International Journal on Advanced Science Engineering Information Technology

Vol.4 (2014) No. 5
ISSN: 2088-5334

Processing Coconut Fiber and Shell to Biodiesel

Sri Aulia Novita, Musdar Effy Djinis, Sandra Melly, Sri Kembaryanti Putri

Agricultural Polytechnic State Payakumbuh, West Sumatera, Indonesia
E-mail: leanovita112@yahoo.com

***Abstract*— Based on research conducted, liquid smoke coming from the husk and coconut shell containing 58-70% Methyl Ester as biodiesel-forming compounds. Then conducted research for the manufacture of methyl esters of liquid smoke based on differences in their boiling points. The purpose of this research is the development of tools producing liquid smoke, liquid smoke processing into biodiesel, biodiesel testing with the diesel engine and the determination of the proper blending between biodiesel. The method used in this study is a phase of making tools, raw material preparation, testing tools for liquid smoke production, purification, separation of methyl esters and methyl esters testing by blending in diesel engines. Obtained from research conducted work capacity device of liquid smoke 1:22 kg / hour with a yield of 32.17%. Performance test by blending biodiesel B10, B20, B30, B40, B50 and B100 with a 6.5 HP engine capable of running a diesel engine with performance that is not much different, more smoke clear, odorless and lighter engine speed.**

***Keywords*— Liquid smoke, Methyl esters, Performance test**

I. INTRODUCTION

Biodiesel is a fuel consisting of fatty acid methyl esters produced from a chemical process between vegetable oil and alcohol. As a fuel, biodiesel can reduce emissions of unburned hydrocarbons, carbon monoxide, sulphates, polycyclic aromatic hydrocarbons, polycyclic aromatic hydrocarbons and nitric solid particles so that biodiesel is the preferred fuel due to its environmentally [1]. In some countries, biodiesel has been produced and consumed in large quantities. In 2008 the United States biodiesel production reaches 700 million gallons [2].

Most of the raw materials used in the production of biodiesel in these countries are soybean oil, canola oil, palm oil, and sunflower seed oil. However, the use of these raw materials into a new obstacle to the fulfilment of food needs. Castor oil which has been developed to overcome this problem is still not economically feasible to build on a large scale due to the discontinuity of supply. Therefore, the search for new raw materials for biodiesel is indispensable.

One new alternative raw materials for the manufacture of biodiesel can be derived from agricultural wastes such as coconut husk and coconut shell that has undergone a process of pyrolysis at a temperature of 120 0C to 150 0C to produce liquid smoke. Reference [3,] [4] show which utilizes waste in the form of coconut husk and coconut shell into liquid smoke, indicating that turns the liquid smoke containing 58% - 70% Methyl Ester (analysis results of GC / MS). It can be said that the liquid smoke can be used as biodiesel through a process of separation and purification of methyl esters were performed with distilled Rotary Evaporator. Based on this line of thought, then conducted research on "Processing of Coconut Fiber shell and into Biodiesel" is implemented gradually. The purpose of this research is the development of tools producing liquid smoke, liquid smoke process into methyl esters, conduct performance testing of biodiesel produced using diesel engines and get the formula mix biodiesel with diesel fuel usage between optimal.

II. METHODS

This research was conducted in the Laboratory of Chemical UPT and UPT Workshop Unand Agricultural Polytechnic, and Polytechnic Health Laboratory Champaign for 12 months starting in January to December 2013.

A. Tools and Materials Used

Equipment used was a technique workshop equipment, chemical laboratory equipment, analysis equipment, rotary evaporator, liquid smoke producing devices, GC / MS, thermocouple, thermometer, diesel engines and others. raw materials used are coconut shell, coconut fiber, activated charcoal, activated zeolite and other chemicals.

B. Research Procedure

1) Development of Liquid Smoke Generating Tool

Liquid smoke generating tools have been made in previous studies but used unruk produce liquid smoke as a food preservative. Through this competitive grant research tools were developed producing liquid smoke into a device of methyl ester biodiesel is the main compound forming. To increase the efficiency of the tool, the tool is modified producing liquid smoke, especially on the tube furnace pyrolysis and combustion. The plan of development tools based on the structural design and functional design.

