US Army Corps
of Engineers
Waterways Experiment
Station

Zebra Mussel Research Technical Notes

November 1992

Use of a Copper-Containing Epoxy Material to Protect a Bay Class Tug from Zebra Mussel Infestations

Background

In March 1992, the U.S. Army Engineer District, Detroit, in cooperation with the U.S. Army Engineer Waterways Experiment Station (WES) protected the hull of a bay class tug, the *Tawas Bay*, from zebra mussel infestations (Figure 1). The tug is 45 feet long, with a beam of 13 feet and a draft of 7 feet. It is used as vessel tender or in support of larger tugs for strike removal and repair operations in the Detroit and St. Clair Rivers, Michigan. In 1991 it was operated for 70 to 80 days.

Additional information

This technical note was written by Dr. Andrew C. Miller, WES, and Mr. Thomas Freitag, U.S. Army Engineer District, Detroit. Contact Mr. Freitag, (313) 226-6753, Mr. Sidney Cox, (313) 226-6840, or Dr. Andrew C. Miller, (601) 634-2141, for additional information. Dr. Ed Theriot, WES, (601) 634-2678, is Manager of the Zebra Mussel Research Program.

Figure 1. Applying the compound to the *Tawas Bay*

Prepared and published by the Zebra Mussel Research Program, U.S. Army Engineer Waterways Experiment Station, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199.

Material used

The *Tawas Bay* was coated with EPCO-TEK 2000™, which is produced by the Hi-Tek Chemical Corporation, Hempstead, New York. The material was applied by Quality Marine Finishers, Mobile, Alabama. The coating is made by mixing epoxy with copper powder, wetting agents, and other materials to produce abrasion resistance and flexibility (Figure 2). The resultant paint is sprayable, hard, smooth, scratch-resistant, and flexible and is barnacle and mollusc repelling, nontoxic, and acts as a water diffusion barrier. In addition to protecting the hull from zebra mussels, this coating will decrease friction in the water, increasing fuel efficiency.

How copper acts to repel zebra mussels

Zebra mussels attach to surfaces by secreting a complex polyphenolic protein. The manner in which copper functions to inhibit attachment of zebra mussels is not known. It is likely that when the polyphenolic protein comes in contact with copper, other compounds are formed that immature mussels find unsuitable. Zebra mussels have been shown to attach and grow to suitable surfaces immediately adjacent to copper coatings.

Application process

Before application, the tug was completely sandblasted below the waterline to remove old paint and other foreign material. The Hi-Tek Chemical Corporation recommends 12/20 grit media to produce a highly profiled surface. Immediately following sandblasting, the surface was cleaned to remove all dust. The antifoulant paint will ultimately accentuate marks or unevenness (unfairness) in the substrate because of its enamellike finish. The Hi-Tek Chemical Corporation recommends that all grooves and welds be faired with the unthinned product or any high quality fairing compound (except a polyester fairing compound). Immediately after the surface was cleaned, a primer was applied. This was a low-viscosity 100 percent epoxy undercoat. It was a woodlike preservative with high “wicking” characteristics. As soon as the primer became tacky, a single undercoat, a thick epoxy that gave an enamellike finish, was applied to a thickness of 0.0006 inch.

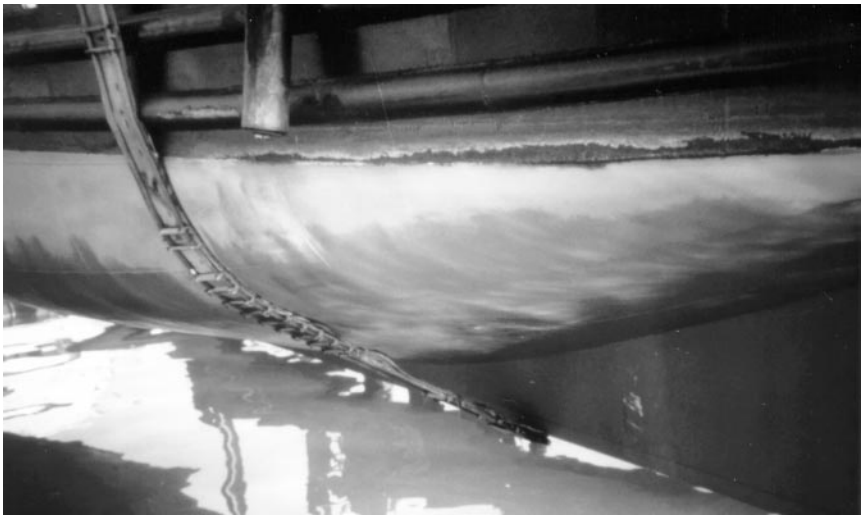

Figure 2. Close up of the copper containing epoxy material

The tug was then painted with five coats of the epoxy/copper coating. The first coat (0.001 to 0.002 inch) consisted of a thinner mixture (25 percent more than the usual amount of solvent was added). The second coat (0.005 to 0.007 inch thick) contained 15 percent additional solvent. Each new coat was applied within 30 minutes. The next coat was applied whenever the previous coat felt tacky. The final thickness was approximately 0.017 to 0.020 inch. The painter attempted to achieve a slightly higher thickness on the stern of the vessel. This would protect the vessel from abrasion caused by sediments stirred up by the propeller.

The pot life (in a tightly sealed container) is about 1 hour at 70 degrees Fahrenheit, the temperature at which the material should be applied. Thinning the material extends the pot life for several hours, and if refrigerated, the material will keep for several days. The Hi-Tek Chemical Corporation recommends that the paint gun nozzle be between 0.055 and 0.063 inch and the air pressure between 70 and 75 pounds per square inch. Although the paint is nontoxic, special precautions were used to handle the solvent, methylene chloride. The painters used respirators and were completely covered with a protective suit.

On the following day, the vessel was moved slightly so that the cradle marks could be painted. The paint was applied by troweling unthinned material. The same process would be used if the coating were damaged by operation of the vessel.

After the paint had cured for 24 hours, the paint was activated. This step is important since the material will not be completely anti-fouling without activation. This process removes the outer coating of epoxy from the copper in the finish. The *Tawas Bay* was activated by sand blasting with light media (40 grit). The surface was allowed to cure for a week at 70 degrees Fahrenheit, although it could have been put in the water immediately.

This paint should be reactivated by light scrubbing once a year to maintain its antifoulant properties. However, samples have been in test for over 6 years without reactivation and show no evidence of fouling. Reactivation can be accomplished while the vessel is in dry-dock. Alternatively, the surface of a small vessel could be activated while in the water by one or more divers using a stiff brush. The waterline will be fouled with a chelating algae that will complex the copper and allow barnacles and molluscs to grow. The waterline should be cleaned periodically, usually every 4 to 6 weeks, to prevent fouling.