UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN AND ANALYSIS FOR DEVELOPMENT OF NATURAL BASED FOR SCALE MODEL FURNITURE PRODUCT

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Maintenance Technology) with Honours

by

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APPROVAL

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ABSTRAK

The purpose of this research is to develop the new composition of naturally made resin reinforced kenaf fibre and to test and analyze the new composition of kenaf mix with natural binder. The production of synthetic fibre that produced by human cause a problem to environment and human's health. The temperature of the world has increasing from year to year and the environment pollution also becomes worst such as air pollution. Kenaf or more commonly known as Hibiscus Cannabinus is an annual, herbaceous fibre which originates from the stems of a plant in Malvaceac family. The naturally made resin used is glutinous rice that acts as a binder to combine with kenaf fibre. The reinforced between glutinous rice and kenaf fibre is made 20 samples by varying its composition. The samples were prepared by mixing the glutinous rice layer by layer with variations of kenaf in the middle. The samples were tested using a destructive test to identify its mechanical properties. The test that has been used is compression test. The results obtained found out that the best in range of composition of compression test is 15% of kenaf fiber and 85% of glutinous rice where the compression load is reach until 6527N and 7024N. By using this percentage of composition, a stool chair is developed out and compression test is used to test the compression load that can withstand by leg of chair. After testing, the compression load that can be withstand by the leg of chair is 140N. Since the stool chair using 4 legs, therefore total maximum compression load that can be withstand is 40kg which is a normal weight of a children. Therefore, all the objective of this project have been achieve where a new composite has been develop, analyze and tested.

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ABSTRACT

Tujuan kajian ini adalah untuk mencipta satu komposisi baru dibuat daripada campuran bahan semula jadi resin dan sabut kenaf dan campuran ini akan diuji dan dianalisis. Penghasilan gentian sintetik yang dibuat oleh manusia telah menghasilkan masalah kepada persekitaran dan kesihatan manusia. Suhu bumi pun meningkat dari tahun ke tahun dan pencemaran alam sekitar pun semakin teruk seperti pencemaran udara. Sabut kenaf atau nama saintifiknya adalah Hibiscus Cannabinus ialah batang yang tidak berteras berasal daripada tangkai dalam keluarga Malvaceac. Untuk bahan semula jadi resin yang digunakan adalah beras pulut di mana ia berfungsi sebagai pengikat kepada bahan sabut kenaf. Campuran antara beras dan sabut kenaf dijadikan sebanyak 20 spesimen dengan berbagai-bagai komposisi. Spesimen ini disediakan dengan mencampurkan beras pulut daripada lapisan ke lapisan dengan berbagai-bagai variasi dengan serat kenaf di tengah. Contoh uji kaji ini kemudian akan dikenakan ujian kemusnahan untuk mengetahui ciri-ciri mekanikal tersebut. 1 ujian kemusnahan tersebut adalah ujian mampatan. Hasil ujian didapati bahawa komposisi terbaik dalam lingkungan tersebut untuk ujian mampatan ialah terdiri daripada 15% sabut kenaf dan 85% beras pulut di mana mampatan ini sampai 6527N dan 7024N. Dengan menggunakan komposisi ini, 1 kerusi najis telah dibuat dan ujian mampatan digunakan untuk menguji mampatan yang boleh ditahan oleh kaki kerusi. Lepas diuji, mampatan yang boleh ditahan oleh kaki kerusi ialah 140N. Oleh sebab kerusi najis menggunakan 4 kaki, jumlah keseluruhan mampatan berat yang boleh ditahan ialah 40kg di mana bersamaan berat badan seorang budak. Justeru, semua objective untuk projek ini telah dicapai dimana satu komposit telah dihasil, dianalisis, dan diuji.

