UNIVERSITI TEKNOLOGI MARA

PHYSICAL AND MECHANICAL PROPERTIES OF THERMOPLASTIC COMPOSITE FROM *GLIRICIDIA SEPIUM*

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ABSTRACT

The study was conducted to determine the fiber morphology, density and the chemical properties of *Gliricidia sepium* concerning tree age. Thermoplastic composite boards of four variables: three tree ages (1, 2 and 6 years old tree) , four wood particles sizes (75μ, 125μ, 250μ and unscreen), three filler loadings (10, 30 and 50%), maleic anhydride grafted polypropylene (MAPP) additions unMAPP and 3% MAPP was manufactured and tested for tensile, impact, dimensional stability, bending properties conforming to the BS and ASTM standards. Scanning Electron Microscopy (SEM) of tensile test samples was performed to determine the bonding sites as evidence of bonding.

In fiber morphology, the fibers were short (approximately 0.9mm) while the fiber wall thickness remained the same for all age groups. The fiber diameter and lumen width was the highest with older tree. The specific gravity and chemical properties increase with age. Most of the properties studied increased with age except for fiber wall thickness that was approximately the same. Gliricidia-filled thermoplastic composite board properties varied significantly with tree age, particle size, filler loading and MAPP addition. An increase in particle size resulted in the decrease mechanical properties and water absorption (WA). Smaller particles were found to be more homogenous with the thermoplastic matrix giving better mechanical properties. The WA and mechanical properties of the thermoplastic composite were significantly affected by increasing the amount of filler loadings. Without MAPP as the coupling agent, the wood particles behaved as standard fillers. The addition of MAPP was found to improve the filler dispersion leading to better mechanical strength. SEM images gave clear indications of interactions in the matrix between MAPP (3%) and unMAPP (0%) thermoplastic boards. The specific objective of this study was to determine the physical and mechanical properties of the thermoplastics composites from *Gliricidia sepium* in relation to tree age, wood particles size, filler loading and maleic anhydride grafted polypropylene (MAPP) addition.

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CHAPTER 1

INTRODUCTION

Wood plastic composites (WPC) are one of the latest developments of wood composites, and they are referred to as composites that contain wood in any form in the present of thermosets or thermoplastics (Clemons, 2002). Thermoset plastics (examples epoxies and phenolics) when cured cannot be melted again, whereas thermoplastic (examples polyethylene and polypropylene) are plastics that can be repeatedly melted. This makes thermoplastics recyclable, hence when wood and thermoplastic are made into composites the resulted product is recyclable and environmentally friendly. This is ideal as the world or consumer focus is now keen on an environmentally friendly product. WPC is currently used in a wide range of applications such as building and construction, automotive, garden and outdoor products, industrial and infrastructure and other low volume niche applications.

The aims of introducing WPC are to reduce the cost of plastic by adding or increasing the amount filler loadings without reducing the properties of plastic product. This addition not only enhances the properties (example stiffness) but also further reduces the cost of plastic and thus the products too. In the past filler has been long used as additives in the plastic industries. Primarily, filler is used as a means of reducing cost of plastics without affecting the properties of the plastic products. The