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Effectiveness Test of Coconut Finding Waste (Cocos Nucifera.) as A Briquettes Building Material Using Latex Performance

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Abstract

Biocharcoal briquettes are one of the fuels derived from biomass. The biomass used in this research is coconut shell with latex adhesive. This study aims to test the effectiveness of coconut shell waste using latex adhesive with a ratio of 90:10, 80:20, 70:30, 60:40, and 50:50 to meet the standard of calorific value, ash content, moisture content, and density in briquettes by SNI No. 01-6235-2000. The results of this study showed that the calorific value, ash content, moisture content, and density of briquettes with a briquette and adhesive ratio of 90:10 respectively ranged from (1949.4), (5.39), (12.86), (0.325). The analysis shows that briquettes with a composition of coconut shell waste to latex 90:10 is a composition of briquette ratio that produces the highest calorific value, low moisture content, low ash content and good density value so this composition has better quality than other compositions.

Keywords: Briquettes, Coconut Shell Waste, Latex Adhesive and SNI

1. Introduction

The depletion of fossil fuel reserves will have an impact on the economy. Fossil fuels have become the most commonly used fuel to meet today's energy needs. To eliminate the worst possible impact of the use of fossil fuels, there are at least several alternative solutions, such as finding new fields, using energy efficiently, and developing renewable energy sources. The formulation of the problem of this research is how effective latex adhesive is in making coconut shell briquettes against SNI No. 01-6235-2000 quality standards consisting of calorific value, ash content, moisture content, and density. The purpose of this research is to test the effectiveness of latex and coconut shell adhesives and meet the standard of calorific value, ash content, moisture content and density in briquettes by SNI No. 01-6235-2000. The benefits of this research focus on the development and utilization of bio-briquettes as a new and renewable alternative energy. And is expected to be a reference for further research related to the development and utilization of briquettes as a new and renewable alternative energy.

Biomass is relatively young organic matter derived from plants, animals, products and wastes of the cultivation industry (agriculture, plantations, forestry, livestock, fisheries). The main elements of biomass are various chemical substances (molecules), most of which contain carbon atoms (C). Biomass is mainly composed of cellulose and lignin (often called cellulosic lignin). The elementary composition of ash-free and water-free biomass is approximately 53% by mass carbon, 6% hydrogen and 42% oxygen, as well as small amounts of nitrogen, phosphorus and sulfur (usually less than 1% each). The ash content of wood is usually less than 1% (Supriyanto and Merry, 2010).

According to Supriyanto and Merry (2010) briquettes are solids produced through the process of compression and pressurization and if burned will produce a little smoke. Charcoal briquettes or oranges are charcoal processed with a pressing system and using adhesives, therefore it takes the form of briquettes that can be used for daily purposes. Briquettes are bars of charcoal made from agricultural and livestock waste and moulded using a press to produce a high calorific value. Southern Asian countries still widely utilize briquettes, for example Indonesia, Thailand, and China. (Jain, Varun, et al, 2014). The best briquette composition that can be used for daily needs is the composition of coal: biomass, 10%: 90% because it burns faster and is more environmentally friendly, while for industrial needs, the best composition with the highest temperature achievement is the composition of coal: biomass, 30%: 70 %. (Sulistyanto, A., 2006).

Coconut (Cocos mucifera L.) is a strategic commodity that has a social, cultural, and economic role in the lives of Indonesian people. This plant is utilized by almost all parts of humans so it is considered a plant and used, especially for coastal communities.

Coconut products that have been traded since ancient times include coconut oil, which since the 17th century has entered into Europe from Asia (Setyamidjaja, 2008). The process of utilizing coconut fruit is only limited to the pulp to be made into copra, oil and coconut milk for household use. While other byproducts, such as coconut shells have not been so much utilized. The utilization of coconut shells is now limited to burning to produce activated charcoal. Coconut shells are one of the biomasses that have the potential to produce energy. Indonesia produces 1.1 million tons/year of shells with a possible energy yield of l8.7 x l06GJ/year. Coconut Shell Waste Coconut shell is categorized as hardwood but has higher lignin content and lower cellulose content with a moisture content of about 6-9% (calculated based on dry mass) and is mainly composed of lignin, cellulose, and hemicellulose.

