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Date : 24TH MAY 2010

STUDY ON WASTE WOOD AS AN ALTERNATIVE CONSERVATION ENERGY

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"I verify that this report is my own word except summary and extract that every one of it I have clarify the resource"

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DEDICATION

For My Beloved Parents and My Family

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ABSTRACT

In this paper project of Projek Sarjana Muda (PSM), the purpose is to study the method or solution to waste wood that are currently increasing fast. This project starts with the study of raw material of wood that are being used by industrial and construction site. There are many types of wood in tropical rain forest like Malaysia. In this case, some mechanical characteristic are being exposed in this project to understand more about woods. Then, this project is narrowed down to rubberwood (*Hevea brasiliensis,)*, oil palm trunk and rice stalks. Then, this paper is continued to review on the previous study and theory that matters in this project. The innovations of these wastes into product that can generate energy are elaborated in Methodology. After taking several studies on theory, it is particularly are to analyze the product or subject. Some physical and chemical tests are being conducted to indicate the effectiveness of this subject by comparing to the commercials. Discussion is to enable the reasons of each of the tests and last but not least conclusion with some suggestions for further studies.

ABSTRAK

Tujuan projek ini dijalankan adalah untuk membuat kajian dan mencari penyelesaian terhadap kayu dan hasil kayu buangan yang semakin bertambah sekarang ini. Penulisan ini bermula dengan kajian tentang bahan mentah iaitu kayu dan bahagian kayu yang dijadikan bahan dalam sector pembinaan dan industry lain. Terdapat banyak jenis kayu yang terdapat dalam Malaysia dan kayu telah dikategorikan kepada beberapa kelas. Dalam kajian ini, beberapa ciri mekanikal kayu perlu diambil perhatian untuk lebih mengetaui tentang ciri kayu. Kemudian, projek ini dikecilkan skop kepada jeni kayu lembut yang banyak digunakan dalam industri ssekunder seperti pembuatan perabot. Kita juga akan mempelajari tentang kajian sebelum ini dari pengkaji lain. Kemudian, inovasi terhadap buangan kayu akan dijalankan untuk menghasilkan jenis kayu yang mampu menjana tenaga. Metodologi dalam dan prosedur kajian juga akan diterangkan dalam kajian ini. Beberapa ujian juga telah dilakukan terhadap hasil kajian produk tersebut. Analisis terhadap subjek yang telah siap ini akan dibandingkan dengan produk komersial.

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m	=	mass, Kg
V	=	volume, m^3
Sm	=	Shrinkage (%)
S_O	=	Total Shrinkage, (%)
M	=	Moisture content, (%)
ρ	=	density, kg/m^3

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CHAPTER I

INTRODUCTION

1.1 Background

Wood comes from trees. This is the most important fact that we have to know in understanding wood. Woods are characterized into hardwood and softwood that differ in the inner structure and characteristics. But in this project we will consider the hardwood including Hardwoods, Medium Hardwoods and Light Hardwood. In engineering, wood is a natural resource that being use in constructions such as poses or pillars, furniture, sailing and others. In manufacturing process, many characteristic involving grains that needs to be considered in order to produce required product with enough strength upon the wood which is the raw material. The word grain is so meaningful to show the pattern of inner the inner wood like the rings, and many other cell that determine the characteristic of woods. There are also several components in woods that need to be considered in understanding wood before being manufactured.

Wood is a natural material and being used as a source of energy since decades to generate electric power and useful thermal output. For woods being exploited by manufacturers, they tend to produce more and more waste. An idea of using waste wood as an alternative energy giving much problem solving to recycling wood and not just let it be thrown away. Wood for use as energy sources comes from a wide variety of sources. The timberland is the primary, and in most cases original, resource base for fuel wood. The derived from this type of wood producing waste wood that can be found in construction site. The others are from manufacturing and

wood processing like furniture from urban tree and landscape views. When we looked into this matter we should know how much people are taking for granted this waste while it can be recycle to produce energy back for human use. Imagine how much could we save on energy if this waste can be applied to energy and being used as regular energy daily.

Wood energy accounts for 9% of total energy consumption in Malaysia. Statistics show that most biomass energy is consumed by industries, but data on wood fuel use by households are not available. In the domestic sector biomass energy is mainly used for cooking (http://wgbis.ces.iisc.ernet.in/energy/). Firewood has been used in some industries for a very long time. In the rubber industry the smoking of rubber sheets to produce Ribbed Smoke Sheets (RSS) rubber is wholly wood fueled (Baharuddin, 1999). This can indicate to us that people are still recycling waste as energy but they are not into taking serious calibration and further studies on managing the waste. Thus the wastes of energy material still happen as specific measurement are not taken.

