

PRESSURIZED PYROLYSIS OF WOOD DUST

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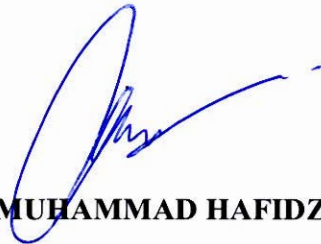
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APPRECIATE

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ABSTRAK

Kajian ke atas ciri-ciri biomas dan arang-bio dari sifat mekanikal dan kekerasannya serta kesan proses penekanan pyrolisis ke atas tindakbalas arang dan strukturnya adalah isu utama dalam kajian ini. Dalam laporan ini, jenis teknologi dan kelebihan setiap teknologi di huraikan dan di klasifikasikan mengikut kesesuaian masing-masing. Penerangan mengenai ciri-ciri dan unsur pada habuk kayu yang dijadikan sebagai bahan kajian untuk kajian ini dan ciri-ciri arang-bio hasil daripada proses penekanan pyrolisis ini, memberi gambaran bagaimana proses pyrolisis ini berlaku dalam perubahan biomas kepada bio-arang tersebut setelah dikarbonisasikan untuk menghasilkan bahan api yang sesuai dan boleh diguna pakai sebagai arang-bio. Kajian ini melengkap aspek membangun dan merekabentuk serta fabrikasi kelengkapan ujian yang akan digunakan dalam eksperimen ini. Kaedah penekanan piston yang ditekan menggunakan mesin penekan hidraulik dipraktikkan dimana biomas ditekan kedalam badan reaktor sambil dipanaskan oleh pemanas luaran kepada suhu antara 180 °C ke 200 °C dengan tekanan kepada 10 – 15 bar dan diuji menggunakan ujian kemampatan untuk menguji kekerasan bio-arang yang sesuai bagi dijadikan sumber bahan bakar alternatif.

ABSTRACT

The study on the biomass and bio-coal characteristics in term of its mechanical properties, coal hardness and the effect of the pyrolysis pressing process over the coal and its structure is the main issue in this study. In this report, the type of technologies and the advantages of each of it have been explained and classified to their satisfaction. The explanation of the characteristics and the substances of the saw dust which had been used as the specimen in this studies and the characteristics of the bio-coal produce from the pyrolysis pressing process have been describe how the pyrolysis process were done in term of bio-coal changes and carbonizations process to produce the suitable coal that to be use as a bio-fuel. This study were completing the development, design and fabrication aspects of the test rig that will be used for this experiment. Piston press method which were pressed using the hydraulic machine presser were practicable where the biomass will be pressing into the reactor while being heating by the external heater to the temperature at 180 – 200 °C, at 10 – 15 bar, to obtained the desired coal which fulfill the bio-fuel characteristics as the alternative fuel.

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CHAPTER I

INTRODUCTION

The use of renewable energy resources involves the tapping of natural flows of energy in the environment. If the resource is used in a sustainable fashion, the energy is removed at a rate comparable to that of which energy is being replenished. Malaysia's agricultural based economy generates substantial amount of agro-industrial waste, a potential renewable energy resources.

1.1 Renewable Energy

Renewable energy is an energy generated from natural resources such as sunlight, wind, rain, tides, and geothermal heat which are renewable. In 2006, about 18% of global final energy consumption came from renewable, with 13% coming from traditional biomass, such as wood burning.

[Estidotmy, Utusan Malaysia, 26 August 2009]

1.2 Project Background

Nowadays, the world populations face the problem of bio industrial wastes (solid wastes) excess. Furthermore, this problem can make our world in dangerous position. More than half development countries have many weakness in manage and reduce the solid wastes material and used partly of ground area to put and vanish the solid wastes material. It is a challenge to manage the solid waste in the future to achieve the objective of reduce the effect to the environment especially the suitable of cost and community acceptance.

Main bio waste that is produced are coffee and paddy chaff, coconut dregs, hay, groundnut skin, mustard seed stem, palm oil shell and cotton stem. There is also bio waste in gyration type as wood dust. This wood dust is produced in big scale. Beside the

problem of transportation, storage and operation, open burning of this bio waste with traditional style with out of control by using low power of burning can cause the critical air pollution. The ability of energy changing is only 40 % with detail spread through the smoke chimney with access of 3000mg/ Nm³. As addition, this problem can cause the high percentage of not burning carbon need to discard. For the case of paddy chaff, it quantity is more than 40% of wood dust burning. As example, 800 tones bio waste of paddy chaff is produced everyday by burning of 2000 tones of hay. So, by briquette the hay, we can reduce the rate of air pollution. Beside that, we can use the bio briquette as important domestic energy source in industry. [Food And Agriculture Organizations Of The United Nations Bangkok, April 1996]

According to the history, the technology of bio waste briquette is expanded in two different way. In Europe and America, they using and upgrade the piston press method. Meanwhile, in Japan, they create and use their self method which is known as screw press method. Both of this technology have their own advantage and weakness. Generally, screw press briquette process is more better than piston press briquette method from the aspect of storage and burning. Now, according to the report, there are many of screw press briquette machine is assembly in Europe factory under license agreement. Meanwhile, there are not information that is report the machine from Europe is produced in Japan.