Fig. 1. Device Of Liquid Smoke

Specifications Tool Producing Liquid Smoke Component Liquid Smoke Generating Tool Dimensions / Specification

1. Gas Cylinder 12 kg
2. Large Gas Stove 24-axis
3. Tube Pyrolysis high = 80 cm, Ø = 50 cm
4. Pipe Smoke dealer leght = 175 cm, Ø = ¾ inc
5. Tar Catcher leght = 7 cm, Ø = 5 cm
6. Drum condenser 200 liters
7. Pipe Coil condenser coil = 10, Ø = ¾ inc pipes, Ø = 80 cm coil
8. Pipe expenditures liquid smoke leght = 5 cm, Ø = ¾ inc
9. Thermometer high temperature of 250 0C

2) Raw Material Preparation

Workmanship this stage are as follows: Preparation of raw materials for the manufacture of liquid smoke each as much as 200 kg of coconut shell and coconut fiber that has been dried until the moisture content reaches 8-10%.

After drying, the samples that are large cut into small pieces with a size of 3 cm x 3 cm which can facilitate the combustion process.

Samples were dried and reduced the net that has been inserted into the pyrolysis tube.

3) Preparation of Liquid Smoke

Combustion (Pyrolysis), from the bottom of the sample ignited a fire that burned the pyrolysis, the observed temperature and time of formation of liquid smoke. The smoke generated will flow into the tube condensation. The burning of the pyrolysis tube performed three replicates of each material.

Condensation, stage condensing (cooling) is done by flowing water conditions. The way it works is as follows: Smoke coming out of the pyrolysis tube will flow to the condenser with plain water temperature as the cooling medium. The smoke will be condensed and melted and flowed into the temporary column. Condensate directly measured the weight so that it can be used as testing samples of liquid smoke next.

4) Liquid Smoke Purification Process

The process of purification of liquid smoke to get liquid smoke that does not contain hazardous materials that are safe for food preservatives.

Liquid smoke smoke condensate obtained from the pyrolysis process deposited for one week, after apart we take the fluid above and inserted into the distillation equipment

Different from the pyrolysis process of distillation, distillation temperature of about 150 0C, the results collected distillate, the distillate is used for the filtration process.

Process Filtration with Zeolite Active distillate. Filtration process with zeolite active distillate intended to get active substances are completely safe from harmful substances such as tar.

5) Liquid Smoke Testing Compounds

To determine the compounds contained in the liquid smoke used tool GC / MS.

6) Performance Analysis Tool

Performance maker of liquid smoke can be measured using the following formula:

$$\text{Machine Operating Capacity (kg / h)} = \frac{\text{The resulting liquid smoke(kg)}}{\text{pyrolysis time (hours)}} \quad (1)$$

$$\text{Yield (\%)} = \frac{\text{The resulting liquid smoke}(kg)\times 100\%}{\text{the total amount of material pyrolysis (kg)}} \quad \ldots\ldots\ldots \quad (2)$$

7) Production Process of Methyl Mster

Liquid smoke from shell and coconut fiber containing 58-70% methyl esters and other compounds such as ethanol, Decenal, Acetic Acid, Hexadecene, Methyl 9,9 Dideutero octadecane, Phenol, Benzene, Palmitaldehyde and other compounds in small amounts. To produce pure methyl esters as biodiesel purification is carried out by using a Rotary Evaporator that will separate the compound is based on differences in their boiling points. The difference between the boiling points of different compounds based on the molecular formula and the properties of these compounds.

III. RESULTS

Liquid smoke generating tools that have been designed and have met the functional and structural design criteria are planned, necessary to improve on the goose neck, cap tightening mechanism retort and the retort wall insulation. Retort walls are made of stainless steel without insulation causes heat transfer process with a high rate.

A. Performance Analysis Tool

Based on the research of liquid smoke from coconut shell, the obtained results are described in Table below.

TABLE I
PRODUCING TOOL PERFORMANCE LIQUID SMOKE

Pyrolysis Process (Reiterant)	Initial material weight (kg)	Liquid Smoke Weigh t (kg)	Time (hours)	Tar Weight (kg)	Working Capacity (kg / h)	Yield (%)
1	20	6.5	6.5	0.12	1.09	32.5
2	20	6.6	5.6	0.10	1.32	33
3	20	6.2	5.1	0.08	1.24	31.0
median	**20**	**6.43**	**5.79**	**0.087**	**1.22**	**32.7**

From the table above shows that the average working capacity pirolysis is 1.22 kg / h with a yield of 32.17%.

