UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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A STUDY ON NEW MATERIAL OF CAR DOOR PANEL FABRICATED FROM BIOCOMPOSITE KENAF FIBER-BASED

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

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Maintenance Technology) with Honours. The member of the supervisory is as follow:

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ABSTRACT

The purpose of this project is to develop the new composition of bio composite made of clay+epoxy as a binder and reinforced by Kenaf fiber. This reaches also to identify and analyse the composition of both mixture composite. The aim of this researches is to reduce the human problem which is synthetic fiber production utilization. This problem cause to environment and human health. The increases of the temperature due to air pollution year by year are effecting environment badly. The natural Kenaf fiber which known are produced by the Kenaf plantation industry. Kenaf has large amount of potential natural fiber because it consist high cellulose contains. The naturally made resin is clay act as the binder mix with kenaf fiber into the composite. The 6 sample has being prepared with varying its composition. Each of variation mixture has 3 sample that will used for the testing process. The sample are prepared by mixing the clay+epoxy layer by layer with the Kenaf in the middle of the composite. All these sample are tested by using NDT which is non-destructive test to identify the mechanical properties. The test involve was tensile test, and flexural test. The result obtain shown the range of the best composition between clay+epoxy and Kenaf fiber until it goes down. The best composition 30 wt% are chosen to be used as a ratio on composite material for the car door trim fabrication. Therefore, all the objective of this project have been studies where a new composite are be developed, analysed and tested.

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ABSTRACT

Tujuan projek ini adalah untuk membangunkan komposisi bio komposit baru yang diperbuat daripada tanah liat + epoksi sebagai pengikat dan diperkuat oleh gentian Kenaf. Ini juga dapat mengenal pasti dan menganalisis komposisi kedua-dua campuran komposit. Tujuan penyelidikan ini adalah untuk mengurangkan masalah yang dihadapi manusia terhadap penggunaan dan pengeluaran serat sintetik. Masalah ini menyebabkan alam sekitar dan kesihatan manusia. Peningkatan suhu disebabkan oleh pencemaran udara pada tahun demi tahun telah menyebabkan keadaan yang tidak sihat. Serat Kenaf semulajadi yang dikenali dihasilkan oleh industri perladangan Kenaf. Kenaf mempunyai sejumlah besar serat semulajadi yang berpotensi kerana ia mengandungi selulosa yang tinggi. Resin yang dibuat secara semulajadi adalah tindak balas tanah liat sebagai campuran pengikat dengan serat kenaf ke dalam komposit. 6 jenis sampel telah disediakan dengan pelbagai komposisinya. Setiap campuran variasi mempunyai 3 sampel yang akan digunakan untuk proses ujian. Sampel disediakan dengan mencampurkan lapisan epoksi tanah liat dengan lapisan Kenaf di tengah-tengah komposit. Semua sampel ini diuji dengan menggunakan (Destructive test)DT yang merupakan ujian memusnahkan untuk mengenal pasti sifat-sifat mekanik. Ujian melibatkan ujian tegangan, dan ujian lenturan. Hasilnya didapati menunjukkan julat komposisi terbaik antara tanah liat + epoksi dan serat Kenaf sehingga ia turun. Komposisi terbaik dipilih untuk digunakan sebagai nisbah bahan komposit untuk fabrikasi pintu kereta. Oleh itu, semua objektif projek ini telah dikaji dimana komposit baru akan dibangunkan, dianalisis dan diuji.

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DEDICATION

To my beloved parents Mr.Musa bin Saleh and Mrs.Sarimah Binti Man 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
deg	-	Degree
G	-	Giga
kg	-	Kilogram
KRFC	-	Kenaf fiber-reinforced composite
L	-	Length
mm	-	Millimetre
N	-	Newton

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Clay is the general material that being used in the construction industry. The clay brick used widely in all building construction. Clay is produce from a dough, which consists of clayey soil and water. It was made from a dough condition and place inside the mold to form the shape of the brick. The brick are fired in the oven for the drying process (Gür et. al., 2012). Clay mostly found at the place with high contain minerals such as river banks, stream beds, road cuts, naturally exposed earth such as in canyon or gullies and mine.