In the world, both of technology are widely used in briquette wood dust and other local agro wastes. Although, the important of bio briquette , like producing of oil from wood, coal and lignite has being introduced long time ago. It shows that so many failure of briquette machines in many of development country, that cause the resistance of using the bio briquette machine widely.

Now, the using of briquette technology become stable in many of development country according to exigency by involvement of technical area and less of knowledge in solving many operation problem in this technology area. Beside that, there is also problem in ensure the quality of raw material to get good output because it is important factor in get commercial success. As addition to this commercial aspect, the important of

this technology is depend on the recover of wood, which it is a wide commodity that is used in development country that having critical problem of forest destroy.

Briquetting can be produced with the density of 1.2 g/cm² from bio waste that is release with overall density of 0.1-0.2 g/cm³. It burning with clean and friendly environment and also other advantages relevance with using of bio waste briquetting. . [Food And Agriculture Organizations Of The United Nations Bangkok, April 1996].

With observation to improve briquetting area in India, Indian Renewable Energy Development Agency (REDA), that is a finance and assistance agency, has spent for many briquetting project, which some of the project use piston press technology for purpose of briquetting. In fact, it cannot be used efficiently caused by less of knowledge in technical area and also less of understanding to the characteristics of bio wastes. By the producing of more good output from the expertise company, cause the existence of technical support and this academic businessman also give big assist in planning of profit achievement and the hope of this area recover.

In other Asia country, although briquetting do not give the big impact in give the confidence to the businessman, the latest development in this technology has started to excite the interest of this businessman. In Indonesia, the research and development (R & D) has be done by various University, National Energy Agency and other Research Institute since 70an. For this time, the main focus of is in biomass change technology. The R & D for relative bio waste density is rarely happen.

There is also export activity for wood dust and coal from shell of coconut from briquetting. This densification of bio waste activity commonly happen at the country that is not carbon and oil is popular. The limitation of coal briquette that is produce small amount of smoke, normally is imported for the using of houses in the big city at the country. But, the prospect of densification of biomass in Indonesia especially for the export, seen the very good development.

Filipina Energy Department, recently is positive in encourage of development and widely use of biomass source as the step to encourage of biomass pallet trial,

demonstration and commercial using for the burning of bio waste as energy change to the gas and other system for the energy, steam and heat generation. It is commercial produce that is produce closely 1 to 50 tones per day. Briquetting is generated by wood dust, coal and paddy hay. At Filipina, the cost for this energy changing is very high.

[Food And Agriculture Organizations Of The United Nation Bangkok, April 1996]

In Malaysia, there are a few local company owner also impetuous in get benefit from this technology in produce various of coal from briquetting technology. As example, Cipta Briquettes Sdn Bhd, a company that is base at Bintulu, Sarawak is one of the company that is produce big scale of coal here. The main business of this company is produce many of coal product for export as coal briquette from wood dust, hard wood coal and so on.

The first factory is at Kemena Industrial Park (KIE), Bimtulu, Sarawak, Malaysia, is built on 1997 and started their production on May 1998. The capacity of output is 800 tones metric of wood dust coal briquette and the product is exported to Japan, Korea, USA, Australia and Middle East of Asia since 1998.

[<http://www.ciptacharcoal.com.my/services.html>]

1.1 Objective

- 1 . To produce biomass that is good and suitable to use as fire material (fuel) source for burning process using Pressurized Pyrolysis.
2. To examine the effort and strength of biomass that is produced from Pressurized Pyrolysis.

1.2 Scope

This project has a few aspect:

1. To produce biomass from bio waste that is wood dust.
2. Prepare and develop pressurized pyrolysis process, study method and study instrument.

Problems statement

- Main problem that is occur in industrial is the extra of solid waste.
- Non systematic solid waste can cause air pollution.
- As example, if we put solid waste into river, it can make river pollution and resist the flow of the river. It can cause aquatic liver cannot get enough oxygen and food.
- Beside that, block river can cause big flood and river bank collapse.
- Because of that, it is need to get drastic step to avoid this problem.
- As example, the solid waste can be processed as biocoal.

