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Original Research Paper

Effect of Biobriquette Composition Made from Peanut Shells and Wood Powder on Calorific Value and Burning Rate

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Abstract: This research aims to determine the effect of the composition of biobriquettes made from peanut shells and wood dust on the calorific value and combustion rate. This research is experimental research carried out in three stages, namely material preparation, making biobriquettes, and testing biobriquettes. The manufacturing process uses a simple briquette press. For the composition, Peanut Shell Charcoal (AKKT) + Wood Powder Charcoal (ASK) with an adhesive percentage of 10%, namely 0%+90%; 15%+75%; 30%+60%; 45%+45%; 60%+30%; 75%+15%; 90%+0%. The research results show that the calorific value ranges from 7387-1806 calories and the combustion rate ranges from 3.81-1.51 grams/minute. Based on the research results, it was found that the greater the AKKT composition, the higher the calorific value, while the resulting combustion rate was lower. So in the future, this research can be developed to make it better and better for making briquettes.

Keywords: *biobriquettes, peanut shells, wood dust.*

Introduction

Energy needs and consumption in Indonesia are focused on the use of fuel oil, the reserves of which are increasingly depleting (Smith & Idrus, 2017). Our country is blessed with various fossil energy resources in relatively limited quantities so with current use these reserves will run out in the not-too-distant future. Even though the potential for biomass in our country that can be used as an energy source is very abundant, its use has not been optimized.

The depletion of energy reserves must be immediately offset by the provision of alternative energy that is renewable, abundant in quantity, and cheap in price so that it is affordable for the wider community (Elfiano et al., 2014). One way to deal with the depletion of energy reserves is to switch to using alternative fuels, namely wood fuel, palm shells, candlenuts, and diesel (Pratama et al., 2020).

The previous researcher (Pangga et al., 2022), explained that this research was preliminary research that aimed to determine the quality of briquettes from different biomass raw materials, namely corn cobs and teak leaves. The still not optimal utilization of corn cobs and teak leaves in the biomass energy sector is the initial idea for research. Apart from that, these two raw materials contain lignocellulose which has the potential to be used as raw material for biomass, especially briquettes. The research method used is experimental with the research procedure being to make two briquettes then the products are analyzed and compared. These two raw materials receive the same treatment in the manufacturing process. The adhesive composition used is 5% of the main ingredient. The adhesive used is starch. Both briquettes were tested for quality including water content, ash content, volatile, and heating value. The test results for water content, ash content, volatile content, and calorific value of corncob charcoal briquettes and teak leaf charcoal briquettes respectively, namely, water content of 3.62% and 5.39%; ash content 4.84% and 2 3.14%; volatile content 11.75% and 25.86%; Calorific value 5653.99 cal/g and 7222.95 cal/g. From the results of this analysis, teak leaf charcoal briquettes dominate in better quality compared to corncob charcoal briquettes, the weakness is that the water content of teak leaf charcoal briquettes is still higher. When compared with the values set by SNI, the two briquettes meet the standards for briquettes that are suitable for use as a substitute for alternative fuel.

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In previous research, researchers tried different raw materials. One of the alternative materials that can be used in the Lombok area is peanut shell waste. Peanut shells for some people may have no meaning. Many peanut shells are simply thrown away without any action being taken to deal with this household waste. The community does not use these peanut shells because they think they are just trash. This condition provides encouragement to look for ways to produce abundant alternative energy, and one option is biomass. Biomass itself is very suitable for development in Indonesia, especially in the NTB region because it is quite abundant (Stiawan et al., 2023).

Apart from peanut shell waste which can be used to make briquettes, there is also sawdust waste. Various kinds of trees and plants, both large and small, with broad leaves and small leaves, growing on this earth, especially in Indonesia. Of the types of trees that exist in our country, they can be used for large industrial and household purposes. In the process of utilizing wood, most of the wood is sawed first, producing sawdust waste (Smith & Idrus, 2017).

