PHYSICO-MECHANICAL PROPERTIES OF SUPER-FAST DRIED OIL PALM LUMBER AS THE CORE OF BLOCK BOARD

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PHYSICO-MECHANICAL PROPERTIES OF SUPER-FAST DRIED OIL PALM LUMBER AS THE CORE OF BLOCK BOARD

By

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**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**

2017

DEDICATION

Special dedication to:

My awesome family members

(Wong Hon Kion, Pang Siew Li, Foo Qwee, Celynn Wong,

Wong Zhi Zhen, Wong Zhi Liang, Wong Zhi Shen and Wong Zhi Jeng)

My coursemates

(E Yee, Yuen Ling, Heather, Arini, Hafiz, Faiz, Rahmat, Waniey and Hani)

Known & Unknown, Oil Palm Tree, Hot Press Machine, Earth

For making me who I am now

ABSTRACT

Super-Fast Drying is a new, efficient technology used to dry oil palm wood by creating minimum drying defects. However, holed appearance on the lumber deducts its economic value. Therefore, block board was suggested to increase the value of super-fast dried lumber. The lumbers worked as the core of block board and laminated with thin Keruing veneers as the surface layers. The possibility of block board as the end product of super-fast dried lumbers was investigated in this project by using high density and low density super-fast dried lumbers. Besides, the physical and mechanical properties of the block board were determined. In the beginning, the core lumbers were holed according to optimum diameter and distance between two holes. Then, 2-step drying was carried out, hot-press drying came first and high temperature kiln drying came then. After one-week conditioning, the lumbers were then further process by butt jointing two lumbers together between two veneers. The sandwich structure was then hot-pressed to cure the resin. Two stoppers were put on the sides to achieve target final thickness of block boards. After one-week conditioning, block boards were cut for testing. The results confirmed the availability of block board as the end product of super-fast dried lumbers. There was significant difference between block board made with untreated oil palm lumber and super-fast dried oil palm lumber as the core in MOE, while for physical properties, there was different between both samples after 2-hour immersion in water. Besides, the block boards made of super-fast dried lumbers showed minimum drying defect.

ABSTRAK

‘Super-fast drying’ merupakan satu teknologi baru yang digunakan untuk mengeringkan kayu kelapa sawit dengan pantas dan menimbulkan kecacatan pengeringan secara minimum. Akan tetapi, lubang yang digerudi atas papan mengurangkan nilai ekonomi kayu tersebut. Oleh itu,papan blok dicadangkan untuk menambahbaik penampilan papan ‘super-fast dried’. Matlamat kajian ini ialah menghasilkan papan blok menggunakan papan ‘super-fast dried’ ketumpatan tinggi dan ketumpatan rendah. Ciri-ciri fizikal dan mekanikal papan blok juga akan dikenalpasti. Pada mulanya, papan ‘super-fast dried’ akan dihasilkan melalui pengerudian lubang atas kayu dan seterusnya menjalankan pengeringan 2-langkah. Langkah pertamanya dijalankan melalui mesin penekan panas dan seterusnya melalui tanur pengeringan. Papan blok diletakkan ke dalam ‘conditioning room’ selama seminggu. Selepas seminggu, pembuatan papan blok dimulakan dengan merekat papan ‘super-fast dried’ di tengah dua keping venir Keruing. Penyumbat diletakkan di sisi papan blok sebelum penekanan panas untuk menentukan ketebalan akhir papan blok. Selepas ‘conditioning’ selama seminggu, papan blok dipotong mengikut saiz untuk menjalankkan ujian fizikal dan mekanikal. Pembuatan papan blok adalah berjaya dalam kajian ini. Bagi ciri-ciri fizikal, papan blok ‘super-fast dried’ dan papan blok tidak dirawat menunjukkan perbezaan yang ketara selepas sampel direndam selama dua jam di dalam air. Bagi ciri-ciri mekanikal, sampel menunjukkan perbezaan yang ketara pada modulus keanjalan. Selain itu, papan blok yang menggunakan papan kelapa sawit berawat menunjukkan kecacatan pengeringan yang minimum.

ACKNOWLEDGEMENTS

First of all, I would like to express my deepest gratitude to my supervisor, Assoc. Prof. Dr. Edi Suhaimi Bakar and my co-supervisor, Dr. Mojtaba Soltani for their passion and patience in motivating and conducting me in this study. Their guidance and advice have helped me to rethink, revise, learn and update knowledge in research field as well as in wood science and technology.

Besides, I would like to deliver my sincere appreciation to my thesis committees: Muhammad Nadzim bin Mohd Nazip, Mohd Rafsan bin Rais, Mohd Hafiz bin Yunus, Muhamad Faiz bin Mohd Fauzi, Arini Madira Puteri binti Daslizar and Chen Yuen Ling, for their helping hands, encouragement and guidance during this study. Moreover, special thanks are given to the staffs of Faculty of Forestry for their assistance and cooperation when carrying out my experiment.

Furthermore, my sincere appreciation to everyone who supported and helped me directly or indirectly throughout the project. Last but not least, I would like to pay tribute to all the researchers for their hard works in any studies to make this world better.

APPROVAL SHEET

I certify that this research project entitled “Physico-Mechanical Properties of Super-Fast Dried Oil Palm Lumber as the Core of Block Board” by Wong Zhi Shan has been examined and approved as a partial fulfilment of the requirement for the degree of Bachelor of Wood Science Technology in the Faculty of Forestry, Universiti Putra Malaysia.

