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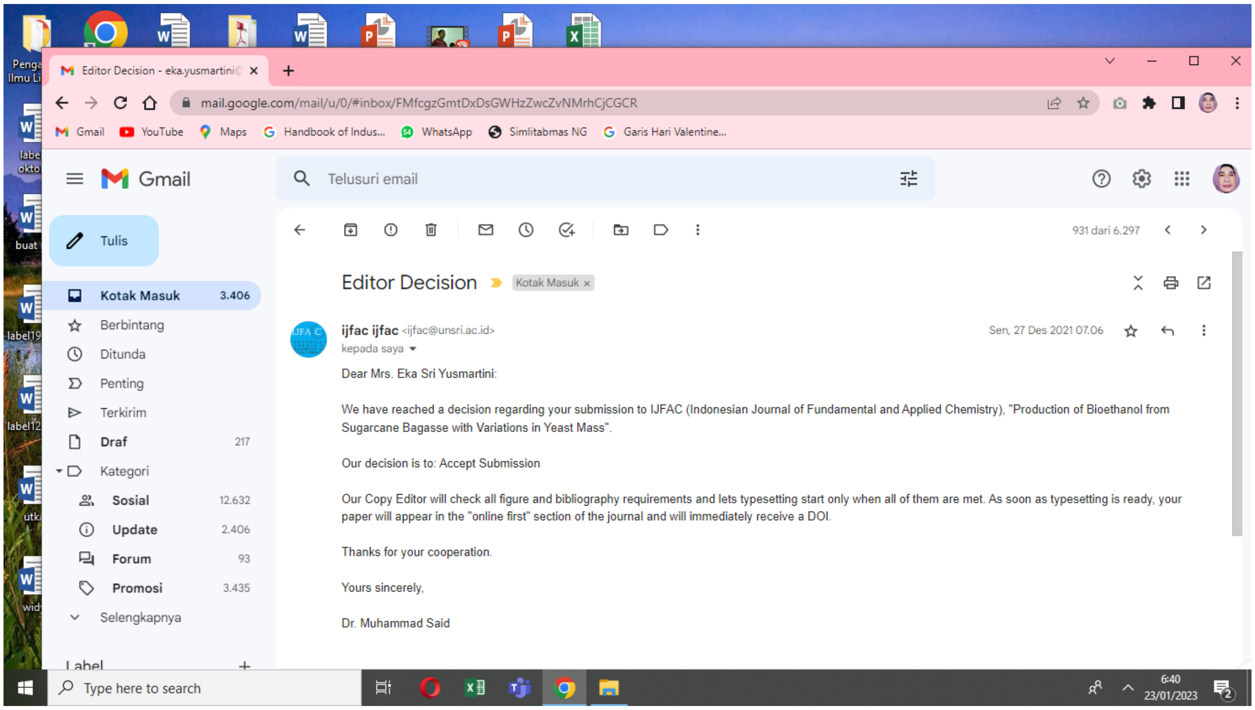

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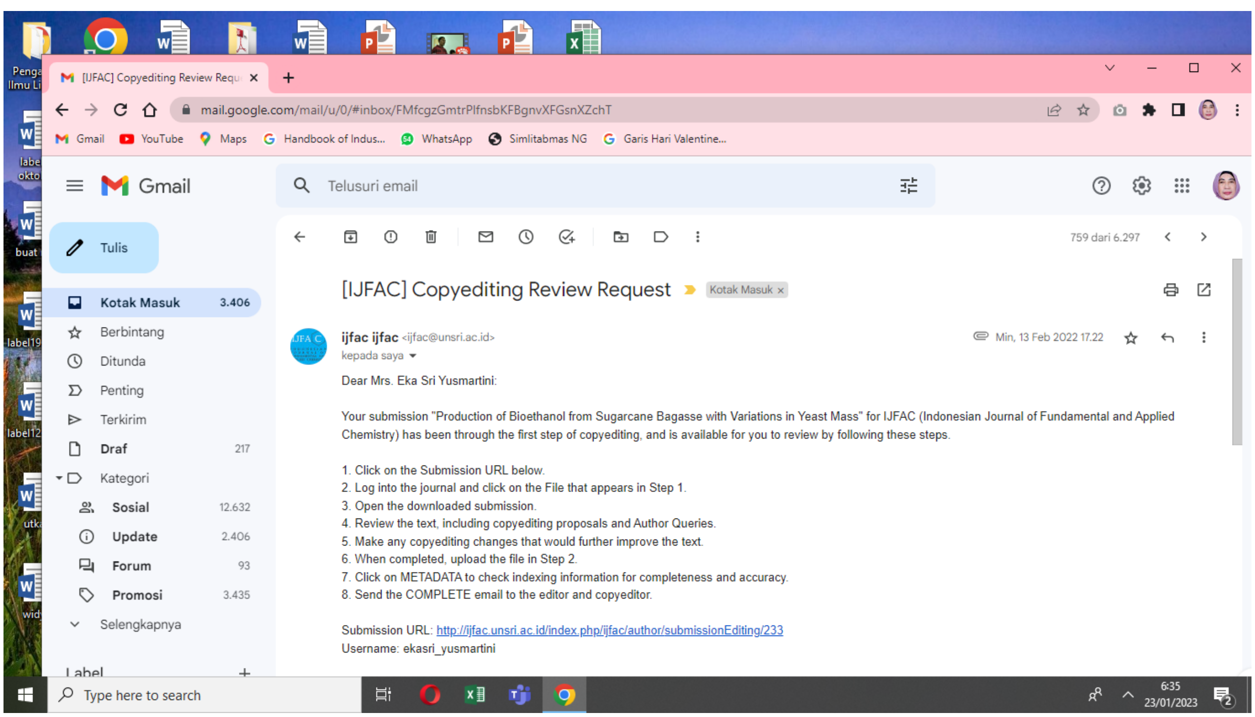

