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Effects of antifouling biocides on coral reefs

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Tributyltin (TBT) compound is a possible most toxic chemical intentionally introduced in the marine ecosystems. TBT was mainly introduced in the aquatic environment as a key ingredient in antifouling paints. A prohibition of the use of organotin compounds as active ingredient in anti-fouling systems in ships by the IMO will be effective in 2008. Paint manufactures developed new compounds known as booster biocides (such as diuron and Irgarol -1051) to replace TBT. Numerous studies have reported the occurrence of antifouling compounds such as TBT, diuron and Irgarol1051 in marine environments. However, very little is known on the adverse effects antifouling compounds in corals. The main focus of this research is to determine the effects of TBT, diuron and Irgarol 1051 on inorganic carbon production (calcification) and organic carbon production (photosynthesis) of coral reefs. The results show that the photosynthesis rate and calcification rate were significantly reduced by 78% and 72% relative to the control when corals were exposed to 5000 ng/L TBT, respectively. No significant effects were observed when corals were exposed to 1000 ng/L TBT.

The Photosynthesis rate of the coral was significantly reduced by 6.5% and 75.7% and 18% and 121% relative to control when the coral exposed to 1000 and 10,000 ng/L of diuron and Irgarol 1051, respectively. The calcification rate dropped to 32.7% and 98.3% relative to control when the corals were exposed to 10,000 ng/L of diuron and Irgarol 1051, respectively. The nominal sensitive concentration of TBT, Irgarol and diuron that causes the alteration of carbon metabolisms of coral are much higher than those currently reported in the coral reef waters. This study reveals that the coral reefs and adjacent aquatic ecosystems around the Ryukyu Archipelago are widely contaminated with antifouling chemicals as a fingerprint of the effects of anthropogenic activities in the coral reefs. While the levels detected in this region do not pose a threat to the carbon metabolisms of corals over a short term exposure, the consequences that might be caused by chronic exposure of the environmental relevance concentrations of these chemicals in coral reef ecosystems remains uncertain.

Keywords: Coral reefs - carbon production - stress - antifouling compounds