

Battle of the BORATES

Powder-in-Water Solution Borates vs. Glycol-Based Borates

Protecting and preserving your wood is a serious matter. Without a preservative, your wood is susceptible to rot, insects and fungi. Both powder-in-water solutions like Tim-bor® and Board Defense®, and glycol-based borate products claim to be effective preservatives — but is there really a difference in their effectiveness? Consider the following data:

Actual Protection Levels

Product	Solution Strength	Depth of Penetration	Recommended Retention Level lbs./cu. ft. BAE*	Actual Levels lbs./cu. ft. BAE*
Powder-in-Water Solution	1 lb. Powder/1gal. water	Ave. 0.65"	0.20	0.251
Glycol-Based	1 lb. concentrate/ 1gal. water	Ave. 0.55"	0.20	0.251

These tests were done on dry lodgepole pine. They were allowed to dry for 60 days, then tested for penetration and concentration.

† Actual testing done by Timber Products Inspection Co. of Conyers, Georgia, in accordance with AWWPA Standard tests A#-89 and M2-89.

** Boric Acid Equivalent: the actual level of "protective power" found in the wood. (These levels were recommended by Dr. Terry L. Amburgey in a paper presented at the First International Conference on Diffusible Wood Preservatives.)*

The Difference:

Although they seem to offer similar protection, powder-in-water solution's depth of penetration of the powder-in-water solution is slightly higher. A more critical difference: the cost.

Powder-in-water solution is substantially lower in cost than glycol-based products. This means you can protect your wood for much less, and without the potential danger to pets that glycols present. (Glycol solutions are sweet and attract animals.)

In addition, glycols take much longer to dry, extending the amount of time one has

to wait between application and staining. And some contain polyethylene glycols, which often don't dry at all, causing stain and sealant problems. These issues are avoided with water-based borates.

Safety and Use:

Powder-in-water solution complies with VOC and VOS regulations across the nation. Glycol-based product solutions may not comply. You may not even be able to use glycol-based products in your state, depending on your individual state's regulations.

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Which Really is Better?

By Mark Noirot, Ph.D.
U. S. Borax

As borates become more widely used for remedial preservative spray treatments of log homes, many studies have tried to prove one borate solution is better than another. While some reported tests may have suggested this, a thorough and comprehensive study by U. S. Borax of two leading borate solutions, TIM-BOR® and BORA-CARE®, shows there is little or no difference in their depth of penetration into wood and, hence, their effectiveness. We found that both products penetrate and protect wood surfaces equally. Any reported variation in effectiveness shown in prior studies is most likely the result of inaccurate test methods previously used and not actual differences on the products themselves. To achieve real accuracy, differences in moisture and condition of the wood must be controlled as much as possible, as well as the application of the borate solution and drying conditions. Test results should be reproducible and should not have very large statistical variations. The only way to get reliable results is to conduct the test an extensive number of times and to control the test elements as much as possible. U. S. Borax's test has produced the most statistically reproducible and reliable results yet.

When conducting a test with wood, the one most uncontrollable factor is the wood itself. With differences in soil, climate and other conditions greatly affecting the makeup of any tree, even two pieces of wood from the same tree can be dramatically different. Any cracks, knots or other irregularities in the wood will let any solution seep into the wood more easily. Also, the level of moisture in the wood can help influence how deep the solvents and borate can penetrate. Because of these factors, great care must be taken in selecting wood for testing.

In our test, we used Southern Yellow Pine and Spruce-Pine Fir (S-P-F) boards. We had selected boards two inches thick and six inches wide with as few irregularities as possible. We cut the boards into 2' sections, labeled and paired the adjacent sections, then sealed the ends with silicone to avoid edge effects. Each piece's moisture content was measured three times, and then averaged. The yellow pine boards were 95 percent sapwood or greater and had typically eight to ten growth rings per radial inch.

Next, one board from each pair was sprayed with a Penetreat solution (which is a solution with 10.5 percent

content of disodium octaborate tetrahydrate [DOT]), then sprayed again 24 hours later. The other was sprayed with a diluted BORA-CARE solution (a solution with 20.1 percent DOT). We applied each according to their respective label instructions.

After treatment, all boards were stored in plastic containers with controlled humidity and relative temperatures. These conditions, though sometimes forcing the wood to dry more rapidly than normal, provided a constant, uniform condition for testing. By controlling both drying and wood surfaces, we worked to ensure our test was both accurate and readily reproduced.

After six weeks, we trimmed all the boards by 3" on each end and by 0.7" on the sides again, to avoid edges effects. Shavings from these boards were then dried and analyzed for their boron content. From these shavings, we concluded that borate molecules from each solution penetrated the wood at equal rates and in equal amounts. The borates in the wood are most likely identical in their makeup. While the glycol-based product starts off with larger borate molecules combined with glycol, these molecules must break down into the same ones used in the powder-in-water solution product before they can penetrate the wood. The glycol probably has little if any actual benefit in helping the borates get into the wood (see Fig. 1). In dry wood, these studies conclusively show that no borate can be expected to penetrate deeper than 1/2" or slightly deeper into the wood. Any claims that remedial borate treatments can penetrate to the core of a dried log are incorrect.

So what are the differences between the two preservatives? One product contains ethylene glycol and the other does not. While ethylene glycol does not improve the product's effectiveness, it is a regulated volatile organic compound (VOC) that can contaminate water sources if not properly applied and disposed of. It is also expensive, adding significantly to the price, but not adding effectiveness.

The tests conducted by U.S. Borax are arguably the most sensitive ones performed to date. The rate at which the powder-in-water and glycol-based borates penetrated the wood samples is the same, yet the powder-in-water product contains fewer VOCs and costs considerably less. The powder-in-water borates are the smart choice all around.

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