1.2 Objectives

The main objective of this project is to innovate from waste wood and manipulated them as an alternative energy for daily purposes. The wastes are to become a reusable energy that can minimize wastes and pollution to the world.

The objectives are to collect information on the types of wood that is being categorized as waste and then consolidate the superior quality of soft wood and their application. After that, the chosen waste woods are to be innovated into solid fuels either pellets or briquette for the compressed waste wood. Last but not least, the final objective is to test the efficiency of the subject comparing with the commercial ones.

1.3 Scope

In this project, the types of wood that are not being used or waste woods are only taken into consideration as the study are directed to only waste woods no matter from raw material or residues.

After general studies, the scope is narrowed down on the chosen wastes for samples to be experimented which are the rubber wood wastes and its product waste (sawdust), rice straws and oil palm trunks.

The Process of innovating the waste parts into potential commercialized pellets are specifically into the types of machines and its principle of works. The models of machine, comparison on the pellets

The Analysis of the pellets involves only in term of physical properties of the densities, volatile matter, carbon content, moisture content, fix carbon. Heat content is evaluated by using bomb calorimeter in its chemical properties to analyze the energy content.

The cost of manufacturing, maintenance and other costing are also not taken into consideration in this paper to concentrate more on idea to perform alternative energy. Further studies should be taken on separate project for better understanding.

1.4 Problem Statement

In Malaysia, we are promoting to save energy and recycle waste. Try to look at our surrounding we can see there are many woods that re being thrown away just like that. Then, people tend to buy more and more new products. Yet, these waste wood are being burnt away just like that without realizing that they still can be use to produce energy which is called biomass energy. In this matter, there are a lot of woods that are being exploited and their unneeded parts are left aside just like that.

Lesser, they will burnt it to vanish it from sight. The wood waste from consumers is getting higher and higher due to the increasing of wood application production for manufacturers. In other perspectives, in rubber estate for example, after the tree reaches its old times, the woods are being cut off and burnt away. There energy that they can produce still wasted for nothing.

Nowadays, maybe there is improvement where we can see the waste wood in manufacturing industry is being used in recirculation energy thus reducing the use of energy fuel in industry. However, the method that they use are not very effective as the just throw the waste into furnace to put up fire and continue to innovate the system that uses the fire as source of energy. The wood must be such to dry and sizes and many more to increase the efficiency upon the energy aspect. In this case, wastage of wood also happens.

CHAPTER II

LITERATURE REVIEW

2.1 Types of Wood in Malaysia

Generally woods are divided into two types which are Hardwood and Softwood. This study will consider more into hardwood and softwood as they are much usage in industrial products considered as abundant woods parts. There are three types of hardwood in Malaysia that are being used in industries. The first is the hard wood, followed by the medium-hard wood and soft wood. Types of woods are characterized by strength group. Forest Research Institution of Malaysia is the responsible institute in Malaysia to determine a species strength group based on Strength Test held by them. From the test, FRIM will divide woods into hard wood, medium hard wood, and soft wood. Under the Malaysian Grading Rules (1984), woods are classified as Heavy Hardwood (HHW) when their density exceeds 800kg/m^3 and the timers are naturally durable. Medium hardwoods (MHW) are timbers with density exceeding 729 kg/m^3 but lack sufficient natural durability. Lightwoods (LHW) are timber with density below 720 kg/m^3 and not naturally durable in exposed condition.

The rubberwood from waste will be use in this project. It is of particular interest to know why this wood is the selected raw material in this project. Light hardwoods especially rubberwood are also developed for construction uses, and not necessarily for building furniture, but they are more being concentrated on furniture like building utilitarian projects (cabinets for the woodshop, painted projects, dog

houses, and many more). So, to consumers, in certain period of time, they have come to change over their old furniture and this waste becoming an annoying part near dustbin for their size. (http://www.process-integrator.com/Solution/Briquette/Feasibility/Intro.htm)

Table 1: The Strength properties of some Malaysian Timber
(Source: Lee at al, 1979)

