

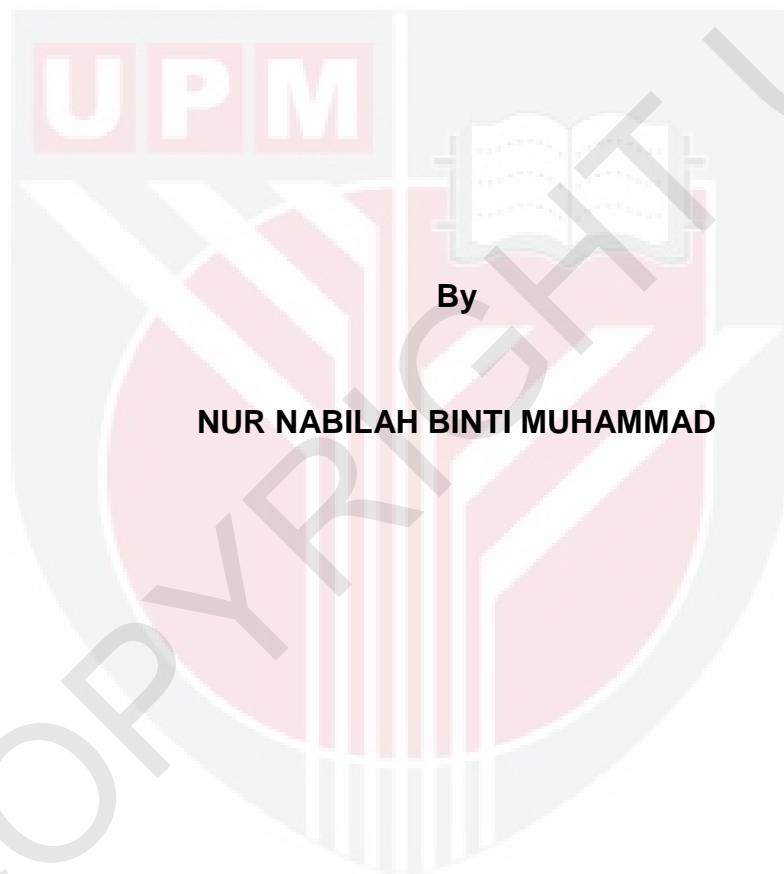


***PHYSICAL AND MECHANICAL PERFORMANCE OF PU AND PRF
ADHESIVE IN CROSS LAMINATING OF DARK RED MERANTI***

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FH 2019 61

**PHYSICAL AND MECHANICAL PERFORMANCE OF PU AND PRF
ADHESIVE IN CROSS LAMINATING OF DARK RED MERANTI**



By

NUR NABILAH BINTI MUHAMMAD

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

2019

DEDICATION

In the name of ALLAH, the most benevolent and the most merciful

For my beloved family:

My Father Muhammad Bin Muda,

My Mother Fazilah Binti Hj Halim,

My Sister Nur Najihah,

My Brothers Muhammad Arif Hamizan and Muhammad Aniq Hasif.

To all my friends,

Thank you for your encouragement supports and the sacrifices that you have given.

Last but not least,

I dedicated this dissertation to Mohamad Pazlan Bin Ngaliman who has encouraged me, helped and give so much support during conducting this research and in my study.

Thank you for everything. May Allah Bless All of us.

ABSTRACT

Cross Laminated Timber (CLT) are widely used in European countries in the construction of conventional buildings. However, solid wood has different durability, strength and characteristics. Therefore, choosing the right wood species should be especially important in making a study. Among the selected species of wood in this study are wood species from specific gravity 5 (SG) groups. In this test, there are two tests involved, namely the Flexural Strength Test where this test uses four bending static bending and where delamination tests is to determine the measure the level of failure of adhesion when the samples immersed in water. The data is analyzed using "Statistical Package for the Social Sciences" (SPSS). PRF is the adhesive that provides the highest strength and the most elastic compared to PU type adhesive.

ABSTRAK

Kayu silang berlapis (CLT) di gunakan secara meluas di negara sebelah Eropah dalam pembinaan bangunan konvensional. Walaubagaimanapun, kayu pepejal mempunyai tahap durability , kekuatan dan ciri-ciri yang berbeza. Oleh itu, pemilihan species kayu yang betul hendaklah di utamakan dalam membuat sesuatu kajian. Antara species kayu yang di pilih dalam menjalankan kajian ini adalah species kayu dari kumpulan specific graviti 5 (SG). Dalam ujian ini, terdapat dua ujian yang terlibat, iaitu Ujian Kekuatan Lenturan di mana ujian ini menggunakan empat titik statik lenturan dan Ujian delaminasi dimana ujian ini untuk menentukan tahap kegagalan lekatan perekat apabila di rendam di dalam air. Data tersebut di analisis dengan menggunakan “Statistical Package for the Social Sciences” (SPSS). PRF merupakan perekat yang memberikan kekuatan paling tinggi dan paling elastik berbanding dengan perekat jenis PU.

