The Effect of Bentonite Addition on Briquettes Quality of Corn Cob and Teak Leaf Mixture

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A B S T R A C T

The effect of adding bentonite to the quality of briquettes from a mixture of corn cobs and teak leaves in this study produced briquettes that met the standards as an alternative fuel. In this research, drying, carbonization, milling, mixing, printing and drying were carried out. The briquettes that have been made are then tested to determine the chemical and mechanical characteristics. The tests applied were tests for water content, ash content, volatile content, carbon content and compressive strength. Variations used in this study by adding bentonite to influence the quality of the briquettes made, variations in the addition of bentonite were carried out 4 trials with 0%, 10%, 20%, 30%, 40%. With each study testing the water content, ash content, volatile content, carbon content and compressive strength. The highest results obtained from testing the water content were from the 40% bentonite variation of 13.03% and the lowest water without bentonite was 10.79%, the highest ash content was at 40% bentonite at 22.41% and the lowest ash content without bentonite was 4. .86%, the highest volatile content was in 10% bentonite at 32.22% and the lowest at 20% bentonite at 25.29%, the highest carbon content was in the treatment without 0% bentonite at 55.78% and the lowest at 40% bentonite at 36, 16%, the highest compressive strength was in the 40% bentonite variation of 135.82(N/cm2) and the lowest compressive strength was in the treatment without 0% bentonite of 39.79(N/cm2). The quality of the briquettes made in this study did not meet the standards (SNI 01-6235-2000) for water content, volatile content and bound carbon content

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I. Introduction

Agricultural waste is a material that can replace fossil fuels, but before the waste is used as an alternative fuel, it needs to be converted into solid fuel, namely briquettes. One way to convert energy in corn cob agricultural waste can be done by changing its shape into solid fuel (briquettes), where in the process the addition of cornstarch and bentonite adhesives is carried out to get the best briquette results. In addition, corn cob waste is also converted using a pressing machine to make it more useful and higher selling power. Making briquettes using corn cob material in order to have a high calorific value, the addition of adhesives using cornstarch and bentonite adhesives is carried out . (Sulistyaningkarti dan Utami, 2017)

Corn cobs are not the only biomass waste that can be briquetted. Another biomass waste that can be used is from teak trees, which can be utilized from wood, powder, and leaves. the teak tree can be utilized from wood, powder, and leaves. This teak leaf has wide. In addition to having a wide shape, teak leaves also have a high lignocellulose content. content, therefore it can cause obstacles if processed into animal feed, so these teak leaves have the potential to be converted into briquettes or alternative energy Making briquettes from teak leaf waste is very easy to do. It's just that all types of leaves are used for their combustion resistance, so the manufacture of briquettes using teak cob charcoal is very easy to do. corn cob charcoal. The moisture content of fresh teak leaves is 8%. However, the moisture content will automatically decrease after being converted into briquettes. Therefore, briquetting is the right way when teak leaves are converted into alternative energy, and this teak leaf waste can save fuel use in industries that are related to burning related to combustion (Sukowati, Yuwono dan Nurhayati, 2019).

In addition to the main ingredients, briquettes also require an adhesive that can bind the two materials with a surface bond. There are several types of adhesives that can be used such as molasses, cornstarch, tapioca starch, and bentonite. Bentonite is a class of clay that has good water absorption when put into water. put into water will expand. And can form a fairly strong mass. Bentonite has binding properties and can also cover the pores in the briquette, so it can be used as an adhesive. can be used as an adhesive material (Patandung, 2015).

Based on some of the descriptions above, it is necessary to conduct experimental research using a mixture of corn cob agricultural waste and teak leaf waste to determine the effect of bentonite on briquettes. determine the effect of bentonite on briquettes.

II. Literature Review

Research conducted by Supeno entitled the effect of the addition of bentonite on the mechanical properties of briquettes from coconut shell. The parameters used were bentonite variations of 1,2,3,4,5. First the charcoal that has been pulverized using a sieve until it passes the size of 40 mesh and weighed with each briquette. to pass the size of 40 mesh and weighed with each weight of 30 grams as many as 5 parts. Then one gram part is mixed with bentonite (AI2O3 SiO2 HO2). Furthermore, it is mixed with the weight of water glass adhesive by using an adhesive weight of 2 grams. Then the charcoal is mixed with the adhesive and stirred until evenly distributed, then the mixture of charcoal and adhesive is put into the mold using a pressing tool. Then the charcoal that has been molded is dried in the same way. The results showed that bentonite can have a great influence on mechanical properties and calorific value. The best result is the addition of adhesive weight of 2 grams without bentonite which has a calorific value of 8025, 26 cal / g and the best compressive strength at 10 grams of adhesive weight with the addition of 5 grams of bentonite which gets a compressive strength value of 55.15 kg / cm3 (Supeno, 2005).

