UNIVERSITI TEKNIKAL MALAYSIA MELAKA

MORPHOLOGICAL STUDY USING OPTICAL MICROSCOPE OF NATURAL RUBBER WITH MODIFIED TAPIOCA STARCH AFTER SOIL BURIAL TEST

This report submitted in accordance with requirement of the UniversitiTeknikal Malaysia Melaka (UTeM) for the Bachelor of Manufacturing Engineering Technology (Process and Technology) (Hons)

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DECLARATION

I hereby, declared this report entitled "Morphological Study Using Optical Microscope of Natural Rubber (NR) with Modified Tapioca Starch (TS) After Soil Burial Test" is the results of my own research except as cited in references.

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APPROVAL

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

……

En. Hairul Effendy bin Ab Maulod

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ABSTRAK

Sekarang ini, di dalam industri automotive memerlukan permintaan yang tinggi terhadap getah asli. Getah asli ini telah diperbaiki dengan pengubahsuaian terhadap sifat-sifat mereka. Kajian ini adalah untuk menganalisis terhadap "Kajian Morfologi dengan menggunakan mikroskop optik terhadap Getah Asli (NR) yang diubahsuai dengan Tepung Ubi Kayu (TS) selepas Ujian Biolupus". Tepung ubi kayu (TS) digunakan sebagai pengisi berasaskan organik untuk Getah Asli (NR) dan sebagai bahan matriks utama dengan menggunakan rumusan berdasarkan mencari peningkatan sifat-sifat fizikal dan mekanikal mereka. Kajian ini adalah untuk mengkaji kesan isian tepung ubi kayu terhadap sifat-sifat getah asli untuk mewujudkan rumusan yang terbaik komposit degradasi getah asli dengan kajian morfologi. Terdapat pelbagai pengisian di dalam kajian ini bermula dari 0-60 phr. Sampel komposit dihasilkan dengan menggunakan formula pencampuran yang berbeza dengan menggunakan kaedah campuran dan mampatan. Sifat-sifat alam sekitar telah ditentukan melalui ujian biolupus. Ujian biolupus dikelasifikasikan dalam 7, 14, 21, 30, dan 60 hari dalam tanaman. Morfologi sample diperhatikan di bawah mikroskop optik. Selain itu, untuk membuktikan prosess biodegradasi kepada sampel, ialah dengan mengukur kekurangan berat dan kekurangan ketebalan. Peningkatan kadar tepung ubi telah meningkatkan kadar pelupusan yang dihasilkan oleh komposit. Secara keseluruhannya, semua objektif kajian yang disenaraikan berjaya dicapai daripada kajian awal ini dengan kadar biodegradasi untuk NR-TS (60) komposit adalah 0.005 mm^2 untuk 7 hari dalam tanaman sehingga 0.069 mm^2 untuk 60 hari dalam tanaman.

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ABSTRACT

Currently, an automotive industry has a strong demand for the natural rubber. The natural rubber are need to be improved with the modification of their properties. The study is focuses on the "Morphological Study Using Optical Microscope of Natural Rubber (NR) with Modified Tapioca Starch (TS) after Soil Burial Test". Tapioca starch is used as organic based filler of natural rubber and as a primary matrix material by using best formulation in search of improvement their physical and mechanical properties. This research is to study the effect of Tapioca Starch (TS) loading on the properties of Natural Rubber (NR) as to establish the best formulation of the Biodegradable Natural Rubber (NR) composite with morphological study. The filler loading was varied from 0-60 phr. The composition was fabricated into this sheet using a hot compression molding machine. The environmental properties were determined through soil burying test. The soil burying test were differences in 7, 14, 21, 30 and 60 days of burying. The morphology of the samples was observed under optical microscope. In other hand to prove the degradation process is with measuring the thickness reduction and weight reduction of samples. The increasing of tapioca starch content had significantly increased the degradation of produced composite. In overall, all the listed research objectives were effectively reached from this earliest research with the range of degradation for NR-TS (60) of composition is 0.005 mm^2 in the 7 days of burial test until 0.069 mm^2 in the 60 days of burial test.

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DEDICATION

This report is dedicated to Mr. Hairul Effendy bin Ab. Maulod for without his early inspiration, coaching and enthusiasm, none of this would have happened. This dedication is special dedicated to my parents. To my father, Khozari bin Salleh, and my mother, Fadzilah binti Baharom, for their ongoing love and support, and they also taught me to trust in Allah and believe in hard work. I also dedicate this report to my family who always support nr with their unconditional love that motives me to set a higher target in completing this final year project. This dedication is also dedicated to my beloved friends that have provided me with a strong love shield and always surrounded me and never lets any sadness enter inside.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

Al203	-	Aluminium Oxide
C	-	Carbon
CB	-	Carbon Black
CH	-	Carbon
DMA	-	Dynamic Mechanical Analysis
F	-	Fahrenheit
IA	-	Iodine Affinities
NA	-	Natural Rubber
OM	-	Optical Microscope
SEM	-	Scanning Electron Microscope
PHR	-	Per Hundred Rubber
RM	-	Ringgit Malaysia
SR	-	Synthetic Rubber
TS	-	Tapioca Starch
U.S	-	United State
UTM	-	Universal Testing Machine
%	-	Percentage
°C	-	Degree Celsius

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CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter will explain the overview of the study and the determination of this study. The chapter involves the background of the study, problem statement, objectives that is estimated to be accomplished and the scope of the study that is going to be showed.

