UTILIZATION OF BANANA FROND BRIQUETTE CHARCOAL AS AN ALTERNATIVE TO ENVIRONMENTALLY FRIENDLY TECHNOLOGY

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ABSTRACT

The purpose of this study is the use of banana frond briquette charcoal as an alternative to environmentally friendly technology. This type of research is an experiment. Experimental data collection techniques, documentation, and literature studies. The data analysis method in this study uses a quantitative approach. Banana frond briquettes are divided into 3 groups: A (81% banana frond charcoal: 19% adhesive), B (71% banana frond charcoal: 29% adhesive), and C (91% banana frond charcoal: 9% adhesive). The results of the banana frond briquette test on the C sample of 91% charcoal briquettes with 9% adhesive showed the best results with a calorific value of 4571 kcal/kg. The study concluded that the best calorific value in sample C with a charcoal composition of banana fronds was 91%; 9% adhesive was 4571 cal/kg.

Keywords: Charcoal briquettes; banana frond waste; nested type

Introduction

Fuel is essential for human life. The increase in population in Indonesia also increases the demand for more fuel. One solution that can overcome this problem is by utilizing simple and renewable alternative energy sources. This includes using banana stem waste as an alternative material for making biomass briquettes.[1]

One natural material containing biomass that can be made into briquettes is banana stems because most fruits contain fiber. Based on the composition of cellulose, hemicellulose, and lignin of banana stems, the cellulose content is around 63% to 64%, the hemicellulose content is around 19%, and the lignin content is around 5%. If banana fronds have become fiber, then banana frond fiber contains 60% - 65% cellulose, 6% - 8% hemicellulose, and 55 - 10% lignin. The diameter of banana fiber is 120 ± 5.8 um.[2] Banana tree has a structure Banana fronds have a unique structure with porous and hollow fibers, so they have a high density.[3] The fuel that can be used as alternative energy is biomass. Biomass is a renewable energy source that is recognized globally and can serve as a transition from human dependence on fuel.

The choice of banana stems to make charcoal briquettes is because the Seluma Regency, Bengkulu Province, especially Genting Juar Village, has quite a lot of banana stems that are not utilized by the community. Especially after the tree bears fruit, it ends up becoming waste that can pollute the environment. After harvest, banana stems and stems are often

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immediately burned and not used. The energy sources used by society mostly come from fossil fuels such as kerosene and gas, the availability of which is currently increasingly limited. The need for energy from fossil fuels increases every year, along with increasing human activity. Therefore, efforts are being made to provide alternative energy sources that are renewable, environmentally friendly, and can be reached by lower-middle-class people.[4]

Briquettes are a more environmentally friendly fuel, and the raw material is easier to obtain; the process is simple and doesn't run out easily. Commonly used briquettes include charcoal briquettes, coal briquettes, bio briquettes, and peat briquettes.[5] The charcoal briquettes made in this research were made from banana stems with added tapioca flour as an adhesive. The composition for making briquettes is to determine the good quality of burning briquettes.

Research regarding the use of banana stem briquette charcoal was previously carried out by Masthura[6] physical analysis ain his research on the physical analysis and burning rate of banana stems. The results of the research showed that the best physical analysis of banana stem briquettes consisted of water content at a composition of 60%; 40% with a value of 8.17%, a density of 0.56 gr/cm3, and a calorific value of 3494.5 cal/gr and the longest burning rate of 0.0698 gr. /minute. The differences between previous research and current research are in the composition of charcoal, adhesive, and ash content. This is the difference between the two types of research. Apart from that, banana stem briquettes can be used as an environmentally friendly technology to produce alternative energy products. This research aims to determine the quality test of the blooming of banana stem charcoal briquettes.

Method

This type of research uses experimental methods. Data collection techniques include experimentation, documentation, and literature study. Data analysis techniques were carried out using a quantitative approach. The sample used in this research was banana stem waste with an adhesive made from tapioca flour. The main tools used in this research included manufacturing, grinding, mixing, and molding machines, scales, knives, and trays. There are seven stages in making charcoal briquettes: drying banana stem waste, burning, arranging, grinding, mixing, molding, and drying. As seen in Figure 1.

