a fortune in R & D, including yours truly, trying to formulate that perfect water-based finish that would mimic or equal solvent-based finishes, particularly fast-drying lacquers. In 1986, many of us testified before the South Coast Air Quality Management District (SCAQMD) in Los Angeles where Rule 1136

was passed, banning all wood finishes exceeding 2.3 lbs/gallon by January 1, 1997. Sixty major cities in the United States were to follow Rule 1136 within five years. That did not materialize, however, regardless of the reasons.

In January 1997, SCAQMD delayed Rule 1136 for six months, then 12 months, then another 12 months, and it is now on hold. The rest of the country followed, delaying enforcement as well. Between 1998 and 2004, water-based manufacturers witnessed sales decreasing as much as 75 percent, forcing many manufacturers and distributors to drop water-based wood coatings for professional woodworkers. As such, since about 1999, no one is investing any more funds into R & D towards water-based finishes until the federal government and states get serious about banning solvent-based wood finishes.

Amateurs don't mind

For the do-it-yourself market, there has been growth in product sales of water-based finishes. That is due to the fact that a DIY consumer is less discriminating than a professional woodworker in the way a finish should look. DIY customers are also more conscious of the health hazards of solvent-based finishes than your typical professional woodworker, to whom productivity is supreme.

Though a minority, professionals are having success with water-based finishes. In most cases, they are the owners of very small shops, spray the finish themselves, and sufficiently warm their shops during application and curing.

Professionals who have never used nitrocellulose lacquers have a better than 80 percent chance of successfully using water-based finishes, simply because they don't know what they're missing.

Nitrocellulose lacquers are perfect solutions, which means the coating is completely soluble in the vehicle (or the solvents). Water-based wood finishes are at best dispersions, but mostly emulsions. Though there are some water-based finishes supplied in a solution form (totally clear in wet state, as opposed to milky in color), these have abysmal water resistance; they are water soluble even after they cure.

In a dried nitrocellulose finish, the light passes through the finish - all the way to the wood grain or stain at 90-degree angle, or straight down. With a water-based finish, the light reflects at a 60-degree angle and doesn't reach the wood grain or stain. Fixing this difference is possible, but no formulator wants to make that investment while nitrocellulose lacquers are still in existence.

Getting technical

Though water-based finishes are no more difficult to use than solvent based lacquers, they are more demanding. They require warmth to flow and cure properly and, tend to raise the grain on certain species of wood, such as oak, walnut and mahogany. Below 60 degrees, they take much longer to dry than at 80 degrees, but equally important, their flow out characteristics diminishes with decreased temperatures as well. Why?

Because the surface tension (resistance to flow) increases as the temperature decreases. Furthermore, since these are evaporative finishes, below 60 degrees their vehicle (water) evaporates much slower from within, causing a hazy look to the finish. That is because top film of the finish skins over trapping the water within.

On the plus side, water-based finishes will not blush though high humidity does affect their speed of drying and cure. At 100 percent relative humidity, the ambient air is already fully saturated with moisture. Hence, there is no more room to further absorb evaporating water as the finish is trying to dry. Circulating air with fans can help speed up the evaporation.

A common complaint concerns applying a water-based finish over a slow drying oil-based stain. Those who try believe that allowing the stain to dry for at least 24 hours will alleviate any potential problems. The reverse, to a point is however, more true. You'll get better results by allowing the stain to dry for two (2) to twelve (12) hours. By letting such stain dry too long, the oil (for example, linseed oil) seeps from the grain to the surface, then remains there without ever evaporating. Since oil and water don't mix, clarity (haze or bluish plum) and adhesion suffer.

As you contemplate switching to water-based finishes from nitrocellulose lacquers keep the following in mind: The temperature of your shop must be above 65 degrees, before, during, and after application (cure); use spray guns with stainless steel internals; never leave finish in the spray gun overnight (keep your guns clean at all times after use); and use quick-drying solvent-based stains (oil free) or water-based stains.