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An Overview of Bioethanol Application Made from Biomaterial Ingredient For Stove and Motorcycle

Sri Nurhatika* and Achmad Arifiyanto

Department of Biology, Faculty of Science
Institut Teknologi Sepuluh Nopember (ITS), Surabaya, 60111, Indonesia

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ABSTRACT

Most of Indonesian people were motorcycle user, whereas it consumed subsidized fuel beside domestic energy consumption. Energy crisis with increasing population number had already forced an alternative energy applied as a solution in the world, involved in Indonesia. Nevertheless, applied of renewable energy on motorcycle was rarely in Indonesia nor for domestic consumption. Bioethanol was one of renewable and a promising alternative energy used for replacing fossil fuel. Ethanol from nature or biological ingredient, known as bioethanol mostly used three materials contained; starch, glucoses, and celluloses. They collected dominantly from human daily foods, so that it need for using other materials beside human daily foods such as waste or toxic materials ingredient from plants. *Mendioca sao pedro petro* or cassava genderuwo was toxic cassava contained highly starch and potentially used in bioethanol ingredient. Indonesia also had potential waste of food likes bananas skins, microalgae, vegetable and fruits traditional market, and grass which had not exploited yet. Under Separated Enzymatic Hydrolysis and Fermentation (SHF) method those materials had observed.We aimed to overview bioethanol usage as an alternative energy. In our previous research used cassava genderuwo gained, 1L of bioehtanol similar with 3L of kerosene in ratio that used in stove.

KEYWORDS:bioethanol, stove,motorcycle

INTRODUCTION

Bioethanol known as alcohol compound biomass that made from plants containing starch, sugar and cellulose through a process of fermentation and distillation. Ethanolconsidered as a more welcoming environment where it has a high octane value (96-111) and used as a replacement for Methyl Tertiary-butyl Ether (MTBE), high octane may enhance the efficiency of the combustion due to it contains 35% oxygen and emissions gas such as carbon monoxide, nitrogen oxides and 19-25%other gases levels were low[1,2,3].

Fuel demand had increased as along as population growth and human activities. On March 2008 reported, Indonesia fuel(petrol) consumption levels reached 1.3 million barrels per day, whereas the national fuel production only amounted to 900 thousand barrels per day. Therefore, it needs an energy sourcereplacement, whereby the base ingredients widely available in Indonesia and untapped. Indonesia total production of bioethanol until June 30, 2008 only 160 000 kiloliters per year [4]. Therefore, Indonesia still requirringmore effective fuel bioethanol sources. Indonesia had high potential in number of biomass that can be converted into bioenergy such as ethanol.Therefore, there should be research on other types of waste that allegedly more potential to keeping develop into bioethanol material sources such cassava, domestic waste, grass, algae etc.

Indonesia has been widely known as a country with vast territory and land. There were many freshwater aquatic found in Indonesia such as rivers and lakes. Various organisms lived there, included algae. Algae were a plant or group that contained chlorophyll consisting of one or more cells and coloniesform. Algae contained organic ingredients such as polysaccharides, hormones, vitamins, minerals and bioactive compounds. So far, algae usaged as a commodity or raw was small compared to algae speciesdiversity found in Indonesia relatively. Whereas it chemical components was useful either for raw and bioethanol. Bioethanol production from waste may replace gasoline respectively. As it carbohydrate content of the waste that washigh enough well. It also had a fastgrowthtoward fregmentation manner[3]

Celluloses in agricultural, forestry and domestic waste had not much utilized. They were source of sufficient energy. It also can be converted into ethanol. Such agricultural waste likes straw and corn stalks of rice had high cellulose content. According to the BPS data, East Java province, no. 40/07/35/VIII, July 1, 2010 the national maize production in 2009 reached 17.6 million tons, while rice production in 2009 reached 64,3 million tons. Thus it can

***Corresponding Author:**Sri Nurhatika**,** Department of Biology, Faculty of Science, Institut Teknologi Sepuluh Nopember (ITS), Surabaya, 60111, Indonesia. Email: nurhatika@bio.its.ac.id; nurhatika023@yahoo.com

be estimated that the amount of waste generated by agricultural output annually. Cellulosic Bioethanol production from agricultural biomasswastes consist as pretreatment, hydrolysis and ethanol fermentation stage [1,3].

