



***PROPERTIES OF HEAT-TREATED RUBBERWOOD USING  
DIRECT CONTACT METHOD***

**CHIA ZI BIN**

**FH 2018 51**

**PROPERTIES OF HEAT-TREATED RUBBERWOOD USING  
DIRECT CONTACT METHOD**



By

**CHIA ZI BIN**

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

**2018**

## DEDICATION

This thesis is special dedicated to:

My parents,

Chia See Huak

Lee Chin Yoon

My grandparents,

Chia Seng Ming

Tan Seck Hiang

My brothers,

Chia Tze Tuang

Chia Chi How

All my beloved friends.

Thanks for all of your supports.

## ABSTRACT

Wood source especially those high quality species is become lesser and the pressure of wood supply to community become higher. This is because the demand of market is higher. This study is describes the effect of thermal modification by using Direct Contact Method on physical and mechanical properties on rubberwood with different thickness, temperature and time of treatment. The samples of rubberwood were prepared in 1cm, 1.5 cm and 2cm thickness and treated at 160°C, 190°C and 220°C with 15 minutes, 30 minutes, 45 minutes and 60 minutes. The testing were done to treated samples. Physical properties were determined by water absorption and volumetric change while mechanical properties were determined by modulus of rupture and modulus of elasticity. The result showed that thickness of samples was significantly affect both physical and mechanical properties. However, temperature of treatment was not significantly affect to both physical and mechanical properties. Time of treatment was only significantly affect the volumetric change at 24 hours and modulus of elasticity.

## ABSTRAK

Sumber kayu terutamanya kepada spesis yang berkualiti tinggi semakin kurang dalam hutan dan tekanan bekalan kayu kepada komuniti semakin besar. Hal ini berlaku kerana permintaan dan keperluan pasaran yang tinggi. Kajian ini menerangkan kesan pengubahsuaian haba dengan hubungan kaedah kajian ke atas sifat-sifat fizikal dan mekanikal Kayu Getah dengan menggunakan ketebalan, suhu rawatan, dan masa rawatan yang berbeza. Sampel Kayu Getah disediakan dalam ketebalan 1cm, 1.5cm dan 2cm, dirawat dalam suhu 160°C, 190°C dan 220°C dengan masa rawatan 15 minit, 30 minit, 45 minit dan 60 minit. Ujian terhadap Kayu Getah selepas rawatan telah dibuat. Sifat fizikal didapatkan melalui penyerapan air dan perubahan isipadu tetapi sifat mekanikal didapatkan melalui ujian Modulus Kepecahan, dan Modulus Lenturan. Keputusan semua ujian menunjukkan ketebalan Kayu Getah menjejaskan dengan ketara terhadap kedua-dua sifat fizikal dan mekanikal. Walau bagaimanapun, suhu rawatan kajian Kayu Getah tidak menjejaskan kedua-dua sifat fizikal dan mekanikal dengan ketara. Manakala, masa rawatan hanya menjejaskan perubahan isipadu selepas 24 jam dan Modulus Lenturan.

## ACKNOWLEDGEMENTS

The success and final outcome of this project required a lot of guidance and assistance from many people and I am extremely privileged to have got this all along the completion of my project. All that I have done is only due to such supervision and assistance and I would not forget to thank them.

I respect and thank my supervisor Assoc. Prof. Dr. Edi Suhaimi Bakar for giving me all support and guidance which made me complete this project duly. I am extremely thankful to his motivation although he had busy schedule. I would remember Dr. Soltani Mojtaba and Dr Roslan Bin Mohamad Kasim for their encouragement and more over for their timely support and guidance till the completion of my project work.

I am thankful and fortunate enough to get constant encouragement, support and guidance from my teammates, Chang Ying Ying, Lim Jia Yuan and Wong Mui Leng. Next, I would like to thank master students Mohd Rafsan Bin Rais, Muhammad Nadzim Bin Mohd Nazip and Hannafi Bin Muktah to guide me along, till the completion of my project work by providing all necessary information especially in data analysis.

Furthermore, I would like to extend my sincere esteems to Encik Zamani Bin Mohd Daud, Encik Mohd Fakhruddin Bin Imam Supa'at, Encik Mohd Rizal Bin Abdul Rahman and all staff in laboratory for their timely support and guidance during my laboratory work. Lastly, I would like to thank my parents and friends who helped me a lot in finalizing this project within the limited time frame.