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Date: January 2017

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LIST OF ABBREVIATION

MC	Moisture Content
OPT	Oil Palm Trunk
OPW	Oil Palm Wood
OPL	Oil Palm Lumber
MOE	Modulus of Elasticity
MOR	Modulus of Rupture
SMOE	Specific Modulus of Elasticity
SMOR	Specific Modulus of Rupture
UF	Urea Formaldehyde
TS	Thickness Swelling
WA	Water Absorption
FB	Flexural Bending
EN	European Standard
SPSS	Statistical Package for the Social Sciences
SFD	Super-Fast Dried

CHAPTER 1
INTRODUCTION

1.1 Background

Since year 1917, oil palm trees (*Elaeis guineensis jacq*.) that originated from West Africa have been planted commercially in Malaysia for production of oil. In 2014, Malaysia is covered by up to 5.3 million hectares of oil palm plantation (Harun & Loh, n.d.). Nowadays, Malaysia has become the second largest of producers and exporters of oil palm in the world (Where is palm oil grown?, 2016; Palm Oil Exports by Country,2016).

However, the extensive development in palm oil sector has created critical environmental problem during the production chain. In 2012, 83 million tonnes dry weight of oil palm biomass which including oil palm trunks, oil palm fronds, empty fruit bunch, etc. was produced. It is estimated that the oil palm biomass production will reach 100 million tonnes dry weight by year 2020 (Oil palm biomass to increase to 100m tonnes a year by 2020, 2013). Moreover, National Innovation Agency Malaysia stated that the availability of oil palm trunk (OPT) biomass is estimated up to 15 million tonnes dry weight per year from 2015 to 2020 (Koay, 2014).

OPT is a lignocellulosic biomass exists in huge amount, but low in quality. It has poor dimensional stability, bad machining properties, low strength and susceptibility to biodegradable agents (Bakar et al., 2013). There are various researches have been carried out such as impregnation and compression in order to enhance the quality of oil palm lumber (Choowang & Hiziroglu, 2015). However, oil palm plywood mills used only 40% of OPT and 60% of OPT still leftover in Malaysia. It is still underutilised by industry due to the poor properties and difficulties in drying process. High cost and long-time are needed, and yet the dried lumbers show severe defects (Dungani et al., 2013). These challenges are caused by high density variation and high moisture content (MC) variation from outer layer to core layer of OPT (Lim & Gan, 2005).

Bakar, Soltani, Paridah and Choo (2016) developed Super-fast drying method which helps to solve the drying problems and improve the efficiency of drying process. In this method, holes are formed on the oil palm lumbers according to optimum diameter and optimum distance between two holes. After that, 2-step drying is carried out to achieve target MC, which hot-press drying comes first, kiln drying comes then. By using this method, inner part and outer part of OPT can be dried within 3 hours and its quality is guaranteed. This effective drying process can be the attraction to prompt the development of oil palm lumber as the alternative of wood in industry. However, the holing surface deducts the commercial value. Thus, block board is suggested as the end product which the super-fast dried lumber is used as the core.

Block board is defined as the wood composite which consists of a central layer (core) made up of solid wood strips which is stiffened and bound together by glued, hot-pressed rotary cut veneers overlaid with grain perpendicular one to another (Zanuttini & Cremonini, 2002). It is almost similar to plywood, while the difference is the thickness of the core layer. The examples of block board application are furniture, backs of cabinet, and centre panels of framed door (Laufenberg, Ayrilmis, & White, 2005).

There are few of basic criteria used for selection of the block board for structural applications, for examples, strength of the block board, strength of the glue adhesion, and dimensional stability of the board. It is expected that good quality block boards can be produced by using super-fast dried lumber as the core of block board and hardwood veneer as the surface layers (Bakar et. al, 2016). Since Super-fast drying method is just established recently, there is no information of block board made of super-fast dried lumber on its mechanical and physical properties. Therefore, in this study, solid wood strips will be replaced by high density and low density super-fast dried oil palm lumber. The physical properties and mechanical properties will be determined to find out the availability of the products for commercial use in the market.

1.2 Problem Statement

Forests in Malaysia are implemented with National Forest Policy (NFP) and Sustainable Forest Management (SFM). Therefore, the production of logs from natural forests reduced and supply is limited (National Timber Industry Policy 2009-2020, 2009).

Oil palm biomass has been one of the serious environmental issues in Malaysia. Most of them are being unused because of the poor machining properties, physical properties and mechanical properties. Every year, the oil palm mills produce up to 18 million OPT biomass (Harun & Loh, n.d.). Therefore, the OPT resources are in a huge amount and ready to be utilised by the industry.

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Bakar et al. (2016) introduced Super-fast drying method which improve the efficiency of drying and minimize the defects happened during drying process. However, the appearance of the super-fast dried lumber is not pleasant to be a final product due to the holes formed during the drying process. Therefore, the surfaces of the dried lumber need to be embellished for commercialization.

The mechanical properties and physical properties of super-fast dried oil palm lumber as the core of block board is chosen to be determined in this study. This is because the basic properties of products such as strength and dimensional stability haven't been determined before.

1.3 Objectives

This study was aimed to produce high performance block board from super-fast dried oil palm lumber as the core and laminated with hardwood veneer which work as surface layer. The mechanical and physical properties of block board with high density core and low density core were determined.

1.4 Justification

Producing block board by using effective Super-fast drying method, higher volume of oil palm trunk biomass can be utilized since industry can dry the oil palm wood in an easier and more effective way (Bakar et al., 2016). Moreover, the lamination of veneers on the top and the bottom of the core can conceal the holed appearance of the super-fast dried lumber and shows presentable product in the market. Furthermore, the strength and dimensional stability of block board made of super-fast dried lumber can be determined to evaluate its availability in market.

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