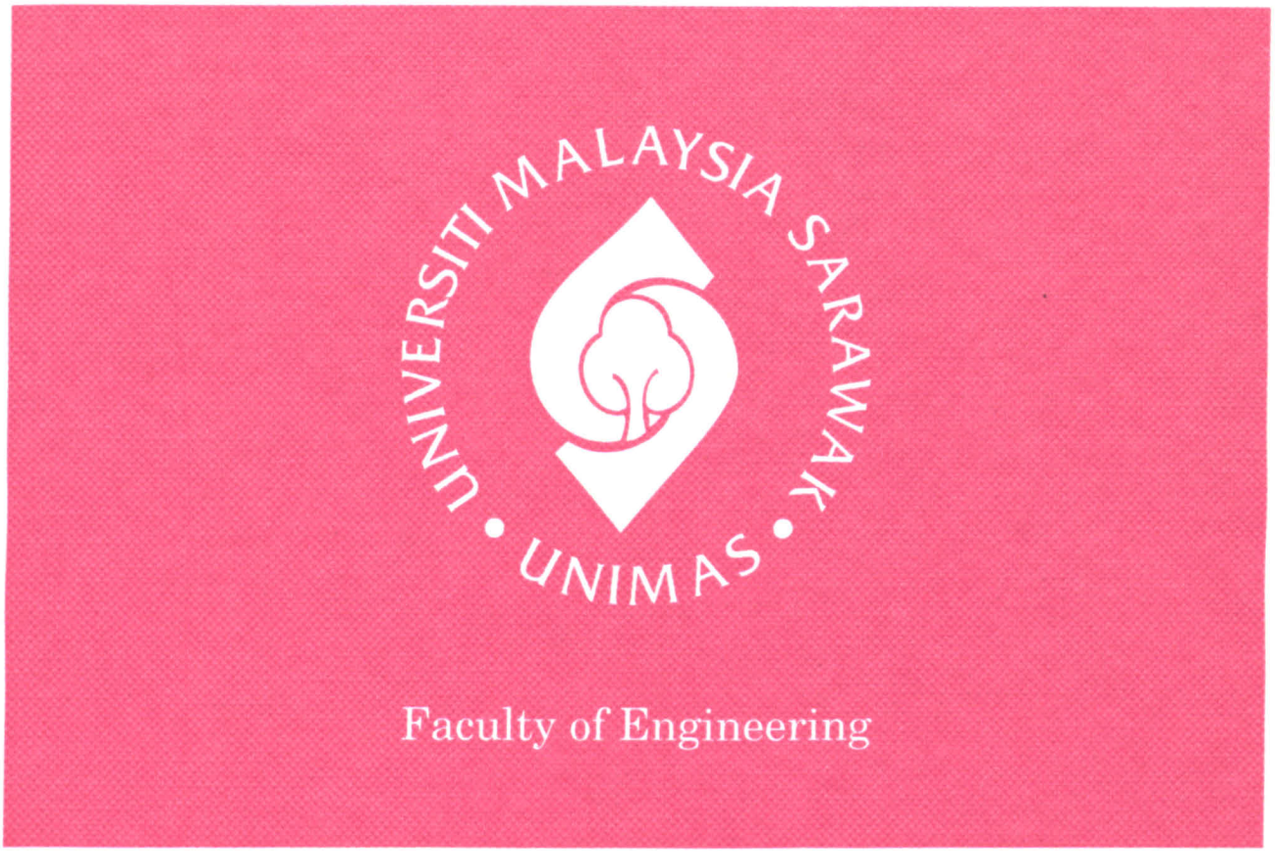

APPLICATION OF OIL PALM EMPTY FRUIT BUNCH COMPOSITE AS AN ECO-EFFICIENT PRODUCT

Mohd Faliq Bin Mohd Jalani

Bachelor of Engineering with Honours
(Mechanical and Manufacturing Engineering)
2008

UNIVERSITI MALAYSIA SARAWAK

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This project report attached here to, entitle **"APPLICATION OF OIL PALM EMPTY FRUIT BUNCH COMPOSITE AS AN ECO-EFFICIENT PRODUCT"** prepared and presented by MOHD FALIQ BIN MOHD JALANI (10513) as a partial fulfillment of the requirement for degree of Bachelor of Engineering with Honours in Mechanical and Manufacturing Engineering is hereby read and approve by:

b/p _____ Date: 26/5/2008

(Mdm. Ervina Junaidi)