## APPROVAL SHEET

I certify that this research project report entitled “**Properties of Heat-treated Rubberwood using Direct Contact Method**” by **Chia Zi Bin** has been examined and approved as a partial fulfillment of the requirements for the degree of Bachelor of Wood Science Technology in the Faculty of Forestry, University of Putra Malaysia.

Approved by:

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Assoc. Prof. Dr. Edi Suhaimi Bakar  
Faculty of Forestry  
University of Putra Malaysia  
(Supervisor)

---

Prof. Dr. Mohamed Zakaria bin Hussin  
Dean  
Faculty of Forestry  
University of Putra Malaysia

Date: January 2018

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## LIST OF ABBREVIATIONS

MOR	Modulus of Rupture
MOE	Modulus of Elasticity
SPSS	Statistical Package for the Social Sciences
ANOVA	Analysis of Variance
WA	Water Absorption
VC	Volumetric Change
DCM	Direct Contact Method

## CHAPTER 1

### INTRODUCTION

#### 1.1 Background

Wood grows naturally and it is a renewable sources to manufacture into many other products. All the products are needed by human. Ashaari (2017) reported that in 2005 the world had 6.5 billion people and this number can exceed to 9 billion by 2050. With the data above, it can be seen the human population is keep increasing. This data give a very big impact of the timber supply to global. So, high quality timber will facing insufficient supply condition. While, human population increases will bring along the demand of furniture and demand of wood to our forest. Forest is our most important asset. Thus, we have to ensure that forest can supply the raw materials to the society for long-term. There are few ways to reduce the pressure of timber supply. Plantation for each high quality timber need rescheduled or increase low quality and huge quantity timber in Malaysia as a substitution of timber supply.

In Malaysia, the wood-based products industry is predicted to face a condition which is lack of raw materials in the future. With the increasing of human population, demand and competitive of other industries, supply of wood can be said that is limited and scanty (Ashaari, 2017). Therefore, alternative way is needed to make sure the supply of wood is consistent. In the other hands, manufacturers are tends to use or attracted to the low density wood species as plantation. Examples of the forest plantations are Sesenduk, oil palm and jelutong.

Rubberwood which is among the non-durable commercialise timber species have low durability. However, few treatment can apply to rubberwood, so that its durability can increase. It is potential to become an alternative way to solve the problems of insufficient raw materials in the future. Therefore, treating to the wood is important nowadays and also for future research.

In this study, Direct Contact Method was used as wood treatment (also known as wood thermal modification). This method is environmentally friendly because do not using any chemical solution. It is using steam as a media to increase the quality of timber. Furthermore, the cost is very low as mentioned just now, there are no need any chemical and other equipment or material. The purpose of wood thermal modification is to enhance the dimensional stability and also quality of the wood species. Treated rubberwood can be one of the substitution of traditional wood species for manufacturing process.

## **1.2 Problem Statement**

In Malaysia, the wood industry especially furniture industry is look forward to withstand the problem of unsustainable high quality wood or raw materials. The cause of this problem is due to illegal logging, deforestation, and human's irresponsible action. Our raw material become lesser. There are some species which is Mahang, Sesenduk and many others species. These species are low density and being discovered to improve the mechanical properties. While, rubberwood known as medium density tropical hardwood. The largest export

country of rubber which is Malaysia have total 6.65 million hectares of rubberwood plantation (Bakar et al., 2012). We can get huge quantity of rubberwood in Malaysia. A study is needed to modify its properties and optimally utilized of rubberwood. Thus, this study is to increase the wood samples properties and reduce the pressure of forest supply to society. Few study shows that chemical and thermal treatment to raw material can enhance its durability and strength. Treatment can reduce the rate of deterioration or attacked by termites (Bakar et al.,2012). Therefore, direct contact method is execute to reach the objective of this study which is improve mechanical and physical properties of rubberwood.

### **1.3 Justification**

Green condition of rubberwood are treated by using Direct Contact Method. This method are newly established. The method is not pressing but only contact between the wood samples and hot plate. This method may affect the physical and mechanical properties of the wood samples. Thus, in this research, Modulus of Rupture, Modulus of Elasticity, Water Absorption and Volumetric Change testing will be determined as the indicator for choosing the best parameter.

#### **1.4 Objectives**

The general objective of this study is to improve the quality of rubberwood by using Direct Contact Method at green condition.

The specific objectives of this study is as below:

- I. To determine the effect of time and temperature to physical and mechanical properties of rubberwood.
- II. To determine effect of wood thickness to physical and mechanical properties of rubberwood.
- III. To improve the quality of rubberwood by Direct Contact Method.



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