



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**LIGHTWEIGHT REFLEXOLOGY BLOCK FROM EMPTY  
FRUIT BUNCHES OF PALM OIL WASTES**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Manufacturing Engineering Technology (Process and Technology) with Honours.

by

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2016

## BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

**TAJUK: Lightweight Reflexology Block From Empty Fruit Bunches Of Palm Oil Wastes**

**SESI PENGAJIAN: 2016/17 Semester 1**

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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 Manufacturing Engineering Technology (Process and Technology) with Honours. The member of the supervisory is as follow:

.....

(Nooririnah Binti Omar)

## ABSTRAK

Tandan buah kosong (EFB) adalah pengisi atau tetulang bahan untuk membuat blok refleksologi yang ringan. Bahan-bahan lain yang telah digunakan adalah simen dan air sebagai matriks manakala pasir sebagai pengikat. Di samping itu, kernel shell kelapa sawit telah digunakan sebagai batu refleksologi berjalan kaki. Semuanya dicampur bersama-sama secara manual dengan beberapa peratusan dan berat dalam bentuk yang sesuai (bentuk heksagon). Blok refleksologi yang terhasil dibahagikan kepada 3 jenis iaitu 0 %, 10 % dan 15 % daripada EFB. Ia telah diuji dengan 2 ujian iaitu ujian mampatan dan ujian berat. Hasil daripada ujian mampatan telah menunjukkan bahawa kekuatan mampatan blok refleksologi itu menurun apabila kandungan EFB meningkat. Keputusan ini mungkin kerana peningkatan peratusan EFB dalam tubuh blok refleksologi membuatkan jumlah lompang meningkat, seterusnya membuatkan ia tidak padat. Selain daripada itu, hasil daripada ujian berat menunjukkan berat blok refleksologi telah menurun apabila peratusan EFB dalam tubuh blok refleksologi meningkat. Berat blok refleksologi yang mengandungi EFB menurun disebabkan oleh EFB menggantikan bahan yang lebih berat iaitu simen. Blok refleksologi yang lebih ringan adalah lebih mudah untuk diangkut dan dikendalikan semasa pembinaan. Sebagai kesimpulan, blok refleksologi yang terbaik untuk kajian ini adalah menambah 10 % daripada EFB ke dalam tubuh blok refleksologi untuk meningkatkan sifat-sifat mekanikal dan fizikal blok refleksologi ringan daripada sisa tandan buah kosong kelapa sawit.

## **ABSTRACT**

Empty fruit bunches (EFB) is a filler or reinforcement material to fabricate the lightweight reflexology block. The other materials that had been used are cement and water as a matrix while sand as a binder. In addition, palm oil kernel shell was used as reflexology walk stone. It all been mixed together manually by several percentage and weight in the appropriate form (hexagon shape). The resulting reflexology block was divided into 3 different types which are 0 %, 10 % and 15 % of EFB. It was tested by 2 tests which are compression test and weight test. The result from compression test was demonstrated that the compression strength of the reflexology block was decreased when the EFB content increased. This result may be because of increasing the percentage of EFB inside the body of the reflexology block make the number of voids increased, then make it not compact. On other hand, the result from weight test shows the weight of reflexology block were decreased when the percentage of EFB inside the body of the reflexology block was increased. The decreased weight of the reflexology block embedded with EFB due to the EFB replaced the heavier material which is cement. The lower weight of reflexology block is easier to be transported and handled during construction. As the conclusion, the best reflexology block for this study is adding 10 % of EFB inside the body of reflexology block in order to improve the mechanical and physical properties of lightweight reflexology block from empty fruit bunches of palm oil wastes.

## **DEDICATION**

I want to thanks to my parents, Mohd Jofrainee Bin Othman and Hashila Binti Abdul Gani, also my supervisor and friends that give me the extra spirit to continue developing this project.

