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Treatability of Tropical Wood Using Newly Synthesized Organotin(IV) Complexes

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Abstract: The treatability of three tropical wood species namely *Alstonia scholaris* (pulai), *Macaranga triloba* (mahang) and *Hevea brasiliensis* (rubberwood) was investigated. Wood species were chemically treated with five newly synthesized organotin(IV) complexes using full-cell treatment method. This study explored whether tropical wood species could be treated successfully with newly synthesized organotin(IV) complexes as wood preservatives. Ten 19×19×19 mm sized wood cubes of each species were treated with three levels of concentration (0.1, 0.5 and 1%) of monomethyltin(IV) (MMT) and monophenyltin(IV) (MPT) of monoseries and dimethyltin(IV) (DMT), diphenyltin(IV) (DPT) and dibutyltin (IV) (DBT) of diseries organotin(IV) complexes with 2-acetylpyridine-*N* (4)-cyclohexyl thiosemicarbazone ligand. The treated wood species were evaluated by chemical retention values and characterized by FT-IR (Fourier Transform Infrared) spectroscopy analysis. The highest retention (10.59 kg m^{-3}) was found in *Alstonia scholaris* treated with 1% DMT complexes and the lowest retention (0.47 kg m^{-3}) was found in *Hevea brasiliensis* treated with 0.1% DMT complexes. FT-IR spectra of treated wood showed new absorption bands in the range of 594-606 and 441-457 cm^{-1} due to Sn-C and Sn-N bonds, respectively. A newly formed absorption band at range 549-569 cm^{-1} due to Sn-O bond was also observed in the treated wood sample spectra. Chemical retention and FTIR spectra suggest tropical wood species are treatable with newly synthesized organotin(IV) complexes as wood preservatives.

Key words: Treatability, tropical wood, retention, FTIR, organotin(IV)

INTRODUCTION

Wood is one of the most attractive materials because of its complex structure and wide range of application in the world. Some wood species are naturally more durable which is preferred building and construction materials due to its physical, mechanical and aesthetically pleasing performance. Most of tropical wood species are non durable or less durable which limits its indoor and outdoor applications. Huge non durable tropical wood species are abundantly available in Southeast Asia (Chao and Lee, 2003; Brelid *et al*., 2000; Yalinkilic *et al*., 1999; Deka *et al*., 2002). The consumption of wood has been rapidly increasing year by year due to population increase. In contrast, however, the production of wood has been drastically decreasing. Quality forest resources are becoming scarce that can't meet the need of people resulted an imbalance between demand and supply of forest product (Tolunay *et al*., 2008). This has driven researchers to look for alternative low-quality resources for value-added applications. One way is to apply suitable wood preservatives needed to improve low-quality resources in order to meet end-use requirements (Wang *et al*., 2007; Zhang *et al*., 2006). Majority of commercial timbers worldwide need to be treated before they can be utilized for various purposes (Sotannde *et al*., 2011). Izreen *et al*. (2011) showed that low quality hardwood timbers can be converted to value added wood products through chemical impregnation which make them resistant to fungal decay.

Most conventional preservatives cause environmental pollution and a few of them are hazardous to animals and human beings (Onuorah, 2000). The toxicity of the conventional wood preservative Chromate Copper Arsenate (CCA) is higher prior to impregnation. Thus, CCA presents a high risk for workers exposed to liquid solutions (Eaton and Hale, 1993). Environmental and health concerns with the use of CCA, including possible arsenic exposure to humans have resulted in its use being significantly restricted or limited (Pohleven *et al*., 2002). For instance, copper in water has detrimental effect on various fish tissues (Balambigai and Aruna, 2011). Suruchi and Khanna (2011) stressed that metals including cadmium, copper, lead, chromium and mercury may be adsorbed into vegetables tissues that pose danger to human health if regular monitoring is not done. Lead is toxic to fish like *Labeo rohita* even at low concentration thus pose a

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