B. Purification Of Liquid Smoke

Liquid smoke from coconut shell which contains 58-70% methyl ester, based on the analysis of GC / MS. Liquid smoke purification process using a rotary evaporator based on differences in boiling point of methyl ester is 130-147 0C. methyl ester will be separate from other materials, especially water. Methyl ester is used as raw material for biodiesel.

C. Testing Of Biodiesel With Diesel Engines

Biodiesel has been produced, its performance will be tested using Ratna diesel engines 6.5 HP by means of blending B0 to B100. To measure engine power using a Prony brake. test results can be seen in table 2.

TABLE II
PERFORMANCE OF DIESEL ENGINES USING BIODIESEL

No	Blending	RPM	F (kg)	R (m)	Power (watt)
1	B0	1156	12	0.05	59.29
2	B10	1160	12	0.05	59.49
3	B20	1090	12	0.05	55.90
4	B30	1114	12	0.05	57.13
5	B40	1159	12	0.05	59.44
6	B50	1165	12	0.05	59.74
7	B100	1180	12	0.05	60.52

Based on the table above, it turns liquid smoke blending with diesel fuel to produce power that is not much different that the use of biodiesel from liquid smoke can be done. Some advantages compared to the use of biodiesel is a diesel exhaust fumes produced fewer with bluish white colour and pungent smell and feel lighter engine speed.

IV. CONCLUSIONS

Based on research that has been done can be concluded that : The average working capacity pirolysis is 1.22 kg / h with a yield of 32.17%. The yield of liquid smoke into methyl esters using a rotary evaporator done is 50 -70%. Performance Test of biodiesel by using a 6.5 HP diesel engine shows Blending 10-100 produces power that is not much different and combustion occurs perfectly.Exhaust fumes generated odourless, colourless whiter and lighter engine speed

ACKNOWLEDGMENT

We would like to thank the Higher Education (Directorate General of Higher Education) who have financed this study as well as the Agricultural Polytechnic P3M Payakumbuh country that has facilitated this activity. thank you to all the colleagues who have helped this research so that it can run properly**.**

REFERENCES

[1] Utami, T.S., Arbianti, R., dan Nurhasman, D. 2007. "Kinetika Reaksi Transesterifikasi CPO terhadap Produk Metil Palmitat dalam Reaktor Tumpak", dalam *Seminar Nasional Fundamental dan Aplikasi Teknik Kimia, Surabaya*, 15 November 2007.

[2] Amonim. 2008. Estimated US Biodesel Production. http://www.biodiesel.org/pdf_files/fuelfactsheets/Production_Graph_ Slide.pdf. [14 November 2009]

[3] Ernita, Yuni, Melly, Sandra dan Syafri, Edy. 2010. Laporan Penelitian: Rekayasa Alat Pembuat Asap Cair Dalam Upaya Pemanfaatan Limbah Pertanian Yang Mengandung Aran. DIPA Politani Negeri Payakumbuh

[4] Aulia Novita, Sri. 2011. Skripsi : Kinerja Dan Analisis Alat Penghasil Asap Cair Dengan Bahan Baku Limbah Pertanian. Pascasarjana Unand Gerpen, JV. 2005. Biodiesel Processing and Production. Jou of Fuel Proc Tech. 86 : 1097-107.

[5] Gerpen, JV. 2005. Biodiesel Processing and Production. Jou of Fuel Proc Tech. 86 : 1097-107.

[6] Mashuri, Mansur. 2008. Infrastruktur Pengolahan Asap Cair. Repindo Trainning Centre. Yogyakarta.

[7] Pranata, Juni. Pemanfaatan Sabut Dan Tempurung Kelapa Serta Cangkang Sawit Untuk Pembuatan Asap Cair Sebagai Pengawet Makanan Alami. http://www.scribd.com/doc/4142857/Asap-Cair [25 FEB 2011]

[8] Tahir, I. 1992. Pengambilan Asap Cair secara Destilasi Kering pada Proses pembuatan Karbon Aktif dari Tempurung Kelapa. Skripsi. FMIPA UGM. Yogyakata