Bioethanol produced through fermentation processes. Decomposition of organic compounds into simpler compounds with the help of microorganisms that produce energycalled as Fermentation. Yeast (*S. cerevisiae*) mostly used as fermentation agent in commercial-scale[4] [7]. *S.cerevisiae* also known as baker's or Brewer yeast,it able to convert nearly 90% of glucose to ethanol[8]. *S.cerevisiae* consumed glucose, fructose, maltose, and maltotriose[9]. Meanwhile, to change it organic compounds into simpler substances it required enzymesfor fermentation process. Enzymes were molecules that composed of biopolymers of amino acids series in the composition and structure from a regular and fixedchain. Enzymes (carbohydrases, amylase, and cellulase) has important role in transforming carbohydratescomplex. Starch has to be converted into simpler molecules and absorbed by the cells firstly. Amylase has the ability to break down starch and glycogenmolecules. Molecular starch, a polymer of 1.4 bond - α-glycosides will be splitted by α-amylase on α -1.4 bond yield glucose, maltose, and dextrin [10].

MATERIALS AND METHODS

Fermentation Process

Starter added into 250 ml erlenmeyer containing Spirogyra extract, it incubated for 10 days at room temperature. Ifethanol levelstill experiencing, the fermentation to be continued. Fermentation process stopped if ethanol levels have been reduced. Close the bottle removed, covered with a lipidcotton and pasteurized at a temperature of ± 80 ° C for 10 minutes [11].

Measurement of Ethanol Concentration

Discuss and consider the distillation tube and 250 ml flasks are prepared, then 50 ml liquid samples had fermented using 50 ml measuring flask, and fed into a distillation tube. Boiled carefully to avoid excessive foam, a mixture of alcohol and distilled water to be collected exactly 50 ml distillate [12]. While it was distilled, piknometer calibrated. Distilled water and Piknometer filled and closed. Piknometer and aquades were weighed (W2). Then piknometer emptied, the remaining absorbed with distilled water, and acetone. Piknometer tube heated byoven, weight that has obtained named as W1. Weight of distilled water (W) is calculated by W2-W1 [12].

Distillate was transferred and dried into a glass beaker. Distillate stirred to homogeneous before filled into piknometer. Piknometer filled with distilled dry, the outer surface piknometer dried and weighed. The results obtained named as W3.

Fig. 1. Bioethanol 90%

Heavy distillate were W3-W1 = L. Heavy water (L) calculated with the "specific gravity" or SPG = L / W. SPG value was determined using Table AOAC (Analysis of the Association of Official Chemists analitical) then calculated the percentage of ethanol [12].

RESULTS AND DISCUSSION

Bioethanol production had made using certain materials such as cassava (*Mendioca sao pedropetro)*, corn stem waste, algae, and domestic waste.Separate Enzymatic Hydrolysis and Fermentation (SHF) method had used to produced ethanol from Corn Stem (Zea mays L.). SHF method processes have been proposed due effective condition in bioethanol production process which the reactor hydrolysis and reactors has done in different batch reactor and incubation time. Corn stem hydrolysis process used cellulase enzyme which being conditioned in pH 5, 45^0C temperature and incubated for 72 hours. The fermentation process was done in a different time, 0, 24, 48, 72

and 96 hours with bacterial inoculum was 0%, 5%, 7,5% and 10%. Measurement of ethanol was carrying by Specific Gravity which compared masses of distillated water (ethanol-water) with a mass of pure water in the same volume. The results ethanol yield showed at Figure 1, Zymomonas mobilis 10% and 96 hours incubation with 2.453% of ethanol obtained as the highest.

