



***EFFECT OF POST AMINE COMPOUND TREATMENT ON  
FORMALDEHYDE EMISSION AND PROPERTIES OF IMPREG***

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**Effect of Post Amine Compound Treatment on Formaldehyde Emission and  
Properties of Impreg**



By

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**A Project Report Submitted in Partial Fulfilment of the Requirements for the**

**Degree of Bachelor of Wood Sciences and Technology in the**

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## DEDICATION

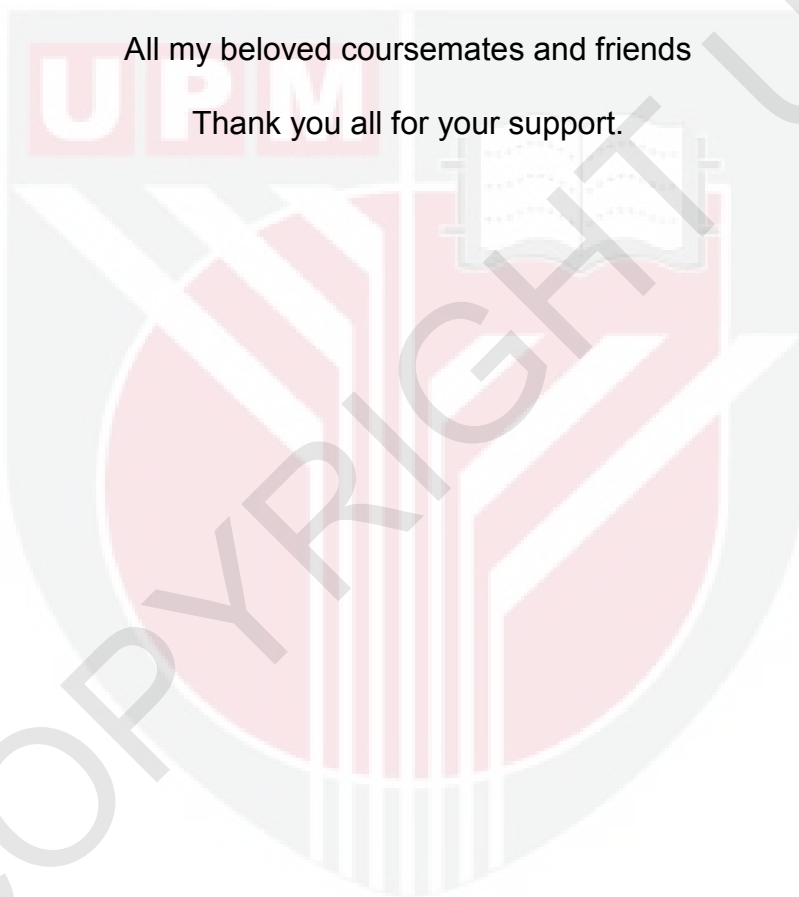
Special dedicate to my parents,

Koo Peng Siong and Kok Lee Hua

My sister, Koo Hui Sien and Koo Hui Min

All my beloved coursemates and friends

Thank you all for your support.



## ABSTRACT

The main objective of this study was to determine the effect of propylamine post-treatment on formaldehyde emission and properties of impreg sesenduk wood. Air dry strips of sesenduk wood were treated with 10%, 20%, 30% of Low molecular weight Phenol Formaldehyde and 10%, 20%, 30% of Medium molecular weight Phenol Formaldehyde using vacuum pressure treatment. After treatment, the treated wood was pre-cured in an oven at 70°C for 3 h. The samples were then cured at 150°C for 30 minutes. Post-amine treatment was carried out after the samples were taken out from oven. The spread rate were 40 g/m<sup>2</sup>, 50 g/m<sup>2</sup> and 60 g/m<sup>2</sup>. After that, the samples were dried at room temperature and wrapped with plastic before conditioned in a conditioning room. The samples were conditioned until constant weight of the samples were achieved. The results showed that post propylamine had successfully reduced formaldehyde emission of sesenduk wood treated with low and medium molecular weight phenol formaldehyde resins. The effectiveness of the treatment dependent on the spread rate of the propylamine.

## ABSTRAK

Objektif utama kajian ini adalah untuk menentukan kesan rawatan pasir propylamine kepada pelepasan formaldehid dan sifat kayu sesenduk yang menyerap. Jalur udara kering kayu sesenduk dirawat dengan 10%, 20%, 30% daripada berat molekul rendah Fenol Formaldehida dan 10%, 20%, 30% daripada berat molekul sederhana Fenol Formaldehid yang menggunakan rawatan tekanan vakum. Selepas rawatan, kayu yang dirawat telah dipanaskan dalam ketuhar pada suhu 70 °C selama 3 jam. Sampel kemudian pada 150 °C selama 30 minit. Rawatan selepas amina dijalankan selepas sampel diambil dari oven. Kadar penyebarannya ialah 40 g/m<sup>2</sup>, 50 g/m<sup>2</sup> dan 60 g/m<sup>2</sup>. Selepas itu, sampel telah dikeringkan pada suhu bilik dan dibalut dengan plastik sebelum dibersihkan di bilik penyaman. Sampel dikondisi sehingga berat berterusan sampel telah dicapai. Keputusan menunjukkan bahawa post propylamine telah berjaya mengurangkan pelepasan formaldehid kayu sesenduk yang dirawat dengan resin formaldehid fenol berat molekul rendah dan sederhana. Keberkesanan rawatan bergantung kepada kadar penyebaran propilamina.

