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# THE EFFECT OF THE ADDITION OF SUB-CEREAL BEACH PUMICE POWDER ON THE ENERGY CAPACITY OF BIOETHANOL FROM MANGROVE FRUIT WASTE ( *Bruguiera gymnorrhiza* ) IN PROVIDING CALORIES THROUGH THE TEMPERATURE TEST OF LIQUID SUBSTANCES WITH INDICATORS ON THE GLASS WICK LAMP

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## ABSTRACT

Bioethanol energy is one of the natural and environmentally friendly renewable energy that plays an active role as a fuel to replace fossil energy in households. Bioethanol energy is made from organic compounds which in this case use mangrove fruit waste or Aiwon fruit (Bruguiera gymnorrhiza) in maintaining its quality by making the fuel not burn out quickly in its daily use. One of the efforts that can be made is to add sub-cereal type rubbing pumice powder which is also not difficult to get on the beaches of coastal villages. The purpose of adding sub-cereal type rubbing pumice to bioethanol renewable energy made from mangrove fruit waste (Aiwon) is to increase the duration of this bioethanol energy ability in providing energy to the affected object or the object undergoes a process of change. The writing method in this study is experimental and literature. The results of the study include: 1) Revealing the basic reasons for the availability of renewable energy bioethanol from mangrove fruit waste (Aiwon) provides heat energy to an object that is affected to undergo changes, especially changes in the temperature of liquid substances. 2) To reveal the difference in the duration of flames that use bioethanol energy with the addition of sub-cereal type rubbing pumice powder in the amount of pumice powder given varies or different amounts. So the conclusion is that by adding sub-cereal rubbing pumice powder with different doses, it will give a difference in the duration of the flame or provide calories when used to influence the change of an object in fulfilling household activities.

*Keywords : Pumice, Bioethanol, Mangrove Fruit*

## 1. Introduction

Indeed, it can be felt together that the development of technology in various forms and variations on the other hand has a fairly high influence on the availability of fossil energy which is now processed into fuel. This means that fuel oil derived from fossil energy will continue to be used to meet the needs of technology and daily life in the community. Understanding what problems are the main topics about energy and the existence of earth temperature, then efforts based on science in making renewable energy, all students in SMA Negeri 5 Denpasar develop renewable energy in the form of bioethanol fuel from mangrove fruit waste (Aiwon) which is sourced from environmental wastes in coastal communities. Bioethanol, which is commonly developed, now needs to be improved in quality so that it can provide energy for longer or longer fuel life by adding sub-cereal type rubbing

pumice powder. The author's interest in developing bioethanol renewable energy made from mangrove fruit waste is because the availability of materials in the form of this waste such as mangrove fruit waste or Aiwon is quite large and the community does not know its benefits in fulfilling human life. In addition, we as researchers also want to develop this biofuel to anticipate the problem of reducing fossil energy, global warming (*global warming*) because the use of renewable energy fuels in the form of bioethanol is much more environmentally friendly compared to fossil energy so that the greenhouse effect is not easily formed in a short time so that life on the earth's surface can grow and develop in a balanced manner and sustainable. However, our efforts as researchers want to increase the duration of this bioethanol fuel in producing energy (hot calories) in the form of a long time that the fire can burn by adding pumice powder to rub sub-cereals so that bioethanol made from corn cobs does not burn quickly.

## 2. Material and methods

### 2.1 Material

**1) Making Bioethanol Baccarat**

**A. Research Tools**

1) Refractometer ( 1 piece )
2) Fermented jerry cans ( 3 pieces )
3) Measuring Cups ( 3 pieces )
4) Material Scale (1 piece)
5) Sieve ( 1 piece )
6) Basin ( 2 pieces )
7) Evadek ( Bioethanol Making Tool )
8) Alcohol meter ( 1 piece )

**B. Research Materials**

1) Pumice powder ( 1 Kg )
2) Water ( 9 liter )
3) Warm water ( 600 cc )
4) Baker's yeast (9 grams)
5) NPK ( 9 gram )
6) Urea ( 9 gram )