Project Supervisor

Faculty of Engineering

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APPLICATION OF OIL PALM EMPTY FRUIT BUNCH COMPOSITE AS AN ECO-EFFICIENT PRODUCT

MOHD FALIQ BIN MOHD JALANI

This report is submitted in partial fulfillment of the requirements for the degree of
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2008

Dedicated to my beloved family and friends

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ABSTRACT

In this project the main idea is to propose a different type of material in usage of producing a product. The different type that is mention in this project is natural composite. This innovation can be called an act on satisfying the changing needs of society, in means of efficient, economical and environmental. Eco-efficient can be suitable in describing those aspects. In this study the evaluation of relationship between natural composite and eco-design product towards environmental is conducted. The result of each of those entities can construct a new mean of environmental product. Natural composite is done by combining two elements which is natural waste and polyester for this particular research. Oil palm empty fruit bunch fiber is a common waste that is increasing in Malaysia agricultural region. From the analysis and the study of design for environment, it shown that the quality of oil palm empty fruit bunch fiber composite can be used for designing an eco-efficient product. In the design process, evaluation is conducted using axiomatic design application. The result for the second level of FR_1 is uncoupled design matrix, FR_2 decoupled design matrix and FR_3 uncouple design matrix. Results of the design satisfied both customer requirement and DFE (design for environmental). End product for this project is eco-cooler pad. The product is an efficient design with added environmental aspect, can be reuse, remanufactured and no waste is involved during the process and after life span.

ABSTRAK

Idea utama dalam projek ini adalah untuk menawarkan jenis bahan yang berlainan untuk kegunaan dalam menghasilkan produk. Jenis berlainan yang dimaksudkan bagi projek ini ialah komposit semulajadi. Perubahan ini boleh dipanggil sebagai satu tindakan bagi memuaskan perubahan keperluan masyarakat iaitu kecekapan, ekonomik dan alam sekitar. *Eco-efficient* boleh dikatakan sesuai dalam menerangkan aspek tersebut. Dalam pembelajaran, penilaian terhadap hubungan antara komposit semulajadi and *Eco-efficient* produk terhadap alam sekitar dilaksanakan. Keputusan bagi setiap entiti boleh membina maksud baru dalam produk alam sekitar. Komposit semulajadi dihasilkan dengan menyatukan dua elemen iaitu buangan alam semulajadi dan *polyester* seperti dalam penyelidikan ini. Serat kelapa sawit ialah bahan buangan yang semakin meningkat dalam kawasan pertaniaan di Malaysia. Daripada analisis dan pembelajaran rekabentuk untuk alam sekitar, ia menunjukkan bahawa kualiti komposit serat kelapa sawit boleh digunakan untuk merekabentuk *Eco-efficient* produk. Dalam proses merekebentuk, penilaian dibuat dengan mengunakan aplikasi rekabentuk axiomatik. Keputusan untuk peringkat kedua bagi FR_1 adalah rekabentuk matrik *uncoupled*, FR_2 adalah rekabentuk matrik *decoupled* dan FR_3 juga rekabentuk matrik *uncoupled.* Keputusan daripada rekabentuk telah memenuhi kedua-dua keperluan pelanggan dan rekabentuk untuk alam sekitar. Produk untuk projek ini adalah *Eco-cooler pad.* Produk ini adalah rekabentuk kecekapan dengan penambahan aspek alam sekitar, yang boleh diguna semula, boleh dibuat semula dan tiada bahan buangan yang terlibat semasa pemprosesan dan selepas jangka hayat produk.

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CHAPTER 1

INTRODUCTION

1.1 Project Background

In the present, people are concerning more in globalization, but before society can think about globalization, people must consider sustainability. Sustainability development involves 3 dimensions which is people, profit and planet. Eco-design plays an important role in sustainability development. It covers the ecology dimension where it plays an important task in respecting the carrying capacity of nature. It is important to implement sustainable use of renewable and minimal use of nonrenewable material in designing a product.

The concept of sustainable development contains sustainable design which included eco-design product. Eco-design product is a design where it is strongly represent economic, functional safety and environmental friendly.

