

WATER RESISTANCE *of epoxy coatings*

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Epoxy coatings are claimed to be the most water resistant protective coatings commonly available, and therefore most suited to sealing and preservation of wood in timber and timber composite boats. Perhaps confusing for general users is that they come in two forms, very thin solvent based coatings which are claimed to penetrate the timber to considerable depth, and rather more viscous solvent free or 'high solids' epoxies. The question is: how relatively effective are these two types of products?

To test this we have measured the rate of water loss through thin wall cardboard tubes coated with the relevant products. The tubes (40mm diameter, 0.75mm thick) were thoroughly coated internally, excess was drained out, and the bottom end was sealed. The epoxies were allowed to set and cure fully for five days before filling with water and covering to prevent evaporation from the top surface (see *photograph*). Any penetration of water through the coating would show as a loss of depth as the water would evaporate from the porous surface of the cardboard.

PRODUCTS TESTED WERE:

High Solids Epoxies

- Bote-Cote one coat
- Bote-Cote/TPRDA one coat plus Bote-Cote one coat (manufacturer's recommendation)
- West Epoxy one coat
- West Epoxy two coats (manufacturer's recommendation)

Solvent Based Epoxies

- Norseal two coats (manufacturer's recommendation).
- Everdure four coats (manufacturer's recommendation).

Loss of water depth was measured over time, and showed a surprisingly significant penetration of water through the solvent based epoxy. The test has been repeated using a single cardboard tube cut into two lengths, one for each product type, to ensure there was no difference arising from different cardboard tubes, and identical results have been obtained. There was a small rate of water penetration through the high solids epoxies which appeared to stabilise over a period of three to four weeks. No differences were evident between the different brands of high solids epoxies.

It is clear that solvent based epoxy fails to present anything like the same water resistance as the high solids types. A possible reason for this is



due to their high solvent/low epoxy resin formulations. According to their published MSDS's Everdure contains 63% solvent by volume (55% solvent by weight), while Norseal contains 60% solvent by volume (53.3% by weight). Therefore each coat will apply less than half the amount of resin delivered by the solvent free epoxies.

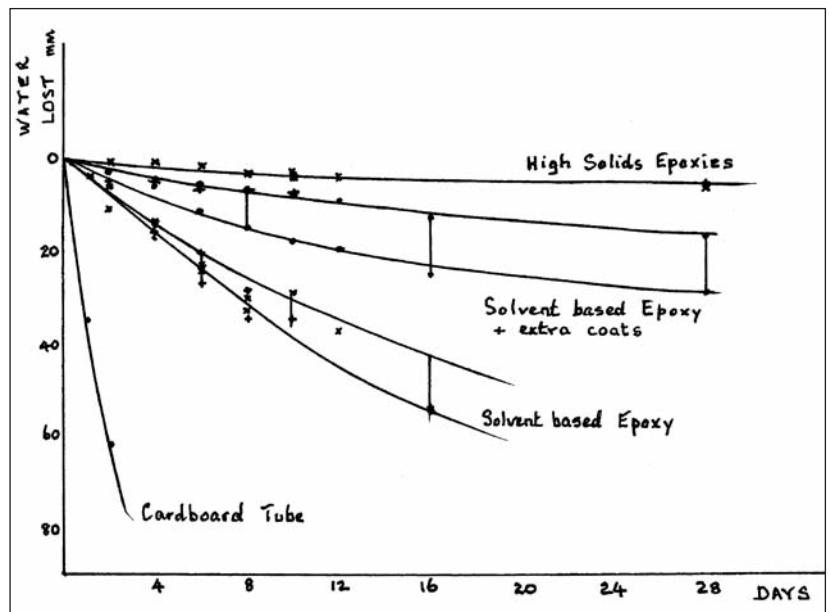
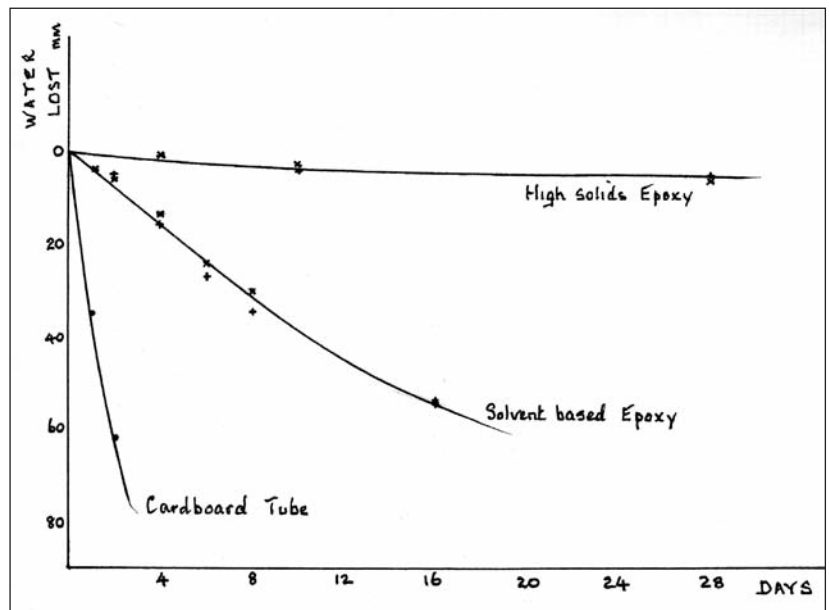
To test this theory, two additional coats were applied to the tubes after completion of the first tests, making four and six coats respectively. Both solvent based products now performed much better with the added coating thickness, but still not as well as the solvent free epoxies.

A further complication results from their penetration into the porous structure of the cardboard surface. (In some cases the liquid penetrated right through the cardboard). The solvents in the mixture become trapped in the pores and cannot evaporate away quickly enough before the epoxy cures. This then leaves a porous film which is more readily penetrated by water. The greater variability of the observations from different tests with solvent based epoxies is probably due to this uncontrollable factor.

Use of these solvent based epoxies for timber coating would display a similar problem, more exacerbated for light weight more porous timbers, while less critical for heavy dense timbers. A reasonable conclusion would be that

solvent based products should only be applied to non-porous surfaces, which is consistent with the widespread use of epoxy paints as very effective protective coatings for steel.

The practical value of solvent based penetration coatings for timber seems questionable. The common statement by users "you can see it being absorbed" should actually be "I can see more than 60% of my money going up in smoke", since the solvent will eventually evaporate away. Many more coats are required to deliver water resistance approaching the solvent free epoxies, with the residual porosity in the remaining coating layer still able to permit some water penetration, which all leads on to a very unsatisfactory end result.



Can solvents be used for thinning epoxy coatings? Yes, certainly, provided two precautions are observed:

1. only a very volatile solvent such as acetone is used, and
2. the thinned mix is only applied to an already sealed or non-porous surface.

Thinning epoxies is especially useful when laminating fibreglass or other fabrics, to accelerate absorption of the resin into the fibre bundles. These precautions are to ensure that all the solvent evaporates away quickly, and well before the epoxy starts to cure. Porosity is the death of any protective coating!