

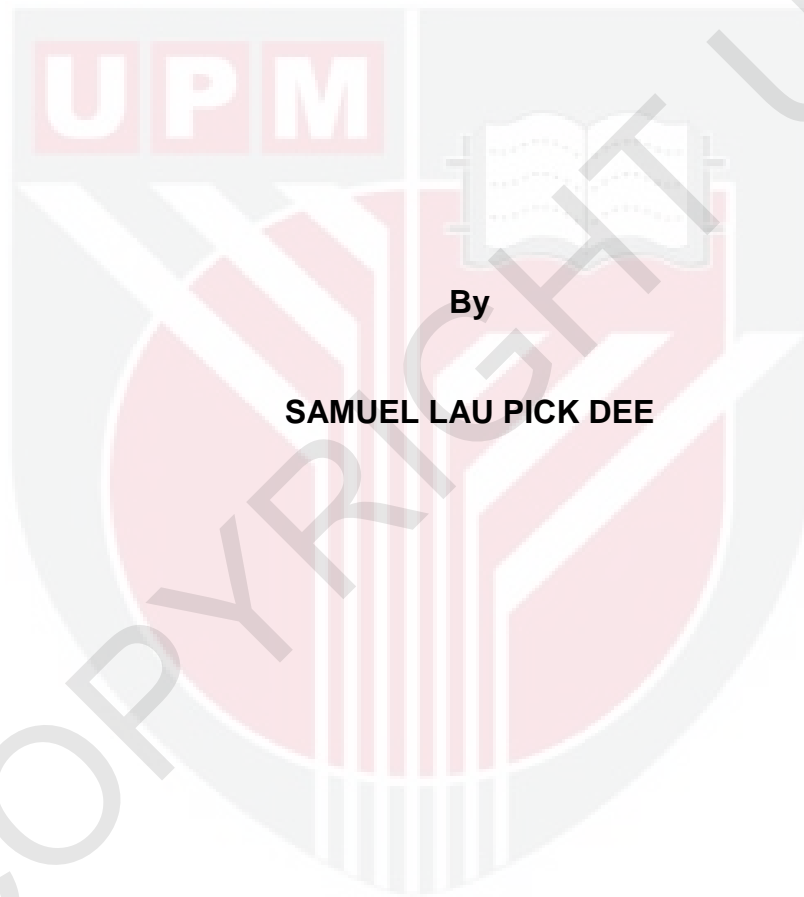


***EFFECTS OF DIPPING IN PALM OIL AND ETHANOL FOLLOWED BY
HEATING ON DIMENSIONAL STABILITY OF PARTICLEBOARD MADE
FROM RUBBERWOOD AND OIL PALM TRUNK***

SAMUEL LAU PICK DEE

FH 2018 77

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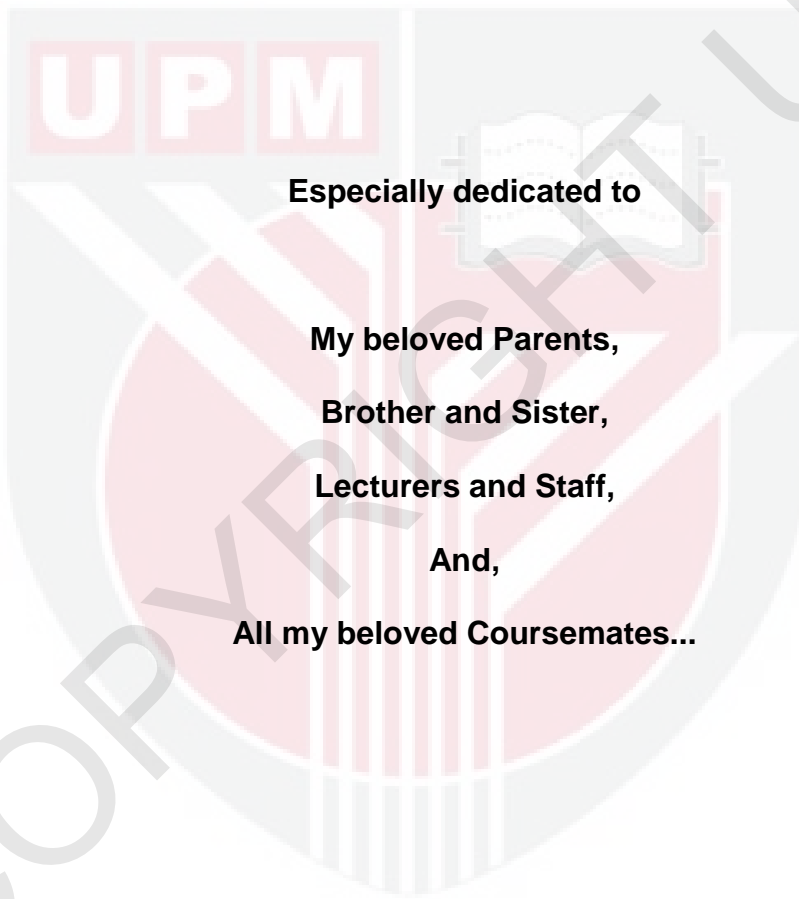


