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Proceeding

SRIWIJAYA INTERNATIONAL SEMINAR ON ENERGY SCIENCE AND TECHNOLOGY 2009 (SISEST-2009)

THEME :
"SAVE OUR WORLD BY SOLVING ENERGY CRISIS"

PALEMBANG, OCTOBER 14-15, 2009
SRIWIJAYA UNIVERSITY
SOUTH SUMATERA-INDONESIA

ORGANIZED BY:

The National Strategic Prime Research
(New & Renewable Energy Development)
Rusnas PEBT, Sriwijaya University

SUPPORTED BY:

RISTEK

SUMATERA SELATAN
BERSATU TEGUH

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EDITOR
H.M.Faizal, DEA
Adiarso
Sumbogo Murti
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David Bahrin
Rynalsi Melati. S
Fitria Heny Widyastuti

PROCEEDING

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PREFACE

On behalf of The Organizing Committee, I would like to extend a warm welcome to all distinguished participants who are attending the Sriwijaya International Seminar on Energy Science and Technology 2009 (**SISEST2009**) with the theme : **"SAVE OUR WORLD BY SOLVING ENERGY CRISIS".**

The Sriwijaya International Seminar on Energy Science and Technology 2009 (SISEST-2009) is the second international seminar organized by Lembaga Pengelola Riset Unggulan Strategis Nasional Pengembangan Energi Baru dan Terbarukan (LP Rusnas PEBT). This seminar is sponsored financially by the State Ministry of Research and Technology of Republic of Indonesia and the Local Government of South Sumatera Province and Sriwijaya University.

The seminar topics are : coal technology (coal liquifaction, coal gasification, coal blending , etc) biomass, biofuel (biodiesel, bioethanol, biogas etc...), natural gas and petroleum energy, water/hydro energy, nuclear energy, solar energy, photovoltaic energy, wind energy, geothermal energy, hybrid energy, energy efficiency and conservation,save the earth with clean energy, energy saving and sustainable development, strategy of new and renewable energy development, and others topics related with energy

The papers in this seminar are contributed by scientist, researchers, engineers, students, professional stakeholders, plant builders, consultants, government officials, marketers and professional users/buyers of energy etc. The number of paper is 46 papers presented in 1 (one) plenary session and 4 (four) parallel sessions.

We do hope that by held on this seminar, the most exciting development of Energy Science and Technology for save our need energy. This activity will provide a forum, where all concerned, may change ideas, information and knowledge to enhance the development of energy science and technology.

I hope that fruitful discussions during the seminar will lead to the next step in expanding energy science and technology cooperation, and once again my cordial welcome, my best wishes and a memorable stay in Palembang "as ***Pempek City*** " to all participants.

Through this occasion, we would like to apologize for all something that not convenient and unfavorable during the SISEST 2009. And also, we will be grateful for comments and criticism, so that a succeeding SISEST may be an improvement.

Thank you very much for your kind attention and cooperation.

Dr. M. Faizal
Chairman of SISEST 2009

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Jatropha Curcas Oil, Physicochemical Property and its Prospect as a Fuel

Supriyono
Chemical Engineering Dept, Engineering Faculty, Setia Budi University
Jl. Let Jend. Sutoyo - Surakarta - Indonesia
Email : kromosuwito@yahoo.com

Abstract

Jatropha Curcas L. can easily be propagated by cutting is widely planted as a hedge to protect the field's erosion as it is not browsed by cattle. J. Curcas can grow well under such adverse climate because of its low moisture demand, fertility requirements and tolerance to high temperatures. Even if the oil productivity is lower than palm plantation J. Curcas was played important role in biodiversity.

Jatropha curcas oil was extracted using n- hexane as solvent in the soxhlet extraction apparatus. The seeds consist of 40% crude oil (dry w/w). Evaluation of physicochemical properties of J. curcas oil showed that the oil contained low moisture level of 0.03%, acid value less than 1%. Gas Chromatography analysis showed that J. Curcas oil composition is dominated by Oleic acid 53.33 % followed by palmitic acid, 40.01 % and stearic acid 6.42 %.

Because of its low water and acid content in J. curcas oil, transesterification is easily done by simple process using base catalyst both homogeneous and heterogeneous. There is approximately 70 million hectare critical and poor land in Indonesia that could be use as J. curcas plantation. With the productivity is up to 5 ton per hectare per year, it was concluded that Jatropha curcas is one of the prospective source for raw materials of biodiesels Indonesia besides of palm oil.

1. INTRODUCTION

Biodiesel became popular for substitute petro diesel, because their physicochemical nearly the same one to other. Increasing biodiesel demand will speed up vegetable oil consuming as source in biodiesel production. This mean that vegetable oil availability must maintained to ensure sustainability production of biodiesel. At least there is two ways for maintain vegetable oil availability, one is increasing production rate of vegetable oil and the other is looking for another source of vegetable oil. Whatever the choosing it is sure that there must a large amount of area for cultivated

In Indonesia, palm oil (CPO) is mostly use as source for vegetable oil especially as edible oil. Utilizing CPO as raw material in biodiesel production falls in other dilemma, oil for food or fuel. Extension of plantation area could be done by deforesting of rain forest, something that always disputed with environmentalist. The problems that surrounded of CPO were tried to solve by offering substituting CPO by jatropa curcas oil.