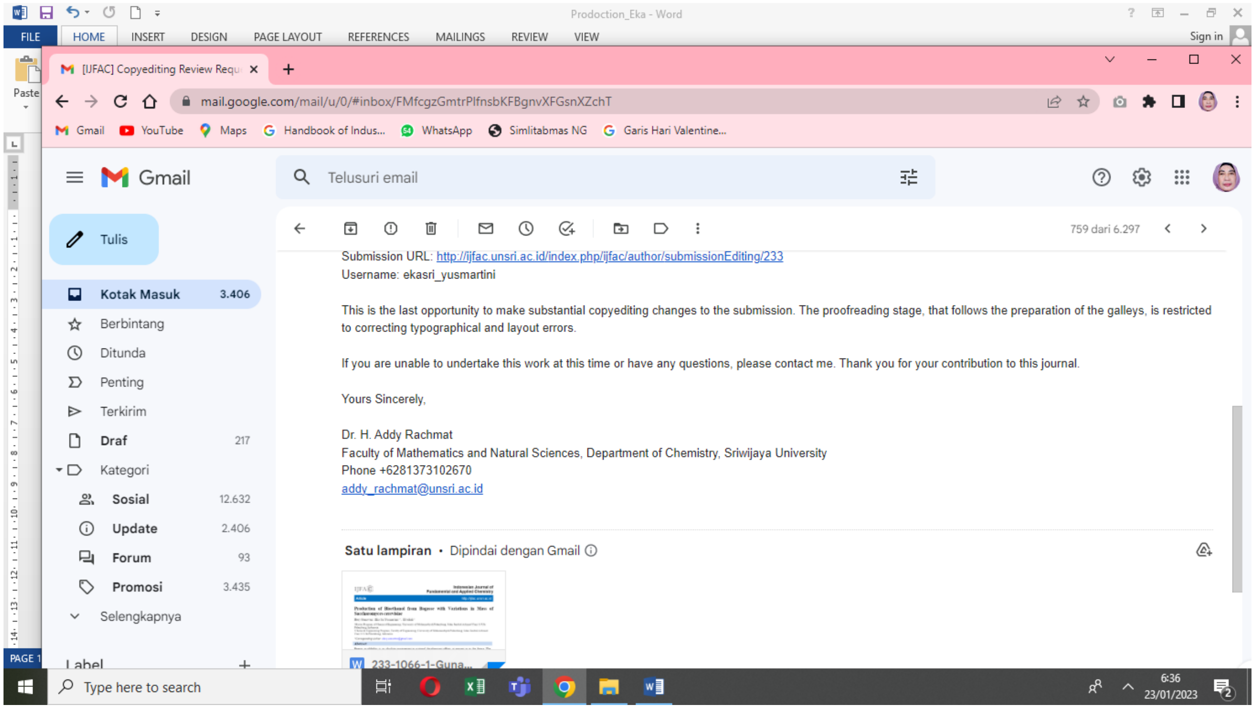

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Yours Sincerely,

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Production of Bioethanol from Sugarcane Bagasse with Variations in Yeast Mass