By

SAMUEL LAU PICK DEE

**A Project Report Submitted in Partial Fulfillment of the Requirements
for The Degree of Bachelor of Wood Science And Technology in
Faculty of Forestry
Universiti Putra Malaysia, Serdang**

2018



Especially dedicated to

My beloved Parents,

Brother and Sister,

Lecturers and Staff,

And,

All my beloved Coursemates...



Abstract

Rubberwood is the main raw materials for particleboard industries in Malaysia. Unfortunately, shortage of rubberwood urged the manufacturer to find alternative raw materials in the particleboard production. In this study, rubberwood and oil palm trunk are used to form particleboard followed by oil – dip treatment with heating. The main objective of this study was to determine physical properties of particleboard made from different proportions ratio of RW and OPT and the effects of dip-treatment in palm oil and ethanol on dimensional stability of particleboard. In this study, the particleboard formed were treated with 10%, 50% and 100% palm oil. The physical properties of untreated and treated particleboard such as equilibrium moisture content, moisture excluding efficiency, thickness swelling, and water absorption and solution uptake were tested. The results showed that higher proportion of OPT had better dimensional stability than that with higher proportion of RW. Particleboard did not meet the thickness swelling requirement according to EN 312 ($\leq 17\%$).

ABSTRAK

Kayu getah adalah bahan mentah utama untuk industri papan serpai di Malaysia. Malangnya, kekurangan kayu getah menyebabkan pengilang untuk mencari bahan mentah alternatif dalam pembuatan papan partikel. Dalam kajian ini, kayu getah dan batang kelapa sawit digunakan untuk membentuk papan serpai diikuti dengan rawatan minyak dengan pemanasan. Objektif utama kajian ini adalah untuk menentukan sifat-sifat fizikal papan serpai yang dibuat dengan pelbagai nisbah kayu getah dan batang kelapa sawit dan menguji kesan rawatan dalam minyak kelapa sawit dan etanol pada kestabilan dimensi papan partikel. Dalam kajian ini, papan serpai dirawat dengan 10%, 50% dan 100% minyak kelapa sawit. Sifat fizikal papan serpai yang tidak dirawat dan dirawat seperti kandungan kelembapan keseimbangan, 'moisture excluding efficiency, kebengkakan ketebalan, dan penyerapan air dan penyerapan larutan turut diuji. Hasil kajian ini menunjukkan bahawa nisbah batang kelapa sawit yang lebih tinggi mempunyai kestabilan dimensi yang lebih baik daripada nisbah kayu getah yang lebih tinggi. Papan serpai tidak memenuhi keperluan bengkak ketebalan mengikut EN 312 ($\leq 17\%$).

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APPROVAL SHEET

I certify that this research paper project report entitled “**Effects of Dipping in Palm Oil and Ethanol followed by Heating on Dimensional Stability of Particleboard Made from Rubberwood and Oil Palm Trunk**” by **Samuel Lau Pick Dee** has been examined and approved as a partial fulfillment of the requirement for the degree of Bachelor of Wood Science and Technology in the Faculty of Forestry, Universiti Putra Malaysia.