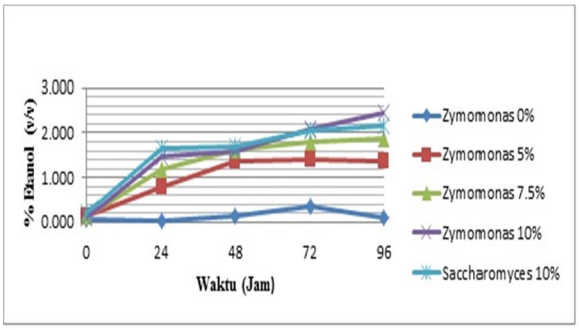

Fig.2. Ethanol rates production from corn stem

While spirogyra algae usage in bioethanol production,we added α-amilase enzyme in varies 0,03, 0,06 and 0,09 gram per 50 mL concentration. The gaining results had shown at Table 1, 0,06 gram α-amilase enzyme addition in 10 days fermentation might be able to produce 9,245 % as the highest ethanol production.

Table 1. Number of bioethanol which producedby*Zymomonas mobilis*

Σ α-amy	Number of bioethanol which produced (%) in t					
	0 day	2 day	4 day	6 day	8 day	10 day
0 gr	0,000	1,095	2,105	3,120	4,155	4,505
0,03 gr	0,035	2,235	3,265	5,485	6,750	8,265
0,06 gr	0,035	2,925	4,415	6,525	8,370	9,245
0,09 gr	0,035	2,970	4,095	6,415	8,310	8,465

Moreover, another materials usage in producing bioethanol had shown in Table 2.While, Indonesia government had biofuel policy based on regional competitiveness product. Even sugarcane known as the highest material for producing bioethanol, only certain area has it competitiveness product. In another way increasing of energy consumption fordomestic and motorcycle were contributed as the highest.

Table 2. Ethanol production per 1000 kg biomass

Materials/ biomass	Mass	Ethanol produced
Cassava 47% starch (usual cassava 26% starch)	1000 kg	166,6 liter
Pineapple skin waste	1000 kg	40 liter
Banana skin and hump waste	1000 kg	40 liter
Sugarcane	1000 kg	250 liter
Sugar palm	1000 kg	200 liter
Corn stem/ hump waste	1000 kg	200 liter
Sago palm	1000 kg	90 liter
Vegetables and fruits waste	1000 kg	
Cogon grass	1000 kg	283 liter

Domestic consumption dominated by kerosene stove usage especially. Bioethanol proposed by us as a replacement toward kerosene for stove and supporting government program namely LPG-kerosene conversion directly. Bioethanol had comparative degree compared to kerosene:

1. Bioethanol gained by both artificial and natural fermentation but not for kerosene.
2. Kerosene might not have contaminated in food but allowed for bioethanol
3. 30% of combustion are degraded ozon for kerosene and inspite of to bioethanol
4. Watering might switch off fire by bioethanol easily and not for kerosene
5. Recycling materials stove aren't suitable for kerosene and not for bioethanol
6. Much more friendly

7. It has cheaper than kerosene; 1 liter bioethanol = 3 liter kerosene
8. Bule flame doesn't produce black carbon

Even it also had a weakness which is 5 minute more time for cooking than we used kerosene.

Fig. 3. Bioethanol stove

Indonesia has energy conversion policy including domestic domain. Many housewife had begun using LPG stove since 2007 [13]. But there was certain field that can't replace by LPG stove conversion from kerosene stove. One of them, are painting batik and food street seller. They need warming their product up without overheat temperature.

Fig.4. Stove design; a) single burner. b) complex burner. c) specified for batik painter and craftsman

Regarding this case our team constructed several type of burner stove likes single burner, complex burner and specified for batik painter and craftsman in Figure 4.

While mass public transportation were constructed and converted to biofuel, those two point above are still consuming fuel. Ethanol usage in motorcycle could more give benefits because it created more efficient in combustion engine and economist. Ethanol has 114 but gasoline only 87-88 octane. The Combination of them would achieve high octane levels. 3% bioethanol addition will lead 0,87 octane point. 5% ethanol addition changed 92 into 94 octane level, or likely Pertamax brand sold by Pertamina (Indonesia oil and gas public company). Sukabumi in Indonesia had developed public transportation based on motorcycle or in local namely 'Ojek'. Nevertheless,gasoline-ethanol blend will increase formaldehyde production, acetaldehyde and acetone 5-13 times higher compared to gasoline usage only [14].

CONCLUSION

Application of Bioethanol from Biomaterial Ingredient on a Motorcycle and Stovewere an overview of biofuel that contributed for any solution in energy diversity and renewable.

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