Fate of the new antifouling compound in aquatic environment.

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Summary

New antifouling compounds are intended as replacement for the highly toxic antifouling agent tributyltin, which has been regulated internationally. Irgarol 1051 (2-methylthio-4-*tert*-butylamino-6-cyclopropylamino-s-triazine), one of the new antifoulants, has emerged as a new aquatic contaminant in Europe, Australia, and Japan with the recent fall in ambient concentrations of organotins. We reported that the compound degraded via three different pathways including biodegradation by white rot fungi, mercuric chloride-catalyzed hydrolysis, and sunlight degradation, and that the degradation product M1 (2-methylthio-4-*tert*-butylamino-6-amino-*s*-triazine) was the major product in each degradation pathway. Both Irgarol and M1 were frequently found in fishery harbours as well as in marinas in the Seto Inland Sea, suggesting that ship bottom paint is a possible source of contamination. Photodegradation experiments using UV-A lamp showed that Irgarol degraded in the presence of some photosensitizing agents such as benzophenone, natural humic substances, and hydrogen peroxide. M1 itself also degraded in the presence of benzophenone and hydrogen peroxide but not in the natural humic substances. M1, simultaneously produced from Irgarol in the presence of photosensitizer, could be more stable than the parent compound and it probably accumulates in the sediments. Natural humic substances in water are the ubiquitous components which affect the fate of Irgarol released from ship bottom paints. To assess the ecotoxicity of five antifouling compounds, a new microbiotest using suspension cultured-fish cells CHSE-sp has been developed. The 24-hour EC50 values to the fish cells were highly correlated with the 28-day LC50 values to juvenile rainbow trout. The short-term test using CHSE-sp cells can be used for toxicity screening of chemicals. One group (Zinc pyrithione and Copper pyrithione) was quite toxic to the fish species and the other group (Irgarol and Diuron) showed weak toxicity. The toxicity of KH101 (triphenylborane pyridine) was middle between the two groups. Thus, the microbiotest could be used for the fate study of antifouling chemicals because the concentrations of some compounds can not be determined by chemical analysis.