Jatropa Curcas or in Indonesia (and Malaysia) commonly known as Jarak pagar (named "pagar" because it is use by peasants for bordering one to others land) was cultivated in south America, south east Asia, India and Africa (Gubitz. et al., 1999). In fact, there is two kind of tree called "jarak", one is jarak pagar (Jatropa Curcas) and the other is jarak kepyar (Ricinus Communis) that also produce oil. Although their name near the same, physically it could be differencing by observed their seed as seen in fig. 1

.

A B

Figure 1. Seed of jatropa curcas (A), and seed of Ricinus Communis (B)

The advantage of Jatropa Curcas is could grow in critical land and such phenomenon could revitalized approximately 69 million hectare critical land in Indonesia (DoA, 2006). With the productivity 5 tons dry seed per hectare per year (DoC), assumes that ten percent of critical land cultivated by J. Curcas and the oil yield is 30%, we gain 10 million tons J. Curcas Oil without destroyed any rain forest, on the contrary we save a large amount of critical land.

J. Curcas Oil mainly composed by fatty Acid of Palmitic, Palmitoleic, Stearic, Oleic and Linoleic. However, the chemical compositions of the oil vary according to the climate, locally and variety of the plant.

2. MATERIALS AND METHODS

2.1. Materials

J. Curcas seed were obtained from Purwodadi Central Java. The ripe seed were collected, cleaned, de shelled and dried in oven at 105°C for 30 minutes. The seeds were ground to powder using grinder. All chemical used in the study were analytical grade.

2.2. Oil Extraction

The extraction was carried out using solvent extraction in soxhlet apparatus. Seeds powder were extracted using n.hexane as solvent for 7 cycles. About 100 g of dried seed powder was used in oil extraction and for lipid content determination

2.3. Analysis

Fatty Acid Composition was determined using Gas Chromatography (GC) Shimadzu 2010. About 0.5 g sample add with 2 mL MeOH 0,5 N and heated, add with 2 mL $BF_3.CH_3OH$ 20% then cooled, add with 1 mL n,hexane and 2 mL saturated NaCl. Approximately 0.1 µL upper layers injected to GC. The GC was equipped with capillarity coulomb (30 m x 0.5 mm x 0.25 µm) and Flame Ionization Detector (FID) Viscosity of seed oil was determined using ASTM D-445 method, water content determined with ASTM D-95 method.

3. RESULT AND DISCUSSION

Table 1 shows the analysis of Indonesian Jatropa Curcas Oil compared to other Countries.

Table 1. Comparison of Indonesia J. Curcas to other countries J. Curcas

Parameter	Indonesia	Malaysia *)	Nigeria +)	Nicaragua =)
Fatty Acid Composition,%				
Oleic	53.33	46.40	41.30	34.3
Palmitic	40.01	13.89	19.5	13.6
Stearic	4.06	7.16	6.80	7.4
Palmitoleic	0.15	0.61	--	0.8
Linoleic	0.09	31.96	31.40	43.2
Σ saturated fatty acid	44.07	21.05	26.30	21.0
Σ unsaturated fatty acid	55.93	78.95	72.70	89.0
Viscosity,(°C/ cSt)	40/44	rt /36	17 – 52	30/37
Water content % (v/v)	0,03	0,02	--	4.4
Total lipid content	40	60.45	47.25	57.4
FFA as Oleic Acid (%)	0,8	1.03	1.76	0.6 – 1.7

*) = Salimon J & Abdullah R., 2008
+) = Akintayo, E.T., 2004
=) = Foidl N et al., 1996

Free fatty acid content of Indonesia J. Curcas oil is lower than 1%, that mean the oil could process directly to produce biodiesel with base catalyst. If the FFA content 1% and up it must be pretreatment by acid (eg. H_2SO_4), this process is wasting time and costly (Sulistyo, 2008). The differences in fatty acids composition was expected due to differences in soil, climate condition and variety of J. Curcas. It was shown from table 1 that unsaturated fatty acid of Indonesian J. Curcas oil composed mainly by oleic acid, this differ with other J. Curcas Oil that their unsaturated fatty acid composed by Oleic acid and Linoleic acid. Total unsaturated fatty acid of Indonesia J. Curcas is least compared to other, this mean unsuitable for biodiesel production. It was supposed that viscosity of Indonesia J. curcas is greatest among the others, such phenomenon causes by least unsaturated fatty acid that cause in high pour point. And most off all, total lipid gained in Indonesia J. Curcas is least than others or in the other word, Indonesian J. Curcas is least productive than others

4. CONCLUSION

Indonesia has prospective area for Jatropa Curcas plantation without deforested rain forest, on the contrary plantation will recovered critical area and enlarge biodiversity. The local Indonesian Jatropa Curcas must be engineered to meet the standards of vegetable oil that use in biodiesel production. This could be started by development of seed centre.

5. ACKNOWLEDGMENTS

The authors wish to thanks to Directorate General of Higher Education for finance support of this research under **Hibah Kompetitif Penelitian Sesuai Prioritas Nasional Batch II** Project.

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