CHARACTERISTICS	**STRENGTH GROUP**			
(MPa)	A	B	C	D
Modulus Elasticity	9700	6600	5500	3100
Bending and Tension Parallel to grain	12.41	9.65	7.24	4.83
Compression Parallel to grain	11.03	7.93	5.51	4.14
Compression perpendicular to grain	1.45	0.90	0.55	0.45
Shear Parallel to grain	1.45	0.90	0.62	0.62

2.2 Rubberwood and Furniture Woods

The rubber tree (*Hevea brasiliensis*), often called rubber tree is a tree belonging to the family *Euphorbiaceae* and the most economically important member of the genus Hevea. Rubber wood is the common name of *Hevea brasiliensis,* the rubber tree that is found in plantations all over the country. It is of major economic importance because its sap-like extract known as latex can be collected and is the primary source of natural rubber (*www.wikipedia.com)*. Malaysia is famous the world over for its quality timber. First in the furniture industry is rubber wood, which makes up 85% of total wood furniture exports. (*http://www.mfpc.com.my*). This also indicates that much furniture manufacturing is made from rubber wood instead of others. Its timber characteristics are moderate

hardness, light to moderate weight, and an even, straight grain in a light colour tone; all these details make rubberwood ideal for furniture manufacturing. Easy to machine and nail, rubberwood is a furniture designer's dream, allowing for an unlimited palette of design options. According to FRIM, rubber wood or *Hevea brasilliensis* have the density of 640 kg/m^3 and types of whitish yellow seasons to a pale straw colour of wood.

According to Lim K.O, 1986, he stated that rubberwood is a possibility for further utilization as fuel for its total matter available per annum is 150x10^3 tonnes and the total energy potentially available current annual basis is 150.73x10^3 boe. Percentage of presently uses as fuel is -62% and the percentage of total utilized for other economic considerations is only -5%. The amount wasted approximately 49.74x10^6 boe. In the other research of quantity of matter and energy potentially available from future replanting wastes in Malaysia. He stated that in 2007 there will be 2851.2x10^3 tonnes and energy potentially available will be 91.359x10^5 boe. The barrel of oil equivalent (BOE) is a unit of energy based on the approximate energy released by burning one barrel (42 US gallons) of crude oil. The US Internal Revenue Service defines it as equal to 5.8 × 10^6 BTU (British thermal unit).
5.8 × 10^6 BTU equals 6.1178632 × 10^9 J

Table 2: Characteristic of Rubberwood

(Source: Forest Research Institute of Malaysia (FRIM))

CHARACTERISTIC	**VALUE**
Density (kg/m^3 at 16%Moisture content)	560-640
Tangential Shrinkage Coefficient (%)	1.2
Radical Shrinkage Coefficient (%)	0.8
Hardness(N)	4,350
Static Bending, · N/mm at 12% Moisture Content	66
Modulus of elasticity, N/mm at 12%Moisture Content	9,700

In Malaysia, according to Rubber Industry Smallholders Development Authority (RISDA), rubberwood plantation covers 51.8% of plantation than others

with 275,665.74 hectares. Pahang has the most quantity of rubber wood plantation which is 46,804.78 hectares of 17% of all state in Malaysia. Rubber Research Institute Malaysia (RRIM) in 2008, 61,100 hectares are estates and 1,185 93000 hectares are smallholdings resulting the total of 1,247 03000 hectares (Please refer Appendices). This can indicate how many woods are planted and this can turn into waste after several years or decades. After the wood turns old and not use, what will happen to the woods is they are burnt rather that being abundant aside.

2.3 Wood Waste

Wood waste can be broadly defined as the solid wood residues resulting from the manufacture, use or disposal of wood products. Wood waste is can generally be any wood from raw material to after processed material that not being used for any applications. This definition can therefore include several broad categories of wood products and by-products. Wood wastes are generally wood residues with no further perceived value that are sent to landfill.

Waste has been a problem for the developing as well as developed countries. German Federal Government Ordinance has announced that there are three classes or categories of wood waste occur in waste streams which are (preservative) treated timber, untreated timber and composite timber products. There are numerous published methods of categorizing wood residue into different components related to various recovery options. These published methods generally include one or several forms of the three broad categories listed above (treated, untreated and composite timber products), as well as some of the by-products such as off cuts, chips, shavings and sawdust

Wood waste has been declared a waste of concern by many countries worldwide, including the 27 countries of the European Union (EU) through the Directive on Packaging and Packaging Waste (EU Directive 94/63/EC, 1994). Wood waste is a declared waste of concern in New South Wales (NSW), a state of Australia (Department of Environment and Climate Change NSW, 2007). In Malaysia, we can