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Abstract

Energy availability is an absolute requirement in national development efforts at present or in the future, because it can guarantee energy needs which are the main challenges for the Indonesian state. The existence of limited energy sources, while the need continues to increase requires alternative sources of fossil energy. Bioethanol is one of the bioenergy which is an alternative to replace the use of fossil fuels. This study aims to obtain bioethanol from bagasse (bagasse). The method used is hydrolysis with sulfuric acid. The research step begins with pretreatment of bagasse raw materials, grinded to a size of 100 mesh. Furthermore, the hydrolysis with sulfuric acid at a temperature of 150 ^{o}C for 1 hour, to form a slurry. The fermentation process uses a mass variation of yeast Saccharomyces cereviceae with a variation of 6.75; 8.75; 11.25; 13.75 and 16.25 g, for 4 days with pH 5, room temperature and anaerobically. Purification is done by distillation method . The best yield in the study with a mass variation of yeast saccaromyces cerevisiae with a pH of 5 and a fermentation time of 4 days was 57.6 mL. The bioethanol content obtained was 98.93 percent.

Keywords: Bagasse, Bioethanol, Saccha sromyces cereviceae, Yeast mass, Fermentation

Abstrak (Indonesian)

Ketersediaan energi adalah syarat mutlak dalam upaya pembangunan nasional pada saat ini ataupun pada masa yang akan datang, karena dapat menjamin kebutuhan energi yang menjadi tantangan utama bagi negara Indonesia. Keberadaan sumber energi yang terbatas, sementara kebutuhan terus meningkat memerlukan alternatif penganti sumber energi fosil. Bioetanol merupakan salah satu dari bioenergi yang menjadi alternatif untuk mengganti penggunaan bahan bakar fosil. Penelitian ini bertujuan untuk mendapatkan bioetanol dari ampas tebu (bagasse). Metode yang digunakan hidrolisis dengan asam sulfat. Langkah penelitian dimulai dengan pretreatmen bahan baku ampas tebu, dihaluskan sampai ukuran 100 mesh. Selanjutnya dilakukan hidrolisis dengan asam sulfat pada suhu 150 ^{o}C selama 1 jam, hingga berbentuk slurry. Proses fermentasi menggunakan variasi massa ragi saccaromyces cereviceae dengan variasi 6,75; 8,75; 11,25; 13,75 dan 16,25 g, selama 4 hari dengan pH 5, suhu ruangan dan secara anaerob. Pemurnian dilakukan dengan metode distilasi. Yield yang terbaik pada penelitian dengan variasi massa ragi saccaromyces cerevisiae dengan pH 5 dan waktu fermentasi 4 hari, sebesar 57,6 mL .Kadar bioetanol yang diperoleh sebesar 98,93 persen.

Kata Kunci: Ampas tebu, Bioetanol, Sacchasromyces Cereviceae, Massa Ragi, Fermentasi

INTRODUCTION

Energy is very much needed in carrying out Indonesia's economic activities, both for consumption needs and for production activities in various economic sectors . Energy availability is an absolute requirement in national development efforts at present or in the future, because it can guarantee energy needs which are the main challenges for the Indonesian state. Oil, natural gas and coal are fossil energies that are needed by society, but these energy sources are limited

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This research will utilize bagasse into bioethanol as an alternative fuel. Previous research on the utilization of bagasse has been done [2,3], with different variables. Meanwhile [4] made bioethanol using banana peels and bagasse with variations in yeast mass by thermal hydrolysis process. The production of bioethanol with the roots of alang –alang is carried out [5], by hydrolysis and fermentation processes. The method used in this research is by hydrolysis of the thermal. The stages used include the pretreatment process, hydrolysis using sulfuric acid, fermentation with variations in the addition of yeast saccha sromyces cereviceae and purification of the results by distillation. The operating conditions for temperature, fermentation time and pH of the research to be carried out refer to [3].

Bagasse particle size of 100 mesh in the pretreatment and hydrolysis process has never been used in making bioethanol from bagasse by thermal hydrolysis method using sulfuric acid, so research will be carried out on this. The purpose of this study was to examine the effect of particle size and yeast mass on the yield and content of bioethanol produced from bagasse. The benefit of the research is to obtain bioethanol as an alternative fuel.

This section should be succinct, with no subheadings. Author should clearly state the research progress position among other reports and its novelty must be explicitly written. References must be cited accordingly [1], do not include irrelevant references. No images or figures contained in this section [2].

