

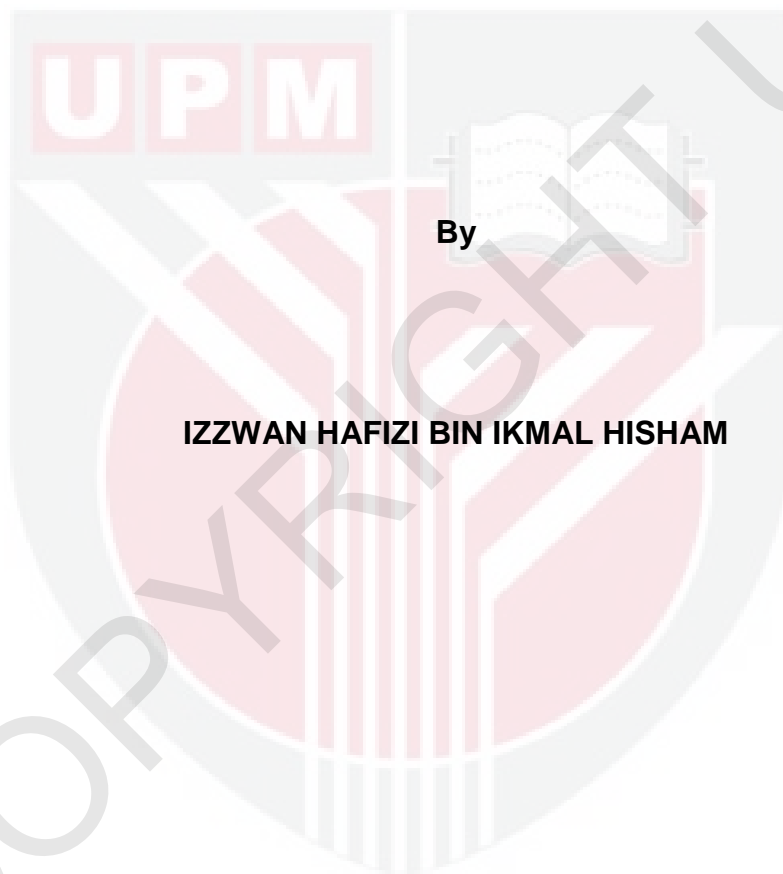


INFLUENCE OF TANNIN-PF RESIN RATIO ON IMPREGNATED PAPERS

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FH 2019 71

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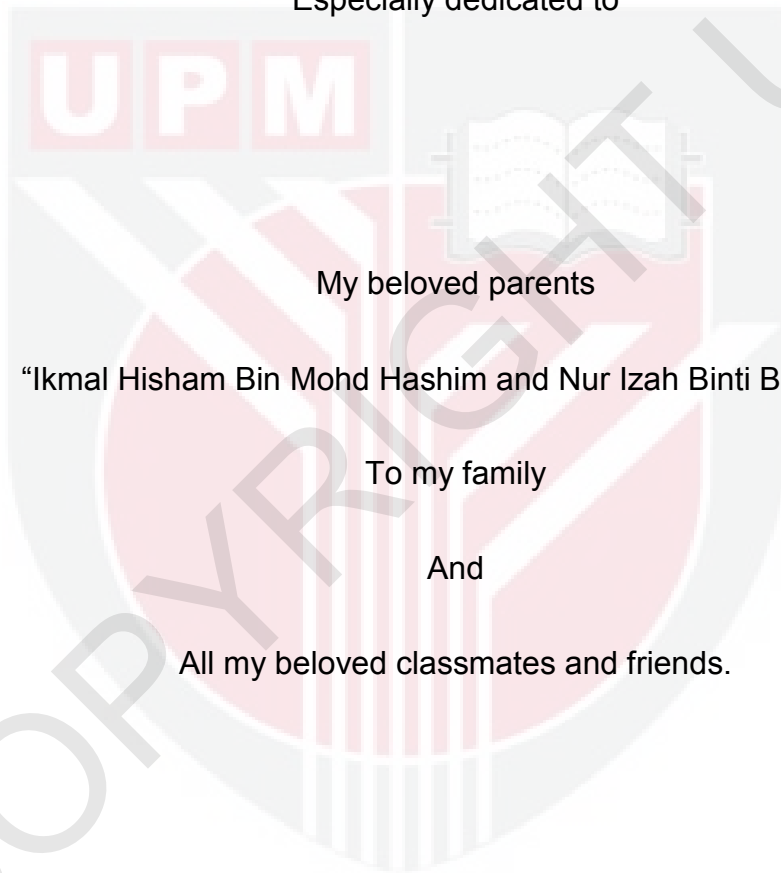
By