## **ACKNOWLEDGEMENT**

I would like to express my appreciation to the individuals who had played a part in ensuring a successful occurrence and flow of activities throughout the duration of my final year project. Endless appreciation and gratitude to my supervisor, Madam Nooririnah Binti Omar for her encouragement, support and spending quite time with me, providing a lot of guidance and ideas for my project research. Her knowledge and experience really inspired and spurred me. I truly relished the opportunity given working with her. Besides, my appreciation to all technicians involved to complete this project especially to materials testing laboratory and welding laboratory in FTK, UTeM. Last but not least, I would like to thank SMK Lenga, Muar because willing to collaborate with me by sharing their knowledge to do this project. Finally, my sincere appreciation is dedicated to my family and as well as my friends for their priceless assistance and patronage throughout the process of data gathering.



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## **LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE**

mm	-	Mililiter
EFB	-	Empty Fruit Bunches
RM	-	Ringgit Malaysia
BC	-	Before Christ
MPOB	-	Malaysia Palm Oil Board
OPT	-	Oil Palm Trunks
PPF	-	Palm Pressed Fibres
%	-	Percent
wt	-	Weight
ASTM	-	American Standard Testing Material
Al	-	Aluminium
Ca	-	Calcium
Fe	-	Iron
Mg	-	Magnesium
Na	-	Sodium
K	-	Potassium
P	-	Phosphorus
Si	-	Silicon
na	-	Not Available
PC	-	Portland Cement
IS	-	Indian Standard
ml	-	Mililiter
g	-	Gram
FTK	-	Fakulti Teknologi Kejuruteraan
CATIA	-	Computer Aided Three-dimensional Interactive Application
V5	-	Version 5
ISO	-	International Organization for Standardization
SI Unit	-	International System of Unit

$\sigma$	-	Stress
Pa	-	Pascal
$F$	-	Force
$A$	-	Cross-sectional Area
$m^2$	-	Square Meter
min	-	Minute
kN	-	Kilo Newton
$W$	-	Weight
$m$	-	Mass
$g$	-	Gravitational Acceleration
$N$	-	Newton
kg	-	kilogram
Eq.	-	Equation
MPa	-	Megapascal
vs	-	versus

# CHAPTER 1

## INTRODUCTION

### 1.0 Background of Research

Reflexology is an option solution including use of pressure to the feet and hands with particular thumb, finger, and hand systems without the utilization of oil or salve. It depends on an arrangement of zones and reflex regions that purportedly mirror a picture of the body on the feet and hands, with the reason that such work impacts a physical change to the body.

Regularly reflexology walk stone can be found in parks, at resorts, in private greenhouses, and at the base of mountain trails so individuals can alleviate their feet and legs after a long climb. The paths consist of smooth stones implanted in cement with one edge staying up, or lying level. Some stones are very thick and adjusted and others are meager to give a more grounded incitement to the feet. Reflexology walking path is an incredible approach to get all the advantages of conventional reflexology, with the additional, very pleasurable and wellbeing giving advantage of being outdoors in fresh air, and taking in the excellence of nature (Matthew Scott, 2013).

Palm oil kernel shell is one of the palm oil industry wastes. It is a biomass residues from the palm oil after crude palm oil processing. Presently, these wastes are utilized as a fuel in boilers to produce steam and electricity for mill processes or disposed of via land filling. However, combustion and land filling cause environmental pollution problems, resulting in the need for more energy efficient, environmentally and economically sound solution (Lai and Goh, 2015). So, in this study, reflexology walk stone will be replaced by palm oil kernel shell and also to fabricate lightweight reflexology block from empty fruit bunches of palm oil wastes.

## **1.1 Problem Statement**

Reflexology walk stone is commonly found at the park in Malaysia. Weather factors can affect the durability of stone and lead to crack and debris. Furthermore, the current reflexology walk stone is very heavy. Therefore, to overcome this problem, empty fruit bunches of palm oil wastes will be used in the mixture to prepare lightweight reflexology block. On top of that, Malaysia is among the largest producers of palm oil in the world. Based on data that have been recorded, 15.3 million tons per year empty fruit bunches have become biomass wasted. Recycling waste of empty fruit bunches into the useful product will help to reduce agricultural waste.

## **1.2 Objective**

The aim of this study are:

- (a) To fabricate lightweight reflexology block from empty fruit bunches of palm oil wastes.
- (b) To study the mechanical properties of lightweight reflexology block.