ACKNOWLEDGEMENT

First and foremost, I would like to acknowledgement and extend my deepest gratitude to my supervisor, Dr. Adlin Sabrina Binti Muhammad Roseley for her guidance, trust , supports and encouragement. Thank you for all knowledge that had been shared with me from the beginning until end of this research.

I would also like to thanks to Forest Research Institute Malaysia (FRIM) especially Forest Products Division staffs and to Mr. Muhammad Adzam Bin Ahmad that give me fully supports and gain their helps during the study at FRIM. But do not forget to staff of Faculty of Engineering Mr. Mohammad Haffis Bin Hamid for his help in guidance and kindly providing the facilities to me along this research.

Last but not least, I would like to express my most sincere appreciation toward my beloved family and friends for their love, encouragement during this research. Thanks also to my best person especially Mohamad Pazlan Bin Ngaliman for his patience and support, helped in ensuring the completion of this study.

APPROVAL SHEET

I certify that this research project report entitled “Physical And Mechanical Performance Of Pu And Prf Adhesive In Cross Laminating Of Dark Red Meranti” by Nur Nabilah Binti Muhammad has been examined and approved as a partial fulfillment 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 |
| ACKNOWLEDGEMENT | v |
| APPROVAL SHEET | vi |
| TABLE OF CONTENTS | vii |
| LIST OF TABLES | ix |
| LIST OF FIGURES | x |
| LIST OF ABBREVIATIONS | xii |
| CHAPTER | |
| 1 INTRODUCTION | |
| 1.1 Background of study | 1 |
| 1.2 Problem statement and justification | 2 |
| 1.3 Objectives | 3 |
| 2 LITERATURE REVIEW | |
| 2.1 Cross Laminated Timber (CLT) | 4 |
| 2.2 The advantages of cross laminated timber (CLT) | 6 |
| 2.3 The mechanical properties of CLT | 7 |
| 2.4 Properties of Dark Red Meranti timber | 9 |
| 2.5 Structural adhesive for bonding of CLT | 10 |
| 2.5.1 Polyurethane | 13 |
| 2.5.2 Phenol Resorcinol Formaldehyde | 14 |
| 3 METHODOLOGY | |
| 3.1 Material | 15 |
| 3.1.1 Structural adhesives | 15 |
| 3.1.2 Solid wood material (Dark Red Meranti) | 16 |
| 3.2 CLT fabrication | 17 |
| 3.3 Equipment and test configuration | 23 |
| 3.3.1 Delamination test | 23 |
| 3.3.2 Mechanical testing | 24 |
| 3.3.2.1 Flexural strength test | 24 |
| 3.4 Experimental design | 28 |

| | | |
|-------|--|----|
| 4 | RESULT AND DISCUSSION | |
| 4.1 | Mechanical Properties | 30 |
| 4.1.1 | Effect of Adhesive Type on Modulus of Elasticity | 30 |
| 4.1.2 | Effect of Adhesive Type on Modulus of Rupture | 32 |
| 4.2 | Failure Modes | 35 |
| 4.3 | Physical Properties | 37 |
| 4.3.1 | Effect of Adhesive Type on Total Delamination | 37 |
| 5 | CONCLUSION AND RECOMMENDATION | |
| 5.1 | Conclusion | 42 |
| 5.2 | Recommendation | 44 |
| | REFERENCES | 45 |



LIST OF TABLES

| | Page |
|---|-------------|
| Table 1: The strength properties of Dark Red Meranti | 10 |
| Table 2: Wood adhesives categorized according to their expected structural performance at varying levels of environmental exposure. | 11 |
| Table 3: Physical and mechanical properties of adhesive. | 15 |
| Table 4: The properties of PRF and PUR adhesives. | 16 |
| Table 5: Physical and mechanical properties of wood. | 16 |
| Table 6: Flexural Strength of CLT with Different Types of Adhesives on MOR | 32 |
| Table 7: T-test of flexural strength for mechanical properties of PRF and PU adhesive. | 34 |
| Table 8: The mean values of Total Delamination and Maximum Delamination derived from the delamination test. | 39 |
| Table 9: T-test of delamination test for physical properties of PRF and PU adhesive. | 41 |

