PHYSICAL AND MECHANICAL PROPERTIES OF PALM KERNEL ACTIVATED CARBON AFTER IMMERSE IN DIFFERENT TYPES OF VEGETABLES OIL

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DECLARATION

I declared that this project entitled “Physical and mechanical properties of palm kernel activated carbon (PKAC) after immerse in different type of vegetables oil.” is the result of my own work except as cited in the references.

Signature: .....

Name : .....

Date : .....

APPROVAL

I hereby declare that I have read this project report and in my opinion this report is sufficient in terms of scope and quality for the award of the degree of Bachelor Mechanical Engineering

Signature : .....

Supervisor's Name : .....

Date : .....

DEDICATION

To my beloved mother and father

ABSTRACT

Palm kernel activated carbon (PKAC) found that become one of the potential self-lubricant materials. Agricultural wastes would be preferred for use in activated carbon industries since they are both cost effective and environmentally favourable. In Malaysia, huge amount of palm kernel is producing as agricultural wastes. low friction coefficient, palm kernel activated carbon reinforced polymeric composite can replace existing high-cost industrial self-lubricated materials. In this project the effect of immersing in different type of vegetables oil on physical and mechanical properties of palm kernel activated carbon reinforced with polymeric composites was investigated. The composition of 60%, 65% and 70% of the weight activated carbon was reinforced with the polymer resin and compacted into a die at 100˚C with 1225kPa pressure for 10 minutes by using compaction technique. Three type shape prepared which is disc, pin and bone for conducting of tensile (ASTM D3039 / D3039M-17), compression (ASTM D 6641), hardness (ASTM D2240-15e1), surface roughness, density, porosity and water absorption (ASTM D570-98(2010) e1) tests. All the test conducted before and after immersing in three types of vegetables oil which is soybean, palm, and corn oil. The 60% sample had the most excellent properties in terms of hardness, surface roughness, tensile and compression. Immersing in different types of vegetables oil give slightly difference physical and mechanical properties of the composites compared to before immersed.

ABSTRAK

Karbon aktvasi isirong kelapa sawit didapati menjadi salah satu bahan yang berpotensi sebagai pelincir sendiri. Kegunaan bahan buangan hasil dari pertanian memberi keuntungan dalam industri aktivasi karbon yang mana ia lebih ekonomi dan mesra alam. Di Malaysia, banyak isirong kelapa sawit ynag terhasil sebagai bahan buangan pertanian. Disebabkan oleh pekali geseran rendah, karbon aktivasi isirong kelapa sawit diperkuatkan dengan komposit polimer boleh menggantikan bahan pelincir sendiri yang sedia ada dalam industry yang mempunyai kos yang lebih tinggi. Di dalam projek ini, kesan setelah direndam didalam beberapa jenis minyak sayur terhadap karbon aktivasi biji kelapa sawit yang diperkuatkan dengan polimer komposit telah dijalankan ujian terhadapnya. Beberapa komposisi PKAC seperti 60%, 65% dan 70% dari berat aktivsi karbon diperkuatkan dengan damar polimer dimampatkan didalam acuan dan dipanaskan pada 100 darjah Celsius serta 1225kPa tekanan selama 10 minit dengan menggunkan teknik pemadatan. Tiga jenis bentuk yang disediakan bagi mencapai objektif projek ini antaranya adalah cakera, pin dan tulang.untuk menjalankan ujian tegangan (ASTM D3039 / D3039M-17), pemampatan (ASTM D 6641), kekerasan (ASTM D2240-15e1), kekasaran permukaan, ketumpatan, keliangan dan penyerapan air(ASTM D570-98(2010) e1). Kesemua ujian yang dijalankan semasa sebelum dan rendam didalam tiga jenis minyak sayur antaranya adalah kacang soya,kelapa sawit dan jagung. Komposisi 605 didapati sebagai yang terbaik dalam ujian kekerasan, kekasaran permukaan, ketegangan dan pemampatan. Merendam dalam beberapa jenis minyak sayur memeberikan sedikit perubahan dalam ciri-ciri fizikan dan mekanikal komposit jika dibandingkan dengan sebelum direndam didalam minyak sayur.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

PKAC	-	Palm Kernel Activated Carbon
COF	-	Coefficient of Friction
DLC	-	Diamond Like Carbon
LCF	-	Low Coefficient Friction
ASTM	-	American Society for Testing and Material
HPF	-	High Positive Friction
VHPF	-	Very High Positive Friction
AW	-	Anti-wear
EP	-	Extreme Pressure
LEO	-	Low Earth Orbit
3D	-	3-Dimensional

CHAPTER 1

INTRODUCTION

1.0. Background of study.

Tribology is science of friction, wear, and lubrication. The word of tribology is derived from the Greek word *tribos* which means rubbing and friction. Tribological inventions are framed within time periods ranging from the prehistoric epoch (the stone age) to 3500 B.C., when one of the first examples of tribological applications was the generation of fire by friction between two pieces of wood. The tribology named officially arises from Jost Report. Tribology is the science and technology of interacting surfaces in relative motion and of the practices related thereto. (Jost, 1966), but tribological concepts, as for instance the way to reduce friction using rolling elements and lubricants, are much older than industry (Frêne et al., 1997; Dowson, 1998). Tribology is highly interdisciplinary involving many research fields as physics, mathematics, chemistry, materials science and engineering, and therefore connecting basic and applied sciences.