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DEDICATION

To my beloved parents and my supervisor Mr Mohd Afdhal bin Shamsudin

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LIST OF SYMBOLS

ASTM	-	America Society for Testing and Material
C	-	Celsius
CO_2	-	Carbon dioxide
Cu	-	Copper
deg	-	Degree
G	-	Giga
kg	-	Kilogram
KRFC	-	Kenaf fiber-reinforced composite
L	-	Length
M	-	Mega
mm	-	Millimetre
N	-	Newton
Pa	-	Pascal
Pb	-	Lead
PBSA	-	Poly(butylenes adipate-co-terephtalate)
PCL	-	Polycaprolactones
PEA	-	Polyesteramides
PHA	-	Polyhydroxyalkanoates
PHB	-	Poly(hyroxybutyrate)
PLA	-	Polylactic acid

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PHA	-	Polyhydroxyalkanoates
SEM	-	Scanning Electron Microscopy
W	-	Width
Zn	-	Zinc

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CHAPTER 1
INTRODUCTION

1.1 Introduction

Natural fibre is any hair like raw material that produced and obtained by animals, plants or mineral source such as cotton, flax, seeds, leaves, animal skins, kenaf, bamboo and more. The natural fibres such as pineapple, banana, rice, bamboo, hemp oil palm, and coconut are the natural fibres or ingredients that normally used to make a composite. Wool is a type of strong fibrous material which already been used back to 35,000 years ago in textile industry. Rayon (artificial silk) was the first man-made fibre and produced in early 1930s. Due to the increase of environment awareness where now many environment problems has been raised as the results of the human activities such as the production of the synthetic materials, there has been increasing in the application of natural fibres in various type of industries such as building, automotive, sporting, and spacecraft where the engineering sectors try to develop new materials from natural resources which is reusable to replace the synthetic materials by its mechanical properties. The natural fibre is very available in Asia and more advantageous compare with traditional reinforcement materials and conventional reinforcement materials such as glass and carbon. Natural fibre has many benefits such as it is environment friendly, fully biodegradable, renewable, non-toxic, low abrasive nature which easy to process and recycling, low cost and easy to handle which provide a possible alternative to synthetic fibre. These are the main reasons why there are many researchers are very interesting on the study of natural fibre composite. Furthermore, natural fibres can grow in different conditions which can helps to reduce the production of the carbon dioxide (CO_2). Some of bast fibrous plant can be

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used to clean the polluted soil by extracting the lead (Pb), copper (Cu) and zinc (Zn) out from the soil. The natural fibre becomes more important as alternative textile resources for the healthy, comfort and the sustainable. The production of the natural fibre is expected to reach at 35-40 million tons per year. The Table 1 shows the most common natural fibre in this world and their world production.

Table 1.1: Natural fiber in the world and their world production (Layth Mohammed et.al., (2015))

Fiber Source	**World Production (10^3 ton)**
Bamboo	30,000
Sugar cane bagasse	75,000
Jute	2300
Kenaf	970
Flax	830
Grass	700
Sisal	375
Hemp	214
Coir	100
Ramie	100
Abaca	70

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1.2 Problem Statement

There is increasing in the awareness toward the environment since now the temperature of the world has increasing and the environment pollution becomes worst. According to the study of M.N. Yahya and D.D.V.S.Chin (2017), it stated that the synthetic fibre cause a problem to environment and human's health. This is because the source to make is from petrochemical sources which are made up using high temperature industrial processes such as hot extrusion which produce a high amount of carbon dioxide. Temperature of the world has increased and causes the sea level increase. Next, it also causes the air pollution of surrounding become worst. According to the study of O. Onuaguluchi and N.Banthia (2016), it also states that the building construction also contribute a significant waste generation, material and energy which cause environment pollution especially greenhouse effect. Furthermore, waste management system in Malaysia is very poor because the cost of dispose of the waste is increasing where the waste of produced by Malaysia is 30000 every day and only 5% of it can be recycle. Based on the study of M.A. Elsawv et al., (2017), it states that more than 50% of plastic product is made up from fossil fuels. After human used it, they discard to the environment by burning it since it is very hard to dispose. The burning process cause a major problem since it can produce toxic gas and it is harmful toward environment and human.

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1.3 Objective

From the background and problem statement that has been stated, the objective of this project is

- To develop new composite
- To test and analyze the new develop composite

1.4 Scope

In order to achieve the objective, several scopes have been determined.

- Developing the new composite using natural fibre as reinforced
- Testing the sample by using the Compression test according to ASTM C170 to find the compressive strength of the new composite

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