**2.2 Methods**

Stages of Experiment I

Bioethanol Energy Generation of Mangrove Fruit Waste

A. Stage : 1 ( Material Processing )

a. Mangrove fruit (2kg) is crushed, then mixed with 3 liters of water little by little and squeezed to be used as an extract. After that, measure the glucose concentration using a *Refractometer* (Unit of Measure: Brix)

b. The mangrove fruit waste extract is then mixed with baker's yeast, NPK and urea each in a dose of 3 grams which has previously been dissolved with warm water of 100 cc each.

B. Stage : 2 ( Fermentation )

The mangrove fruit waste extract is then put into a fermentation jerry can, and sealed tightly. Do not be contaminated with outside air. Let the fermentation last for 3 days or 72 hours. Fermentation goes well if bubbles appear in the jerry can and on the 3rd day the bubbles begin to disappear, a sign that the fermentation has gone well.

C. Stage: 3. Evaporation, Distillation and Condensation Process in Evadek Equipment

a. After the fermentation process ends, the fermentation results are transferred to an evaporator and then heated on the stove. At this stage, efforts are made to use environmentally friendly fuels, such as biobriquettes, and so on.

b. The evaporation process will take place through a distillator. If the temperature has reached 60, then PAM water is flowed with a maximum discharge of 1 liter/minute. The steam is flowed into the condenser (a barrel that has been filled with cold water) and the condensation process occurs. ℃

c. The temperature in the distillator is kept to not exceed 78. If it is more, the alcohol content in bioethanol will decrease. Reduce or extinguish the heat in case of an increase in temperature.℃

d. The result of this condensation process will be formed bioethanol. The bioethanol fuel will come out of the condenser and be stored in a sealed container.

h. After 4 hours, measure the alcohol content of the bioethanol with a thermometer or alcohol meter. Alcohol content is measured in percentage units.

D. Make pumice stone powder by grinding pumice stone and then sifting.

E. Put 300 ml of bietanol each on the glass wick lamp

A- Glass wick lamp: Not filled with pumice powder as **Control Data / K**

B- Glass wick lamp: Fill this 300 ml Bioethanol with 50 grams of pumice powder. **Treatment Data 1 / P.1**

C- Glass wick lamp: Fill 300 ml of Bioethanol with 100 grams of pumice powder. **Treatment Data 2 / P.2**

D- Glass wick lamp: Fill 300 ml of Bioethanol with 150 grams of pumice powder. **Treatment Data 3 / P.3**

E- Glass wick lamp: Fill 300 ml of Bioethanol with 200 grams of pumice powder. **Treatment Data 4 / P.4**

F- Glass wick lamp: Fill 300 ml of Bioethanol with 250 grams of pumice powder. **Treatment Data 5 / P.5**

F. Record the data of the activity by looking at the length of the fire and the temperature reached by the liquid substance (water) with a volume of 1 liter each

## 3. Result and Discussion

### 3.1 Mangrove Fruit Waste ( *Bruguiera gymnorrhiza* ) Can Be Used as Renewable Energy Bioethanol as a Substitute for Fossil Energy

The student movement of SMA Negeri 5 Denpasar in helping the government and the community is to develop renewable energy in the form of bioethanol energy which in this case utilizes mangrove fruit waste which is quite abundant in the community from the results of the processing process in the food industry which is indeed made from mangrove fruits. But what matters now is why researchers are using the waste to be used as an alternative fuel instead of fossil energy? Scientifically, the problem can be explained as follows:

