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DESIGN OF RIGID BOARD MATERIAL FROM
BANANA TREE TRUNK FIBER

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This report was adduced as
fulfilling a part of requirement for award of
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April 2010

"I declare that this report is my own work except for summary and quotation that I had described the source for each one of them"

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Date ; ………………………………………..

*"To family and friends"*

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Thank you very much

# *ABSTRAK*

Laporan ini menghuraikan tentang proses merekabentuk bahan papan tegar dari serat batang pokok pisang dengan bahan komposit polyester. Penggunaan sumber semula jadi telah meningkat di abad untuk mengekalkan kehijauan bumi. Oleh itu, penggunaan serat semula jadi adalah sangat digalakkan untuk tujuan industri. Fokus utama projek ini adalah untuk mendapatkan nisbah terbaik serat batang pisang kepada polyester yang boleh memberikan kekuatan tertinggi kepada produk bahan papan tegar. Repot ini menyoroti kajian literatur dan dokumen lampau berkaitan dengan bahan komposit. Terdapat juga kajian teori yang meninjau beberapa teori yang berguna berkenaan dengan kekuatan bahan yang boleh dikaitkan kepada bahan komposit. Beberapa kaedah digunakan oleh penulis untuk mencapai matlamat kajian seperti menemuramah pakar di dalam bidang serat semula jadi. Penulis juga menerangkan cara-cara untuk memperoleh serat batang pisang di dalam bab kaedah kajian. Serat mentah tersebut digabungkan dengan polyester untuk dijadikan sebagai spesimen ujian. Spesimen-spesimen tersebut diuji kekuatannya melalui ujian mekanikal. Sifat-sifat mekanikal yang diperolehi daripada ujian mekanikal dianalisis dan dibincangkan. Hasil daripada kajian ini, didapati jumlah optimum serat batang pisang didalam polyester resin adalah antara 4% hingga 6%.

# ABSTRACT

This report describes the design of rigid board material from banana tree trunk fiber reinforced polyester composite. The use of natural source is increases in this century for the green environmental protection. Hence, the use of natural fiber is highly recommended for industrial purpose. The main focus of this project is to obtain the best ratio of banana tree trunk fiber to polyester composite that can gives the highest strength of the rigid board product. This paper is first review some literatures and past documents regarding to the nature of the composite. There are theoretical studies that revised some useful theory about strength of material that can be related to the composites materials. Several approaches were applied by the author to achieve the goal such as interviewing the expertise in the natural composite fields. The author described the method to extract the banana tree trunk fiber in the methodology chapter. The raw fiber is then reinforced into polyester in the fabricating process for of test specimen. The specimens subjected to mechanical testing to measure their strength properties. The results are then analyzed and discussed. From this study, the optimum amount of banana tree trunk fiber in polyester resin is between 4%and 6%.

# CONTENTS

| CHAPTER | ITEMS | | PAGES |
|---|---|---|---|

| CHAPTER | ITEMS | | PAGES |
|---|---|---|---|

| CHAPTER | ITEMS | PAGES |
|---|---|---|

# LIST OF TABLES

# LIST OF FIGURES

# LIST OF SYMBOLS

| | | |
|---|---|---|
| $E$ | = | longitudinal modulus of elasticity, GPa |
| $E_m$ | = | modulus of elasticity of the matrix, GPa |
| $V_m$ | = | volume fraction of the matrix |
| $E_f$ | = | modulus of elasticity of the fibers, GPa |
| $V_f$ | = | volume fraction of the fibers. |
| $V_c$ | = | volume fraction of the composite. |
| $P_c$ | = | load on the composite, N |
| $P_f$ | = | load on the fiber layer. N |
| $P_m$ | = | load on the matrix layer, N |
| $\sigma_c$ | = | stress of composite, Pa |
| $\sigma_f$ | = | stress of fiber, Pa |
| $\sigma_m$ | = | stress of matrix, Pa |
| $A_c$ | = | fractional area of composite, $m^2$ |
| $A_f$ | = | fractional area of fiber, $m^2$ |
| $A_m$ | = | fractional area of matrix, $m^2$ |
| $\varepsilon_c$ | = | stain of composite |
| $\varepsilon_f$ | = | strain of fiber |
| $\varepsilon_m$ | = | strain of matrix |
| $l_c$ | = | length of composite, m |
| $S_T$ | = | tensile strength of the composite, MPa |
| $S_{Tf}$ | = | tensile strength of the fibers, MPa |
| $S_{Tm}$ | = | tensile strength of the matrix, MPa |
| $E_b$ | = | modulus of elasticity in flexural, MPa |
| $L$ | = | support span, mm |
| $m$ | = | slope of the tangent to the initial straight line portion of the load deflection curve, N/mm |

| | | |
|---|---|---|
| *b* | = | width of the beam, mm |
| *d* | = | depth of the beam, mm |

## LIST OF APPENDIXES

# CHAPTER I

# INTRODUCTION

Project Sarjana Muda (PSM) or Final Year Project is an academic and scientific research that related with programs at Faculty and compulsory for every final year students as to fulfil the requirements before being awarded the degree. This project will cover certain scopes in every student's field study. The title of this project is Design of Rigid Board Material from Banana Tree Trunk Fiber. This project is categorized into biocomposite field study because the product that will be developed is characterized by the fact that the synthetic fibers are replaced by the natural fiber, which is a banana tree trunk fiber.

## 1.1 Project Background

Banana tree grows from underground rhizomes, forming a pseudo-trunk, with large, showy leaves that shred naturally in the wind, giving the plant its exotic looks. In the past decades, many research works has been carried out on the natural fiber reinforced composite materials in many applications. Banana tree are available in abundance in nature and can be used to reinforce polymers to obtain light and strong materials. Banana fiber, also known as banana stem fiber is a new type of natural plant fibers, but the information of the usage of banana fibers in reinforcing polymers is limited in the literature. Hence, the aim of this project is on the investigation of the banana tree trunk fiber rigid board material.