ISSN : 2301-5690

INTERNATIONAL CONFERENCE

ENGINEERING & TECHNOLOGY DEVELOPMENT
UBL ICETD
2013

The Second International Conference on Engineering and Technology Development

2nd ICETD 2013

27, 28, 29 August 2013, Bandar Lampung, Indonesia

PROCEEDINGS

In Cooperations With :

APTIKOM

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

SURYA INSTITUTE

Hosted by :
Faculty of Engineering and Faculty of Computer Science,
Bandar Lampung University (UBL), Indonesia

2nd ICETD 2013

The Second International Conference On Engineering And Technology Development

28 -30 January 2013
Bandar Lampung University (UBL)
Lampung, Indonesia

PROCEEDINGS

Organized by:

Faculty of Computer Science and Faculty of Engineering
Bandar Lampung University (UBL)
Jl. Zainal Abidin Pagar Alam No.89 Labuhan Ratu, Bandar Lampung, Indonesia
Phone: +62 721 36 666 25, Fax: +62 721 701 467
website :www.ubl.ac.id

ISSN 2301-6590

PREFACE

The Activities of the International Conference is in line and very appropriate with the vision and mission of Bandar Lampung University (UBL) to promote training and education as well as research in these areas.

On behalf of the Second International Conference on Engineering and Technology Development (2nd ICETD 2013) organizing committee, we are very pleased with the very good response especially from the keynote speaker and from the participans. It is noteworthy to point out that about 80 technical papers were received for this conference.

The participants of the conference come from many well known universities, among others : University Kebangsaan Malaysia – Malaysia, APTIKOM – Indonesia, Institut Teknologi sepuluh November – Indonesia, Surya Institute – Indonesia, International Islamic University – Malaysia, STMIK Mitra Lampung – lampung, Bandung Institut of Technology – Bandung, Lecture of The Malahayati University, B2TP – BPPT Researcher – lampung, Starch Technology Center – Lampung, Universitas Islam Indonesia – Indonesia, Politeknik Negeri Malang – Malang,University of Kitakyushu – Japan, Gadjah Mada University – Indonesia, Universitas Malahayati – Lampung, Lampung University – lampung, Starch Technology Center – Lampung, Universitas Riau – Riau, Hasanuddin University – Indonesia, Diponegoro University – Indonesia, King Abdulaziz University – Saudi Arabia, Parahyangan Catholic University – Indonesia , National Taiwan University– Taiwan, Surakarta Christian University – Indonesia, Sugijapranata Catholic University – Indonesia, Semarang University – Indonesia, University of Brawijaya – Indonesia, PPKIA Tarakanita Rahmawati – Indonesia, Kyushu University, Fukuoka – Japan, Science and Technology Beijing – China, Institut Teknologi Sepuluh Nopember – Surabaya, Researcher of Starch Technology Center, Universitas Muhammadiyah Metro – Metro, National University of Malaysia – Malaysia.

I would like to express my deepest gratitude to the International Advisory Board members, sponsor and also to all keynote speakers and all participants. I am also gratefull to all organizing committee and all of the reviewers who contribute to the high standard of the conference. Also I would like to express my deepest gratitude to the Rector of Bandar Lampung University (UBL) who give us endless support to these activities, so that the conference can be administrated on time

Bandar Lampung, 29 August 2013-08-26

Mustofa Usman, Ph.D
2nd ICETD Chairman

ISSN 2301-6590

PROCEEDINGS

2nd ICETD 2013

The Second International Conference
On Engineering And Technology Development

28 -30 January 2013

INTERNATIONAL ADVISORY BOARD

Y. M Barusman, Indonesia
Ahmad F. Ismail, Malaysia
Mustofa Usman, Indonesia
Moses L. Singgih, Indonesia
Andreas Dress, Germany
Faiz A.M Elfaki, Malaysia
Warsono, Indonesia
Raihan Othman, Malaysia
Zeng Bing Zen, China
Tjin Swee Chuan, Singapore
Khomsahrial R, Indonesia
Rony Purba, Indonesia
Alex Tribuana S, Indonesia
Hon Wei Leong, Singapore
Imad Khamis, USA
Rozlan Alias, Malaysia
Rudi Irawan, Indonesia
Gusri Ibrahim, Indonesia
Jamal I Daoud, Malaysia
Riza Muhida, Indonesia
Heri Riyanto, Indonesia
Agus Wahyudi, Indonesia
Lilies Widojoko, Indonesia

