EFFECT OF MACHINING PERFORMANCE ON RECYCLE PALM OIL WASTE BASED MATERIAL

MUHAMMAD AZRI HANAFI BIN ABU SAMAH

B091810035

BACHELOR OF MANUFACTURING ENGINEERING TECHNOLOGY WITH HONOURS

2022

Faculty of Mechanical and Manufacturing Engineering Technology

EFFECT OF MACHINING PERFORMANCE ON RECYCLE PALM OIL WASTE BASED MATERIAL

Muhammad Azri Hanafi Bin Abu Samah

Bachelor of Manufacturing Engineering Technology with Honours

2022

EFFECT OF MACHINING PERFORMANCE ON RECYCLE PALM OIL WASTE BASED MATERIAL

MUHAMMAD AZRI HANAFI BIN ABU SAMAH

A thesis submitted
in fulfillment of the requirements for the degree of
Bachelor of Manufacturing Engineering Technology with Honours

Faculty of Mechanical and Manufacturing Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2022

DECLARATION

I declare that this Choose an item. entitled " Effect Of Machining Performance On Recycle Palm Oil Waste Based Material".The oil palm fruit bunches as raw material is the result of my own research except as cited in the references. The Choose an item. has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : *Azri*

Name : Muhammad Azri Hanafi Bin Abu Samah

Date : 25 January 2022

APPROVAL

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor of Manufacturing Engineering Technology with Honours.

Signature : ....

Supervisor Name : Dr. Khairum Bin Hamzah

Date : 25 January 2022

DEDICATION

All the praises and thanks to be to Allah S.W.T for His Love. Im would love to dedicate this final report of my project to my late father, Abu Samah Bin Yip and my late mother, Norzabah Binti Sahar. The two persons that give me strength to be here during my sutudies. Special thanks to my supervisor and co-supervisor, Dr. Khairum Bin Hamzah and Dr. Fariza Binti Ab Wahab for the encouragement, constructive guidance and patient in fulfilling my aspirations in completing this project. To my brothers, groupmates and entire friends, will never archieve without all of you.

ABSTRACT

The effect of machining performance on recycle palm oil based epoxy is not a new idea, but there have been very few studies about reinforcing oil palm fiber with epoxy composite. In this study, to analyze the machine performance and mechanical properties on recycle palm oil fibers using tensile testing, surface roughness and impact testing. The oil palm fiber were used and will be mix with epoxy resin composite to improve the mechanical properties of oil palm fiber. For this experiment, three ratios are available: 55Natural 45Epoxy (55N45E), 60Natural 40Epoxy (60N40E), and 65Natural 35Epoxy (65N35E). Following the process, the cutting procedure is carried out using a machine which is a CNC router machine. The collected data were analyzed using statistical analysis. Numerical computation and graphical demostration are carried out to observe the effect of machining and mechanical properties on recycle palm oil with epoxy resins. The results were obtained from the ratio of materials and parameter of machine will be effect on the result strength of materials.

ABSTRAK

Kesan prestasi pemesinan pada epoksi berasaskan minyak sawit kitar semula bukanlah idea baharu, tetapi terdapat sangat sedikit kajian mengenai pengukuhan gentian kelapa sawit dengan komposit epoksi. Dalam kajian ini, untuk menganalisis prestasi mesin dan sifat mekanikal pada gentian minyak sawit kitar semula menggunakan ujian tegangan, kekasaran permukaan dan ujian impak. Gentian kelapa sawit telah digunakan dan akan dicampur dengan komposit resin epoksi untuk meningkatkan sifat mekanikal gentian kelapa sawit. Untuk eksperimen ini, tiga nisbah tersedia: 55Natural 45Epoxy (55N45E), 60Natural 40Epoxy (60N40E) dan 65Natural 35Epoxy (65N35E). Mengikut proses tersebut, prosedur pemotongan dijalankan menggunakan mesin iaitu mesin penghala CNC. Data yang dikumpul dianalisis menggunakan analisis statistik. Pengiraan berangka dan demostrasi grafik dijalankan untuk melihat kesan pemesinan dan sifat mekanikal ke atas minyak sawit kitar semula dengan resin epoksi. Keputusan diperoleh daripada nisbah bahan dan parameter mesin akan memberi kesan kepada hasil kekuatan bahan tersebut.

ACKNOWLEDGEMENTS

In the Name of Allah, the Most Gracious, the Most Merciful

First and foremost, I would like to thank and praise Allah the Almighty, my Creator, my Sustainer, for everything I received since the beginning of my life. I am grateful and thankful to my supervisor, Dr Khairum Bin Hamzah and my co-supervisor, Dr Fariza Binti Ab Wahab for the encouragements, advice and unwavering support in the completion of the project. I can never pay both of you back for all the experience that you have helped to make sure my thesis progress always on track.

