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UTILIZATION THE QUALITY OF DURIAN SKIN BRICKETS AS AN ENVIRONMENTALLY FRIENDLY TECHNOLOGY ALTERNATIVE

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ABSTRACT

Durian skin briquettes can be used as an alternative energy product environmentally friendly technology, cause the potential for durian skin waste is still very large in Bengkulu. The research objective focuses on testing the quality of Durian Skin Briquettes as an alternative environmentally friendly technology. The type of research is experimentation, with the independent variable namely durian skin briquettes, the control variables namely heating value, water content and grade. Data collection techniques were carried out by observing the potential for durian skin in Bengkulu. The data analysis method this research involves quantitative data analysis. Durian skin briquettes are divided into 2 groups: A1 (90% yellow durian skin charcoal: 10% adhesive), A2 (90% green durian skin charcoal: 10% adhesive). Durian skin briquette test results comparing 90% green durian skin charcoal with 10% adhesive showed the best results with a total heat of 4748 k cal/kg. Meanwhile, a ratio of 90% yellow durian skin charcoal to an adhesive ratio of 10% produces a total heat of 4670 K cal/kg. The conclusion of this research is that the quality test of durian skin briquettes as an alternative environmentally friendly technology shows the best results with a heat amount of 4748 k cal/kg in green durian skin briquettes.

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1. INTRODUCTION

Bengkulu Province is one of the highest producers of durian which causes the volume of waste (durian skin) to also increase. According to the Bengkulu Province Central Statistics Agency 2021, almost all districts in Bengkulu Province in 2018-2019 produced durian fruit production with a number of trees of 167,300 in 2018 and 98,938 in 2019 and fruit productivity of 150,573 quintals in 2018 and 113,953 quintals in 2019. Durian skin waste can causes unpleasant odors, reduces the aesthetic value and beauty of the city. Until now, the use of durian skin waste has not been optimized because it is difficult to decompose and can become biological waste, causing environmental pollution (Suryani et al., 2019; Arlofa et al., 2019). One suitable solution to overcome this problem is to convert durian skin waste into briquettes containing biomass energy sources.

Durian peel is a type of biomass that can be made into briquettes and has significant potential as an alternative energy source. The main component that can be used is carbohydrates,

with a high carbohydrate content in durian skin. Durian skin consists of lignin (15.45%), hemicellulose (13.09%), and cellulose (60.45%) (Andika et al., 2015; Puspita et al., 2024)The use of the amylase enzyme found in tapioca flour can increase the production rickets from durian peel waste as an alternative fuel source that is environmentally friendly (Sitogasa et al., 2023; Purwati, 2016). Biomass energy obtained from briquettes can be an alternative energy substitute for petroleum and natural gas, which are still in limited supply, because briquettes are made from cheap raw materials and simple technology. Briquettes can be produced using raw materials derived from agricultural waste, such as coconut shells, sawdust, straw, dry leaf litter (Budi, 2017; Sribudiani & Somadona, 2020).

Briquettes are a simple, renewable fuel in terms of the production process and use of environmentally friendly raw materials, because the heat value of the briquettes is relatively high and the burning time long (Adhesives, n.d., 2019; Rahmawati et al., 2023). The briquettes in this study were made from yellow durian skin and green durian skin with the addition of tapioca flour as an adhesive for the briquettes. Geatvalue (GCV) *Gross Calo Value* is the total heat value of coal combustion, calculated when all the water is in the form of gas. Net calorific value (NCV) is the net heat value produced when coal is burned, and the calories produced represent the calorific value (Jannah et al., 2022; Ramdani et al., 2020).

To overcome this problem, this research aims to focus on testing the quality of Durian Skin Briquettes as an alternative environmentally friendly technology. The existence of different color variations in making durian skin briquettes is a novelty and determines the best burning quality of durian skin briquettes. The use of durian skin briquettes is very supportive for application in the field of education to improve students' abilities to be more creative, innovative and affective. And the context of durian skin briquettes can also be an interesting part to teach in junior high school science lessons, especially environmentally friendly technology material.