LIST OF FIGURES

| | Page |
|---|------|
| Figure 1: The previous project of CLT by XLam, New Zealand | 5 |
| Figure 2: | |
| (a) The samples wood planing to have straight wood | 18 |
| (b) Application of adhesives | 18 |
| (c) CLT pressing | 19 |
| (d) Wood surface planing | 19 |
| (e) Wood cutting process | 19 |
| (f) Final rapping of CLT | 19 |
| Figure 3: Sample CLT where adhesive is applied | 20 |
| Figure 4: The arrangement of solid wood and glue line | 21 |
| Figure 5: The hardened gluelines of PRF and PU adhesives | 22 |
| Figure 6: Test arrangement of global modulus | 26 |
| Figure 7: Flexural test using four point bending using Universal Testing Machine (UTM). | 27 |
| Figure 8: Experimental Design of study | 28 |
| Figure 9: The differentiation between adhesives in MOE | 30 |
| Figure 10: Mean MOE of PRF and PU adhesive types | 31 |
| Figure 11: The differentiation between adhesives in MOR | 33 |
| Figure 12: Mean MOR of PRF and PU adhesive types | 33 |
| Figure 13: Thickness of wood surrounding the bond-line | 35 |
| Figure 14: The failure location of the glued-in | |
| (a) PRF | 36 |
| (b) PU | 36 |
| Figure 15: Bending failure due to shear stresses between the laminates | 37 |

| | |
|---|----|
| Figure 16: Delamination Test of two types of adhesives PRF and PU using Standard EN 391. | 38 |
| Figure 17: The delamination occurred at the shortest edge board | 38 |
| Figure 18: The differentiation between total delamination for all three block samples | 39 |
| Figure 19: The values of maximum delamination for all three block samples | 40 |



LIST OF ABBREVIATIONS

| | |
|------|---|
| CLT | Cross laminated timber |
| PU | Polyurethanes |
| PRF | Phenol-resorcinol formaldehyde |
| ASTM | American Society of Testing and Materials |
| MC | Moisture content |
| CNC | Computerized Numerical Control |
| FRIM | Forest Research Institute Malaysia |
| DRM | Dark Red Meranti |
| UTM | Universal Testing Machine |
| LVDT | Linear Variable Differential Transformer |
| MOE | Modulus of Elasticity |
| MOR | Modulus of Rupture |

CHAPTER 1

INTRODUCTION

1.1 Background of Study

The construction industry has been undergoing continuous modification and improvement in order to successfully comply with the requirement of sustainable development. One of the most promising materials meeting these requirements is cross laminated timber (CLT). CLT is a pre-fabricated multi-layer engineered panel wood product, manufactured from at least three layers of parallel boards by gluing their surfaces together with an adhesive under pressure. The grain direction of consecutive layers is orientated orthogonally. Generally, the number of laminates in CLT is odd, therefore face layer are parallel to each other. The related of manufacturing, design, and performance of CLT in construction such as, structural design of CLT, connections in CLT building, fire performance of CLT assemblies, environmental performance in CLT timber and others. One reason for this development is the commercial launch of the innovative CLT.

Many timber species for CLT production have been investigated worldwide. A study by Fortune and Quenneville (2010) proposed on the usage of locally grown softwood species bonded using resorcinol adhesive in the production of CLT in New Zealand. Other than that, in overseas they used spruce species, example pine. CLT material fabricated using Southern pine to make a test.

Most manufacturers use formaldehyde-free interior and exterior polyurethane (PU) adhesives. Boards are face-glued and then pressed, planed and sanded into panels using Computerized Numerical Control (CNC) machinery. The panels can be custom fabricated to create openings, compound angles and unique features requiring complex geometry to meet specific end-use applications.

Therefore, apart from the natural, sustainable characteristic of its base material, there are many other important advantages of CLT itself and the product in comparison to other timber products.

1.2 Problem Statement and Justification

A variety of adhesives have been tested to CLT. The wood adhesives based on phenol-resorcinol (PRF) or Polyurethane (PU) are used. For this research, the adhesives used are PFR and PU to test the suitability of adhesives in manufacture CLT using Dark Red Meranti.

In Malaysia, there is limited data about CLT using solid hardwood species, so that the research want to compare either hardwood species in Malaysia is suitable for CLT purposes or vice versa.

Generally speaking, Dark Red Meranti is one of the plantation species which is the timber that are sustainably sourced. Based on the previous research, the distributions of this species mostly at southern of Peninsular Malaysia.

According to the FRIM, there are no uses of Malaysian timber hardwood as CLT in construction structure, so that this research to be carry out to test the ability of our country hardwood.

1.3 Objectives

The objective of this research is to investigate the relationship between the adhesive and the hardwood species toward Malaysia timber. In order to achieve the objective, the following specific objective required to be fulfilled.

1. To determine the mechanical and physical properties of CLT panels fabricated using PRF and PU adhesives.
2. To identify the failure modes of cross laminated timber (CLT) using Malaysian solid hardwood.

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