I would like to thank all lecturers throughout my studies in University Technical Malaysia Melaka (UTeM) also because giving a lot of knowledge and guidance. Their helps making me possible to complete this project.

Last but not least, I would like to thank all my groupmates and friends who have been helping hands directly or indirectly to complete this project. The completion of this project can be achieved with helps from them.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS AND ABBREVIATIONS

CAD/CAM	-	Computer-Aided Design/Computer-Aided Manufacturing
CNC	-	Computer Numerical Control
CO2	-	Carbon Dioxide
EOPF	-	Empty Oil Palm Fruit
FFB	-	Fresh Fruit Bunches
HAZ	-	Heat Affected Zone
MDF	-	Medium Density Fibreboard
NaOH	-	Sodium Hydroxidesodium Hydroxide
OPEFB	-	Oil Palm Empty Fruit Bunches
OPF	-	Oil Palm Fruit
YAG	-	Yttrium Aluminium Gamet
55N45E	-	55 natural 45epoxy
60N40E	-	60 natural 40 epoxy
65N45E	-	65 natural 45 epoxy

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter discuss about the problem statements, the objectives and project scope. The tittle of this project is the Effect of Machining Performance on Recycle Palm oil waste-based material. The material is Empty Oil Palm Fruit (EOPF) bunches as raw material and Epoxy Resin.

1.2 Background

In the Eco-products Directory 2010, "Eco Materials" refer to "Materials" (or material technologies) which are capable of producing, using, recycling or disposing of high-performance characteristics that have little impact on the environment, but also have a human friendliness." The range of environmental-friendly materials includes recyclables, hazardous substances-free materials, low energy-consumption materials and clean conditions, water and air-contaminated materials, highly efficient and resource-efficient materials and much more.

Malaysia is the world's largest supplier of palm oil, and the major source of lignocellulos is palm oil waste in the form of empty palm fruit oil bunches. At the moment, only a limited amount of equipment has been created to remove this trash, and there is a severe shortage of disposal space for it. As a result, many palm oil refineries burn these residues to eliminate them. The results of this combustion might lead to environmental contamination. Numerous research on the conversion of discarded palm fruit bunches into a range of value-added goods have been undertaken.

The aim of this task is to explore, in several factors like physical and mechanical properties, the structure of the oil palm fibre composite with epoxy resin. The palm oil fibres are a build-up of the agro-business, usually produced on a high level. The use of characteristic fibre to promote research has been an enormous advantage. This has developed an important source of unlimited lignocellulosic biomass with considerable effort and an eagerly acquired result.

The elastic and tensile characteristics of these composites were investigated, and it was shown that high-quality composites made of oil palm fibre may be effectively produced. Natural fibres such as pulp, bamboo, wood, hemp, bagasse, and cotton, as well as plant fibres (for example, jute, lime, two ramies, and sisal), are found in a variety of diverse environments. Natural features of carbon fibres and glass fibres give a number of compensations, including suppleness by minimising machine wear and its lower causes; minimum hazards to human health; and vital fibre phase proportions (Cerqueira, Baptista and Mulinari, 2011).

There are two different types of cutting machines that are used to test the surface roughness on the specimen which is Computer Numerical Control (CNC) router machine after the materials had cut. Due to its precision and high intensity, router machining has a large application in fine composite cuttings. Loser-aided cutting has revolved around a range of materials, including wood, glass and plastic, in the manufacturing industry.

1.3 Problem Statement

Material and energy consumption are causing a rapid global environmental deterioration. Our safety is threatened by an increase in ageing systems, installations and machinery. Since the Earth's capacity is limited from both the input (resources) and output (disposal) aspects, environmental load minimization, and the most efficient use of energy and resources are essential for sustainable international development. "Eco materials" are suggested as a key concept in material technology which harmonises with the environment, in other words, to minimise environmental stress in a whole lifetime (Nowosielski, Kania and Spilka, 2007)

It claims that because the usage of synthetic plastic materials in the environment cannot be abolished, an unending buildup of waste on the ground and serious pollution might occur. It consisted of fine fibres embedded in a variety of plastics (polymers) that have dominated the market for synthetic composites for the last 40 to 50 years (Kindo, 2010). Although worldwide research is shifting its focus to another synthetic fibre option as a result of the accumulated global energy crisis and ecological risk. Although significant advancements in the elastic and flexural characteristics of these composites have been made, high-quality composites may be manufactured efficiently utilising natural fibre as their component.

However, sample preparation may be extremely challenging when mechanical characteristics are used to detect vacuums, fractures, and other flaws, as damage can readily be induced during preparation (Cerqueira, Baptista and Mulinari, 2011). To resolve this concern, this study proposes that further research be conducted on the influence of machining performance on palm fruit bunch-based epoxy resin in terms of physical and mechanical characteristics.

