

Assessing the Release of Copper from Nanocopper-Treated and Conventional Copper-Treated Lumber into Marine Waters I: Concentration and Rates

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ABSTRACT

Little is known about the release of metal engineered nanomaterials (ENMs) from consumer goods, including lumber treated with micronized copper. Micronized copper is a recent form of antifouling wood preservative containing nanosized copper particles for use in pressure-treated lumber. The present study investigated the concentrations released and the release rate of total copper over the course of 133 d under freshwater, estuarine, and marine salinity conditions (0, 1, 10, and 30‰) for several commercially available pressure-treated lumbers: micronized copper azole (MCA) at 0.96 and 2.4 kg/m³, alkaline copper quaternary (ACQ) at 0.30 and 9.6 kg/m³, and chromated copper arsenate (CCA) at 40 kg/m³. Lumber was tested as blocks and as sawdust. Overall, copper was released from all treated lumber samples. Under leaching conditions, total release ranged from 2 to 55% of the measured copper originally in the lumber, with release rate constants from the blocks of 0.03 to 2.71 (units per day). Generally, measured release and modeled equilibrium concentrations were significantly higher in the estuarine conditions compared with freshwater or marine salinities, whereas rate constants showed very limited differences between salinities. Furthermore, organic carbon was released during the leaching and demonstrated a significant relationship with released copper concentrations as a function of salinity. The results indicate that copper is released into estuarine/marine waters from multiple wood treatments including lumber amended with nanoparticle-sized copper.

Full Text

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