The result of burning banana stem charcoal was 300 grams, and the adhesive used was 30, 70, and 120 grams. Then, the sample percentage was made into three samples. In sample A, charcoal 81%:19% adhesive, B, charcoal 71%:29% adhesive, and C, charcoal 91%:9% adhesive. After the charcoal and adhesive were weighed, each concentration of tapioca flour was dissolved in 200 ml of water and cooked until thickened. After that, mix it with the sample until it is homogeneous between the adhesive and the banana stem charcoal flour. Taking percentages from the three samples was carried out by:

Charcoal mass + Adhesive mass = Total mass (1)

Charcoal time =300 grams

Adhesive mass = 30.70, and 120 grams

$$Ingredient\ percentage = \frac{\text{Charcoal mass}}{\text{Total mass}} x100\% \quad (2)$$

$$\text{Adhesive percentage} = \frac{\text{Adhesive mass}}{\text{Total mass}} x100\% \quad (3)$$

Results and Discussion

Based on the results of the banana stem briquette charcoal burning test, the data obtained can be seen in Table 1.

Alternative energy is a solution to reduce people's dependence on fuel and can be done through briquettes. Briquettes are an environmentally friendly solid fuel and can be produced from industrial or organic waste.[7] According to Indonesian National Standards (SNI), briquettes have a maximum water content of 8%. The SNI standard has a maximum ash content of 10 – 20%, and the SNI standard has the best calorific value of more than 5000 cal/gram. SNI is an indicator of the production of test results for water content, ash content, and heat content, which influence standards (SNI).

With the percentage of charcoal flour: tapioca flour in 3 samples, the first in sample A (81%: 19%) produces a water content of 8.80%, ash content of 40.63%, and heat content of 4257 kcal/kg. Sample B (71%; 29%) produced a water content of 9.36%, ash content of 30.42%, and heat content of 4279 kcal/kg. The results for sample C were 91%; 9%), water content 8.27%, ash content 45.88%, and heat content 4571kcal/kg.

a. Moisture content

Moisture content affects the quality of charcoal briquettes; the higher the moisture content, the more difficult it is to ignite the briquette fuel. High moisture content results in lower heating values.[8]

Table 1. Results of Urji Charcoal Burning Briquettes Perleep Banana

Kind	Percentage of Charcoal Flour and Tapioca Flour	Moisture Content (%)	Ash Content (%)	Calorific Rate (k cal/kg)
A	81% : 19%	8,80	40,63	4257
B	71% : 29%	9,36	30,42	4279
C	91% : 9%	8,27	46,88	4571