There are several type of the clay being used in the industry such as earthenware, stoneware, ball, fire and porcelain clays. The most popular type being used was the earthenware where used in pottery. Clay can be appears in various colour which is white to dull and brown to deep orange-red depending on the composition of the soil.

The clay has being used widely in historical and modern uses like building material know as loam, the oldest building material on earth compare to stone and wood. Now days, clay has being used to in building element such as clay floor, clay paint, and the most popular is ceramic. The ceramic are widely used in the electric field as thermal resistance and insulator.

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To increase the characteristic of the traditional clay for industrial requires, some additive must be added to change the properties of the clay. For example, the organic coatings that increase corrosion protection, can be mix in epoxy, as a pigment in a clay composite, to protect steel against corrosion. (Abesach M.mothaly vol 2018).

Natural fiber became one of most popular applied fiber in composite technology. The natural fiber actually produced by animal, plant or mineral source such as oil palm, hemp, cotton, flax, seed kenaf and more. This source has been used in widely in the industry such as automotive, construction, sport and leisure. The industry globally was increase the the requirement of the natural based fiber in the last few decade (Yaujiang Wang, 2010). For example, the artificial silk has been used in textile industry in early 1930 due to strong fibrous material. There are many beneficial by using natural fiber such as it renewable, low density, can dispose easily due to biodegradability and also it flexible.

The natural fiber became popular among researcher in Malaysia because it can get the source easily and there has no limitation to use it. There are some research has being made to develop new material from natural fiber for replaced the synthetic material usage. The synthetic material seen as a toxic material that can harm nature and hazard to the human being. Due to increase by using the natural resource, it help to reduce the toxic gas produced to the air that cause air pollution and acid rain.

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1.2 Problem Statement

Based on the increase synthetic fiber used in industrial, it actually has increased of temperature of the world. This will make pollution became worst. Synthetic has many known negative impacts on the environment and the health of workers, being a chemical heavy production, often in developing countries (Rastogi et. al., 2008). Synthetic fiber are made from the chemical source which through many process such as heat extrusion, chemical reaction and also using high temperature to melt all the composite. This will cause sea level increase due to hot air produced by all the process involve.

Moreover, by using the synthetic fiber, the acid level inside the air gas increase. This will cause the greenhouse effect to the human (Worst Polluted, 2013). For example, the place with high capacity of industrial building will experience acid rain. Several impact due to acid rain such as the painting at the house will damage, the corrosion at the steel which is exposed at the short time. Furthermore, the synthetic fiber also cause the improper gas release to the air. This happen due to open burning furnace to process the synthetic material. This method has being done because the synthetic fiber cannot dispose easily. It takes more than 10 years and more too disposed (Human Rights Watch (HRW), 2012). So, with the larger requirement of synthetic needed, the waste material will be abandon at the disposal place for a long time. It also increase the rate of unhealthy environment for the human.

Besides that, the increases of automotive industry will give big impact to the environment. This due to demand on the resources to produce the vehicle. For now, the main material being used on the interior of the vehicle was synthetic. A lot of ton plastic being used for a year. This will increase the pollution problem and it not a good for automotive industry.

With high exposed to the natural fiber, it will help to decrease all the problem of synthetic fiber. Natural fiber are easily dispose and it safe for human because it made up from the vegetable, wood and also the waste food. The behaviour of natural fiber will be analyse and compared to synthetic fiber in order to draw the conclusion either natural fiber are technically qualified to replace the synthetic fiber.