1.1 Research Background

Natural Rubber (NR) is the elastomer one of the most common types of material used in Malaysia due to their ease of use. The demand for natural rubber is driving expansion of automotive industry. The application of rubber components in automobiles continues to be on rise. In United States, auto industry consume about 80 per cent of natural rubber. In automobile application, tires are the largest used of natural rubber.

The characteristics of rubber like flexing endurance withstanding greater distortion without injury. Meanwhile, the mechanical properties of rubber for the tensile strength is much larger than the proportionality limit which is greater degree of stretch adjustment that can change the rubber from soft rubber to hard rubber and the higher capacity to absorb energy (South et al. 2001).

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In the other hand, natural rubber are be improve with the modification of their properties to reduce the use of natural rubber for the tire manufacturer according to the higher demand. This study is focusing on the "Morphological Study Using Optical and Electron Scanning of Natural Rubber with Modified Tapioca Starch after Soil Burial". Moreover, to create the same or better quality of natural rubber, some material are mixed together with the natural rubber to reduce the amount used of natural rubber in application.

This study choose the combination of Natural Rubber modified with Tapioca Starch as the filler. The Tapioca Starch are been choose because of the properties of tapioca that able to be degradable. Beside tapioca is one of the natural organic fillers and also light weight, environmentally, low cost and friendly nature. Many industry use a starch to produce a wide range of products with extracted from the raw material (Maizatul et al. n.d.).

In our country, tapioca is the one plant that easy to develop because this plant never need the specific procedure to planting. Tapioca also used as a biodegradable products, for example tapioca root can be used to manufacture biodegradable bags developed from a tapioca resin of the plant as a viable plastic substitute. Beside biodegradable, it correspondingly able be composed, is renewable, reusable, recyclable and sustainable.

Furthermore, rubber is elastomeric and it is slow to degrade because it consists of molecule with high average molecular weight of nearly a million. In that case, the soil burial method are been choose to test the biodegradable functioning. Microorganism able to degrade any biopolymer act functioning when soil burial process and it perform an environmentally friendly (Plastics 2014).

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1.2 Problem Statement

Rubber will be vital for cars, and the auto industry will be necessary of the rubber industry. Tires are a stand out between the huge majority paramount parts of an auto. Furthermore beside tires, rubber is likewise utilized to making various belts, hoses also seal-s serious of the working of a car's motor. Such as plastic, rubber will be tough and more effectively formed under distinctive shapes. Over all, the demand for rubber that bursts starting with those auto industry accounts for give or take 80% of the world's downright rubber handling (Ă, Bobancu, and Ţă 2010).

Moreover the price of rubber increasing by day, so it is not possible to produce a product that using the natural rubber only. With this cases, the study a few materials are required which could be mixed with natural rubber to create same or better quality items up to the consumer expectations. The research found that fillers can be the added substance and also functioning to improve the strength of natural rubber. Modified tapioca starch is one of the natural fillers that used to improve the mechanical properties and also can reduce wastes from landfills.

In nature, one of the substance that widely found is starch. Starch is the organic nature that used as a filler with their characteristic like low cost, light weight, environmentally friendly nature, and because of enhances the mechanical properties of the filled materials. Beside, starch is a biopolymer consisting of amylose and amylopectin, present in most plants and in considerable amounts. This study is to formulation the tapioca starch and natural rubber to know the potential utilization, effects and mechanical behavior of natural rubber (Mazliah, Mohamad, and Jeefferie 2016).

In order to get the best formulation on the mixing of Natural Rubber compound with Tapioca Starch, some research studies on the physical and mechanical properties of tapioca starch and natural rubber. The improvement types fillers based on the current research formulation to mix with natural rubber compound (Maizatul et al. n.d.).

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1.3 Objectives

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

i. To study the effect of the physical and surface behaviour of Natural Rubber (NR) compound with Tapioca Starch (TS) in terms of degradation under soil burial test.
ii. To find the degradation rate of Natural Rubber (NR) compound with Tapioca Starch (TS) underdoing soil burial test.
iii. To show physical effect of degradation of Natural Rubber (NR) compound with Tapioca Starch (TS) after soil burial test.

1.4 Scopes

This research is to study the "Morphological Study Using Optical Microscope of Natural Rubber (NR) with Modified Tapioca Starch (TS) After Soil Burial Test" through the mixing material using internal mixer followed by various physical such as optical microscop. The study of this topic can come out with benefit for surroundings. Moreover this study focus on analysis structure of the material testing Natural Rubber (NR) with modified Tapioca Starch (TS) after soil burial test. After testing the soil burial test for several days, this sample will be analyze to see the structure of material which is the tapioca starch able to react to the natural rubber for degradation process.

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