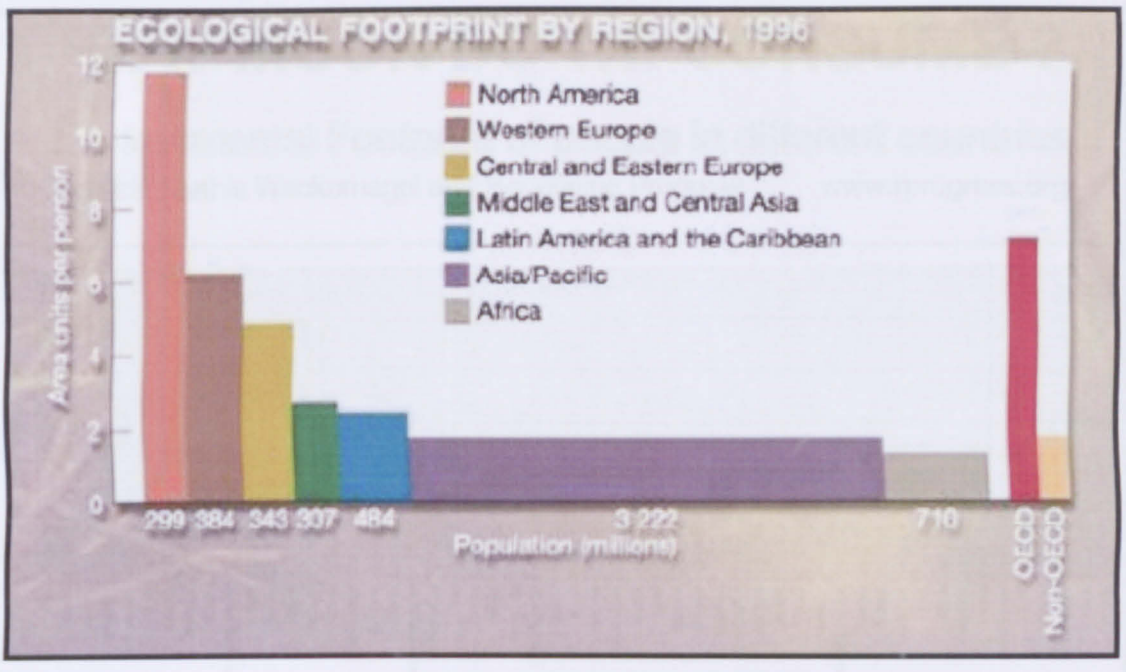

Figure 1.1 Ecological footprint by region in 1996

Figure 1.1 shows the graph of ecological footrpint by region in 1996. It shows that 20 % of the world population only uses 80 % of natural resources where the remaining world porpulation only uses 20 % of natural resources. The situation proved that 80 % of the world population is not using the natural resouces and prefer more in conventional material. Based on the graph itself only 20 percent of the world population acknowledge the importants of the natural resources.