ISSN 2301-6590

PROCEEDINGS

2nd ICETD 2013

The Second International Conference
On Engineering And Technology Development

28 -30 January 2013

STEERING COMMITTEE

Executive Advisors
Dr. M. Yusuf S. Barusman
Andala R. P. Barusman, MA.Ec

Chairman
Mustofa Usman, Ph.D

Co-Chairman
Dr. Ir. Hery Riyanto, MT
Ahmad Cucus, S.Kom., M.Kom

Secretary
Marzuki, S.Kom., M.Kom
Maria Shusanti Febrianti, S.Kom., M.Kom

Technical Committee
Indyah Kumoro, ST. IAI
Ardiansyah, ST., MT
Sofiah Islamiah, ST. MT
Taqwan Thamrin, ST., MSc
Dina Ika Wahyuningsih, S.Kom
Agus Sukoco, M.Kom
Hj. Susilowati, ST. MT
Haris Murwadi, ST, MT
Robby Yuli Endra, S.Kom., M.Kom
Fenty Ariani, S.Kom., M.Kom

Treasure
Samsul Bahri, SE
Dian Agustina, SE

ISSN 2301-6590

PROCEEDINGS

2nd ICETD 2013

The Second International Conference
On Engineering And Technology Development

28 -30 January 2013

ORGANIZING COMMITTEE

Chair Person
Dr. Ir. Hery Riyanto, MT

Vice Chair Person
Yuthsi Aprilinda, S.Kom., M.Kom

Treasure
Dian Agustina, S.E

Secretary
Aprizal, ST. MT
Ir. Tjejeng Sofyan, MM
Ir. Muhammad Zein, MT
Ir. Bambang Pratowo, MT

Special Events
Ir. Juniardi, MT
Ir. Indra Surya, MT
Ir. Sugito, MT
DR. Baginda Simaibang, M.Ed
Berry Salatar, S.Pd
Yanuar Dwi Prasetyo, S.Pd.I., M.A

Receiptionist
Ir. Najamudin, MT
Kunarto, ST. MT
IB. Ilham Malik, ST. MT
Ir.A Ikhsan Karim, MT
Ir. Asikin, MT
Usman Rizal, ST., M.MSi

Transportation and Acomodation
Irawati, SE
Desi Puspita Sari, S.E
Tanto Lailam, S.H

ISSN 2301-6590

Ilyas Sadad, S.T., M.T

Publication and Documentation
Ir. Indriati Agustina Gultom, M.M
Noning Verawati, S.Sos
Hesti, S.H
Rifandi Ritonga, SH
Violita, S.I.Kom

Cosumption
Dra. Yulfriwini, M.T
Wiwin Susanty, S.Kom., M.Kom
Fenty Ariani, S.Kom., M.Kom
Reni Nursyanti, S.Kom., M.Kom
Erlangga, S.Kom
Arnes Yuli Vandika, S.Kom

Facility and Decoration
Siti Rahma Wati,SE
Dina Ika Wahyuningsih, S.Kom
Zainal Abidin, SE
Ahyar Saleh, SE
Eko Suhardiyanto
Wagino
Sugimin

ISSN 2301-6590

Table Of Content

Speaker

2nd International Conference on Engineering and Technology Development (ICETD 2013)
Universitas Bandar Lampung
Faculty of Engineering and Faculty of Computer Science
ISSN 2301-6590

ENERGY UTILIZATION TECHNOLOGY OF AGRICULTURE AND FORESTRY WASTE

Hardoyo
Starch Technology Center, Lampung
Agency for Assessment and Application Technology
Email : hardoyo.bppt@yahoo.co.id

Abstract-*The increasing of fossil energy consumption and will be limited of fossil energy source, cause important to develope alternative energy. One of alternative energy is energy from biomass waste, like agriculture and forestry waste. Those biomass wastes contain cellulose, hemicellulose and lignin. The utilization technology of biomass waste could be done by thermochemical and biochemical process. Direct combustion, gasification, convertion to solid fuel and esterification are the termochemical process, that produce heat supply generator , flameable gas, solid fuel and diesel fuel. Anaerobic digestion and ethanol fermentation are the biochemical convertion, that produce methane gas and ethanol. The energy bioconverrtion technology to convert ethanol from biomass waste are pretreatment, hydrolysis, fermentation, distillation and dehydration.*

