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# Title: X-ray fluorescence mapping of copper in wood treated with a copper-based preservative and exposed to the copper-tolerant fungus *Fibroporia radiculosa*

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Synchrotron-based X-ray fluorescence microscopy (XFM) was used to map copper distribution in southern pine sapwood that was treated by vacuum pressure with micronized copper quat preservative (0.34 pcf) and then exposed to the copper-tolerant brown rot fungus *Fibroporia radiculosa* in an E22 soil block test. The objective was to produce the elemental maps at different time points during decay and to correlate the fungus-controlled spatial redistribution of copper in the wood with wood compression strength loss, a sensitive measure of incipient decay. Results showed that the treated wood initially exhibited a mostly uniform distribution of copper through the thickness of the wood wafer with highest concentrations in earlywood than latewood. After fungus exposure of 25 days (no strength loss), the uniform distribution of copper was punctuated with a few patches of very high levels of copper in the earlywood at the earlywood/latewood boundaries and along the cross-cut faces of the wood wafer. At 70 days (slight strength loss), the uniform distribution was replaced with many random patches of high, low, and very low levels of copper concentration within the thickness of the wafer. Areas of high copper concentration were also evident along both cross-cut edges of the wafer. At 154 days (high strength loss), large areas within the thickness of the wafer and on the top surface of the wafer (i.e. the cross-cut face that was not in contact with the inoculating fungus on the wood feeder strip) showed no or minimal levels of copper concentration. The highest levels of copper were found along or near the bottom face of the wood that was in contact with the feeder strip. The edges of this face were also irregular due to conspicuous mass loss that occurs during advanced stages of decay. These results suggest that the while the fungus was actively mobilizing the copper, it was initiating decay in the regions with little to no copper, eventually transporting the copper to “dumping grounds”, which were areas that had been decayed the most and depleted of nutrients useful to the fungus.