CHAPTER II

LITERATURE REVIEW

2.0 Briquetting Technologies

2.1 Piston Press and Screw Press Technology

High Compress Technology or Non Bond Technology consist of Piston Press and Screw Press. Some of it units have being installed in India recently is press cycle type which is the Biomass is compressed in a block by hot press with a very high pressure. For the Screw Press Compress, this Biomass is extruted non stop by the screw through a hot and taper block. For Piston Press Compress method, the hardness at the touch part like at the compress and block part is less compare with screw and block for Screw Press type. At the pass, the energy using is less compare at this time. From quality aspect, the briquetting and production prosedur for Screw Press is more good compare with Piston Press type. The centre of pore that is joint in briquetting process from Screw Pressure help in achieve the perfect and flat burning. So, this briquette can be carbonization. Below is the list of the different between Piston Press and Screw Press.

Table 1 : Different between Piston Press and Screw Press
 (Source : Food And Agriculture Organizations Of The United Nations
 Bangkok, April 1996)

	Piston Press	Screw Press
The optimum of raw material Moisture Contain	10-15%	8-9%
The Hardness of between touch part	Low for compress and block case	High for screw case
Output of machine production	Level by level	Non stop
Energy using	50 kWh/tonne	60 kWh/tonne
Briquette Density	1-1.2 gm/cm ³	1-1.4 gm/cm ³
Maintenances	High	Low
Briquette burning performance	Not so good	Very good
Carbonization to the coal	Impossible	Produce the good coal
Appropriate of gas changing	Not appropriate	Appropriate
Homogeneity in the briquette+	Non-homogenous	Homogenous

Now, Piston Press is used in India, also known as pressurizer and block technology. In this case, the biomass will be pressed into a pressurizer through a pressurizer operation with a high pressure. Because of that, the biomass can be compressed to maintain a briquette. This briquette produce 66mm outer diameter. This machine has capacity with 700 kg/hr and the needed power is 25 kW. This pressurizer move with 270 kali / min in this process.

[Food And Agriculture Organizations Of the United Nations Bangkok, April 1996]

2.1.1 Advantage and Disadvantage of Piston Press

1. The relative movement between compressor and biomass is less. So, the hardness at the compressor is considered decrease.
2. This is the cheapest technology that is bargained in India market.
3. Experience in operation can be achieved by using various type of biomass.
4. Moisture contain of raw materials must less than 12% to get the best result.
5. Quality briquette material must less with the increase of output when use the power at same level.
6. Carbonization at the couter layer cannot happen caused by the brittle condition of the briquette.

2.1.2 Advantage and Disadvantage of Screw Press

1. Output is non stop and the size of briquettes are constant.
2. Some of the outer part of briquette is carbon, make the ignition is fluent and easy burning.
3. The hole at the centre of briquette can help in burning caused by the enough air circulation.
4. The machine operate in very silent without vibration from the load.
5. The machine more light compare with piston press caused by it do not have overturn and energy disc part.
6. Machine and oil part that is used is free from dust and dirt of raw material.
7. Mchine need high power compare with piston press.

In screw press technology, the biomass is pressed continously by the screw through a taper block that is hot from outer to decrease the friction.

Nowaday, piston and screw press become very important for the commecial value. Although the technology of piston press more elder than screw press, but, there are more screw press technology is operating in India. Inspite of that, as the screw press technology get authority in fast, it causes more impression have being given to this technology. Less of basic research to improve press piston technology and also unability of manufacturer in understand that technology is two main reason why this type of press do not been applied well as a basic commercial.

Manufacturer face many problems, normally relevance with the hardness of compressor and block. The life-cycle of compressor and block will be observed from 33 to 300 hours. This is the normal instrument of briquette that is oftenly used and produced around the world. It contains of energy disc that generate piston that will press the material through a taper block which briquette is shaped. But, this piston press still not success caused by the leaking of understand about the raw material behaviour that can effect to the parameter of machine design like the size and speed of energy disc, crank shaft size and the piston long cycle. In this case, the mechanism of channel must perfect because of the overall density of the raw material. Eventhough the suitable technology is very important for briquette, the compactibility behaviour of biomass also important aspect need to be considered.

2.2 Others Briquetting Technology

Others type of machine for briquette is “Hydraulic Piston Press”. It is differ than Mechanical Piston Press which the energy to the piston is delivered from electric motor through a high pressure hidraulic oil system. This machine also compact and light because of low pressure at the cylinder compare with mechanical machine, which the result is low. Briquette produce the size of compact less than 1000 kg/m suit with the limit of pressure at 40-135 kg/h. This machine also can be adjustable with moisture capacity very high normally accept 15% moisture capacity of mechanical piston press.