MATERIALS AND METHODS

Materials

This study aims to obtain bioethanol from bagasse (bagasse) . Bagasse used was taken from the Sugar Factory PT Laju Perdan a Lovely (PG Ogan). The research was conducted at the Laboratory of the Process Unit of the Chemical Engineering Study Program, Faculty of Engineering, University of Muhammadiyah Palembang. Tools that are used in this study include the digester, glass beaker , Bunsen, stative and clamp holder , three-neck flask, hotplate , blenders, rotary evaporator, thermometers, shaker , balance sheet analysis, jars plastic, oven , measuring cup, flask, filter paper, furnace , and pH meter, hydrolysis tank and blender. While the materials used include bagasse (bagasse), yeast (Saccharomyces cereviseae) , sulfuric acid (H_2SO_4) 0.3 M, urea, distilled water .

Methods

Preparation of raw materials (pretre a tment)

The bagasse which will be used as raw material is dried for 3 days under the hot sun and then heated in an oven at a temperature of $105^{o}C$ for 1 hour, then crushed using a blender to form a powder. The bagasse flour is then stored in an airtight plastic container to prevent contamination.

Thermal Hydrolysis Process

Bagasse samples that have passed the pretreatment stage are mixed with sulfuric acid solution with a concentration of 0.3 M. The ratio between bagasse and sulfuric acid solution (w/v) is 1: 18. Then it is hydrolyzed at $150^{o}C$ for 1 hour, so that slurry shape. After the hydrolysis process is complete, the digester is removed and cooled suddenly to stop the hydrolysis process. Cooling is done by immersing the digester in a container with water until it reaches room temperature. After that, it was continued by filtering the results of the hydrolysis and the filtrate was taken for the fermentation process.

Fermentation Process

The results of the hydrolysis were put into the fermentation place as many as 5 pieces each with a volume of 30 mL. Then yeast was added to each sample with a variation of 6.75; 8.75; 11.25; 13.75 and 16.25 g. The addition of urea was carried out on each sample of 0.125 g , and stirred well before the anaerobic fermentation process was carried out. The operating conditions in the fermentation process were carried out at room temperature or at $25^{o}C$, with a pH of 5 for 4 days [3] .

Distillation Process

Results of fermentation is purified by distillation process by using a set of tools distillation at a temperature of 79-80^{o}C. The distillate which dihasil right fit and measured its volume and content of etano l produced were analyzed using methods refractometer.

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Analysis procedure

Analysis of the ethanol content was carried out using the refractometer method with the following procedure [6]:

The refractometer was preheated for 15 minutes, then prepared a standard solution of 40%, 50%, 60%, 70%, 80%, 90%, 96% ethanol and bioethanol samples. The standard solution was dripped on the object glass of the refractometer and closed . The same steps were also carried out for bioethanol samples. Directing the light to the slide that has been dripped with standard and sample solutions. Then press the nD (bias index) button and wait for the recorder to generate a number. Take note of the numbers that are read , then calculate the bio-ethanol content with the following equation:

$$\% \text{ Sampel A} = \frac{(\mu sampelA - \mu air)}{m(slope)} \quad (1)$$

$$m(slope) = \frac{\Delta y}{\Delta x} = \frac{y2 - y1}{x2 - x1} \quad (2)$$

RESULT AND DISCUSSION

Subsection of Results

The raw material used in this research is bagasse . The bagasse was dried in the sun, then in the oven at 105 0 C for 1 hour. The dried bagasse is then mashed and disassembled with a size of 100 mesh or equivalent to 0.149 mm.

Figure 1. Bagasse (bagasse)

Pretreatment process and hydraulic pretreatment process is a very important stage of the process which may affect the acquisition of ethanol yield. The pretreatment process was carried out to condition the lignocellulosic materials both in terms of structure and size [7]. This is in line with [8], where the pretreatment process is carried out due to several factors such as lignin content, particle size and hydrolysis ability of cellulose and hemicellulose. The smaller the particle size will increase the porosity. The size of a mPas cane (bagasse) which is obtained from the treatment process is compliant, amounting to 0.149 mm or 1 00 mesh , to be used in the process of hydrolysis . The hydrolysis process aims to break bonds and remove lignin and hemicellulose content as well as damage the crystal structure of cellulose into simple sugar compounds [7]. The size of the raw material will affect the porosity so that it can maximize the contact between the material and the acid to increase the hydrolysis of hemicellulose [7]. According to [9], bagasse has a lignin content of 22% and cellulose 37%. From the literature obtained, it is known that bagasse (bagasse) contains lignin 21.42%, cellulose 48.12%.