Friction is when two surfaces are making contact that produce energy, heat, and make the surface wear. The application of lubrication is to improve energy efficiency and mechanical reliability. Previous tribology research has yielded some promising wear-control methods, such as film coating, multi-phase alloying, and composite structuring, as well as lubrication. (Tahir et al., 2015). Solid lubrication, once considered an art form, has evolved into an important part of materials science and engineering. For a long time, companies have

used solid lubricating materials to achieve low friction and wear under a variety of conditions. Enhancing the tribology performance of solid lubricant materials will significantly reduce costs while also enhancing the efficiency of the machining method. (Shankar et al., 2017). Carbon has sparked the most interest among solid lubricants because of its unique properties. Carbon exists in a variety of ways, each with its own set of properties based on its particular structure (Lettington, 1998).

Palm kernel shells containing high carbon (50.01%) can be used as a precursor to produce of activated. (Mak et al., 2009). Physical or chemical activation carbon may be modified to produce activated carbon with high porosity and surface area. (Hadoun et al., 2013). Activated carbon is a carbonaceous substance that is mostly amorphous in nature but develops a high degree of porosity during the production and treatment process. Every activated carbon has a memory that is influenced by the source and the conditions of preparation. (Guzel F. and Uzum I, 2002) Almost any carbonaceous material can be used to make activated carbon. Agricultural wastes, on the other hand, are the most readily available and least expensive of all known raw materials. Since activated carbon is a cheap adsorbent, it is commonly used (Joshi et al., 2013). In this industrial revolution 4.0 era, environmental pollution became an issue with a great impact on social commitment in the last years, the need and demand for activated carbons is growing continuously. Because of its low friction coefficient, palm kernel activated carbon reinforced polymeric composite has the ability to replace existing high-cost industrial self-lubricated materials. At various temperatures and loads, palm kernel activated carbon reinforced polymeric composite has good tribological properties with high friction resistance and low wear rate. (Mat Tahir et al., 2016).

1.1. Problem statement.

The projecting edge or rim on the circumference of a steel wheel that is designed to hold the wheel on a rail is referred to as a flange. When transporting loads between fixed locations on a regular basis, rail transportation with flanged wheels is ideal. Loads may be made up of individuals, raw materials, or finished goods. Metal tracks provide low-friction movement, high-loading capability, and long-term durability. They are often self-contained and do not need the assistance of a driver. The wheels on a car or a shopping cart require a different level of precision and design than flanged wheel rail installations. To provide traction on flat surfaces, rubber or plastic tyres are made from softer materials. Metal wheels used on tracks, on the other hand, depend on precise geometry and engineering to stay on track.

Since the forces produced by contact between wheel and rail are dependent on the friction (or creep force) characteristics, friction conditions between wheel and rail play an important role in car dynamic action. For climbing a slope or braking near a station, for example, a high coefficient of friction (COF) is necessary. High COF, on the other hand, is not desirable for a car passing through a tight curve because it causes lateral force squeak noises and rail corrugation.(Tomeoka et al., 2002)

Friction control between wheel and rail has been used for many years, with sand being used to help a locomotive climb mountain, grease lubricant being used in tight curves to avoid corrugation or wheel-flange wear, and so on. However, even when using these techniques, COF may be set to a high or low level in a step-like manner. Too low or too high a COF causes wheel or rail problems, such as braking skids, station overruns, wheel/rail wear, and corrugation.(Tomeoka et al., 2002)

The heat generated in the contact zone between a wheel and a rail, as well as the increased temperature of the working surfaces, causes changes in the structure and mechanical properties of working bodies. It causes contact surface wear, which contributes to wheel flange and rail premature failure. (Descartes et al., 2011). The aim of lubricating the contact between the active rail gauge corner and the wheel flange is to minimise wheel and rail deterioration and thus wear. It must also ensure protection by reducing friction in curves to prevent wheel lift and, as a result, derailment. (Descartes et al., 2011) . One of the ways to reduce wear processes of surfaces in the flange contact is the application of lubrication devices for working surfaces. (Spiryagin et al., 2010)

1.2. Objective.

The objective of this study is:

- To study physical and mechanical properties of Palm Kernel Activated Carbon (PKAC) before and after immersion in different type of vegetable oil.
- To study the application of PKAC as solid lubricant for wheel flange railways.

1.3. Scope.

The study covers the physical and mechanical properties of palm kernel activated carbon (PKAC) before and after immersing in different types of vegetables oil. Hardness, surface roughness, density, weight, porosity, tensile and compression test were conducted in order to observe the effect of vegetables oil to PKAC. Making comparison of their properties between both before and after immersion in vegetables oil.