IZZWAN HAFIZI BIN IKMAL HISHAM

**A Project Report Submitted in Partial Fulfilment of the Requirements
for the Degree of Bachelor of Wood Science and Technology in the
Faculty of Forestry
Universiti Putra Malaysia**

2019

Especially dedicated to



My beloved parents

“Ikmal Hisham Bin Mohd Hashim and Nur Izzah Binti Berahim”

To my family

And

All my beloved classmates and friends.

ABSTRACT

Acacia mangium is a fast growing species that dominating the plantation in Malaysia. Tannin extracts from *A. mangium* tree bark were found to be rich in phenolic compounds and had the potential to replace synthetic adhesive used in the wood products industry. In this study, resin impregnated papers were prepared by impregnating filter paper with *A. mangium* tannin solution mixed with phenol formaldehyde at five different ratios which were 100:0, 70:30, 50:50, 30:70 and 0:100. These impregnated papers were then overlaid on a five ply plywood as a substrate. The aim of this study is to determine the effect of Tannin-PF resin ratio on the surface properties of the impregnated papers. Stain test, cross cut test and water vapour test were carried out to test the surface properties of the impregnated papers. The results show that resin impregnated paper with a 50:50 ratio of tannin-phenol formaldehyde resin gives an excellent results in all aspects compared to the other ratios.

ABSTRAK

Acacia mangium merupakan spesies yang berkembang dengan pesatnya dan menguasai perladangan di Malaysia. Tannin yang diekstrak dari kulit kayu *A. mangium* didapati kaya dengan sebatian fenolik dan mempunyai potensi untuk menggantikan perekat sintetik yang digunakan dalam industri produk kayu. Dalam kajian ini, kertas campuran resin disediakan dengan mencampurkan kertas penapis dengan larutan *A. mangium* tanin bersama campuran fenol formaldehid pada lima ratio yang berbeza iaitu 100:0, 70:30, 50:50, 30:70 dan 0:100. Kertas-kertas yang telah diimpregnasi ini kemudiannya dilapisi pada papan lapis lima lapis sebagai substrat. Tujuan kajian ini dijalankan adalah untuk mengkaji kesan nisbah campuran Tannin-PF pada sifat-sifat permukaan kertas lamina. Ujian kesan kotoran, ujian silang potong dan ujian rintangan wap air telah dijalankan untuk menguji sifat permukaan kertas yang telah diimpregnasi. Keputusan ujian-ujian tersebut menunjukkan kertas diimpregnasi resin bernisbah 50:50 memberi keputusan yang cemerlang dalam semua aspek berbanding dengan nisbah-nisbah yang lain.

ACKNOWLEDGMENT

I would like to thank all those people who made this thesis possible and an unforgettable experience for me. First and foremost, I would like to express my special appreciation to my supervisor, Dr. Umami Hani Abdullah for her excellent and patient guidance and infinite suggestion and help throughout this project.

I also would like to extend my thank you to Institute of Tropical Forestry and Forest Products (INTROP) and to Putra Infoport for allowing me to use their lab and high tech equipment. Without their supports this project is impossible to continue.

Last but not least, I would like to express my sincere thanks and appreciation to those who have directly or indirectly given generous contribution towards the completion of this project and my endless gratitude to my beloved parents, families and my fellow friends for their love, concern and moral support.

Thank you.

APPROVAL SHEET

I certify that this research project report entitled “Influence of Tannin-PF Resin Ratio on Impregnated Paper” by Izzwan Hafizi Bin Ikmal Hisham has been examined and approved as a partial fulfilment of the requirements for the Degree of Bachelor of Wood Science and Technology in the Faculty of Forestry, Universiti Putra Malaysia.