Latex Adhesives are one of the adhesives derived from natural materials, such as rubber tree sap. latex is a colloidal solution consisting of rubber particles and non-rubber particles dispersed in water, has a white to yellow colour, and has elastic properties. Water Content The moisture of briquettes affects the heating value. The less water in the briquette, the higher the heating value. Moisture content can be determined using the equation:

$$\text{Moisture content (\%)} = \text{x } 100\% \tag{1}$$

Where:
a = Initial sample (g)
b = Sample shrinkage results (g)

According to Onu, et al. (2010), ash is the material that remains when the briquette is heated to a constant weight. Ash content is proportional to the content of inorganic materials in the briquette. The procedure for calculating moisture content using the SNI standard is as follows:

$$\text{Ash content (\%)} = (a-b)/a \times 100\% \tag{2}$$

Where:
a = Initial sample mass (g)
b = Total ash mass (g)

The heating value of fuel consists of the highest heating value and lowest heating value. The highest heating value is the heat produced by the complete combustion of one unit weight of solid or liquid fuel. The lower calorific value (NKB) is the heat equal to the upper calorific value minus the heat required by the water contained in the fuel and the water formed from burning the fuel calculation of calorific value based on SNI as

$$\text{q-reaction} = \text{q-water} + \text{q-bomb} \tag{3}$$

$$\text{q-Air} = m \times c \times \Delta T \tag{4}$$

where
m = the mass of water (constant) = 1000 g
c = the specific heat of water = 4.2 J/g. °C
ΔT = the temperature

$$\text{q-bom} = \text{C-calorimeter} \times \Delta T \tag{5}$$

where
C = the calorimeter heat capacity (= 75 J / °C)
ΔT = the temperature

The automatic calorimeter is a device used to measure the combustion material or calorific power of a material.

Density testing is done by weighing the weight of the briquette, then measuring the height and diameter of the briquette, then multiplying the results. The density calculation procedure uses the following formula:

$$\rho = M/V \quad (7)$$

where:
ρ = the density
M = the mass of briquette (g)
V = the volume of briquette (cm^3)

2. Materials and Methods

This research was conducted from January to March 2023 and was conducted at the environmental engineering laboratory of UIN Ar-Raniry and the physical chemistry laboratory of Syiah Kuala University (USK). The preparation of this sample was carried out at the UIN Ar Raniry for the process of making briquettes starting with cleaning the material and then drying it. then, the coconut shell is charred. The results obtained from combustion are in the form of charcoal particles, after which grinding and screening are carried out, mixing coconut shell material with latex adhesive. Data Analysis Water Content The moisture content of the briquettes can be determined by weighing the empty aluminium than the briquette sample is placed on the empty aluminium. The sample is leveled and placed on the heater and the sample is heated for 30 minutes with a heating temperature of 100 ℃ and cooled for 15 minutes, then weighed the mass. To determine the moisture content of coconut shell briquettes by using Equation (2.1).

Determination of ash content is done by drying the cup on a heater at 100°C for 30 minutes. Then the cup was cooled for 30 minutes and the empty mass was weighed. The sample and the cup were placed on a heater at 150°C for 4 hours until the sample became ash. Then the cup is removed cooled and weighed. To determine the ash content of coconut shell briquettes can use Equation (2.2).

The combustion process is activated in an oxygen atmosphere inside a fixed-volume container. All materials are immersed in an outer water bath and the entire apparatus is in the calorimeter vessel. The calorimeter vessel is also immersed in the outer water. The temperature of the water inside the calorimeter vessel and the external bath are both monitored. Density determination is done by weighing the mass of the coconut shell briquettes after compression using a press tester, and also the length, width, and height of the briquettes are measured. To determine the density value of the briquette using Equation (2.7).

