

UNIVERSITI TEKNOLOGI MARA

**STRENGTH AND DURABILITY PROPERTIES OF
CEMENT BONDED PARTICLEBOARD FROM
*Leucaena leucocephala***

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ABSTRACT

This study focuses on application of 8 and 16 year (8Y and 16Y) old of *Leucaena leucocephala* or locally known as petai belalang as wood particles in three and single-layered Cement Bonded Particleboard (CBP) and incinerator Waste Paper Sludge Ash (WPSA) from paper industry as a cement replacement in CBP manufacturing. The CBP panels in this study were made in three (3) layers (sandwiching board) and single (1) layer. The CBP specimens were prepared at six (6) series of wood to cement ratio for three-layered CBP and three (3) series wood to cement ratio for single-layered CBP. The effects of using different wood to cement ratio on the mechanical and physical properties of the resulted CBP boards were investigated. A combination of aluminum sulphate $Al_2(SO_4)_3$ and sodium silicate (Na_2SiO_3) were incorporated in the mixing system to improve the bonding properties between the binder and matrix. The mechanical and physical properties of the boards were evaluated based on Malaysian Standard MS 544: 2001. In three-layered CBP, three (3) different particle sizes of wood particles were adopted. Particle sizes which retained at 2 mm sieve size were used to make a core layer while a combination of 1 mm and 0.5 mm particles in size was used for the outer layer. The study showed the strength properties of the boards satisfied the minimum requirement of Malaysian Standard and comparable to those of commercial CBP. The presence of higher proportions of WPSA as a part of Portland cement had reduced the mechanical properties and retarded the degree of cement hydration properties. The presence of WPSA up to 20% for 8Y CBP had generally met the Malaysian Standard requirement on mechanical properties. In terms of durability, the present CBP indicated that the CBP also resulted better mechanical and physical properties after being externally exposed to the Malaysian climate for up to 300 days.

Keywords: Cement Bonded Particleboard, Internal Bond, *Leucaena leucocephala*, Modulus of Rupture, Modulus of Elasticity, Thickness Swelling, and Water Absorption

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TABLE OF CONTENTS

TITLE PAGE	
CANDIDATE'S DECLARATION	
ABSTRACT	ii
ACKNOWLEDGEMENT	iii
TABLE OF CONTENTS	viii
LIST OF TABLES	ix
LIST OF FIGURES	xii
LIST OF PLATES	xv
LIST OF ABBREVIATIONS	xvi
CHAPTER 1: INTRODUCTION	
1.1 General	1
1.2 Significance of the Study	2
1.3 Aims and Objectives	2
1.4 Scope of the Study	3
1.5 Layout of the Thesis	6
CHAPTER 2: LITERATURE REVIEW	
2.1 Introduction	8
2.2 Wood Fibre Reinforced Cement Composites	12
2.3 Type of Wood Cement Composites	15
2.3.1 Wood Wool Cement Board	17
2.3.2 Wood Chip Cement Board	18
2.3.3 Wood Fibre Cement Composites	19
2.3.4 Cement Bonded Particleboard	20
2.4 Applications of Cement Bonded Particleboards	22
2.5 Compatibility of Wood with Cement	27
2.5.1 Improvement of Wood-Cement Interaction	31
2.5.2 Hydration of Cement with Wood	34
2.6 Durability of Wood Cement Composites	37
2.7 Microstructural Behaviour of Wood Cement Composites	40
2.8 Potential Utilisation of <i>Leucaena leucocephala</i> for Wood Cement Composites in Malaysia.	42
2.9 Critical Summary of Literature	45

CHAPTER 1

INTRODUCTION

1.1 General

Wood cement bonded composite is a value-added wood product made from the combination of two or more raw materials such as wood particles, cement and fly ash. The public, the government agencies, engineers and scientist in the world are also continuing to access waste resources (for instance waste paper, wood residues, etc), fast growing tree and lesser known species as raw materials for the manufacture of wood cement composites. However, with the increasing global concern on the environment, the utilisation of small diameter log of fast growing tree, agricultural residues or lesser known species for value-added products such as Cement Bonded Particleboard (CBP), Cement Bonded Fibreboard (CBF) and particleboard should be given a priority. Natural fibre such as wood particle has been the popular raw material used in wood cement composite industry instead of glass fibre or asbestos. In fact, during the last decades, the literature and knowledge on natural fibre used in wood cement composite products has increased substantially (Swamy, 1990b; Coutts, 1988). The incorporation of natural fibre in wood cement composites had improved flexural strength, improve bending strength, keep the environment safe and reduce cost (Coutts, 1988). In addition, interest in using natural fibres or wood particles has increased because natural materials are cheaper and they are also renewable resources.

Large volumes of small dimension wood, fast growing tree and wastes from wood processing, agricultural and other industrial processing are being used in the production of wood cement composites such as CBP. Therefore, the fast growing or lesser known species such as *Leucaena leucocephala* or locally known as petai belalang need to be