Wood dust waste can also be used as a briquette mixture. Not many people use sawdust waste, in fact, it is not utilized and is only burned. However, burning sawdust still has an impact on the environment. This is the focus of research on utilizing wood powder as a material that can be made into a product that can be economical, which means it can be processed into a product that can produce economic value, of course, there are other mixtures to make these goods, one of which is made into briquettes (Ariyanto et al., 2014).

Of the two ingredients above, peanut shells and wood dust, where the cellulose content of peanut shells is 65.7% and wood powder is 41.17%, peanut shells, and wood powder when combined will produce excellent fire, the benefits of peanut shells soil and sawdust for fuel are great.

The quality of the calorific value and combustion rate greatly influences bio briquettes, because the higher the calorific value and the longer the burning rate, the better the briquettes produced, conversely if the calorific value is low and the combustion rate takes less time, then the briquettes produced will also be less Good.

Based on the description above, researchers are interested in conducting research on the effect of the composition of biobriquettes made from peanut shells and wood dust on the calorific value and combustion rate.

Methode

Jenis penelitian ini adalah penelitian eksperimen di laboratorium Fisika dan Kimia Universitas Pendidikan Mandalika. Penelitian briket ini menggunakan dua bahan yaitu arang kulit kacang tanah (AKKT) dan arang serbuk kayu (ASK) campuran atau presentase bahan briket dan prekat yang digunakan tertera pada Tabel 1

Tabel 1. Komposisi presentase bahan briket dan prekat yang digunakan

AKKT (%)	ASK (%)	Perekat	Jumlah
0	90	10%	100%
15	75	10%	100%
30	60	10%	100%
45	45	10%	100%
60	30	10%	100%
75	15	10%	100%
90	0	10%	100%

Dalam penelitian ini alat yang digunakan yaitu Neraca digital, alat pencetak briket, alat uji kalor, kotak cetakan, stopwatch, korek gas, mortar dan thermometer. Sedangkan bahan yang digunakan yaitu kulit kacang tanah, serbuk kayu, tepung tapioka, air secukupnya dan kertas label. Secara rinci, tahapan penelitian ini yaitu sebagai berikut.

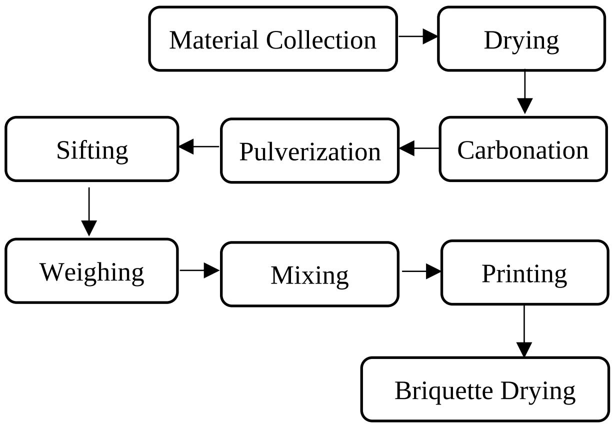

Figure 1. Stages of Research Activities

Peanut shells are taken from peanut shelling waste in Lepak Village, East Sakra District, East Lombok, and wood dust. The remaining sawn wood sawdust was taken in Lepak Village, East Sakra District, East Lombok, and was collected in the amount of 1/2 sack of Peanut Shell rice and 1 sack of Wood Sawdust rice which was then dried. Dry peanut shell biomass and sawdust are spread in a place exposed to direct sunlight. Then every 1 hour it is turned over so that the drying process is even,

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which lasts for approximately 6 days due to uncertain weather conditions. The dried Peanut Shells and Wood Powder are then put into a cooking stove (carbonization receptacle). One sample raw material used is Peanut Shell Charcoal (AKKT) and Wood Powder Charcoal (ASK). The two ingredients are pounded using a pounder until smooth, and the results of the collision are separated, collected, and weighed. After the ingredients are crushed, they are then sifted to produce soft charcoal. After the pounding process, the sample is weighed first to determine the mass used. The raw materials that have been weighed are then mixed with the adhesive until they forms the desired dough. After mixing the dough, then print the briquettes. The mold shape used is a cube with a diameter of 3 cm. The molded briquettes are then dried in the sun for approximately 6 days.