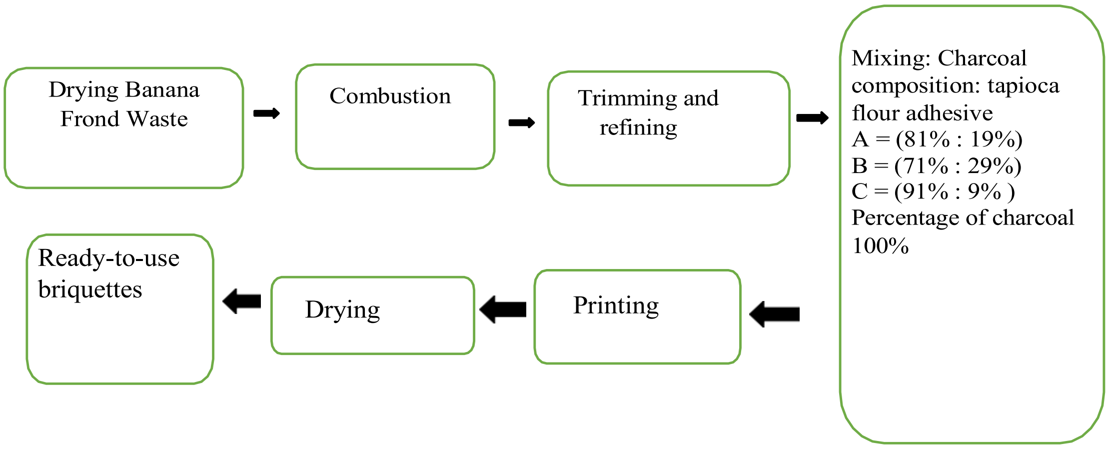

Figure 1: Steps for making briquettes

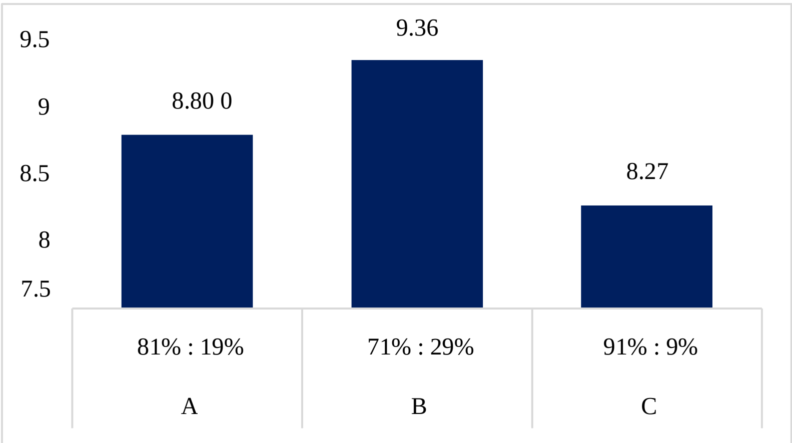

Figure 2. Graph of Moisture Content Determination Results in Banana Peel Bricks

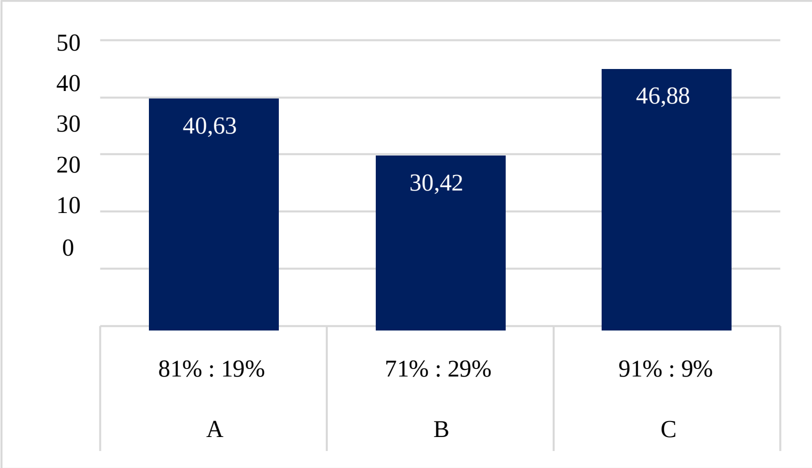

Figure 3. Graph of the Results of the Cultivation of Crisper Levels of Bananas

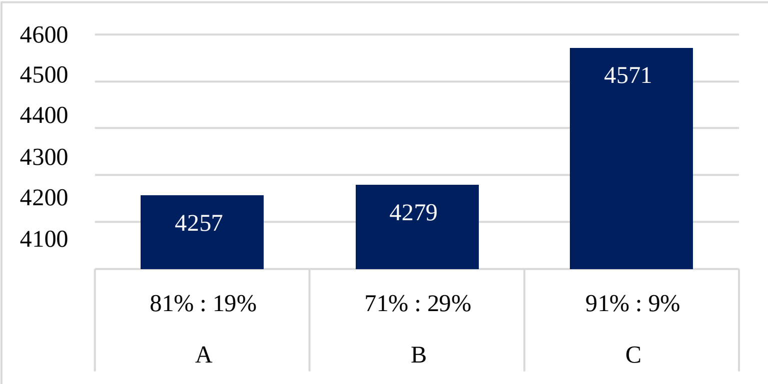

Figure 4. Graph of the results of the calculation of the calorie content of the banana briquettes

