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Bioincision of Gmelina Arborea Roxb. Heartwood with Inonotus Dryophilus (Berk.) Murr. for Improved Chemical Uptake and Penetration

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Abstract : Treatment of wood with chemicals in order to prolong its service life may prove difficult in some refractory wood species. This impermeability in wood is usually due to biochemical changes which occur during heartwood formation. Bioincision, which is a short-term, controlled microbial decomposition of wood, is one of the promising approaches capable of improving the amenability of refractory wood to chemical treatments. Gmelina Arborea, a mainstay timber species in Nigeria, has impermeable heartwood due to the excessive tyloses which occlude its vessels. Therefore, the chemical uptake and penetration in Gmelina arborea heartwood bioincised with Inonotus dryophilus fungus was investigated. Five mature Gmelina Arborea trees were harvested at the Departmental plantation in Ajibode, Ibadan, Nigeria and a bolt of 300 cm was obtained from the basal portion of each tree. The heartwood portion of the bolts was extracted and converted into dimensions 20 mm x 20 mm x 60 mm and subsequently conditioned (200C at 65% Relative Humidity). Twenty wood samples each were bioincised with the white-rot fungus Inonotus dryophilus (ID, 999) for 3, 5, 7 and 9 weeks using standard procedure, while a set of sterile control samples were prepared. Ten of each bioincised and control sample were pressure-treated with 5% tanalith preservative, while the other ten of each bioincised and control samples were pressure-treated with a liquid dye for easy traceability of the chemical in the wood, both using a full cell treatment process. The bioincised and control samples were evaluated for their Weight Loss before chemical treatment (WL, %), Preservative Absorption (PA, Kg/m3), Preservative Retention (PR, Kg/m3), Axial Absorption (AA, Kg/m3), Lateral Absorption (LA, Kg/m3), Axial Penetration Depth (APD, mm), Radial Penetration Depth (RPD, mm), and Tangential Penetration Depth (TPD, mm). The data obtained were analyzed using ANOVA at α0.05. Results show that the weight loss was least in the samples bioincised for three weeks (0.09%) and highest after 7 weeks of bioincision (0.48%). The samples bioincised for 3 weeks had the least PA (106.72 Kg/m3) and PR (5.87 Kg/m3), while the highest PA (134.9 Kg/m3) and PR were observed after 7 weeks of bioincision (7.42 Kg/m3). The AA ranged from 27.28 Kg/m3 (3 weeks) to 67.05 Kg/m3 (5 weeks), while the LA was least after 5 weeks of incubation (28.1 Kg/m3) and highest after 9 weeks (71.74 Kg/m3). Significantly lower APD was observed in control samples (6.97 mm) than in the samples bioincised after 9weeks (19.22 mm). The RPD increased from 0.08 mm (control samples) to 3.48 mm (5 weeks), while TPD ranged from 0.38 mm (control samples) to 0.63 mm (9 weeks), implying that liquid flow in the wood was predominantly through the axial pathway. Bioincising G. arborea heartwood with I. dryophilus fungus for 9 weeks is capable of enhancing chemical uptake and deeper penetration of chemicals in the wood through the degradation of the occluding vessel tyloses, which is accompanied by a minimal degradation of the polymeric wood constituents.

Keywords : Bioincision, chemical uptake, penetration depth, refractory wood, tyloses
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