UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **The residue of palm oil (Empty fruit bunch) as fiber reinforcement with the comparison between epoxy and polyester as matrix in composite material.**

SESI PENGAJIAN: **2016/17 SEMESTER 2**

Saya **NURUL AFIQAH BINTI SA'AYA**

mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (✓)

☐	SULIT	(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972)
☐	TERHAD	(Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)
☐	TIDAK TERHAD	

Disahkan oleh:

_____ _____

Cop Rasmi:

Alamat Tetap:

No. 67 Jalan AU4/1

Taman Sri Keramat Tengah

54200 Kuala Lumpur,

Tarikh: _____

Tarikh: _____

** Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini perlu dikelaskan sebagai SULIT atau TERHAD.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

THE RESIDUE OF OIL PALM (EMPTY FRUIT BUNCH) AS FIBER REINFORCEMENT WITH THE COMPARISON BETWEEN EPOXY AND POLYESTER AS MATRIX IN COMPOSITE MATERIAL

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Manufacturing Engineering Technology (Process and Technoly) with honours.

by

NURUL AFIQAH BINTI SA'AYA

B071310827

920627-14-5142

FACULTY OF ENGINEERING TECHNOLOGY

2016

DECLARATION

I hereby, declared this report entitled " The residue of palm oil as fiber reinforcement with the comparison between epoxy and polyester as matrix composite material" is the results of my own research except as cited in references.

Signature : ……..

Author's Name : Nurul Afiqah Binti Sa'aya

Date :

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirement for the degree of Bachelor of Manufacturing Engineering Technology (Process) with Honours. The member of supervisory is as follow:

…….

(Project Supervisor)

……..

(Co-Project Supervisor)

ABSTRAK

Penggunaan bahan rencam polimer semakin meluas penggunaannya, keutamaan bahan tersebut banyak digunakan dalam bidang automotif, perkapalan, lokomotif dan juga paling utama dalam pembuatan kapal terbang serta roket. Ini kerana bahan rencam polimer ini adalah terbukti ketahanan struktur serta ciri-ciri kekuatannya jika dibandingkan dengan bahan-bahan yang lain seperti besi, seramik dan kayu. Kelebihan yang ada pada bahan rencam polimer ini juga menjadi buruan bagi sektor-sektor perkilangan dalam menggunkannya sebagai antara bahan bagi produk mereka. Namun, sumber bahan mentah bagi bahan rencam polimer ini adalah dari minyak petroleum. Bahan petroleum adalah bahan yang dipercayai merupakan bahan yang sangat terhad dan tidak boleh di perolehi semula seperti balak. Oleh itu, serat semula jadi di percayai mampu menggantikan bahan serat sintetik seperti serat gentian kaca sebagai salah satu langkah untuk menampung kemahuan dari sektor industry yang menginginkan suatu bahan maju dan juga dapat mengurangkan masalah kemerosotan sumber bumi.. Serat semula jadi ini, dikatakan mampu mengurangkan kos serta menambahkan keuntungan margin pelaburan. Dalam projek ini, serat kelapa sawit di gunakan sebagai bahan penguat rencam bersama dua jenis resin atau ‘dammar’ digunakan, iaitu, Epoxy dan juga Polyester,kemudian bahan-bahan ini dicampur serta akan difabrikasikan untuk dijadikan satu kepingan bahan rencam polimer semula jadi, bahan ini kemudian diuji daya tahan serta kadar penyerapan bahan, seterusnya dibandingkan untuk melihat keserasian serat kelapa sawit ini bersama dua jenis dammar yang berbeza. Perbezaan serta kerasian dapat dibuktikan melalui ujian yang dibuat.

ABSTRACT

The use of polymer composite materials more widely used, the priority of the material widely used in the automotive, marine, locomotive and also the most important in the manufacture of aircraft and rockets. This is because the polymer composite material structure is proven durability and strength characteristics compared with other materials such as metal, ceramic and wood. The advantage in the polymer composite material is also being hunted for the manufacturing of materials to use it as one of their products. However, the source of raw material for the polymer composite material is from petroleum. Petroleum substances are substances that are believed to be of a very limited and cannot be obtained originally like the logs. Thus, the natural fiber in the trust is able to replace synthetic fibers such as fibers of glass fiber as one of the measures to accommodate the wishes of industry sectors who want an advanced materials and also can reduce the deterioration of the earth's resources .. This natural fiber, is said to reduce costs and increase profit margin investments. In this project, palm fiber used as reinforcing material for composites with two types of resins or resins used, namely, Epoxy and Polyester, then these ingredients are mixed and are fabricated as a single piece of composite natural polymer materials this is then tested durability and absorption of material, so compared to oil palm fiber compatibility with two different types of resins. Differences and congenial proven through tests made.