2. METHOD

The type of research is experimentation, with the independent variable namely durian skin briquettes, the control variables namely heating value, water content and grade. Data collection techniques were carried out by observing the potential for durian skin in Bengkulu. The data analysis method this research involves quantitative data analysis. Charcoal briquettes are made from waste from yellow durian skin and green durian skin. The adhesive required is the tapioca flour used, and the main equipment used in this research is a manual kneading machine, manual grinding, manual mixing. Manual printing, scales, spoons, pans and trays. The following is the process flow for making durian skin briquettes.

Test the quality of burning briquette charcoal using 2 types of briquettes with certain variations in composition, such as composition A1 = yellow durian skin charcoal: 90%: 10% tapioca adhesive, Composition A2 = green durian skin charcoal: 90%: 10% tapioca adhesive. The quality test for burning briquetted charcoal is seen from the time it takes for the briquettes to boil water. The time calculation starts from placing the pan until the water boils completely. Furthermore, the results of the durian peel briquettes experiment can also be used as an interesting part to teach in science lessons in junior high schools regarding environmentally friendly technology.

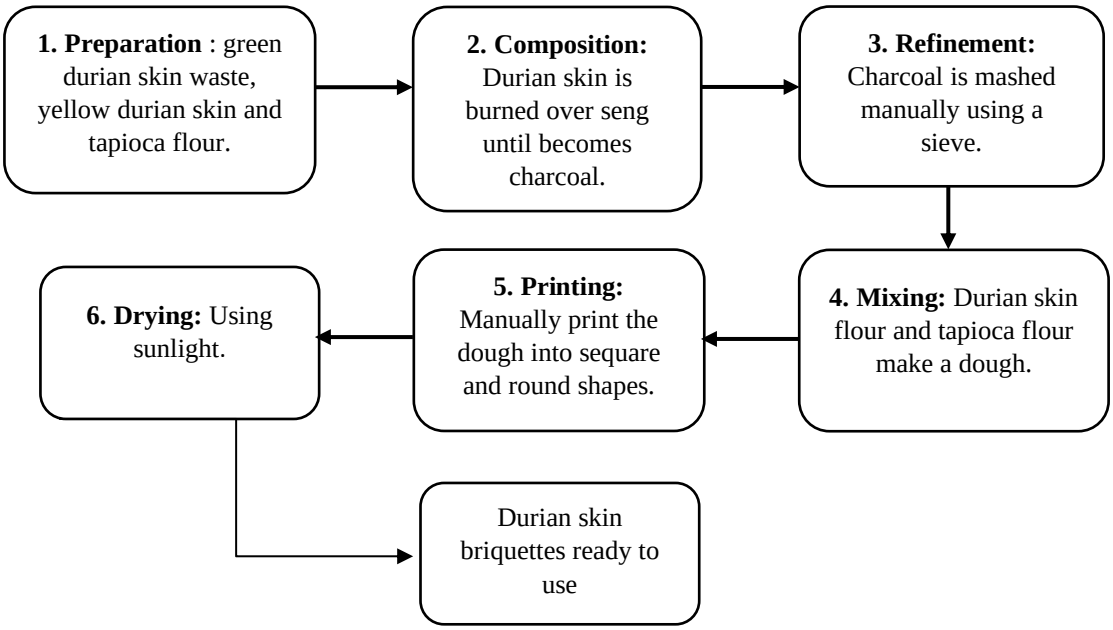

Figure 1. Durian Skin Briquette Making Process

3. RESULTS AND DISCUSSION

Based on the results of the quality test of burning durian skin briquettes, several data were obtained which are shown in the following table 1 and figure 1.

Table 1. Quality Test Results for Burning Durian Peel Briquettes.