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LIST OF ABBREVIATIONS

RW	Rubberwood
OPT	Oil Palm Trunk
UF	Urea Formaldehyde
EN	European Standards
EMC	Equilibrium Moisture Content
MEE	Moisture Excluding Efficiency
TS	Thickness Swelling
WA	Water Absorption
Sol. Uptake	Solution Uptake
ANOVA	Analysis of Variance
SAS	Statistical Analysis System
HSD	Honest Significant Difference
SPSS	Statistical Package for the Social Science

CHAPTER 1

INTRODUCTION

1.1 Background

Rubberwood timber is a cheap source of raw material. In 1990s, rubberwood timber comprised more than 70-80% of the wooden furniture produced in Malaysia due to its light colour, smooth surface texture, attractive appearance and light in weight. This resulted in increasing demand for rubberwood timber as raw material for local wooden furniture making industry. However, demand of rubberwood increase cause rubberwood face shortage problem. Figure 1.1 shows the planted area of rubber declined from 1430.68' 000 ha in 2000 to 1020.38' 000 ha in 2010. It is then slightly increase to 1091.63' 000 ha in 2016.

Year	Malaysia Total ('000 ha)		
	Estate	Smallholding	Malaysia
2000	123.78	1,306.90	1,430.68
2001	95.52	1,293.80	1,389.32
2002	84.81	1,264.00	1,348.81
2003	78.46	1,247.14	1,325.60
2004	64.42	1,214.41	1,278.83
2005	57.37	1,213.93	1,271.30
2006	54.15	1,209.44	1,263.59
2007	53.35	1,194.69	1,248.04
2008	61.10	1,185.93	1,247.03
2009	61.10	967.14	1,028.24
2010	64.20	956.18	1,020.38
2011	64.20	962.84	1,027.04
2012	65.94	975.25	1,041.19
2013	77.41	979.86	1,057.27
2014	80.12	985.51	1,065.63
2015 ^e	86.12	992.51	1,078.63
2016 ^f	92.12	999.51	1,091.63

Figure 1.1: Statistic of Malaysia's Rubber Planted Hectares

(Source: Department of Statistics Malaysia, 2016)

Due to the insufficient supply of rubberwood, oil palm had been found to replace rubberwood as raw materials in wood industry. The oil palm tree has become valuable commercial crops in Malaysia. Figure 1.2 shows the plantation area of oil palm trees in Malaysia. As of 2011, the total planted area was 4.917 million hectares.