DEDICATION

I know you see me, I know you're there,
But in my heart it's not fair. If I look up I see the sky,
And I know up there It's hard to hide.
The sky is soft blue, With white milky clouds,
How can you be in a place. Not found?

In the end,

I fall to my knees, tcose my eyes and think of thee.
If you are who you say to be,
Then please, oh please, take care of me.
'Cause I believe!

-Elizabeth McCrorie

ACKNOWLEDGEMENT

Bismillahirrahmanirrahim,

Alhamdulillah, I would like to express our thankfulness to Allah S.W.t for giving me all the strength in fulfilling and completely this bachelor degree project. All the praise and blessing be upon Prophet Muhammad S.A.W. I would like to thank to those who had been involved whether directly or indirectly in helping me to complete my bachelor degree project. It could not have been written and produced without the help of many people.

Firstly, I would like to return my gratitude and courtesy to all that assisted and encourage me in completing this project and report. Special thanks to our supervisor, Mr. Mohd. Fariduddin Bin Mukhtar, for his support, critics and encouragement throughout the project. Also, thanks to all lecturer and technicians at the faculty of Engineering Technology for the valuable comments and knowledge on using machining at laboratory.

I also would like to acknowledge my appreciation to UTeM for providing the lab to be used and also the library for supplying the relevant literatures. I also would like to thank to my fellow classmate for giving me support, endless helps, views and very useful tips.

A big gratitude also for my ex-lecturers from my previous study in diploma, that give me so much help, finally, I feel very grateful to my family members for giving me support and encouragement from beginning to the end of the project.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF CHART

LIST OF GRAPH

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

ANOVA	-	Analysis of Variance
Vf	-	Fiber volume fraction
OPEFB	-	Oil palm empty fruit bunch

CHAPTER 1

INTRODUCTION

1.0 Introduction.

This chapter will explain the purpose of this project as well as detailing explain about the problem statement and research background. It also includes the back ground of the study, problem statement, the objective of the project which is expected to be achieved and the scope of the study that is going to be conducted.

1.1 Research background.

In Malaysia, the technology of advance material is roses in few decades as many industry companies are racing to be a step ahead in manufacturing and engineering. The increase of demand from the consumers challenging the technology to be kept on track to fulfill the daily needed. As the non-renewal material such as oil, metals, rocks, sands, and renewal material such logs is use to be main material to build thousands of products searching to find another replacement material, that effecting the cost, properties, process and the application and perhaps the new material is greater from conventional materials. The idea of using recycled material is already implement on the plastic industry. The material is prove to be very economy material, cost saving in term of production, and well performance of their mechanical performance leads the researcher to find and create more material that can be improve the existing material.

Curiosity comes when the composite material is said to be have better mechanical properties and it can be made by combining two or more different material to produce a single composite material. Composite materials have many

classification and the properties and characteristics among them are differ. In composite polymer, common material to produce a composite panel is fiber glass and matrix that act as the binder. Fiber glass is an example of a reinforcement material to fabricate a composite product. Composite material is widely choose to build a complex shape, and because of the advantages of the polymer composite properties that is light weight, high strength and can withstand at high temperature compare to steel and concrete, composite polymer is use to make a boat, airplanes, submarines, ships and even other custom product.

Nowadays, the replacement of natural fiber in composite polymer is interesting topics as it prove to be good performance from previous study, natural fiber can be an alternative approach because it has many properties and able to increase the strength ratio of the composite (Taufik et al, 2014). In addition to the material demands, the manufacturing sector is searching for new materials that lower the cost and profits margins. Because of the limitation of petroleum based product, the renewable source is list to be replacement reinforced material. The replacement of the reinforcement is said not just to cost effective but it enhances the material properties and physical properties.

Malaysia is a large producer of oil palm and the plantation conquering all state in the nation. The suitability of soil and whether, the production able to produce mass production of edible palm oil and exports the product around the world at the same time the industry helps to increase the sustainability of national economy. A fresh bunch of palm oil tree has mass of 25 kg, and about a ton of bunches can produce 200kg of pure oil palm, the leftover waste or residue is usually use as fertilizers and use to generate electricity in steam industry. (C. Y. Lin.2009).

The purpose of this project is to study the mechanical properties and comparing the compatibility of natural fiber with the polymer matrix. The Oil Palm Empty Fruit Bunch is choose to be as reinforcement in this project. In this project, with 30 weeks of two semester, this project will be done and at the end of the study, the objective can be fulfills. The limitation is to test the mechanical properties of natural and polymer composite by comparing the compatibility of natural fiber with these two types of matrix resin which is Epoxy resin and Polyester as binder.