The fermentation process in this study used variations in the addition of yeast mass , where the compound used was Saccharomyces cereviceae . The mass amount of yeast saccaromyces cereviceae added to the hydrolysis solution for fermentation was 6.75; 8.75; 11.25; 13.75 and 16.25 g. Fermented and then purified by distillation at a temperature of 79-80°C, this is because the boiling point of ethanol is 78.29°C . The distillation process was carried out for 6 hours until the bioethanol no longer dripped. The results of the measurement of distillate volume and ethanol content in various yeast masses are shown in Table 1 .

Table 1. Distillate yield and bioethanol content

Sample	Yeast Mass (g)	Distillate yield (mL)	Bioethanol content (%)
1	6,75	66,4	83,53
2	8,75	62,8	86,425
3	11,25	60,6	90,275
4	13,75	50,4	93,102
5	16,25	57,6	98,93

Fermentation operating conditions at temperature (t) 25°C, pH 5 and fermentation time (T) for 4 days and anaerobic process.

Influence yeast mass to yield bioethanol

The fermentation was carried out at room temperature operating conditions (25°C) with yeast mass variation of 6.75; 8.75; 11.25; 13.75 and 16.25g, fermentation time 4 days and pH 5. Fermentation time for 4 days and pH 5 were taken based on [1,5], where the best conditions for fermentation with yeast Saccharomyces cereviceae were obtained at pH 5 and fermentation time for 4 days, the maximum ethanol yield was obtained. The yield of bioethanol carried out under the operating conditions as mentioned above is shown in Table 1 and Figure 1.

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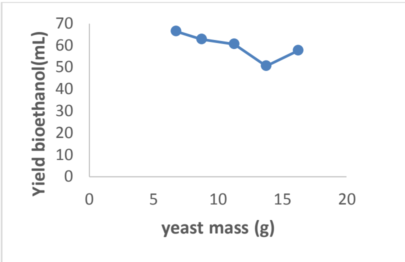

Figure 2. Effect of yeast mass on bioethanol yield (t = 4 days, pH 5, T = 25°C)

In Figure 1 it can be seen that the yield of bioethanol obtained by adding yeast mass is 6.75; 8.75; 11.25; 13.75 and 16.25 g with a fermentation time of 4 days and a temperature of 25°C and pH 5, generally fluctuated . The yield of bioethanol tends to decrease with the addition of yeast mass of 8.75 and 11.25 g. At the addition of 13.75 g the decrease was sharper, but at the addition of 16.25 g there was an increase in the yield of bioethanol , approaching the yield at the addition of 11.25 g , which was 57.6 mL. P enelitian conducted using pH 5 and this influences the yield of the masses than the addition of yeast. The yield increased with operating conditions at pH 5 and fermentation time for 4 days, which was greater than the results obtained [3], which obtained a maximum ethanol yield of 23 mL at these operating conditions.

Effect of yeast mass on bioethanol content

The effect of adding yeast mass is very influential on the bioethanol content. This is shown in Figure 2.

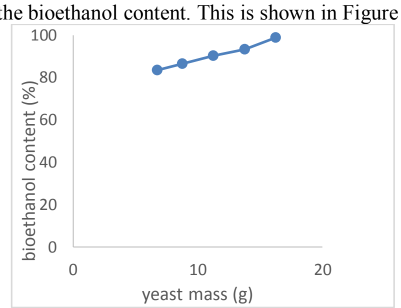

Figure 3. Effect of yeast mass on bioethanol content (t= 4 days, pH 5, T = 25°C)

Measurement of bioethanol content using the refractometer method. Bioethanol levels showed a significant increase in each addition of yeast mass. The more yeast mass added, the higher the bioethanol content produced , where the highest bioethanol content was 98.93 percent with the addition of 16.25 g yeast. The increase in bioethanol content due to the addition of yeast mass is caused by microorganisms that break down glucose into ethanol more and more, so that the resulting ethanol content increases [4]. These results are consistent with a study conducted [10], which used Chinese rice with Saccharomyces cerevisiae which experienced an increase in ethanol content in the 4-day period of fermentation and the addition of varying yeast mass .

CONCLUSION

The particle size of bagasse used is 100 mesh, affecting the hydrolysis process, thereby increasing the porosity. The more yeast mass added to the fermentation process, the yield and ethanol content produced will increase. The best yield in the study with the yeast saccaromyces cerevisiae with a pH of 5 and a fermentation time of 4 days was 57.6 mL. The bioethanol content obtained was 98.93 percent.

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