1.4 Research Objective

The objectives of the current study are:

a) To fabricate on recycle oil palm oil palm fruit bunches waste.

b) To perform the different process of cutting recycle palm oil fruit bunches waste into the testing specimen.

c) To analyze the machine performance and mechanical properties on recycle palm oil fibers using tensile testing, surface roughness and impact testing.

1.5 Scope of Research

This project will be focus on the effect of machining performance on recycle palm oil fruit bunches waste based on materia and its mechanical properties. This project involves the materials from palm oil waste to be used in industry. This product will consist of palm oil waste and epoxy resin. To create the composite, the fabrication process of alkalinizing, drying, and milling must be considered. To carry out the distinct process of cutting palm oil into the testing specimen, a router machine will be needed. The test that involve are a tensile testing, surface roughness testing and impact testing will be use to analysis the product. The result will be selected from the analysis and will be decide from the three different process for better quality of specimen material. All the results will be analyze using statistcical analysis.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In the cutting machine sector today, many various materials generate variable quality, which normally must prevent or make the cutting processes less complicated. This chapter identified a process for cutting performance which is CNC router machine been utilized or used in the industry. Tensile, surface roughness and impact quality knowledge of workpieces or products cut would assist in the evaluation of the CNC router machine which are better for each ratio.

2.2 Work Material

Work material means the materials, tools, equipment, components, installations, equipment, supplies and utilities required for job performeance but not for integration in production or consumption at regular intervals while the task is performed. This thesis will be conducted by several materials.

2.2.1 Oil Palm Fruit Bunches

(a) (b)

Figure 2.1 (a) Oil Palm Fruits Bunches, and (b) Oil Palm Tree

Palm oil fibers originate from the empty fruit bunch that is one of the oil palm residues. The fibers used in the present study are shown in Figure 2.1. The wastes of Palm Oil are made from large amounts of lignocellulosic substances, such as empty fruit bunches, oil palm fronds and trunks, which contribute to enhance the binding of construction material. These residues help the country to transform its large supply of by-products from the oil palm industry into value-added products that optimise its utilisation of these residues and totally neutralise the idea of burning those residues, which frequently cause environmental problems through the generation of severe air pollution, which is opposite to environment law (Ismail and Hashim, 2008).

After three years in the plantation, fresh fruit bunches (FFB) were generally harvested from oil palm trees. After removing the fruitlets, scientists dried the Empty Fruit Bunch (EFB) to a moisture level of 10% and crushed it into 1 mm particles using an IKAE grinder (German) (Hamzah, Idris and Shuan, 2011). Oil palm empty fruit bunch (OPEFB) fibres are biodegradable, natural reinforcing fibres. The quantity of biomass wastes that may be utilised as reinforcing components in the polymer composite provides a natural source of fibres. It is a non-toxic, renewable, and economically viable industrial interest (Ewulonu and Igwe, 2011).

2.2.1.1 Oil Palm Fruit Material Properties

The primary elements of lignocellulose are cellulose, hemicellulose, and lignin, and fresh EFB from the mill typically includes 30.5 percent lignocellulose, 2.5 percent oil, and 67 percent water. Physically, their elements are tough and powerful. As a result, the EFB possesses properties that are promising for future applications (Gunawan et al., 2009).

Table 2.1 Summary of some properties of palm fruit with standard deviation

Property	Mean Value (±standard deviation)	
	Dura Variety	Tenera Variety
Length, mm	30.5 (±5.07)	35.96 (±4.08)
Width, mm	19.94 (±2.64)	20.15 (±3.79)
Thickness, mm	15.66 (±2.25)	17.11 (±1.91)
Sphericity, %	70.67 (±9.27)	64.23 (±6.58)
Aspect Ratio, %	67.78 (±15.29)	56.77 (±9.47)
Fruit mass, %	7.66 (±2.04)	8.50 (±2.00)
True density, kg/m^3	1112.50 (±52.60)	995.70 (±26.99)
Bulk Density, kg/m^3	659.40 (±21.74)	611.04 (±27.79)
Density ratio, %	59.33 (±2.21)	61.45 (±4.01)
Porosity, %	40.67 (±2.21)	38.55 (±4.01)

Table 2.1, the dura sphericity and aspect ratio of the dura are 70.67 percent and 67.78 percent, respectively. The high sphericity of the palm fruit implies that its form is prone to become spherical. When paired with the high aspect ratio of 67.78 percent (the ratio of the fruit's breadth to its length), it's simple to see why palm fruits roll rather than glide on their smooth surfaces. The tenera variety's average fruit mass was 8.50 g, whereas the dura variety's average fruit mass was 7.65 g. The tenera's average fruit mass is more than that of