Parameter	Reporting Bases	Satuan	A1	A2	Referensi Metode
Inherent Moisture	(adb)	%	16,90	16,32	ASTM D 3173 – 17 a
Ash Content	(adb)	%	46,55	50,36	ASTM D 3174 – 12 (2018) el
Gross Calorific Value	(adb)	k cal/kg	1707	1582	ASTM D 5865 – 19
Gross Calorific Value	(dafb)	k cal/kg	4670	4748	ASTM D 5865 – 19

Information:
A1 = Composition of briquettes: 90% yellow durian skin charcoal: 10% tapioca adhesive
A2 = Briquette composition 90% green durian skin charcoal: 10% tapioca adhesive
Adb = Conditions where the Calorie value under normal conditions still contains levels water and ash/impurities.
Dafb = Condition where the Calorie value is considered without any water content and ash/impurities.

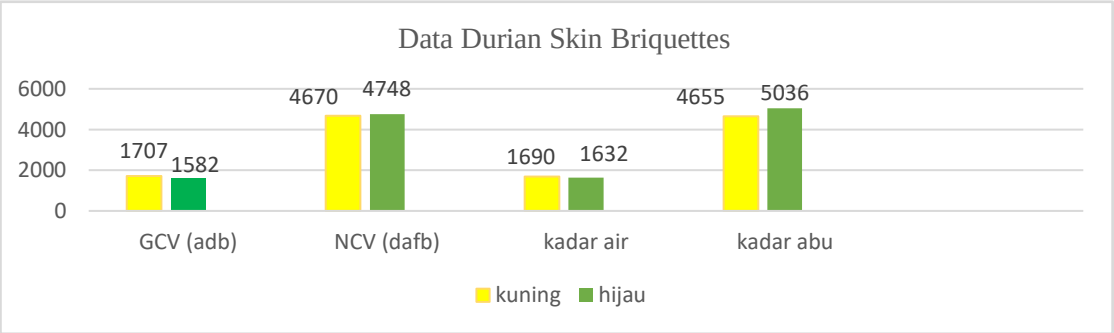

Figure 2. Data Bar Diagram of Durian Skin Briquettes.

One of the alternative energy raw materials is briquettes. Briquettes are a simple renewable fuel from the point of view of the manufacturing process and use of environmentally friendly raw materials, because briquettes have a fairly high level of heat energy and have a longer burning duration (Mandra, 2019). According to Indonesian National Standards (SNI), the best quality briquettes have a calorific value of more than 5000 cal/gram, a maximum ash content of 8%, and a maximum water content of 8% (I. et al., 2018;Utami et al., 2023) SNI is the reference for the Briquette standard indicators used in this research, namely the heat, humidity and ash content values that meet the standards (SNI). Based on the data in the bar diagram the calorific value can be measured in gross calorific value (GCV) and net calorific value (NCV). From the bar chart data, the best results are obtained from the net calorific value (NCV) because the calorific value is considered to be without water and ash/impurity content.

The results of this research obtained *a gross calorific value (GVC*) or the gross calorific value of the A1 composition of yellow durian skin briquettes, namely (1707 k cal/kg) and the A2 composition of green durian skin briquettes, namely (1582 k cal/kg). For *the net calorific value* (NCV) or net calorific value, composition A1 of yellow durian skin briquettes is (4670 k cal/kg) and composition A2 of green durian skin briquettes is (4748 k cal/kg). From the bar chart data, it is obtained that *the net calorific value* (NCV) is higher than the *gross calorific value* (GCV). In this study, the charcoal briquettes with the best burning quality results were A2 (90% green durian skin charcoal: 10% adhesive) with a calorific value/amount of 4748 k cal/kg because it was obtained from the net calorific value.