3. Results and Discussion

The process of making coconut shell charcoal briquettes and rice husks begins with the preparation of samples, cleaning the material then drying. After that, the combustion process is carried out manually using a drum, burning coconut shell for 2 hours. The results obtained from the combustion process are in the form of charcoal particles, after which grinding, screening, and mixing of coconut shell material with latex adhesive are carried out. Furthermore, forming, forging, cooling, moisture content, calorific value, ash content, and density are carried out. Briquette Test Results The results obtained from this study include briquette calorific value, moisture content, ash content, and density. From the test results and observations made in the laboratory, the following values were obtained:

Table 1 Comparison of Head Shell Charcoal and Latex Adhesive.

No	**Sample**	Shell Charcoal **(%)**	Latex Adhesive **(%)**
1	A	90	10
2	B	80	20
3	C	70	30
4	D	60	40
5	E	50	50

No	**Sample**	**Parameter**			
		Calorific (Kal/gr)	**Water (%)**	**Ash (%)**	**Density**
1	A	1949.4	5.39	12.86	0.325
2	B	1641.6	5.61	13.33	0.333

3	C	1436.4	5.84	13.38	0.337
4	D	1231.2	6.11	13.51	0.345
5	E	1128.6	6.29	13.63	0.354

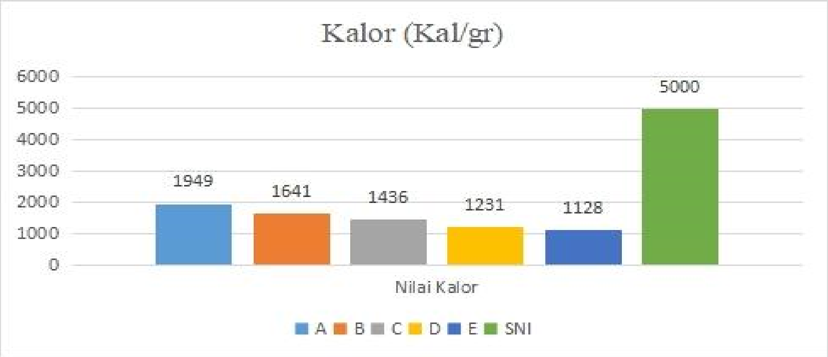

Figure. 1 The Calorific value

Fig, 1 shows that although the calorific value for all briquette compositions varies, in general, the calorific value is higher the greater the composition of coconut shell charcoal and the calorific value decreases the greater the composition of latex adhesive. The greater the calorific value of the briquettes, the better the quality of the briquettes. This is because the higher the calorific value, the higher the ignition rate of the briquettes. Therefore, based on the calorific value of the briquettes, it can be said that the briquettes with the composition (90% coconut shell and 10% latex adhesive) meet the better briquette quality even though all compositions do not meet the SNI briquette quality standards. Effect of Coconut Shell Charcoal Composition with Latex Adhesive on Water Content Value