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1.3 Objective

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

- To develop new composite by using natural source
- To analyse the mechanical properties of new composite

1.4 Scope

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

- Developing the new composite by using reinforcement from natural source which clay+epoxy as a binder and Kenaf fiber as a reinforcement.
- Analysing the new composite by using ASTM D3039 and ASTM D790

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CHAPTER 2

LITERATURE REVIEW

2.1 Problem of Synthetic Fiber

Due to increase in world population and living standard, the fiber consumption are increasing in the past few decades. Fiber are used in several categories which is home furnishing, industrial and also textile construction itself. The utilization of fiber has given the trend of increasing the waste material produce by fiber. Based on (Youjiang wang, 2010), in USA, the total waste of textile industry about 11.9 million tons produced in 2007 and 15.9% from that value are the textile waste.

This large amount of waste are actually gives big impact to the world. This happen because the main material of synthetic fiber are made from petroleum which is not renewable. It also need several of stage of making the synthetic fiber which cost a lot energy. Example of the synthetic fiber are polyester, nylon, rayon and acrylic. This actually increase the awareness on back to the basic which is by using the natural fiber as a main part because natural fiber are biodegradable.

Natural fiber such as cotton, wool, silk and also polylactic acid are made from renewable source such as starch or sugarcane. The biodegradable based fiber can be discompose to organic matter after sorted time which can be as a nutrient to the soils. This will help to decrease the pollutions produced in the fiber industry.

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2.2 Fiber Classification

Fiber are known as the material which is have very small diameter in relation to their length. Fiber are main part of textile industry. There are some different type of fiber which to identify on their usage and function. Fiber with short length are called staple fiber and the long length are called filament. Based on (B. Vijaya Ramnath et. al., 2018), fiber are consist of composite material that made from two or more bonding to produce the chain. It include methods like weaving, knitting, braiding, felting, twisting, or webbing, and which is the basic structural element of textile products. The classification of fiber has been shown in figure 2.1.

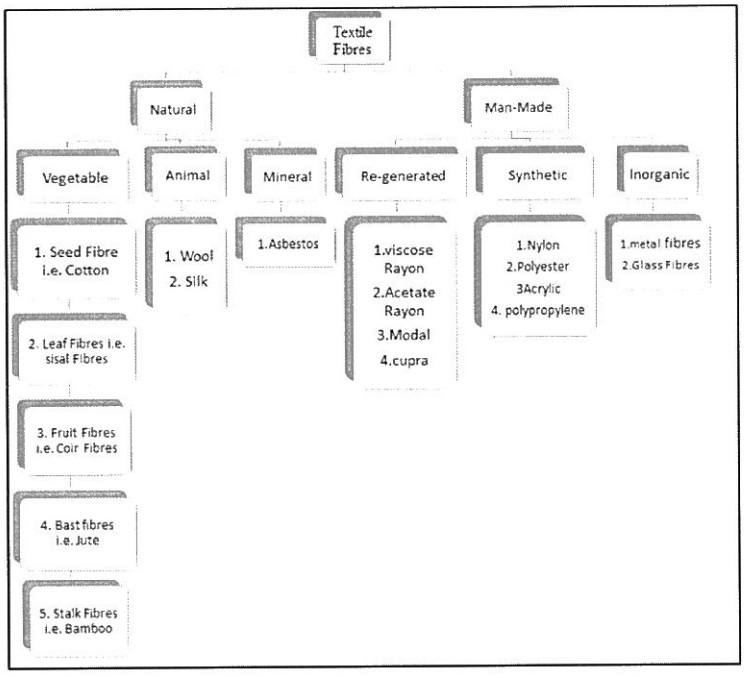

Figure 2.1 **Classification of fiber** (Sanjay et. al., 2015)

2.3 Natural Fiber Classifications

2.3.1 Introduction

Natural fiber was the alternative ways in order to replace the usage of synthetic material that can give harmful to the human and the environment which is pollution problem In addition, there are many advantages from utilization of the natural fiber such as low cost, low power of energy needed and last it have a better mechanical

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