1. Mangrove fruit waste or Aiwon is found to contain chemical compounds, namely cellulose and hemicellulose which after hydrolysis with water (H2O) and sulfuric acid (H2SO4) will be able to turn into glucose.
2. Based on the results of the research contained in these materials using a *Refractometer device, it is known that the concentration of glucose in* mangrove fruit waste is 11.4 Brix so that it can be ascertained that the two materials can be processed to be used as bioethanol energy because the glucose standard is at least 6 Brix to be used as bioethanol.
3. The process of making bioethanol from mangrove fruit waste extract or Aiwon is very easy to do through fermentation with the addition of baker's yeast, NPK and urea so that within 72 hours or 3 days, the fermentation process has been successful.
4. To prove that these two materials can be used as renewable energy, namely bioethanol, experimental activities have been carried out. The results of the experiment can be seen in Table 1 below:

**Table 1**

Research Results of Bioethanol Alcohol Content from Waste Mangrove Fruit

| It | Experiment | Number of Ingredients | Experimental Activities | Glucose Concentration | Up to Alkohol Bioethanol |
|---|---|---|---|---|---|
| 1 | I | 2 liters | 20 – 23 July 2024 | 11.5 Brix | 80, 6 % |
| 2 | II | 2 liters | 24 – 27 July 2024 | 11.3 Brix | 80,3 % |
| | Average | 2 liters | | 11.4 Brix | 80,45 % |

In this study, mangrove fruit or Aiwon has a fairly good alcohol content, which is above 60% so that the calories produced are also higher. From the results of this study, mangrove fruit waste or Aiwon is very feasible to be used as bioethanol fuel in supporting household energy needs.

### 3.2 Effect of Adding Rubbing Pumice Powder Sub Cereal Type in

**Provides heat energy to the length of time the fire can burn with the temperature of the substance**

**Achievable Liquid**

To determine the effect of the addition of pumice stone powder on the length of time bioethanol can ignite a fire or provide heat energy and temperature to a liquid substance (water) which can be affected by the dosage or volume of 1 liter of water at an initial temperature of 27℃, an experiment or experiment was carried out with the results can be described as follows:

1. A- Glass wick lamp: ( 300 ml bioethanol without pumice powder )
2. B- Glass wick lamp: ( 300 ml bioethanol + 50 gr pumice powder )
3. C- Glass wick lamp: ( 300 ml bioethanol + 100 gr pumice powder )
4. D- Glass wick lamp: ( 300 ml bioethanol + 150 gr pumice powder )
5. E- Glass wick lamp: ( 300 ml bioethanol + 200 gr pumice powder )
6. F- Glass wick lamp: ( 300 ml bioethanol + 250 gr pumice powder )

Turn on these lights simultaneously when used to heat water (liquid)

**Table 2**

| It | Bioethanol Fuel 300 ml | Data | Experiment |
|---|---|---|---|
| 1 | Bioethanol Energy Without Pumice Powder ( Lamp : A ) | Control | 43 Minutes |
| 2 | Bioethanol Energy With Pumice Powder 50 Grams ( Light : B ) | Treatment 1 / P.1 | 54 Minutes |
| 3 | Bioethanol Energy With 100 gram Pumice Powder ( Lamp : C ) | Treatment 2 / P.2 | 1 hour 8 minutes |
| 4 | Bioethanol Energy With Pumice Powder 150 Grams ( Light : D ) | Treatment 3 / P.3 | 1 hour 16 minutes |

| | | | |
|---|---|---|---|
| 5 | Bioethanol Energy With Pumice Powder 200 Grams ( Light : E ) | Treatment 4 / P.4 | 1 hour 1 minute |
| 6 | Bioethanol Energy With Pumice Powder 250 Grams ( Lamp : F ) | Treatment 5 / P.5 | 48 Minutes |

Comparative data on the length of time the fire burns (the ability of the fuel to provide heat energy) in a dose of 300 ml of bioethanol

**Discussion:**

Based on the data in Table 2 above, bioethanol energy made from mangrove fruit waste is all effective as a fuel to replace fossil energy in daily life in households. The effect of adding pumice stone powder also gives a positive value where pumice stone can increase the duration of the flame to the bioethanol energy but still at a certain dose such as the comparison of table 2 above bioethanol fuel with a dose of 300 ml can provide longer durability to ignite (provide heat energy) through the addition of 150 grams of pumice powder (can be associated with a 300 ml ratio: 150 grams or 2 : 1 ). However, what remains a note is that if the addition of too many pumice stones will actually reduce the ability for the fire to stay on for longer (heat energy decreases).