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Date: January 2019

TABLE OF CONTENTS

	Page
DEDICATION	ii
ABSTRACT	iii
ABSTRAK	iv
ACKNOWLEDGEMENTS	v
APPROVAL SHEET	vi
TABLE OF CONTENTS	vii
LIST OF TABLES	ix
LIST OF FIGURES	x
LIST OF ABBREVIATIONS	xi
CHAPTER 1 INTRODUCTION	
1.1 Background	1
1.2 Problem Statement	3
1.3 Objectives	4
CHAPTER 2 LITERATURE REVIEW	
2.1 <i>Acacia mangium</i>	5
2.1.1 Geography and Distribution	6
2.1.2 Barks of <i>Acacia Mangium</i>	8
2.2 Tannins	8
2.2.1 <i>Acacia Mangium</i> Tannin Chemical Properties	12
2.2.2 Tannin Extraction	15
2.3 Phenol Formaldehyde (PF) resin	16
2.4 Resin impregnated paper	18
CHAPTER 3 METHODOLOGY	
3.1 Materials	20
3.2 Methodology	20
3.2.1 Preparation of raw material	20
3.2.2 Extraction of tannin	20

3.2.3	Evaporation of tannin	22
3.2.4	Preparation of tannin phenol formaldehyde solution	23
3.2.5	The impregnation of filter paper	23
3.3	Testing of water vapour	24
3.4	Cross cut test	26
3.5	Mark stain test	27
3.6	Experimental design	29
CHAPTER 4 RESULTS AND CONCLUSION		
4.1	Surface Quality Properties of the Impregnated Papers	30
4.1.1	Water Vapour Test of Tannin Phenol Formaldehyde Impregnated Paper Surface	30
4.1.2	Cross Cut Test of Tannin Phenol Formaldehyde Impregnated Paper Surface	33
4.1.3	Mark Stain of Tannin Phenol Formaldehyde Impregnated Paper Surface	35
CHAPTER 5 CONCLUSION AND RECOMMENDATION		
5.1	Conclusion	38
5.2	Recommendation	39
	REFERENCES	41
	PUBLICATION OF THE PROJECT UNDERTAKING	46

LIST OF TABLES

	Page
Table 3.1: Stages to classified for water vapour testing	25
Table 3.2: Classification of cross cut test	27
Table 3.3: The ratings for stain resistance	28
Table 4.1: Results for water vapour testing on the surface of impregnated paper	32
Table 4.2: Results for cross cut testing on the surface of impregnated paper	34
Table 4.3: Results for stain test on the surface of impregnated paper	37



LIST OF FIGURES

	Page
Figure 2.1: <i>Acacia mangium</i> tree	5
Figure 2.2: Generalized range of distribution of <i>Acacia mangium</i>	7
Figure 2.3: A typical polymer structure of <i>Acacia mangium</i> tannin repeating unit: (A) profisetinidin, (B) prorobinetinidin and (C) prodelphinidin	13
Figure 2.4: A proposed tannin structure for <i>Acacia mangium</i> tannin with an angular structure resolving itself into a branched polymer structure	14
Figure 2.5: The formation of phenol formaldehyde	17
Figure 3.1: Samples of <i>Acacia mangium</i> particles	21
Figure 3.2: Extraction process of tannin	22
Figure 3.3: Evaporation process of tannin using rotary evaporator	23
Figure 3.4: Water vapour testing	25
Figure 3.5: Cross cut test	26
Figure 3.6: Mark stain test	28
Figure 3.7: Experimental design	29
Figure 4.1: Water vapour testing on the surface of impregnated paper. (a) T:PF 0:100 (b) T:PF 30:70 (c) T:PF 50:50 (d) T:PF 70:30 (e) T:PF 100:0	31
Figure 4.2: Cross cut testing on surface of impregnated paper. (a) T:PF 0:100 (b) T:PF 30:70 (c) T:PF 50:50 (d) T:PF 70:30 (e) T:PF 100:0	33
Figure 4.3: Mark stain test on surface of impregnated paper. (a) Acid test on T:PF 0:100 (b) Alkali test on T:PF 0:100 (c) Acid test on T:PF 30:70 (d) Alkali test on T:PF 30:70 (e) Acid test on T:PF 50:50 (f) Alkali test on T:PF 50:50 (g) Acid test on T:PF 70:30 (h) Alkali test on T:PF 70:30 (i) Acid test on T:PF 100:0 (j) Alkali test on T:PF 100:0	36