Result and Discussion

In making these briquettes, 10% tapioca flour adhesive is used. The tapioca flour is put into a container by mixing the adhesive with water and then heated until it thickens. The adhesive material that has been prepared is then mixed with peanut shell charcoal and wood dust, where the percentages used for peanut shell charcoal are: 0%, 15%, 30%, 45%, 60%, 75%, and 90%, Meanwhile, the percentage of sawdust charcoal used is: 90%, 75%, 60%, 45%, 30%, 15% and 0%. After mixing it with the charcoal until it forms a briquette mixture. Then the dough is put into a cube-shaped mold, pressed using a manual press and dried in the sun. To determine the quality of the briquettes produced, tests such as density, water content, heating value, ash content and burning rate need to be carried out. Following are the results of the briquette tests that have been carried out.

1). Water Content Analysis

Water content is an indicator of briquette quality. It is hoped that the water content in the briquettes produced is as low as possible to increase the calorific value. The water content of a briquette is inversely proportional to the calorific value it produces. The higher the water content in the briquettes, the smaller the calorific value produced when burning and the longer it takes for the briquettes to ignite. The complete water content of the biobriquettes produced can be seen in Figure 2.

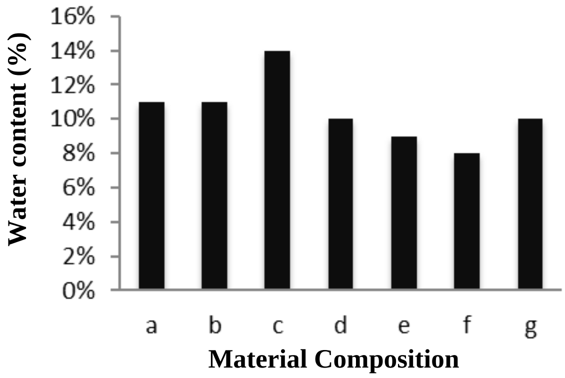

Figure 2. Water content diagram for composition a.0+90; b.15+75; c.30+60; d.45+45; e.60+30; f.75+15; g.90+0

Based on Figure 2 above, it can be seen that the percentage of ingredients has a different influence on the water content of biobriquettes. The percentage of biobriquette water content ranges from 8% - 14%. Research results (Za et al., 2021) show that the water content value increases as the percentage of material or adhesive in the briquettes increases. From this research, the water content produced is not yet stable, but the influence of the AKKT and ASK materials is very influential, the higher the AKKT material, the lower the water content produced, while the higher the ASK material, the higher the water content produced.

2). Density Analysis

Density (ρ) is a measure of the concentration of a substance and is expressed in mass per volume. The complete density of the biobriquettes produced can be seen in Figure 2.

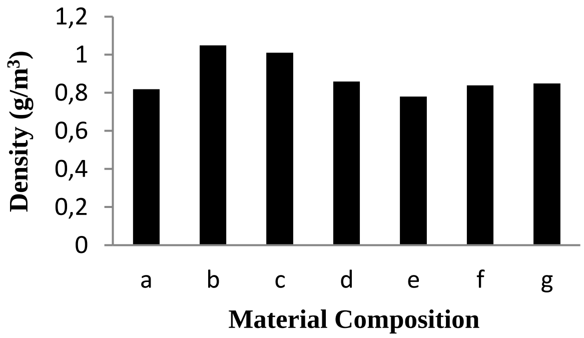

Figure 3. Density diagram of briquettes for Composition a.0+90; b.15+75; c.30+60; d.45+45; e.60+30; f.75+15; g.90+0

Based on Figure 3 above, it can be seen that the percentage of ingredients has a different influence on the density of the briquettes. The

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density of the briquettes produced ranges from 0.781 g/cm3 – 1.052 g/cm3. The highest density of briquettes with a material percentage of 15% AKKT + 75% ASK produces 1.052 g/cm3, and the lowest density value with a material percentage of 60% AKKT + 30% ASK produces 0.781 g/cm3. There is no standard measurement to determine the quality of briquettes based on their density. From this research, the effect of the AKKT and ASK materials produced is less stable, resulting in fluctuating density values. From research (Aljarwi et al., 2020), the denser or finer the briquettes, the longer the burning time. So density has a significant influence because it is directly proportional to the combustion rate.

