UNIVERSITI TEKNIKAL MALAYSIA MELAKA

VIBRATION INSULATOR FROM NATURAL FIBER COMPOSITE

This report submitted in accordance with the requirements of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Engineering Material) with Honours

by

MOHAMAD FADLIZAN BIN ROSNI

FACULTY OF MANUFACTURING ENGINEERING

2009

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APPROVAL

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ABSTRACT

Due to high interest in high quality but low cost material, lots of researches have been done by the researcher and engineers. Together with the increasing usage of composite material from the mixture of natural materials. This technical report will proposed a research for a vibration insulator application. Coconut fiber and natural rubber is the material selected materials for this research as it offer lots of advantage which it has high quality as well as easy to found especially in Malaysia. This mixture of coconut fiber and natural rubber is mixed together then it goes to cold press process in a mold. The mixture is fabricated into composite with different composition of natural rubber of 5 wt.%, 10 wt.%, 15 wt.%, 20 wt.%, 25 wt.%, 30 wt.%, 35 wt.%, 40 wt.%, 45 wt.%, 50 wt.%, 55 wt.% and 60 wt.% of latex respectively. Mold of ten millimeters in thickness is prepared as the mold of the specimen preparation. A specimen of 100 percent coconut fiber also fabricated as comparison to the specimens with natural rubber for its mechanical properties determination. From the results obtained in the vibration testing, the fiber composite with 35 wt.% of latex is the best specimen in the vibration insulator application. This is because the vibration coefficient that produced in the vibration testing is the higher compared to the others specimen with 1.344×10^{-2}. The different percentage between the specimen with 35 wt.% of latex and the actual material also is higher that is 313.26 %. While the value of Young's Modulus for the tensile test and compression test are 0.033473 MPa and 0.07959 Mpa respectively. This data show that the composite with 35 wt.% of natural latex is suitable in the vibration insulator application.

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ABSTRAK

Selaras dengan permintaan yang tinggi untuk bahan yang berkualiti dan berkos rendah, banyak kajian telah di lakukan oleh para pengkaji dan jurutera. Sejajar dengan penggunaan bahan komposit daripada campuran bahan semula jadi yang semakin meluas masa ini, laporan teknikal ini membentangkan hasil kajian untuk digunakan dalam aplikasi sebagai peredam getaran. Sabut kelapa dan getah asli semula jadi adalah bahan mentah yang digunakan dalam kajian ini. Campuran sabut kelapa dengan getah asli semula jadi dihasilkan menerusi proses mampatan menggunakan kaedah mampatan acuan untuk mengfabrikasi komposit dengan 5 wt.%, 10 wt.%, 15 wt.%, 20 wt.%, 25 wt.%, 30 wt.%, 35 wt.%, 40 wt.%, 45 wt.%, 50 wt.%, 55 wt.% dan 60 wt.% kandungan getah asli semula jadi. Plat acuan setebal 10 milimeter disediakan sebagai acuan untuk penyediaan sampel. Sampel sabut kelapa sepenuhnya juga difabrikasi untuk tujuan perbandingan sifat mekaniknya dengan sabut kelapa yang diisi dengan getah asli semula jadi. Kesemua sampel ini akan diuji dengan ujian tegangan, ujian mampatan, ujian getaran dan ujian resapan lembapan untuk dibuat penilaian. Daripada keputusan yang diperolehi daripada ujian getaran yang telah dilakukan, komposit yang mengandungi 35% getah asli adalah spesimen yang terbaik untuk dijadikan sebagai peredam getaran. Ini kerana, pekali getaran yang dihasilkan menunjukan nilai paling tinggi berbanding spesimen yang lain dengan nilai 1.344×10^{-2} . Peratus perbezaan antara spesimen yang mengandungi 35 wt.% getah dengan peroduk sebenar juga menunjukan nilai yang besar iaitu 313.26%. Manakala nilai Modulus Young untuk ujian tegangan dan mampatan masing-masing dengan 0.033473 MPa dan 0.07959 MPa. Ujian peyerapan lembapan pula menunjukan nilai yang kecil iaitu hanya menyerap 2.4% lembapan dari persekitaran. Ini menunjukan, bahan komposit yang mengandungi 35% getah asli sangat sesuai untuk digunakan dalam aplikasi sebagai alat peredam getaran.

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DEDICATION

I would like to dedicate this report to myself, my beloved parents and family, my supervisor an also my fellow friends. Without these people's support and help it would be difficult for me to complete this research.

