UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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INVESTIGATION ON MECHANICAL, PHYSICAL AND ENVIRONMENT PROPERTIES FOR HYBRID METHOD OF FABRICATION ON CORNSTARCH COMPOSITES REINFORCED BY SHORT PINEAPPLE LEAF FIBER

This report is submitted in accordance with the requirement of the UniversitiTeknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Maintenance Technology) with Honours.

by

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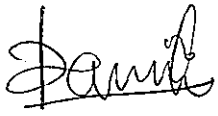
Signature: 

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APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of UniversitiTeknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Maintenance Technology) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Kajian yang dijalankan ini adalah untuk mengkaji kesan serat daun nenas (PALF)yang diperkukuhkan dengan kanji jagung termoplastik (TPCS)menggunakan teknik hybrid dalamproses pembuatan melalui ujian mekanikal, fizikal serta tindak balas terhadap alam semulajadi. Komposit yang dihasilkan adalah mengunakan serat daun nenas pendek, dimana setiap komposit mempunyai nisbah berat serat yang berbeza (20, 30, 40, 50,60, dan 70) wt%. Penyediaan TPCS adalah dengan mencampurkan 70 wt% kanji jagung asli serta 30 wt% gliserol menggunakan campuran manual dan pengadun berkelajuan tinggi. Kemudian PALF dan TPCS disusun mengikut urutan kedalam acuan secara hybrid, dimana berat keseluruhan campuranPALF dan TPCS adalah sebanyak 40g.PALF/TPCS komposit ini kemudian dikaji dan dibandingkan untuk mendapatkan bacaan nilai tertinggi dan terbaik bagi setiap ujikaji, Nisbah optimum yang diperolehi bagi kajian ini adalah pada nilai 30 wt% kandungan serat.Sifat mekanikal tertinggi untuk ujian tegangan dan impak adalah pada kandungan serat 30 wt%, manakala bagi ujian lentur adalah pada kandungan serat 60 wt%. Bagi ujian fizikal, ketumpatan tertinggi adalah pada kandungan serat 20 wt%, ujian kadar kelembapan dan penyerapan kelembapan mempunyai bacaan tertinggi pada pemuatan serat 60 wt% manakala bagi ujian penyerapan air bacaan tertinggi adalah pada kandungan serat 40 wt%. Akhir sekali, kandungan serat pada 20 wt% menunjukkan nilai sifat persekitaran tertinggi berbanding dengan kandungan serat yang

lain. Oleh itu, PALF/TPCS komposit yang dihasilkan ini mempunyai ciri-ciri komposit yang baik danmesra alam.

ABSTRACT

This study is about the effects of pineapple leaf fibers (PALF) reinforced with thermoplastic corn starch (TPCS) using hybrid techniques in manufacturing through mechanical, physical and environmental testing. The composites are made using short pineapple leaf fibers, where each composite has a different fiber weight ratio (20, 30, 40, 50.60, and 70) wt%. The preparation of TPCS was by mixing 70 wt% of native corn starch and 30 wt% glycerol using via hand-mixed and high speed mixer. Then PALF and TPCS were arranged in ahybridorder sequence into the molding, where the total weight of PALF and TPCS was 40g.PALF/TPCS composite was studied and compared to obtain the highest and best value readings for each experiment. The optimum ratio that been earn from this study is 30wt% fiber loading. The highest mechanical properties for tensile stress and impact were at 30 wt% fiber content, while for the bending tests were at 60 wt% fiber content. For physical tests, the highest density was at 20 wt% fiber content, moisture content and moisture absorption tests had the highest reading at 60 wt% fiber loads while the highest reading for water absorption test was at 40 wt% fiber content. Finally, the fiber content at 20 wt% shows the highest value of environmental properties compared to other fiber content. Therefore, the PALF / TPCS composite produced have good composite and environmental characteristics.

DEDICATION

This project report is lovingly dedicated to my family member my beloved mother Rohana Binti Ibrahim, to my father Izamuddin Bin Dahlan and my brothers, who was constant source of inspiration. A gratitude of thank you to my supervisor TS. Nazri Huzaimi Bin Zakaria and all my lecturer that have been helping and supporting me throughout this project. They have given me the drive and disciple to tackle any task with enthusiasms and determination. Last but not least, to all my friends that have been there for me. Without their support this project would not been made possible.

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LIST OF SYMBOLS

ρ	-	Density
m	-	Mass
v	-	Volume
W_i	-	Initial / Original weight
W_f	-	Final weight

LIST OF ABBREVIATIONS

PALF	Pineapple leaf fibre
CS	Cornstarch
TPCS	Thermoplastic Cornstarch
RH	Relative Humidity

CHAPTER 1

INTRODUCTION

1.1 Background

Pineapple is a perennial herbaceous plant belong to the Bromeliaceae family with a height of 1-2 meters (Tran, 2006). It is grown mainly in coastal tropical regions for the fruit season. In India, it is grown on approximately 2,250,000 acres of land and its production is continuously growing.

Pineapple plant is a short steam with a dark green colour as shown in Figure 1.1 the first leaf sprout looks attractive, later it becomes 3 ft long, 2 to 3 inches wide word shaped and many spirally set fibrous edges of the leaf as well as curved to the cross section to keep the leaf steady (D. P. Bartholomew, R. E. Paull, and K. G. Rohrbach, 2003).Every pineapple fruit has the same number of hexagonal outer shell sections and does not depend on dimension or shape.Now, as much as Hawaii, Malaysia is one of Asia's big producers. It produces about 384, 673 metric tons of waste material in 2008 (Khalil, 2011).

Pineapple leaf fiber production is plentiful for industrial purposes without any additional and is easily accessible annually and renewable(A. R. Rahmat, A. Hassan, and M. Mokhtar, 2007).Pineapple is known in Malaysia as Nanas, basically using red pineapple and green pineapple for commercial purposes, they prefer Sarawak pineapple and Morris pineapple for edible purposes. Pineapple fruits contain a lot of major and

trivial elements Figure 1.1 shows the percentage of fruits in pineapples.It is particularly a source of bioactive compounds in proteolytic enzymes. Pineapples are a very rich source of bromelein and other cytosine proteases can be found in different parts of pineapples (S. Ketnawa, S. Rawdkuen, and P. Chaiwut, 2010). Bromelain has been widely used in many food industries, cosmetics and dietary supplements.

Figure 1.1 : Pineapples (Annascomosus) mature plant (Faostat, Food and Agriculture Organization of the United Nations, 2011, http://www.fao.org/.)