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Dynamic Young's Modulus and Dimensional Stability of Batai Tropical Wood Impregnated with Polyvinyl Alcohol

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Abstract

Batai tropical wood (*paraserianthes moluccana)* was impregnated with three levels of poly vinyl alcohol (PVA) solutions (25%, 50% and 75%) and the dynamic Young's modulus, water absorption and dimensional stability of the manufactured wood polymer composites (WPC) were assessed. The modified wood polymer composites (WPC) were characterized by microstructural analysis (Fourier transform infrared spectroscopy and scanning electron microscopy) and free-free vibration testing. The dynamic Young's modulus (E_d) was calculated using the free-free flexural vibration method. Fourier transform infrared spectroscopy indicated the absorption bands of raw wood to be 1627 cm^{-1} due to carbonyl stretching and WPC show increased absorption band near 1733 cm^{-1}. WPC of 75% PVA solution exhibited improved dimensional stability and lower water absorption. The manufactured WPC yielded a higher Young's modulus compared with the raw one.

Keywords: Wood polymer composite; Tropical wood; Non-destructive testing.

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1. Introduction

Wood is a three-dimensional polymeric material, made up mainly of cellulose, hemicellulose and lignin. These three polymers constitute the cell wall and are responsible for the physical and chemical properties exhibited by the wood. All of these polymers have accessible hydroxyl groups. Wood attracts moisture through hydrogen bonding, making it dimensionally unstable. The dimensional stability and mechanical properties of wood can be improved by using impregnation techniques with suitable chemicals that can react with cell wall components [1].

The physical and mechanical properties of wood may also be improved by preparing composites with different monomers. The polymer component of the wood polymer composite (WPC) simply fills up the capillaries, vessels and other void spaces within the wood structure. WPC may be one of the most dynamic sectors of today's plastic industry.

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