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## Utilization of Durian Shell Waste With Janeng Pati as a Raw Material of Briquette for Renewable Energy

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# Utilization of Durian Shell Waste With Janeng Pati as a Raw Material of Briquette for Renewable Energy

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**Abstract.** Bio-briquette is an alternative energy substitute for fuel produced from organic materials or agricultural waste (biomass) which is underutilized, especially durian shell waste. This study aims to see the effect of differences in ash content, heating value, and bio-briquette flame test. The making of this bio-briquette uses 1:2 starch from the bio-briquette weight, the bio-briquette particle size is 8 mesh. The bio-briquette is cylindrical. The result showed that the bio-briquette produced had met the fuel standards of households. Durian shell bio-briquette produces 7.7% ash content, the heat value produced is greater than 5000 cal/gr which is 5040 cal/gr with a 55-minute flame test. Based on the combustion test, the bio briquette.

## 1. The first section in your paper

Population growth continues to increase, causing energy demand to increase. This causes concern about the occurrence of fuel shortages in the future. Thus, it is necessary to seek other alternative energy sources derived from continuous and renewable raw materials such as biomass energy [1]. The increasing population makes the need for more fuel so that alternative sources are needed. One of the renewable energy that needs attention to be developed is biomass.

Biomass is a solid waste that can be used again as a fuel source. Biomass which is used as an alternative fuel must be environmentally friendly, easily obtained, economically used by the community [2]. Efforts to provide alternative energy is to utilize organic waste as raw material. Based on Indonesia's Energy Statistics, it is stated that biomass energy potential in Indonesia is quite large, reaching 434,008 GWh [3].

One type of potential biomass that has not been exploited is durian shell waste. Durian shell waste is a biomass that has great potential as an alternative raw material for renewable energy. Durian shell waste is organic waste that has nutritional content that can still be utilized. The main content that can be used is carbohydrates. The content of carbohydrates in the durian shell is quite high. Durian shell fiber is waste from durian fruit, around 60-75% is durian shell fiber from durian fruit. durian shell consists of ofignign (15.45%), hemicellulose (13.09%) and cellulose (60.45%) [4]. The use of the enzyme alpha -amylase and glucose- amylase E can increase the



production of bio ethanol the durian shell waste as alternative fuels that are environmentally friendly [5]. As the durian season arrives in the cities of Banda Aceh and Aceh Besar, the increasing waste of durian shell is a concern for the cleaning government. Therefore, the utilization of durian shell waste into bio-briquette is done by adding starch janeng as an alternative energy that is environmentally friendly.

## 2. Materials and Methods

### 2.1. Materials

The equipment used is a knife, machete, mesh sieve, measuring cup, stirrer, hot plate, basin, bio-briquette mold, oven, Bomb Calorimeter, Furnace, desiccator, Test Strength. The material for making briquettes is waste of durian shell, starch janeng as adhesive and hot water. The selection of janeng starch as an adhesive because it contains about 20% amylose and 80% amylopectin, has the potential to be a good adhesive, high purity of the solution, good gel strength and high adhesion.

### 2.2. Procedure

Research procedures include preparation of raw materials, preparation of adhesive materials, and making briquettes.

*2.2.1. Raw material preparation.* In this process, the raw material is cut into small sizes, then dried in the sun until the water content is 12%, and then carbonized at 400 °C.

*2.2.1 Preparation of starch janeng adhesive.* The tuber of janeng was washed to remove cyanide poison, then diced and blended with the addition of 100 ml of aquadest. The janeng slurry is then heated to thicken.

*2.2.2. Making briquettes.* The filtered durian skin charcoal is mixed with starch janeng adhesive with a little water added while stirring until lumped. After the charcoal mixture is put into the mold to be dried in an oven at a temperature of 60 °C. The dried briquette is then analyzed for the quality of the briquette, namely heat value, ash content and flame test.

## 3. Results and Discussion

Making charcoal briquettes from the waste of durian skin by using adhesive starch 2:1. The results of testing the durian charcoal briquette quality can be seen in Table 1. These data are then compared with the quality standards of Japanese, English, American and Indonesian charcoal briquettes. Table 2.

**Table 1.** Observation data

Type Briquettes	Output Parameters		
	Ash Content (%)	Substance Fly (%)	Value Heat (cal / gr)
A1 (charcoal)	6.8	5	5460
B1 (Briquette)	7.7	6	5040
Standard Quality	Max. 8	15	Min. 5000

**Table 2.** Quality of Japanese, British, American and Indonesian Charcoal Briquettes

Properties of briquettes	Japan	English	America	Indonesia
Water content (%)	6-8	3-4	6	Max 8
Ash content (%)	3-6	8-10	18	Max 8

Evaporative substances (%)	15-30	16	19	Max 5
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### 3.1. Making durian skin charcoal briquettes

Durian skin is a potential organic waste and has the potential to be used as fuel. Durian skin is used as a basic ingredient in making briquettes, because of the high content of cellulose, hemicellulose and lignin [4]. In the durian season, the volume of durian coolers is abundant and not utilized, which keeps the occurrence of waste pollution. So, to increase its use, durian skin is made into briquettes as an alternative fuel.