As can be seen in Figure 2, the water content (inherent moisture), the measurement results show that the lowest water content is in the composition of sample C (91% charcoal: 9% adhesive) with a water content value of 8.27% and the composition of sample A (81 % charcoal: 19% adhesive) the water content value is 8.80% and sample B (71% charcoal: 29% adhesive) has a water content value of 9.36%, this shows that the water content does not meet SNI standards, by Norman's statement Iskandar[9] stated that the water content value in briquettes that complies with standards based on SNI No.1/6235/200 is a maximum of 8%. Some factors cause the high water content in these three samples, which could be due to the influence of the tapioca flour mixing process, which is not evenly distributed when making the briquette dough, thus affecting the ability to absorb water in the briquette dough.[10]
There are other factors caused by the drying process needing to be more optimal because the drying is only done in the sun.

a. Ash content

Ash content analysis is carried out to determine the number of parts of the briquette that are not burned. In Figure 3, the highest ash content can be seen in the composition of sample C (91% charcoal: 9% adhesive) with an ash content value of 46.88%, sample A (81% charcoal: 19% adhesive) with an ash content value of 40.63%. Meanwhile, the lowest ash content value was found in the composition of sample B (71% charcoal: 29% adhesive) at 30.42%; based on the results of ash content testing on samples A, B, and C, it showed that the ash content did not meet SNI standards. This is in accordance with the statement by Setyono & Purnomo,[11] namely, the ash content in briquettes based on SNI No.1/6235/200 is only 10-20%. According to the statement by Saputra et al.[12] It shows that the overall high ash content is caused by the high percentage of adhesive, which also results in a high ash content. This is because the concentration of the adhesive causes the high ash content. In contrast, in Figure 3, the briquette ash content testing results are not directly proportional to the statement. A decrease in the concentration of charcoal used causes the ash content to decrease because the inorganic substances contained in charcoal produce ash. If the concentration of charcoal used is low, the ash content in the briquettes will also be low. This is by research by Rahmadani et al.[13] which states that increasing the charcoal concentration will cause an increase in the value of briquette ash content, and a decrease in charcoal concentration will reduce the value of briquette ash content.

b. Calorific rate

The calorific value is the maximum heat energy a fuel generates through a complete combustion reaction. A tool called a bomb calorimeter is used to calculate the calorific value of a fuel. A bomb calorimeter tests the heating value by burning a small fuel sample at normal air temperature and the same volume.[15]

In Figure 4, the test results obtained the best results for the highest briquette heating content with sample composition C (91% charcoal: 9% adhesive), with a heating value of 4571 kcal/kg. Of the three samples, when compared with the Indonesian briquette quality standard with a calorific value of >5000 cal/gram based on the SNI 01-6235-2000 standard, it does not meet the SNI briquette quality standard; this is influenced by the calorific value of the banana stem briquettes containing high ash content. Tall. High water and ash content can produce low calorific value, which aligns with Mathura's[6] statement that the calorific value of briquettes is influenced by water and low ash content. High ash content is caused by the high value of substances in the air that contaminate or enter the sample, so the value of bound carbon will be smaller and affect the overall heating value to be low.

Conclusion

Based on this research, it can be concluded that the results of the quality test of banana stem charcoal briquettes with sample C (91% charcoal: 9% adhesive) showed the best results with a water content of 8.27%. In comparison, sample B (71% charcoal: 29% adhesive) produced the best ash content was 30.42%, and sample C (91% charcoal: 9% adhesive) with the best calorific value of 4571 cal/kg. With this, banana stem briquettes can be an environmentally friendly alternative technology.

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