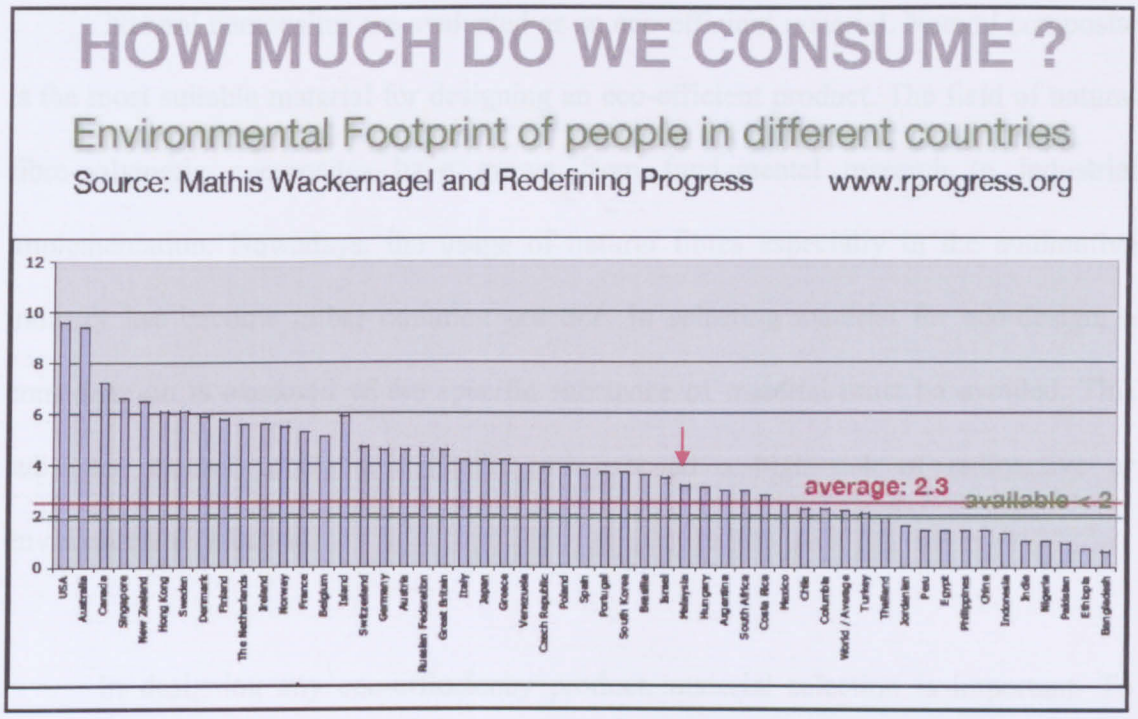

Figure 1.2 Global consumption rate of natural resources

The sense of importance in sustainability is due to the consumption rate of people nowdays. According to figure 1.2, the graph of global consumption rate of natural resources, it shows that Malaysia only consume an above average rate, hence shows that Malaysia is lack in supporting the sustainability development.

Eco-Efficiency come into view after combination issues of economic efficiency which has positive environmental benefits and cleaner production starts from issues of environmental efficiency which have positive economic benefits. Inovation and efficiency thinking must be implemented in every consumer and developer.

Natural composites are evaluated as an eco-efficient material. Natural composite is the most suitable material for designing an eco-efficient product. The field of natural fibre-polymeric composites have grown from fundamental research to industrial implementation. Nowadays, the usage of natural fibres especially in the automotive industry has become rather common practice. In selecting material for eco-design, a consideration is executed where specific substance of material must be avoided. This substance caused problematic health and exposed a high risk of radioactive or environmental pollution.

In designing any eco-effieciency product, material selection is important. To produce an eco-design product natural resources is the suitable material. Natural composite strength is based on the selection of its fibres. Sustainable fibres or natural fibres are used in making natural composites. The product can invoke people in using natural composite material rather than the conventional material source such as wood, metal and etc.

1.2 Project Objectives

The main objective of this project is to apply oil palm empty fruit bunch composite as eco-efficient product. The other objectives are:

a) To investigate the properties of the oil palm empty fruit bunch fiber.

b) To study and evaluate oil palm empty fruit bunch fiber as a composite.

c) To evaluate oil palm empty fruit bunch composite as ecological-efficient products.

d) To fabricate an eco-efficient product using the oil palm empty fruit bunch fiber.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In designing an eco-efficiency product, there are a lot of areas that are needed to be covered. Eco-efficiency product is design based on an eco-design concept. This design is under the application of sustainable development where it is strongly represent environmental, functional and economical efficiency. To fabricate a product based on eco-design concept, the material must be toxic proof or environmental friendly.

Throughout the research of eco-design product it is most likely that the design method is seldom approach. This is due to the fact that the design itself is under research and slowly develops to society interest. In industrial company a lot of people are still using the conventional material. Natural resources is slightly neglected due to lack of knowledge on the benefits of using the resources. This chapter will evaluate the potential of natural resources and the outcome of the development that other idealist society had created.

Furthermore it is also important to know the function of eco-design and eco-efficiency concept. The concept explained the criteria of eco-design that is required in producing an environmental friendly product. This section included the material selection which is suitable for designing eco-design product.

This chapter included some of the example of methodology that is being used in designing eco-design product. The last section will discuss the advantages and disadvantages between conventional material and natural resources.

2.2 Eco-efficiency

Eco-efficiency has been defined as "the efficiency with which ecological resources are used to meet human needs" [12]. The purpose of eco-efficiency is to maximise value creation while having minimised the use of resources and emissions of pollutants. Measuring ecoefficiency is important in order to measure the decoupling of economic growth and environmental pressure. Eco-efficiency is in most cases expressed by the ratio [15].

$$\text{Eco} - \text{efficiency} = \frac{\textit{Product or service value}}{\textit{Environmental influence}} \qquad (2.1)$$