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## APPROVAL SHEET

I certify that this research project report entitled “Effect Of Post Amine Compound Treatment On Formaldehyde Emission And Properties Of Impreg” has been examined and approved as a partial fulfilment 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

LmwPF	-	Low Molecular Weight Phenol Formaldehyde
MmwPF	-	Medium Molecular Weight Phenol Formaldehyde
FE	-	Formaldehyde Emission
WPG	-	Weight Percent Gain
MOR	-	Modulus Of Rupture
MOE	-	Modulus Of Elasticity
NATIP	-	National Timber Industry Policy
MTIB	-	Malaysian Timber Industry Board
MPOB	-	Malaysian Palm Oil Board
MTC	-	Malaysian Timber Council

# CHAPTER 1

## INTRODUCTION

### 1.1 Background

The timber industry in Malaysia is one of the main contributors to the Malaysia economy, for more than a decade, sustainable development of the timber industry is very important to ensure the nation's economy can keep on increasing. As Malaysia is well-blessed with an abundance of rainforest and land, the supply of forest resources is never suspended. Nearly 80% of the Malaysian furniture production are being exported every year. Besides the wooden furniture, the export of other materials-based furniture such as metal, plastic and rattan is also gaining the prominence (Ratnasingam, 2015). Furthermore, the industry is predominantly owned by Malaysian and it is estimated that 80 - 90 per cent of the companies comprise small and medium-size (SME) establishments.

Most of the larger sawmills, veneer and plywood mills are located in Sabah and Sarawak. Mills in Sabah and Sarawak utilise tropical wood species for the production of sawn timber, veneer, plywood and other veneered panel products.

More than 45 per cent of the plywood mills and 60 per cent of the mouldings mills are located in Sabah and Sarawak. The concerns regarding the market, technology, raw materials, human capital and other key factors that are crucial

for the continued viability of a resource-based industry such as the wood-based sector.

Malaysia has previously placed a great important on value-added downstream manufacturing and the current industry structure will be re-aligned to achieve the target of RM53 billion per year by 2020, through an average annual growth rate of 6.4 per cent (NATIP, 2012). Malaysia already achieve RM19.3 billion in the export of major timber product in January, 2017. Among the export products in January 2017, the export of wooden furniture contributed 35.9% of the total which is about RM6.9 billion while the export of plywood contributed RM3.46 billion which is 17.9% (MTIB, 2017). From the statistic provided by MTIB, we can know that that Malaysia is maintaining competitiveness while enhancing Malaysia's position as a supplier of quality timber products to the world especially the wooden furniture.

The rapid growth of timber industry has increase the nation's economy but it also brought. However, the demand of timber will continue to increase, leading to concerns of a timber shortage by the end of the 21<sup>st</sup> century. Therefore some of the Malaysia institution like MTIB and MPOB are trying to find the alternative and improve the effectiveness of the products for getting better quality products. The fast growing species are suitable for the alternative material. Sesenduk (*Endospermum diadenum*) is one of the potential species, but, sesenduk is a

low density species with poor properties, non-durable, less susceptible to biodeterioration agents than solid wood.

Therefore, series of studied has been conducted to enhance the properties for further application. There a some potential treatments that suitable for sesenduk to improve the dimensional stabilization, the treatments are shown as following :-

- i. Non-chemical treatment
- ii. Chemical treatment
  - a) Bulking
    - Non-bonded and leachable
    - Non-bonded and non-leachable
    - Bonded and non-leachable
  - b) Crosslinking

The treatment with phenol formaldehyde (PF) resin has been carried out to improve the dimensional stability, mechanical strength and durability of the wood. Impregnation with PF, followed by compressing at high temperatures, has been proven to be effective in enhancing the properties of the treated wood (Rabi' atol et al., 2012). Impregnation of sesenduk wood with low molecular weight phenol formaldehyde (LmwPF) and medium molecular weight phenol formaldehyde (MmwPF) resin through *impreg* method can practically solve the imperfections of sesenduk wood. Numerous studied have been done to reduce the emission of

formaldehyde from wood based products. One of the methods that can be used is to mix the treating solution with formaldehyde scavenger, such as amine compound, urea and sodium thiosulphate, to capture the free formaldehyde (Roffael, 1993).

## **1.2 Problem Statement**

The demand for high density timber such as Rubberwood and Mahang has continued to increase while the total area replanted in rubber has been decreasing. Therefore, utilising an alternative raw materials such as sesenduk would promise the sustainability future for wood-based industry.

The sesenduk species has a high potential as alternative for current raw materials because it is a fast-growing species and very easy to be treated with chemicals. Sesenduk is a low density hardwood, has poor dimensional stability and low mechanical strength. Hence, the sesenduk need treatments to enhance its properties and the potential treatment is bulking with phenol formaldehyde.

However, the main concern of treated sesenduk wood with phenol formaldehyde is that high amount of formaldehyde has been released. Therefore, attempt was made to reduce the formaldehyde emission from impreg wood treated with



LmwPF and MmwPF by introducing post treatment with amine compound without affect the others properties.

### 1.3 Objectives

The objectives of this study are :-

- i. To determine the treatability of sesenduk with low molecular weight phenol formaldehyde (LmwPF) and medium molecular weight phenol formaldehyde (MmwPF).
- ii. To evaluate the properties and formaldehyde emission(FE) of the resin impregnated wood.
- iii. To determine the effect of post amine compound treatment on FE of the treated wood.

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