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LIST OF ABBREVIATIONS

ASTM	-	American Society for Testing and Materials
SI	-	International System of Units
UTeM	-	Universiti Teknikal Malaysia Melaka
UTM	-	Universal Testing Machine
Sdn. Bhd.	-	Sendirian Berhad
UTS	-	Ultimate Tensile Strength
Min	-	Minimum
Max	-	Maximum
Ave.	-	Average

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LIST OF SYMBOLS

%	-	percent
cm	-	centimeter
s	-	second
min	-	minute
g	-	gram
L	-	length
rms	-	root mean square
m	-	meters
m/s	-	metres per second
m/s^2	-	metres per second squared
γ	-	specific weight
V	-	volume
W	-	water absorption
S-t	-	strength immersion time
ε	-	strain
E	-	elasticity
MPa	-	mega Pascal
GPa	-	giga Pascal
NBR	-	nitrile elastomers
RPDM	-	Ethylene-propylene rubbers
σ	-	stress
P_{MAX}	-	Maximum load before failure
P_i	-	load at X data point
A	-	cross sectional
℃	-	degree Celsius
℉	-	degree Farenheit
G	-	Gram
Z	-	Damping ratio

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CHAPTER 1
INTRODUCTION

In this chapter, there are briefly discussed about the main body part of the thesis. In this chapter, it's focused about the vibration insulator from the natural fiber composite. This chapter consist the background, problem statement, objective, scope and rational of the research.

1.1 Background

Vibration is referring to forces that are not constant in amplitude or direction over time. It can cause solids to move repetitiously. The similar motion imparted to the air is called sound. These phenomena are somewhat interchangeable since sound can cause vibration and vibration can cause sound. One difference is that sound is only dealt with when it is audible while vibration must be addressed even when it is outside the range of human perception. (Anonymous, 2003)

Vibration is measured in hertz units (Hz). The hertz is a measure of frequency, informally defined as the number of events occurring per second. It is the basic unit of frequency in the International System of Units (SI), and is used worldwide in both general-purpose and scientific contexts. Hertz can be used to measure any periodic event; the most common use for hertz is to describe frequency of rotation, in which case a speed of 1 Hz is equal to one cycle per second.

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In English, hertz is used as both singular and plural. As any SI unit, Hz can be prefixed; commonly used multiples are kHz (kilohertz, 103 Hz), MHz (megahertz, 106 Hz), GHz (gigahertz, 109 Hz) and THz (terahertz, 1012 Hz). One hertz simply means one cycle per second (typically that which is being counted is a complete cycle), and for example 100 Hz means one hundred cycles per second. The unit may be applied to any periodic event such as a clock might be said to tick at 1 Hz, or a human heart might be said to beat at 1.2 Hz. The frequencies of a periodic events, such as radioactive decay, are expressed in becquerels. (Anonymous, 2008)

Fiber reinforcement composite materials is widely use in mainly industry such as air craft, space structures and robot arms because have high specific strength and damping ratio. Composite is a combination of two or more materials, for example, fiberglass and epoxy where fiberglass will act as reinforcement and while epoxy will act as matrix. Combination of materials should be more than 5 percent to be the composite. If the combination is less than 5 percent, it's called as impurities and not a composite. Composite also present in interphase. The main function interphase is to transfer the stress from matrix to fibers. Composite also have a different mechanical or physical properties if compare to the original raw materials.

1.2 Problem Statement

Vibration control is very important nowadays and not even limited to our daily life. The vibration control is very important in the industry either small and medium or high technology industries. Vibration can cause major problems and not only limited to the physical condition but it's also can affected mentally.

The purpose for this research is to produce new inventor insulator material in reducing excessive vibration. Vibration insulator is already used, but this research is to design the vibration insulator from the natural fiber composite. Mostly insulator used the

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petroleum. based to produce noise, vibration and heat insulator. This research will study the potential for the natural fiber composite as fiber reinforcement.

1.3 Objectives

The studies of this research are:

(a) To identify the mechanical properties of natural fiber and natural rubber that will suit the vibration insulator application.

(b) To design and fabricate the vibration insulator material from the natural fiber based composite with the use of coconut fiber as the reinforcement and the rubber as the binder or the matrix material.

1.4 Scope

(a) To study the coconut fiber as a reinforcement agent in natural fiber composite.

(b) To study the natural latex as matrices in natural fiber composite.

(c) To study the mechanical properties of the natural fiber composite.

(d) To study the potential of natural fiber composite as a vibration insulator.

.

1.5 Rational of Research.

(a) To apply the advantages of natural fiber based composite in term of engineering technology.

(b) Analysis the potential of natural fiber composite as a vibration insulator.

(c) Develop natural fiber composite as a one of the raw materials for technology application.

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1.6 Thesis Frame

This project is done with five main chapters which are introduction, literature review, methodology, analysis and discussion and lastly conclusion and recommendation. Chapter one briefly explained the background, objective, scope, problem statement, rational of research and the expected result. Chapter two is a literature review which consist the definition of vibration, natural fiber, natural rubber and composite. Chapter three is mentioned about the way of project being conducted and stated the method that will be used from the beginning process until the final process. This chapter also included the data of specimen parameters. In chapter four, all the gathered result based on tensile test, compression test, vibration test and moisture absorption test is attached and also analyzed. Here, the data of young's Modulus, maximum force, maximum stress and maximum strain is determined. In chapter five, it explained the conclusion for overall of this research and recommendation for the future improvement of this research.

1.6 Expected Result

The expected result for this project is the materials that produce from coconut fiber and the natural latex can be use in vibration insulator application without any problem. This product hope can get into international market and also can be widely use in the daily life.

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