The durian skin waste that will be used as briquettes is cleaned first and dried under the sun to be carbonized. The carbonization process is carried out using a kiln drum with limited air supply. Charcoal produced from carbonization of 100 kg of durian skin waste is 25 kg or 25%. Charcoal formed from the carbonization process is ground using a grinding machine to reduce the size of the charcoal particles. Charcoal powder is sieved with an 80-mesh sieve.

The adhesive used in this study is janeng flour. Tuber Janeng is a natural material that is easily obtained at low cost. Starch in janeng tubers is about 56-78% of dry weight [6]. Charcoal mixture with janeng adhesive is printed using a cylindrical mold. Drying is done in an oven at 60 °C for 3 x 24 hours.

### 3.2. Determination of mutual durian charcoal briquettes with adhesive of janeng starch

**3.2.1. Ash content.** Ash is the remaining material when solid fuel (wood) is heated to a constant weight [7]. Ash is called mineral material contained in solid fuel which is a material that cannot be burned after the combustion process. Figure 5 shows that the type of bio-briquette durian skin with a type of charcoal with a size of 80 non-hollow cylindrical mesh has the highest ash content of 7.7%, while the type of charcoal with a size of 80 mesh in the form of a hollow cylinder has the lowest ash content compared to the type of bio-briquette the other is 6.8%.

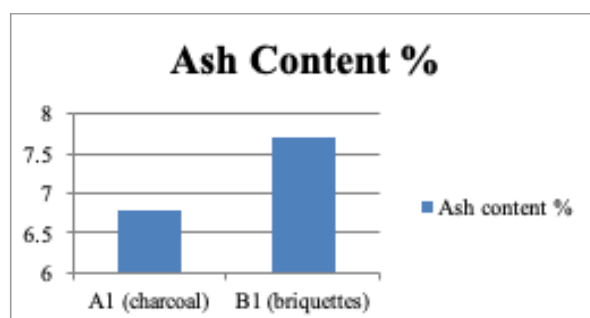


Figure 1. Comparison of ash levels of charcoal types and bio-briquette types

The results obtained are inversely proportional to [7], which states with smaller particles, a solid fuel will burn faster. This is suspected in the process of mixing bio-briquette the content of starch adhesives with raw materials is not homogeneous so the process the burning of the adhesive material burns to ash. If compared with solid fuel specifications issued by the SNI (01-6235-2000), ash content bio-briquette levels of durian leather waste have met the specification was 6.8% and 7.7%, or less than 8%.

**3.2.2. Heating value.** The heating value produced in durian skin bio-briquette research with janeng starch as adhesive (Figure 2) has generally been meet fuel specifications for household scale (> 5,000 cal/gr).

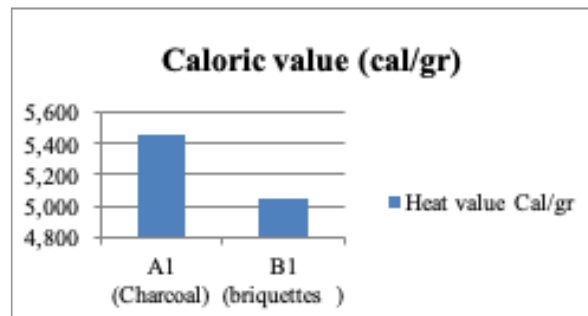


Figure 2. Comparison of calorific value of charcoal types and bio-briquette types

The highest heating value is found in charcoal type 100 mesh hollow cylinder at 5460 cal /gr, while the smallest calorific value is bio-briquette waste durian skin size 80 cylindrical mesh without cavity of 5040 cal/gram. Based on [8], this heating value is influenced by water content, the smaller the water content in the bio-briquette, the greater the heat value obtained. For bio-briquette, it has the lowest water content because it has a larger cavity and particle size so that during the drying process the water content in bio-briquette is more volatile. Another factor that influences the heat value is the bio-briquette composition, but at This study did not vary the bio-briquette composition.

**3.2.3. Flame test.** Table 3 shows the fire ignition times for charcoal and briquettes in a row are 7 minutes and 10 minutes. While the flame in the type of briquette is longer than the type of charcoal which is 55 minutes, the longer the flame, the better the quality of the bio-briquette. In bio-briquette, there is no smoke at the beginning of combustion, it shows that the bio-briquette quality of the durian skin waste is very good compared to charcoal.

Table 3. Flame test

Treatment	Flame test			Initial smoke burning
	Start-up time (minutes)	Long fire (minutes)	Flame stability	
Charcoal	7	40	Unstable	There is
Briquettes	10	55	Unstable	There is no



(a)



(b)



(c)

Figure 3. (a), (b) Comparison of bio-briquette and charcoal type flame tests, (b) Ash produced from the flame test

The Figure 3 showed that the ash produced from the flame test during ignition is grayish and very smooth, indicating the quality of ash content in accordance with the SNI Quality Standards. From the start of ignition to ash, bio-briquette from durian skin waste by using adhesive starch does not produce burning smoke. So that this bio-briquette is worthy of being an environmentally friendly alternative renewable fuel.

#### 4. Conclusion

The quality of charcoal briquettes with starch adhesive with 80 m of ice size obtained ash content of 7.7%, heating value of 5040 heat /gr and flame test of 55 minutes.

#### 5. Acknowledgement

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