US Army Corps
of Engineers
Waterways Experiment
Station

Zebra Mussel Research Technical Notes

Copper-Based Marine Antifoulants

Purpose This technical note discusses the use of copper containing marine antifoulants as deterrents to zebra mussel attachment and subsequent macrofouling at public facilities.

Additional information Contact the author, Mr. Tim Race, U.S. Army Construction Engineering Research Laboratory, (217) 373-6769, or Dr. Andrew C. Miller, U.S. Army Engineer Waterways Experiment Station (WES), (601) 634-2141, for additional information. Dr. Ed A. Theriot, WES, (601) 634-2678, is Manager of the Zebra Mussel Research Program.

Definition An antifouling coating is a paint or other coating used to prevent the growth of barnacles and other organisms on the hulls of ships. In addition to ship hulls, antifouling coatings can be used on any stationary structure. These materials typically contain a substance which is toxic to the developing organisms.

Description Marine fouling is a long-standing problem for vessels that spend part or all of their time in salt water. Attachment of fouling organisms will slow ship speed considerably and result in higher fuel consumption. The earliest methods of repelling marine organisms consisted of attaching plates of zinc, copper, or lead to wooden ship hulls. Today's antifouling coatings incorporate copper or copper salts into a paint coating. Cuprous oxide is recognized as the best broad-spectrum antifouling biocide available in the United States. Other products using tin, mercury, and arsenic biocide compounds are not environmentally sound. Tests conducted on cuprous oxide antifoulants have shown resistance to zebra mussel attachment over a 1- to 2-year period.

Four basic categories include the majority of marine antifoulants. Soluble antifoulants incorporate cuprous oxide into a water-soluble matrix. Release of the toxin into the water occurs at a controlled rate which is dependent on the ratio of soluble to insoluble binder. Antifouling properties are lost when the coating is exhausted, typically after about 1 year. Other antifoulants rely on the diffusion or leaching of the cuprous oxide biocide from the coating. These materials form an oxide layer which must be mechanically cleaned every 1 to 2 years to reactivate the coating. Similar to the leaching antifoulants are the new free association antifoulants which use metallic copper dust as a freely mixed component of the coating. These coatings must also be reactivated at least every other year in order to restore their antifouling properties. Ablative or self-polishing coatings rely on the constant flow of water to erode or polish the coating surface. In theory, a biocide is not necessary to prevent marine fouling; however, in practice cuprous oxide is included to ensure that vessels are protected during

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

periods of inactivity. Like the ablative-type coatings, these products are sacrificial and will typically last 1 to 3 years depending on coating thickness and water velocities.

A fifth category, which does not incorporate a toxic component, is the abhesive or foul-release type coatings. These products are the subject of a separate technical note.

Marine antifoulants are applied directly over the top of anticorrosive marine coating systems and, as such, are designed to be compatible with these materials. Antifoulants are not designed to protect vessels from corrosion.

Recommendations

The use of copper and copper salt containing antifoulants is recommended on a trial basis for control of zebra mussels on steel and concrete components that are critical to facilities operations and are susceptible to infestation. Concrete surfaces to be painted should be prepared by pressure water cleaning, followed by sweep blasting with a suitable abrasive. Steel surfaces should be prepared in accordance with SSPC SP-5, White Metal Blast Cleaning. Application of antifoulants directly to steel is not recommended. Suitable compatible primers and intermediate coats must be used to protect the steel from corrosion. Some antifoulants may be compatible with concrete surfaces. In some instances compatible primers will be necessary to ensure adhesion of the antifoulant to the surface.

As part of the Zebra Mussel Research Program, test panels coated with several different commercially available marine antifoulants will be evaluated in field tests from May through October 1992. Further information on the effectiveness of these paints at repelling zebra mussels will be available at the conclusion of this study.

Reference

McMahon, R. F. 1990. "The Zebra Mussel: U.S. Utility Implications," Electric Power Research Institute Report GS-6995.

March 1992