In the figure 1, it can be seen that the water content of green durian skin briquettes is smaller than that of yellow durian skin briquettes. The amount of water used has an impact on the final quality of the briquettes. The calorific value increases as the water content decreases. Conversely, a higher water content will result in a lower heating value. In figure 1. Shows the water content value in composition A1 Yellow durian skin briquettes (90%:10%) which is (16.90%), the water content value in composition A2 Green durian skin briquettes (90%:10%) is equal to (16.32%). The greater water content in durian skin briquettes is also caused by the addition of adhesive composition. It is known that charcoal briquettes with composition A2 green durian skin produce less water content so that the energy produced is also better compared to briquettes with composition A1 yellow durian skin briquettes.

Ash content is the only component of combustion residue that does not contain carbon components. Based on the data from table 1 and the bar diagram, it shows that the ash content value in composition A1 of yellow durian skin briquettes (90%:10%) is (46.55%), the ash content value in composition A2 of green durian skin briquettes (90%:10 %) which is (50.36%). Raw

material imperfections cause high ash content, which means charcoal has a high mineral content and leaves a lot of ash as a result of combustion. Apart from that, in the briquette making process, contaminants originating from the surrounding environment contribute to high ash levels (Variasi et al., 2021; Faradaiza et al., 2023). Various factors influence the burning process of solid fuel (briquettes), namely: 1) The smaller the particle size, the faster it burns. 2) The burning rate of briquettes increases with increasing air flow rate and increasing temperature. 3) The type of fuel determines the properties of the fuel. These properties include volatile matter and water content. 4) Combustion air temperature. The higher the combustion temperature, the shorter the combustion time. This increases the burning rate (Nuriana et al., 2013; Novi et al., 2021). The quality test when compared with the Indonesian National Standard (SNI) is still superior to the briquette quality test according to the Indonesian National Standard (SNI). However, the potential for durian skin waste in Bengkulu is still very large. So a suitable solution to overcome this problem is to make durian skin waste into briquettes. According to (Fariadhie, 2009; Jacob et al., 2021). cellulose can be used as contains 50-60 % where the quality of the briquettes produced will be better as the cellulose increases.

(a) (b)

Figure 3. Briquettes skin durian (a) A1 = Composition of briquettes: 90% yellow durian skin charcoal: 10% tapioca adhesive, and (b) A2 = Briquette composition 90% green durian skin charcoal: 10% tapioca adhesive

Yellow durian skin briquettes can be seen in picture 2, while square-shaped green durian skin briquettes can also be seen in the same picture. Charcoal briquettes tested for burning quality have different composition variations, for example composition A1 = 90% yellow durian skin charcoal: 10% tapioca adhesive, A2 = 90% green durian skin charcoal: 10% tapioca adhesive. The results of the briquette quality test showed that green durian skin briquettes had a greater calorific value than yellow durian skin briquettes. Charcoal briquettes with the best burning quality are A2 (90% green durian skin charcoal: 10% adhesive) with a total heat of 4748 k cal/kg. The context of durian skin briquettes can also be an interesting part to teach in junior high school science lessons regarding environmentally friendly technology by utilizing Integrated Science models.

4. CONCLUSION

This research conclude that the quality of Durian Skin Briquettes as an alternative environmentally friendly technology. Durian skin briquettes are divided into 2 groups: A1 (90% yellow durian skin charcoal: 10% adhesive), A2 (90% green durian skin charcoal: 10% adhesive). Durian skin briquette test results comparing 90% green durian skin charcoal with 10% adhesive showed the best results with a total heat of 4748 k cal/kg. Meanwhile, a ratio of 90% yellow durian skin charcoal to an adhesive ratio of 10% produces a total heat of 4670 K cal/kg. This shows that

durian skin briquettes can be used as an alternative energy source, besides that the potential for durian skin in Bengkulu is still very large. The conclusion of this research is that the quality test of durian skin briquettes as an alternative environmentally friendly technology shows the best results with a heat amount of 4748 k cal/kg in green durian skin briquettes.

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