

The Regulation and Environmental Effects of Biocides – A Look at the Tributyltin Disaster

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ABSTRACT

The biocide industry is highly diverse; however, immense amounts of research have been performed on biocides used in antifouling paints. The study of antifouling paints developed from the need to control excessive growth of barnacles and tubeworms on the hulls of boats. Implementation of biocides, specifically organotin compounds like Tributyltin, into antifouling paints has resulted in substantial energy savings. Alternatively, residual concentrations of biocides in the marine environment have led to toxic and mutative effects for shellfish and other water organisms. With an understanding of their environmental harm, further studies have shown that sorption and volatile effects reduce the residual biocide contamination in the marine environment. Facing heavy regulation, the trend in the biocide industry is towards more careful consideration of the environment and to finding a replacement for Tributyltin.

KEYWORDS

Biocide, organotin, Tributyltin, TBT, copper

INTRODUCTION

Biocide is a general term describing a family of microorganism controlling products including: disinfectants, preservatives, fungicides, pesticides, and slimicides. A great deal of research and money is used to develop such products because the industry is moving towards a heavily regulated future. This regulation is necessary because, although the products provide a specified control mechanism, controlling the application and preventing residual traces of the biocides in the environment is almost an impossible task. Even a small trace in the environment can lead to an increase in toxicity and mutative effects for non-targeted animal populations including aquatic and human. Tributyltin or TBT, an organotin used extensively in antifouling paints for ship hulls and home interiors, for example, is one of the most harmful and prevalent pollutants ever introduced into the environment. My discussion of biocides is focused on research literature on antifouling paints with TBT, specifically its characteristic effects and alternatives, as well as brief discussions of biofilm control in chemical processes, and uses in the paper industry.

This topic is of interest to the study of environmental microbiology because microorganisms are the target of biocides. Unlike in water treatment where the growth of microorganisms is encouraged and aides in the final goal, microorganisms can have damaging effects to a broad spectrum of industries and equipment if left uncontrolled. The application of a biocide has been the control element against such attacks. The topic of organotins or TBT, specifically, has been heavily researched on American and international coasts and waterways. It is a subject I had little knowledge of prior to beginning my research, but have found to be both interesting and shocking. The subject holds relevance to my pursuit of a degree in chemical engineering, with specific links to the material in my environmental chemodynamics class.

USES OF BIOCIDES

There exists a system to condense and regulate what seems like the infinitely large industry of biocides. Biocides are first grouped into one of four categories and then