Key word-*Agriculture and forestry waste, direct combustion, gasification, convertion to solid, anaerobic digestion, ethanol fermentation*

INTRODUCTION

In the recent years, the energy consumption in Indonesia was increased significally. This condition has to seriously attention, consider with the energy fossil source will be limited. With that prediction, it is a fortune to develop another energy alternative to change of the energy fossil. One of the alternative energy that has to develop is energy from biomass waste, like agriculture and foresty wastes.

The concept lies within the cascading utilization of biomass in order that biomass resources are utilized to their full potential. The aim is to first utilized biomass as raw material and product, use it as fuel after it deteriorates, and repeat recycling it gradually from higher to lower quality, thereby saving biomass resources. There are two main method to utilize biomass, i.e the material utilization method and the energy utilization method. For the energy utilization of biomass, it is necessary to convert the biomass resources into easily accessible energy such as electricity, heat and transport fuel. The biomass energy utilization can be broadly divided into thermo-chemical utilization and biochemical utilization. The former deals with causing chemical reaction via heat, and the latter obtain useful substances as energy via biological actions.

AGRICULTURE AND FOREST WASTE

The agriculture and forestry waste are content of major lignocellulosic material. Garotte et.al.were reported compilation of lignocellulosic waste material of different hardwoods, softwood and agriculture residue. The hardwoods contain 39-54% cellulose, 14-37% hemicelluloses and 17-30% lignin. The softwoods contain 41-50% cellulose, 11-27% hemicelluloses and 20-30% lignin. The composition of agriculture residues are rise widely.

ENERGY UTILIZATION TECHNOLOGY OF BIOMASS WASTE

The agriculture and forestry biomass waste energy utilization can be broadly divided into thermo chemical convertion, extraction convertion and biological convertion. The thermo chemical convertion deal with causing chemical reaction via heat. Extraction

 ISSN 2301-6590

convertion is a physically process and biological convertion useful substance as energy via reaction. The typical of technologies available with agriculture and forestry biomass waste energy utilization is shown in figure 1

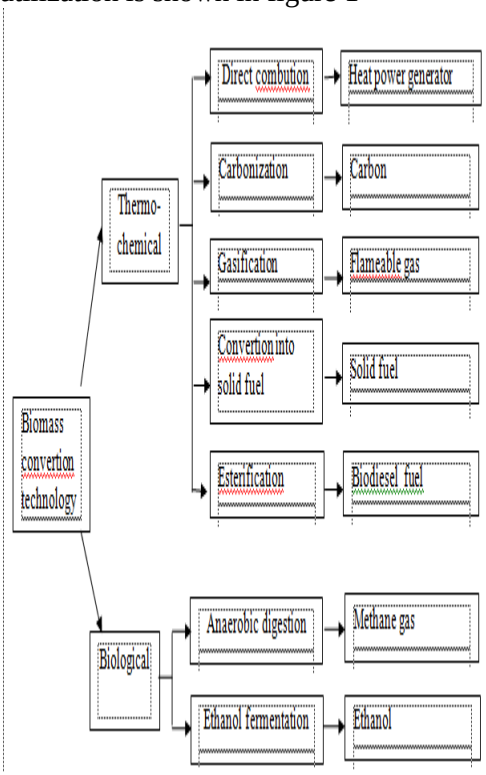

Figure 1. Energy utilization technology of biomass

Direct combustion

Direct combustion is the most common and basic technology involving the extraction of thermo energy from direct combustion of ligneous or herbaceous biomass. This is a major way of energy utilization especially in developing countries. In addition, the heat generated during the process can also be used to create steam for power generation. Although direct combustion is already a technology widely used, the issue concerning technical development for better and efficient usage needs to be addressed.

