

Analyses of Copper Nanoparticles Impregnated Wood and Its Fungal Degradation Performance

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Abstract : Most wood species used in construction deteriorate when exposed to environmental conditions that favor wood-degrading organisms' growth. Therefore, chemical protection by impregnation allows more efficient use of forest resources extending the wood useful life. A wood protection treatment which has attracted considerable interest in the scientific community during the last decade is wood impregnation with nano compounds. Radiata pine is the main wood species used in the Chilean construction industry, with total availability of 8 million m³ sawn timber. According to the requirements of the American Wood Protection Association (AWPA) and the Chilean Standards (NCh) radiata pine timber used in construction must be protected due to its low natural durability. In this work, the impregnation with copper nanoparticles (CuNP) was studied in terms of penetration and its protective effect against wood rot fungi. Two concentrations: 1 and 3 g/L of NPCu were applied by impregnation on radiata pine sapwood. Test penetration under AWPA A3-91 standard was carried out, and wood decay tests were performed according to EN 113, with slight modifications. The results of penetration for 1 g/L CuNP showed an irregular total penetration, and the samples impregnated with 3 g/L showed a total penetration with uniform concentration (blue color in all cross sections). The impregnation wood mass losses due to fungal exposure were significantly reduced, regardless of the concentration of the solution or the fungus. In impregnated wood samples, exposure to *G. trabeum* resulted ML values of 2.70% and 1.19% for 1 g/L and 3 g/L CuNP, respectively, and exposure to *P. placenta* resulted in 4.02% and 0.70%-ML values for 1 g/L and 3 g/L CuNP, respectively. In this study, the penetration analysis confirmed a uniform distribution inside the wood, and both concentrations were effective against the tested fungi, giving mass loss values lower than 5%. Therefore, future research in wood preservatives should focus on new nanomaterials that are more efficient and environmentally friendly. Acknowledgments: CONICYT FONDEF IDeA I+D 2019, grant number ID19I10122.

Keywords : copper nanoparticles, fungal degradation, radiata pine wood, wood preservation

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