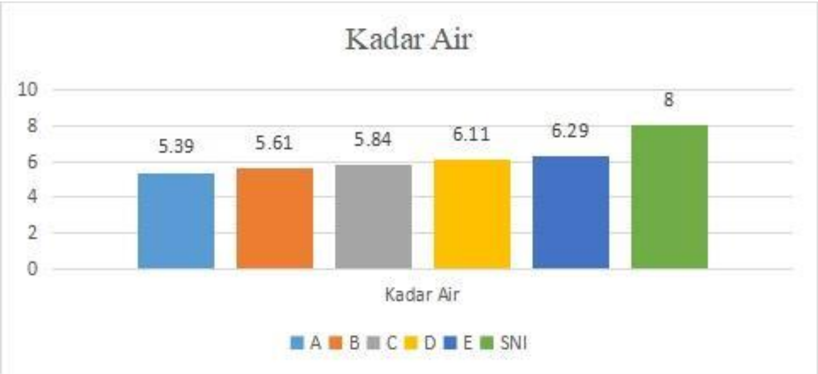

Figure. 2 Water Content

Figure 2 presented that although the moisture content values for all briquette compositions vary, in general, the moisture content values decrease the less latex adhesive composition. The smaller the moisture content of the briquettes, the better the quality of the briquettes. This is because the higher the moisture content it can inhibit the ignition of briquettes. Therefore, based on the moisture content value of the briquettes, it can be said that the briquettes with the composition (90% coconut shell and 10% latex adhesive) meet the better briquette quality even though all compositions meet the briquette quality standards. Effect of Coconut Shell Charcoal Composition with

Latex Adhesive on Ash Content Value

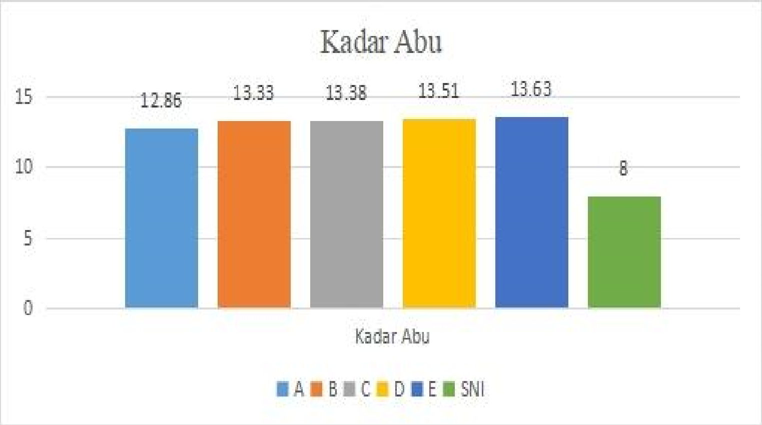

Figure. 3. Ash Content

Figure 3 shows that although the ash content for all briquette compositions varies, in general, the ash content is higher the higher the latex adhesive composition. The higher the ash content, the poorer the quality of the briquettes. The type of raw material has a strong influence on the ash content of the briquettes produced. Ash is the remaining part of the combustion results, the main element of ash is silica mineral and its effect is not good on the heating value produced, the higher the ash content produced, the lower the quality of the briquettes.

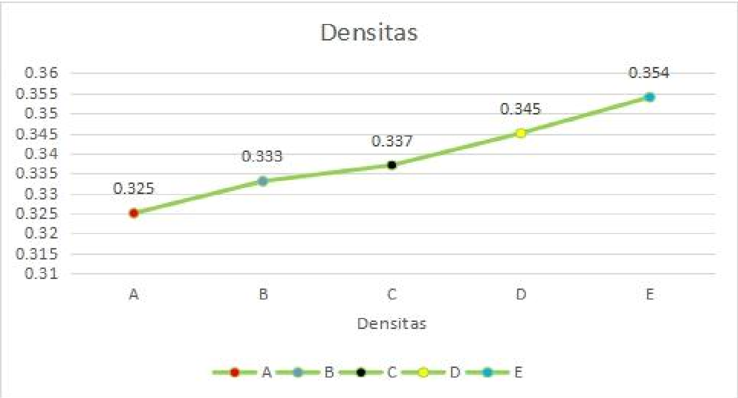

Figure. 4 Density

Figure 4 shows that the greater the composition of coconut shell charcoal, the smaller the density value, for all variations of adhesive and thickness. This is because the factor of the type of raw material is very influential on the high density of coconut shell charcoal produced.

4. Conclusion

The results of this study showed that the calorific value, ash content, moisture content, and density of briquettes with a briquette and adhesive ratio of 90:10 respectively ranged from (1949.4), (5.39), (12.86), (0.325). The analysis shows that briquettes with a composition of coconut shell waste to latex 90:10 is a composition of briquette ratio that produces the highest calorific value, low moisture content, low ash content, and good density value so this composition has better quality than other compositions.

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