Carbonization

The carbonization technology has long been used as a method of turning ligneous waste, unsed materials, etc into high calorie substances. By heating and decomposing pyrolytically under oxidant-free condition, an efficient solid substsnces containing high level of carbon can be obtained. In developing countries this is widely use along with direct combustion and anaerobic digestion

Gasification

The gasification is used to decompose the biomass waste, first by heating then reduce the molecule level before using the final product as flammable gas or as raw material that synthesize with liquid fuels. When biomass waste is heated in oxygen deficient, environmental thermal decomposition usually take place and flammable gas, tar and coal are produced. The variable process control such as adding steam, the level of oxygen added and quick-heating is called gasification control. The composition of the product depends on the condition given, though the main constituents are hydrogen, methane, carbon monoxide and carbon dioxide.

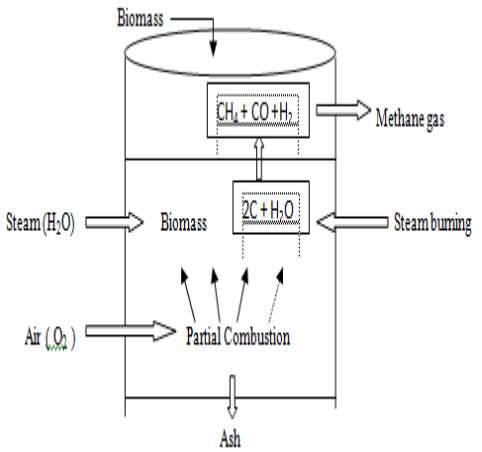

Figure 2 Example of the Structure of Gasification tank

Convertion into solid fuel

Through this technology fuel is created by first compressing biomass waste meal or mixture of biuomass meal and coal after heating at 100-150 ^{o}C, followed by solidifying the substance by utilizing the adhesive nature of lignin. The pellet produced are convenient for

fluidity and portability, and serves as excellent fuel due to their dry nature which allows easy ignition and combustion.

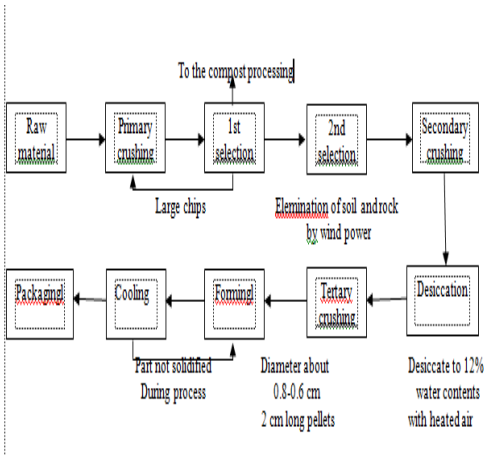

Figure 3. Example of Solid Fuel Utilization

Esterification

Esterifdication is a technology where fuel diesel automobiles (Bio Diesel Fuel) is obtained by chemical reaction between methanol and oil (rape oil, sunflower oiul, soybean oil , etc). Oil is a glycerine and ester molecular structure formed by fatty acid, when it is mixed with methanol with catalyzer as alkali added and then heated for about an hour at 70 ^{o}C. Fatty acid creates methanol and ester to produce methyl ester, and glycerine is released. The methyl ester from fatty acid can be used as diesel fuel

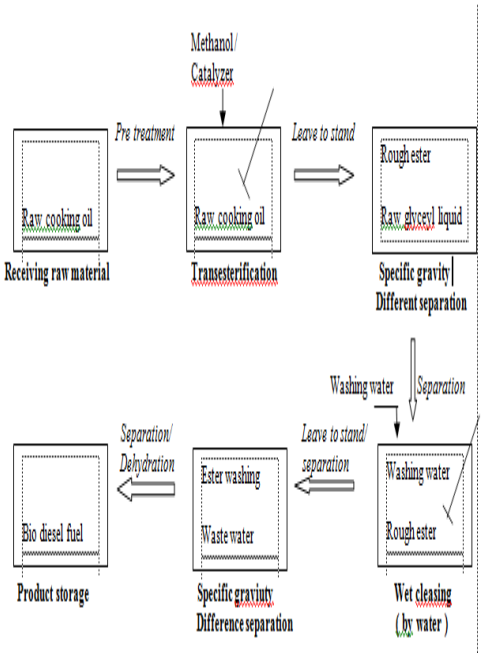

Figure 4 . Manufacturing of Bio Diesel Fuel

Anaerobic digestion

When biomass is exposed to an environmental devoid of air, anaerobic microorganisms work to decompose into methane and carbon dioxide and from this main substancesd flammable gas is produced. Depending on the substance the composition can be different, but generally the gas mainly is composed by methane and carbon dioxide, and the concentration of methane is abaout 50-70%