3). Analysis of the Calorific Value of Briquettes

Calorific value is the maximum amount of heat energy released or generated by a fuel through a complete combustion reaction per unit mass or volume of the fuel. The complete calorific value of the biobriquettes produced can be seen in Figure 4.

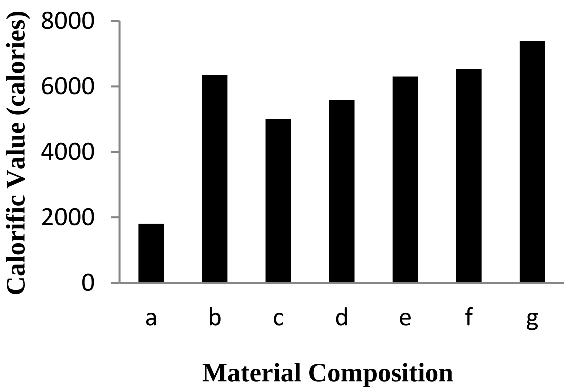

Figure 4. Diagram of the calorific value of briquettes with composition a. 0+90; b.15+75; c.30+60; d.45+45; e.60+30; f.75+15; g.90+0

From the picture above, the calorific value of briquettes ranges from 1806.84 calories – 7387.968 calories. The briquettes produced have the lowest calorific value in briquettes that use an ingredient percentage of 0%AKKT+90%ASK. Meanwhile, the highest calorific value is in briquettes that use an ingredient percentage of 90%AKKT+0%ASK. From this research, the influence of the calorific value is on the materials used, because the higher the AKKT material, the higher the calorific value, even though the resulting calorific value is unstable. From research (Stiawan et al., n.d.) the resulting heating value is stable depending on the adhesive used. Because this research only uses one adhesive material, the ASK and AKKT materials have a very strong influence on the calorific value results, where for the high ASK material the resulting calorific value is low, while the high calorific value is found in the AKKT material.

4). Burn Rate Analysis

The burning rate is the speed at which the briquettes burn out. The greater the combustion rate value, the faster the briquettes will be used up. The complete combustion rate value of the briquettes produced can be seen in Figure 5.

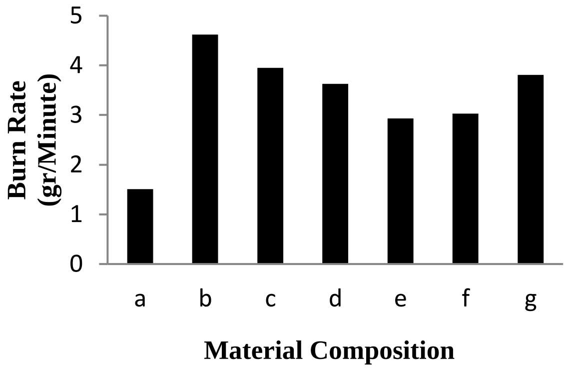

Figure 5. Diagram of briquette burning rate at composition a. 0+90; b. 15+75; c. 30+60; d. 45+45; e. 60+30; f. 75+15; g. 90+0

From Figure 5, it can be seen that the percentage of ingredients has a different influence on the burning rate of the briquettes produced. The burning rate of peanut shell briquettes and sawdust ranges between 1.51g/minute – and 4.62g/minute. The briquettes with the smallest burning rate are briquettes with a material percentage of 0%AKKT+90%ASK. Meanwhile, the briquettes with the highest burning rate are briquettes with an ingredient percentage of 15%AKKT+75%ASK.