In this case, it should be explained that there is an increase in calories / the length of the flame produced if added with pumice powder because pumice stone itself has resistance to high temperatures, pumice stone has a very dense collection of minerals, pumice stone contains *Basalt*, mafic lava which is able to provide resistance to the fuel to which it is bound, Pumice has fine rocks of crystals called *Pozolan* and *Ignimbrite* that can withstand the rapid burning of bioethanol-forming materials. But behind that, if you give too much pumice powder from the material in bioethanol, it will actually be reversed, unable to bind the bioethanol material because the crystal is too dense so that the bond is very small and the bioethanol fuel will burn faster, which in the end the calories produced are also reduced. So the most effective addition of rubbing pumice stone to bioethanol is with a dose of 300 ml: 150 grams which can be associated with 2 : 1.

To find out the ability of bioethanol made from mangrove fruit waste with its pumice mixture in its speed to provide heat energy to reach a temperature of 100 in 1 liter of heated water, the initial temperature is 27, the research process and the results can be explained as follows:

**Table 3**

Data on the comparison of the time of bioethanol's ability with its pumice mixture in heating water until it reaches a temperature of 100℃

| It | Bioethanol Fuel | Data | Experiment |
|---|---|---|---|
| 1 | Bioethanol Energy Without Pumice Powder | K | 23 Minutes |
| 2 | Bioethanol Energy With Pumice Powder 50 Grams ( Light : B ) | P.1 | 18 Minutes |
| 3 | Bioethanol Energy With 100 gram Pumice Powder ( Lamp : C ) | P.2 | 13 Minutes |
| 4 | Bioethanol Energy With Pumice Powder 150 Grams ( Light : D ) | P.3 | 11 Minutes |
| 5 | Bioethanol Energy With Pumice Powder 200 Grams ( Light : E ) | P.4 | 15 Minutes |
| 6 | Bioethanol Energy With Pumice Powder 250 Grams ( Lamp : F ) | P.5 | 17 Minutes |

Based on the table above (Table: 3) that bioethanol fuel is actually all classified as fuel oil that is effectively used in supporting household life. This can be seen from its energy ability to provide heat energy to change materials that will later have different conditions from their origin, in which case there is a temperature difference from 27 to a hotter temperature, which is 100. This happens because of the influence of energy from bioethanol materials with the ability of pumice to be effective in changing the temperature conditions of the water. From these changes, it can be seen that bioethanol fuel from mangrove fruit waste with the addition of the right amount of pumice is quite effective in supporting household energy needs instead of fossil energy.

## 4. Conclusion

Mangrove fruit waste or Aiwon can be used as bioethanol fuel because the waste still contains cellulose and hemicellulose compounds which in the process of hydrolysis into glucose. The glucose in mangrove fruits is 11.4 Brix which can produce an alcohol content of 80.45% each. If mixed with pumice powder in the appropriate ratio, the combustion process will take longer or the heat energy produced can provide a longer time to be used in carrying out activities.

Bioethanol fuel is a fuel that is quite effective in its use as household energy. This is seen from its ability to provide heat energy in changing the condition of water from temperature 27 to hot to reach a temperature of 100 with a time according to the alcohol content contained in it and the provision of pumice powder with the right ratio which in this case can have a ratio of bioethanol: pumice powder which is 2 : 1 ( 300 ml : 150 grams )

## Credit authorship contribution statement

**M. Savana** : Conceptualization, Writing, Review & editing

**A. Wulandari** : Supervision, Writing, Review & editing

**R. Lestari** : Writing, Review & editing

## Declarating of Competing Interest

The authors declare that they have no known competing financial interests or personal relationship that could have appeared to influence the work report in this paper.

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