## **1.3 Purpose of Study**

Lightweight reflexology block from empty fruit bunches of palm oil wastes is a project that use agricultural waste. It is also for the health benefits of being outside and breathe fresh air while enjoy the natural beauty. There are lots of benefits such as stimulates reflexology areas and pressure points in your feet that correspond to all major body organs and areas.

## **1.4 Scope of Project**

(a) Design Mould:

The mould to fabricate lightweight reflexology block from empty fruit bunches of palm oil wastes is made from mild steel with dimension the mould is 170 mm x 170 mm x 30 mm (hexagon shape).

(b) Testing:

The lightweight reflexology block will be tested using compression testing and weight testing.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.0 Introduction**

Reference and understanding were gained from various sources that are journals, books and internet. The focus in this literature is about lightweight reflexology block from empty fruit bunches (EFB) of palm oil wastes.

#### **2.1 Reflexology Walk Stone**

Reflexology, a bodywork technique that uses reflex points on the hands and feet to stimulate the body's own healing mechanism, is designed to bring the body into balance by applying pressure at points corresponding to areas of the body (Horowitz, 2004). Reflexology is a therapeutic nursing skills that are very valuable and very useful in health care from special care baby units up to elderly care. It is same with other therapies by rebalancing the body to restore and maintain health. Whilst to many, reflexology may appear a gentle therapy, it is vital that the contraindications are known and that it is only carried out by trained therapies (Griffiths, 1996).

Reflexology walking path were made from soft and smooth river stones (or cobblestone) that are placed in the path. It is simple and effective methods to massage the bodies for improved health. An area distant and not related to the body can be attributed with walking on the stones. This is because it can stimulate acupressure points on the feet. Besides, reflexology walking path usually can be found at park, hospital, resort and at the bottom of mountain trails so people can relieve their feet after a long hike.



Figure 2.1: Reflexology walk stone

## 2.2 Foot Reflexology Chart

There are many type of sensory nerve receptor and it all different. Furthermore, sensory nerve endings is connected to it. Reflexologists believe if given pressure in the right areas, it can stimulate the reflex points and give good effects on organs and health. They learn the location of these points from reflexology foot maps or charts. Eunice Ingham made the claim that the application of reflexology massage to reflex points on the fee increases blood supply to the corresponding mapped organs in the body (Jenny Jones and Stephen J. Leslie, 2012). The human body can be divided into ten longitudinal zones. Five zones in each of the left and right. If any problems occur in the organ, then it can be treated by giving pressure on the same zone with that organ.

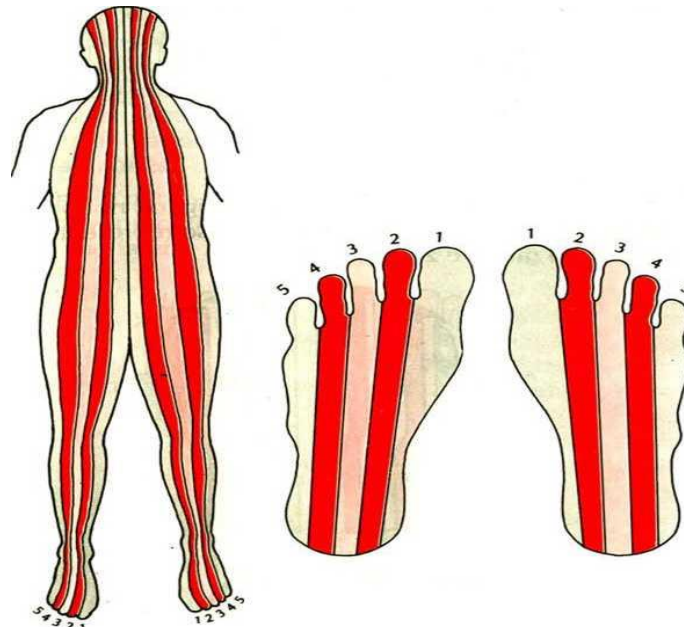


Figure 2.2: Ten zones in the human body



Figure 2.3: Foot reflexology chart