

UNIVERSITI TEKNOLOGI MARA

**MECHANICAL AND PHYSICAL PROPERTIES
OF WOOD POLYPROPYLENE COMPOSITES
FROM THREE MALAYSIAN WOOD SPECIES**

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Candidate's Declaration

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

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ABSTRACT

The study focuses on the effects of wood species, particle sizes and filler loading on the mechanical and physical properties of the wood polypropylene composites. The sawdust was derived from three Malaysian hardwood species; Kelempayan (*Anthocephyllus cadamba*), Rubberwood (*Hevea brasiliensis*) and Simpoh (*Dillenia reticulata*) were used as fillers in polypropylene composite at 10%, 30% and 50% by weight. The particle sizes used were 40BS-mesh (354 microns), 60BS-mesh (250 microns) and unscreened. The study was statistically designed and analyzed based on a 95% confidence level ($p < 0.05$). The bulk density of sawdust species had significant effect on all the mechanical and physical properties. The correlation coefficient of bulk density sawdust showed insignificant effects on tensile strength, tensile modulus and tensile elongation. The analysis of variance (ANOVA) showed that composites containing Kelempayan and Rubberwood sawdust were observed to have insignificant effect on tensile modulus. Simpoh sawdust showed insignificant effect on tensile strength and its modulus. The correlation coefficient analysis revealed that, the composites present small differences in their properties in relation to the reinforcement particle size and do not significantly influence the mechanical and physical properties. With increasing filler loading; flexural strength, tensile strength, tensile elongation decreased while flexural modulus and tensile modulus increased. With higher filler loading the water absorption of all the composites increases significantly. As a conclusion, sawdust from the three Malaysian wood species without coupling agent can be use for non-moisture resistance uses and renewable products in the near future.

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CHAPTER 1

INTRODUCTION

In previous years, the deterioration of waste management and environment of wood-based product has become a global issue amongst developed countries. Use of recyclables and practise of environmental safety have become increasingly important as consumers' pressure on manufacturing of materials and end products to consider the environmental impact of their products at all stages of their life cycle, including ultimate disposal of wood flour or wood waste (Peijis et al, 2002).

Wood waste sourced mostly from demolition projects, land clearing, new construction and wood-based industries; especially from the pallets and packaging industry, which reaches almost 70% of the original wood volume (Suttie, 2004). Wood waste can be a valuable secondary material (highest value use) because it can be used in a wide variety of processed products such as in the manufacturing of particleboard, flake board, medium-density fibreboard, oriented strand board, hardboard, waste to energy scheme, composting and landscaping. It is the fact that the linear usage of wood waste materials is a long-term sustainable option.

Malaysia as a developing country and is also facing the above global issue. Malaysia is home to the centre of environmental criticism in the past for deforestation, and has been ranked ninth in the Environment Performance Index (Malaysia Timber Council [MTC], 2006). Malaysian wood-based industries - particularly in saw milling, plywood, chipboard and moulding industries have expanded rapidly since the 1980's. Among the tropical forest countries, Malaysia contributes 80% of the tropical sawn timber through international trade (MTC, 2002b). The construction sector accounts for nearly 60% of local sawn timber, while the furniture and moulding industries are 29% and 4% of the timber were