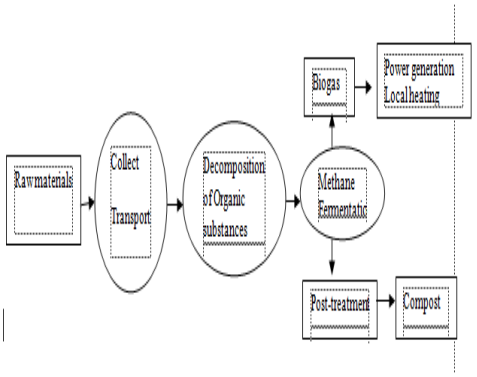

Figure 5 . Process flow of anaerobic digestion

Ethanol Fermentation

Ethanol and carbon dioxide are produced by yeast decomposition of sugars, such as glucose, fructose and sucrose. This type of microorganism

mechanism has been employed in alcoholic beverage production since ancient times, and is known as ethanol fermentation. With this method, which uses yeast to obtain ethanol, high purity fuel can be collected by distilling the ethanol. When using lignocelluloses raw materials, sugar is first obtain from hydrolysis of cellulose and hemicelluloses, followed by the ethanol fermentation of the acquired sugar.

There is prospect for a large market for biomass ethanol as automobile fuel or oxygenated octane boosting gasoline additive. Ethanol fermentation is a technology expected in the future to have the price competitive power against gasoline that comes from fossil fuel.

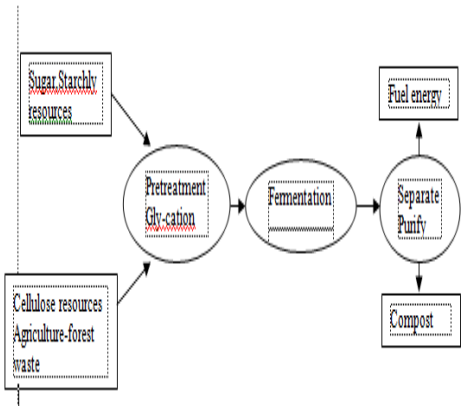

Figure 6 . Process flowchart of Ethanol Fermentation

CONCLUSION

3. The agriculture and forest wastes have potentially as energy raw material
4. The energy utilization of the agriculture and forest waste can be carry out by thermochemical utilization and biochemical utilization.
5. The heat energy were produced from direct combustion, convertion into solid fuel, gasification and anaerobic digestion process, and the fuel energy were produced from esterification and ethanol fermentation process

REFERENCES

6. Anke Koopmans (2003) ; *Fuel Production from Biomass* ; International Seminar on Appropiate Technology For Biomass Derived Fuel Production, Jogyakarta, Indonesia.
7. Hayashi K (2004) ; *Lignocellulose Biodegradation*, American Chemical Society, Washington DC, 49-68
8. Kamarudin Abdullah (2007) , *Waste as Renewable Energy Source,* Ascoja Conference on Integrated and Community Based Waste Management, Jakarta-Indonesia
4. Manurung, R. (1995), *Overview on the Biomass Energy Development in Indonesia; International Workshop on the Use of Coconut Industry Waste for Energy*, UNIDO, Bali, Indonesia.
5. Olsson. L. et al (1993) ; *Fermentation performance of bacteria and yeast in lignocelluloses hydrolyzate,* Process Biochem,28
6. Stout,B.A.;(1979 *); Agricultural Biomass for Fuels*; Michigan State University
7. Sun Y, Cheng J (2002), *Hydrolysis of lignocelluloses materials for ethanol production review*, Bioresources Technol, 83

universitas
bandar lampung

Jl. Z.A. Pagar Alam No.26 Labuhan Ratu
Bandar Lampung 35142 Phone: +62 721 701463
www.ubl.ac.id
Lampung - Indonesia

copyright@2013