LIST OF ABBREVIATIONS

<i>A. mangium</i>	<i>Acacia mangium</i>
TPF	Tannin Phenol Formaldehyde
PF	Phenol Formaldehyde
Na₂SO₃	Sodium Sulphate
Na₂CO₃	Sodium Carbonate
HCl	Hydrochloric Acid
NaOH	Sodium Hydroxide
T:PF	Tannin : Phenol Formaldehyde
MDF	Medium Density Fiberboard

CHAPTER 1

INTRODUCTION

1.1 Background

A. mangium is one of the most popular amongst the most mainstream quickly fast-growing tree species not only in Malaysia, but also in the rest of Asia. *A. mangium* trees have been planted under the forest plantation program both in Malaysia and Indonesia. Usually, this fast-growing tree is utilized as raw material for pulp and paper production due to small log diameter characteristics as well as for glulam production because of its high bond strength (Alamsyah et al., 2007) and good mechanical properties (Matsumoto, 2003). In Sarawak alone a large area of land (480,000 ha) was designated as Planted Forest Zone (PFZ), within which 125,000 ha were planted with *A. mangium* in 2011 (Tanaka et al., 2015). This is a good sign of a new raw material for tannin extraction.

Tannins are naturally occurring polyphenolic compounds and are soluble in water. Generally tannins can be found in the bark, stem, phloem, seeds, fruits, fruit pods, wood leaves and needles of dicotyledon plants (Zucker, 1983). Tannins can be divided into two categories which are hydrolysable tannins and condensed tannins (Hoong et al., 2010). According to Cong et

al. (2005), tannin extracted from the bark of *A. mangium* belongs to the condensed type and contains up to 36.75% of tannin.

Resin impregnated paper is a preprinted or solid colour paper that has been saturated with melamine, urea formaldehyde or phenolic resins. The purpose of putting impregnated papers onto the surface of wood panels is to avoid or minimize water absorption and eliminate formaldehyde release. Almost 70% of the wood panels produced are covered with resin impregnated paper and the rest is finished with wood veneer and thermoplastic film or is painted or printed (Kandelbauer et al., 2010). Resin impregnated paper have gained wide acceptance as particleboard surface material and they are widely used in cabinet shelving, table and counter tops, flooring, wall panelling and other furniture. Generally paper impregnation is done with melamine formaldehyde (MF), urea formaldehyde (UF) and melamine urea formaldehyde resins (MUF) (Roberts and Evans, 2005).

Phenol formaldehyde adhesives are synthetic adhesive and have been used extensively to glue the veneer plies of exterior grade plywood panels due to its high strength. They are extremely resistant to moisture which prevents delamination and gives excellent temperature stability and low initial viscosity (Pizzi, 2006). However, PF resins can be very expensive products as regards to the phenol price and toxic. Therefore, natural and economical products as substitutes for PF resins is essential. Tannins represent the best

substitute for phenol in resin preparation and an amazing sustainable resources which can be utilized for supplanting petroleum derived phenolic compounds.

1.2 Problem Statement

A. mangium was generally planted in Sabah and the timber are widely utilized as a part of wood panels. Therefore, there are a considerable measure of these *A. mangium* bark where we can extract the tannin to be applied as an adhesive.

There are strong interest in the recovery of byproducts from wood industries to be converted into value-added products all over the world. *A. mangium* bark is abundant waste byproduct in Malaysia wood industry. Mostly, its primary function for the wood industry as firewood and it has been underexploited satisfactorily. The bark consist high level of tannin but the tannin is not commercially extracted or produced. Studies have shown that *A. mangium* bark could be used as possible alternatives for phenolic materials in adhesive resins.

In the meantime, synthetic resins tend to be expensive and contain carcinogenic substances that are harmful to human. Therefore *A. mangium*

resins is a great substitute to commercial synthetic resins due to its natural characteristics, massive amount and same characteristic as synthetic adhesive.

1.3 Objectives

The objectives of this research are:

1. To determine the effect of different resin ratio of *A. mangium* tannin – phenol formaldehyde as impregnated resin.
2. To determine the surface quality of the impregnated papers.

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