1.4. General Methodology

a. Literature review.

Collect information from previous studies journal, article, book and any related reference about the project.

b. Sample preparation.

Disc, pin and bone shape with composition of 70%, 65% and 60% of palm kernel activated carbon (PKAC) mixed with epoxy and hardener going through moulding process by using compacting technique using hot press machine with 100˚C of temperature with pressure of 120kPa.

c. Experiment.

The experiment will focus on physical and mechanical properties test such as hardness, surface roughness, density, water absorption and porosity for disc shape sample, tensile for bone shape and compression for pin shape sample. The experiment conduct before and after immersing in different type of vegetables oil, which is palm, soybean, and corn oil. The duration of immersion is 24 hours.

d. Thesis writing.

A complete thesis will be written including all the data and results from the experiment. The general methodology of this study is simplified in the flow chart as shown in figure 1.1.

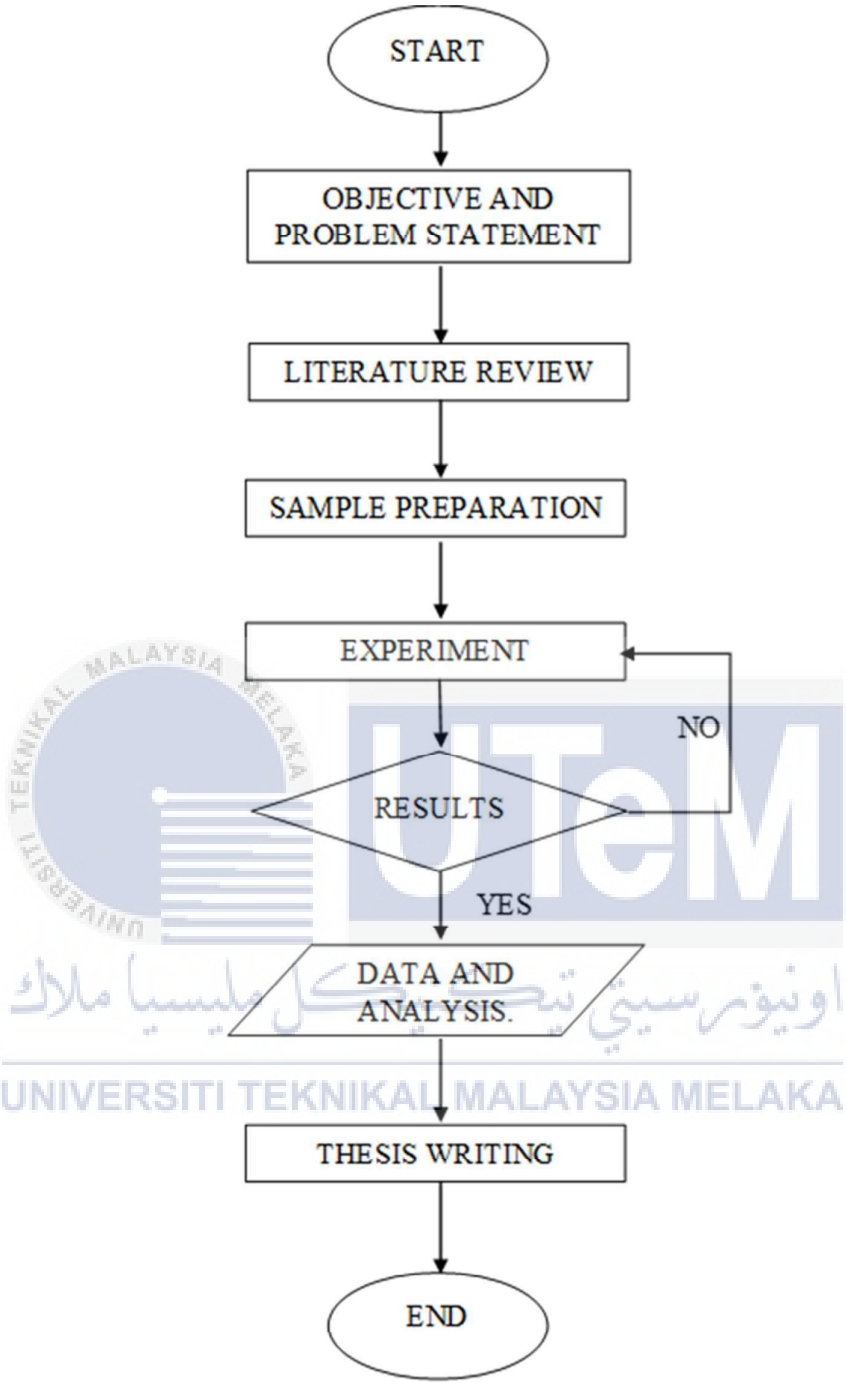

Figure 1-1: Flow chart of project.