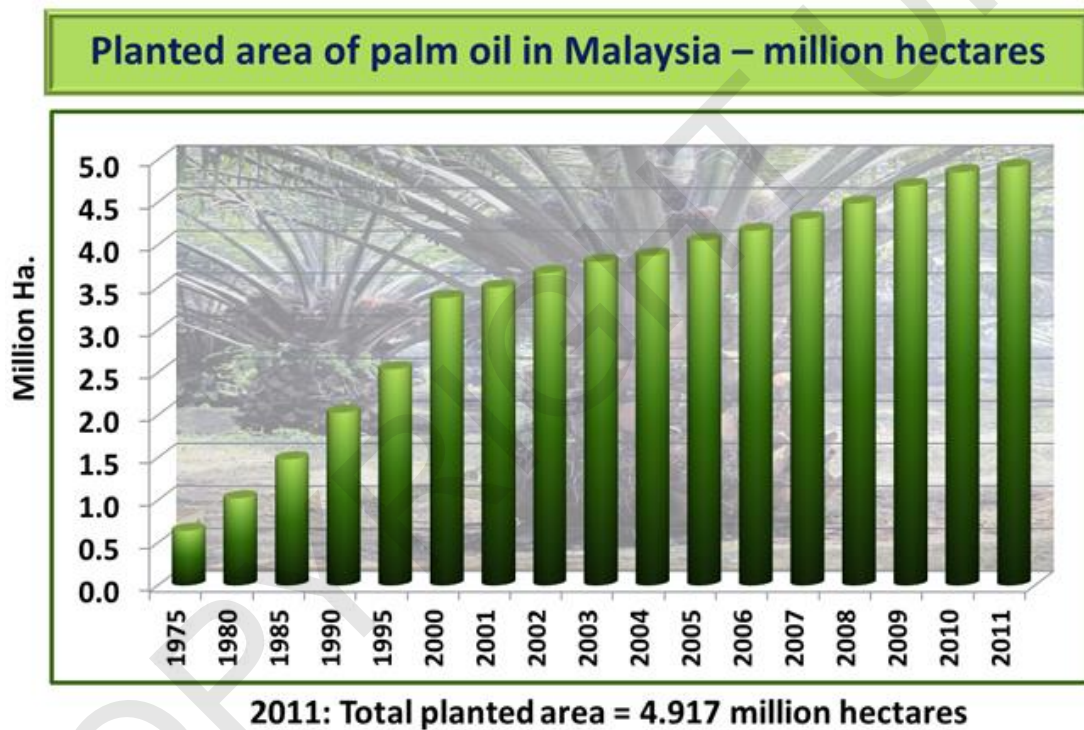


Figure 1.2: Plantation area of oil palm trees in Malaysia from 1975 to 2011.

(Source: Malaysia Palm Oil Board, n.d.)

Some of the particleboard plants used mixed wood materials for production. However, it was not profitable because the mixed wood materials are expensive and more adhesive was needed for production, but the price of the final product was almost the same as rubberwood particleboard (Ratnasingam et al., 2011).

Several researches had studied the application of oil palm trunk (Lee et al., 2017) and resam (Ahmad et al., 2016) as mixed materials in the production of particleboard. The results showed that utilization of resam and OPT particleboard as mixed materials are feasible to produce particleboard.

However, particleboard that make with mixed materials had an unstable dimensional stability. Hence, treatment is needed to improve the properties stability. According to Lee et al. (2017), oil treatment accompanies by high temperature treatment had been done to improve the dimensional stability of particleboard made with oil palm trunk and rubberwood. Surface treatment by dipping rubberwood particleboards in a solution of essential oil (cinnamon oil or clove oil to achieve concentrations of up to 0.63%) to protect against molds (*Aspergillus* sp., and *Trichothecium* sp.) had been investigated by Yingprasert et al. (2015). Effect of the treatment on some important physical and mechanical properties of particleboards was also examined in the same study (Yingprasert et al., 2015).

1.2 Problem Statement and Justification

Rubberwood is the main raw material for particleboard industries in Malaysia. Unfortunately, shortage of rubberwood urged the manufacturer to find alternative raw materials in the particleboard production. On that account, utilizing of oil palm trunk would be promising the sustainability future for particleboard processing due to the increasing land area of oil palm plantation in Malaysia. Nevertheless, the

practice of using mixed materials in particleboard production is not common in Peninsular Malaysia as the density differences between OPT and RW particles could affect the adhesives consumption and interfere the adhesion between particles.

A preliminary study revealed that the thickness swelling (TS) of particleboard made from admixture of OPT and RW at different proportion ratios ranged from 18.99% to 25.69% (reported as control results in the present study). The findings failed to meet the minimum requirement of thickness swelling for particleboard type P3 (12 mm thickness) stated in EN 312 (Particleboards: Specifications), which is 17%. Therefore, treatment is needed to improve the dimensional stability of the particleboard.

Vegetable oils such as linseed, rapeseed, soybean and palm oil have been used to improve the dimensional stability and biological resistance of wood and wood composite. Application of these vegetable oils has drawn a lot of attention in the recent years because it is environmentally friendly owing to its low-toxicity. Oil absorption during treatment could form a protective layer to inhibit water uptake by the wood. Nevertheless, the cost of using vegetable oils are relatively high and high retention of oil could produce undesirable odors. Therefore, to reduce the application of oil, this study proposed a procedure in which different ratio of palm oil (mass/mass basis) were dissolved in ethanol followed by dip-treatment of the particleboard samples.

1.3 Objectives

The aim of this research is to study dimensional properties of the particleboard made with OPT, RW and admixture of both particles. Specifically, subject to be studied included:

- i. To determine the physical properties of particleboard made from different proportions ratio of RW and OPT.
- ii. To determine the effects of dip-treatment with palm oil and ethanol followed by heating on dimensional stability of particleboard.

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