It can be concluded that the results of a good combustion rate to produce briquettes in this research are the higher the ASK and the lower the AKKT. Where if the percentage of AKKT is low, the resulting combustion rate will be longer, conversely, if the ASK material is high, the resulting combustion rate will be higher. Although the results of the combustion rate are not yet stable.

According to research (Sulistyaningkarti & Utami, 2017) which states that if the heating value of the briquettes is higher, the combustion rate value of the briquettes will also be better. However, what is good about this research is that if we look at the results of the heating value and combustion rate, it is found in e(60%AKKT + 30ASK) and f(75%AKKT + 15%ASK), because the heating value is high and the combustion rate is low.

5). Ash Content Analysis

Briquettes that have too high ash content can reduce the quality of the briquettes. High ash content can reduce the heating value, and form scale, and make ignition difficult. From Figure 5, it can be seen that the lowest ash content is 15% AKKT + 75% ASK, and the highest ash content is 45% AKKT + 45% ASK. The more charcoal the briquette contains, the higher the ash content of the briquette. So from this research, the influence of ingredients plays a very important role in the ash yield in briquettes, even though the results are unstable.

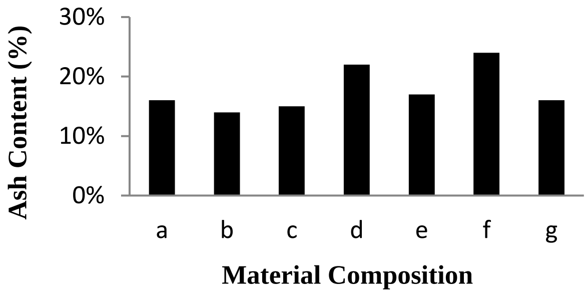

Figure 6. Diagram of briquette ash content in composition a. 0+90; b.15+75; c.30+60; d.45+45; e. 60+30; f.75+15; g.90+0

6). Feasibility Analysis of AKKT and ASK Briquettes

From the description above, it can be seen that the feasibility of briquettes from AKKT and ASK materials cannot be said to be feasible, because the water content is very high and only one meets SNI, namely a composition of 75%+15% with a water content of 8%. From research (Stiawan et al., n.d.), none of the water content produced from AKKT materials exceeds 8%. For density analysis, the results were also very unstable, from research (Lailatul Jannah et al., 2022) the density results were stable, with durian skin and adhesive materials using tapioca flour and rice flour. In the results of this study, the ash content value was also very high but not yet stable.

The calorific value produced from this research is still not very good, because the calorific value produced is not yet stable with changes in the composition of the basic ingredients. It is still visible that the heating value increases and decreases with changes in the composition of the material. However, in general, it appears that the percentage of AKKT and ASK ingredients influences the calorific value and combustion rate produced. In this research, the correlation between heating value and combustion rate is still difficult to establish, where heating value and combustion rate must be interrelated. The resulting research results have a high heating value but a low combustion rate value, conversely a low heating value but a high combustion rate value. The symptoms that appear indicate that peanut shell charcoal and wood shavings charcoal must be given separate treatments and given stronger compaction to produce more stable briquettes.

Conclusion

Based on the results of research and data analysis, it can be concluded that the composition of briquettes made from AKKT and ASK materials greatly influences the calorific value and combustion rate. The research results show that the calorific value ranges from 7387-1806 calories and the combustion rate ranges from 3.81-1.51 grams/minute. Based on the research results, it was found that the greater the AKKT composition, the higher the calorific value, while the resulting combustion rate was lower.

Suggestions that can be recommended from this research include research that examines the manufacture of briquettes by combining peanut shells as a raw material with other supporting mixtures to improve the quality of the briquettes. It is recommended that the process of preparing, making and testing biobriquettes be carried out simultaneously and provide the same treatment to minimize the impact of environmental factors in the form of atmospheric temperature and humidity which cannot be guaranteed to always be the same during research because they use sunlight.

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