1.2 Problem statement.

In composite field, discovery of new advance material is always give ideas for new advance material innovation. With all these innovation, the technology is struggling to overcome any limitation ahead. The source of material for the traditional composite material such as glass fiber and carbon is having limited resources. So the idea of to find renewable to reinforcement to replace traditional composite material, is become early objective of the project.

From previous study, the natural fiber is state to be low cost and easy to gain as the material is highly renewable and it helps for global sustaining the environment. To find the material which is lower the cost and profit margin is always be the opportunity for the manufacturing sector (Mishra et al. 2016). As the new material discover, further study is need to done to approve the claim of natural fiber have good properties performance, as well as in order to increase the application of the materials. Finding biodegradable material as the thermosetting polymer have disadvantage which is it cannot be degrade.

1.3 The objective.

The objective of this study can be outlined as the following:

i. Study the compatibility of natural fiber with two different resin matrices.

ii. To compare the value of water absorption rate percentage with different volume fraction natural fiber.

iii. To study the mechanical properties of impact test and hardness test.

1.4 Scope

The research is to study the properties of a composite panel using residue of Oil Palm Empty Fruit Bunch (OPEFB) as the fiber reinforcement with the comparison between Epoxy and Polyester as matrix resin. The research more focusing on comparing the result test value which carry out from three different types of test, Hardness test, Impact test and Water absorption test. In small scale, the wet hand lay-up is the chosen method to fabricate the composite.

1.5 Significant of research

The rationale from this research is, the new parameter can be use as reference and additional point of view based on the test result and analysis. In composite polymer field, the usage of natural polymer is still need to be study more in order to produce better and greater advance material for manufacturing and industrial sector.

Oil palm empty fruit bunch is now catch attention for the researcher to make it in part of the natural fiber composite. Even the popularity of this natural material in gaining popularity, there is some of limitation which must to be considered. The suitability of hybrid the material and the compatibility with the matrix and the main problem of OPEFB is the limited form of material which is it rarely being process to use as raw material. In this project, the objective of comparing the analysis result value is to know what application that this material can be use.

From this finding, hopefully, the manufacturing and industrial sectors are able to use it for further improvement. Not to forget, natural fiber also renewable resources that can help to be the part of choices of reinforcement fibers in composite field and believe to lower the cost of production and margin profits which the main reason for industry to find them as solution of produce good product with high profit.

CHAPTER 2

LITERATURE REVI EW

2.0 Introduction.

In this chapter, will be explain detail about literature review that consist the material that will use in this project the properties and the brief information about resin matrix and the composite material.

2.1 Composite Material and Manufacturing

Composite is the combination two or more different material to produce/combine into single material. Composite were consisting reinforcement material and matrix as binder, in addition these two basic combinations of materials able to enhance the properties of its material. As example, cement can be as brittle as ceramic, to improve this structure, iron rod and rocks pebbles is added together to produce tough and strong concrete. That is an example of composite. Fiber-reinforcement polymer (FRC) consist polymer as resin matrix and fiber reinforced can be form from synthetics material of natural resources.

Hard material are engineered or natural materials made from two or more major component material with significantly different physical or chemicalproperties which remain separate and distinct within the completes structure. Most composite have strong, stiff fibers in a matrix which is weaker and less rigid. The aim is usually to make an element which is strong and stiff often with a low density. Commercial materials commonly have glass or carbon fibers in matrices based on thermosetting polymers, such as epoxy or polyester resins.

Sometimes, thermoplastic polymers may be preferred, since they are moldable after initial production. Generally there are further classes of composite where the matrix is a metal or a ceramic. In most cases, these are still in a developing stage, with problems of high manufacturing costs yet to be overcome. Furthermore, in these composite the reason for adding the fibers (or in some cases, particle) are often rather complex. For example, improvement may be searched for in toughness, thermal stability, and many others. Fiber reinforced polymer (FRP) are composite used in almost every types of advance engineering structure, with their use ranging from aircraft , helicopter, spacecraft through to boats, cruise ships and automobiles, sports goods and city infrastructure suck as links and buildings.

The use of FRP composite is growing at an impressive mainly because these materials are being used more in their existing on marketplaces and established in relatively new markets such as biomedical devices and structures. The increased of applications of composites over the past few years is the development of the new advanced varieties of FRP materials. The consist of development in high performance resin system and the new varieties of reinforcement, such as carbon nano-tubes and nano-particles.(Mishra et al. 2016).

The properties of the composite depend upon the reinforced material. Tensile properties of the composites are mostly affected by the materials, method, specimen condition and preparation and also by percentage of the reinforced (Alaa A. Abdul Hameed, et al. 2014).

In FRC (Fiber reinforcement composite) can be evaluated in term of potential advantages present in use of FRP composite related to considerations such as:

- Higher strength
- Lighter weight
- Higher performance
- Longer lasting
- Rehabilitating existing structure and extending their life
- Ocean environment