Research conducted by (Kurniawan, Rahman and Pemuda, 2019) entitled the study of the characteristics of coconut shell briquettes with various types of briquette adhesives. The materials used in this study are coconut shell charcoal, tapioca flour, clay and betonite. Coconut shell charcoal is reduced to a size of 40 mesh and mixed with various types of adhesives by 15%. Furthermore, the dough is given water so that it is easier to print and pressed on the briquette printing. then after the briquettes are molded drying is done using a cabinet dryer. After the drying process is complete, then the analysis is carried out. The best research results were obtained in the P1 treatment of 6314.46 cal/g, P2 obtained a calorific value of 5451.56 cal/g. While the lowest treatment in the P3 treatment amounted to 5177.49 cal/g.

According to (Jamali, Mufakhir, and Amin, 2012) conducted research on the effect of adhesive materials and reduction time on the manufacture of sponge briquettes from local iron ore. Research using laboratories to get the optimal process in making sponge briquettes. The manufacturing method uses bentonite-based adhesives and flour adhesives. The results showed that sponge briquettes with flour adhesives provide opportunities as furnace feed for the power industry and compared to bentonite-adhesive briquettes which have a great opportunity to become cupola feed.First, confirm that you have the correct template for your paper size. This template has been tailored for output on the A4 paper size. If you are using US letter-sized paper, please close this file and download the Microsoft Word, Letter file.

III. Methods

A. Material

Bentonite serves as an adhesive in the process of making bio-charcoal briquettes. Corn cobs are one of the main raw materials used during the process of making biochar briquettes besides teak leaves. And the corn cobs used are not tied to any one type of corn plant. Teak leaves here function as the main raw material besides corn cobs. Teak leaves used are teak leaves that have been dried.

B. Type of Research

The type of research used experimental research (experimental research) is research that uses quantitative data or statistical data, research using cornstarch and bentonite adhesives to determine the quality of bio charcoal briquettes mixed with corn cob and teak leaves.

C. Research Parameters

The parameters used during the study consisted of pressing load, adhesive content, mesh size, and volume weight of corn cobs and teak leaves used. The pressing load of the press used was 2 tons, and the mesh size was 50 mm.

D. Research variables

Variables used in this study using 2 types of variables, namely independent variables and dependent variables. The independent variables of this study are using bentonite and without bentonite. While the dependent variable of this research is the data test results of water content, ash content, volatile matter, fixed carbon, and compressive strength.

IV. Result And Discusssion

The discussion of the test results in this study has five parts, including the results of the moisture content (%), ash content (%), volatile matter (%), and fixed carbon test results. fixed carbon test results are the result of the reduction of impurities, namely water content, ash content, volatile matter, then the fixed carbon data results can be obtained. ash content, volatile matter, then the results of fixed carbon data (%) and compressive strength (N/cm^2) can be obtained.

The research was carried out using the parameters of compressive strength testing and fixed carbon on briquettes. Testing carbon content can be done by reducing water content, ash content and volatile meters, where this research is carried out to determine the quality of charcoal briquettes mixed with corn cobs and teak leaves with the addition of bentonite to the bio-carbon briquette dough, based on the test results on compressive strength that bentonite has a great influence on the compressive strength of briquettes.

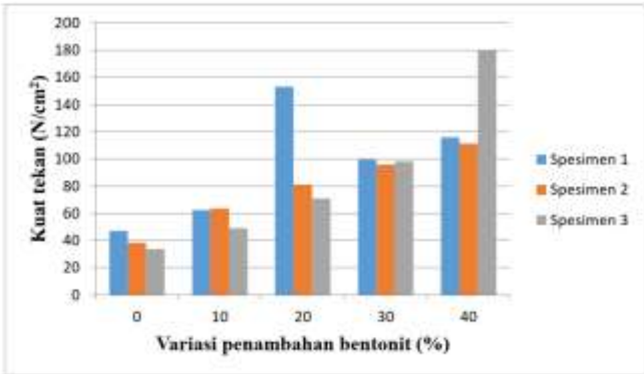

Fig. 1. Graph of average compressive strength

Based on the compressive strength graph above, it can be seen from the results of the compressive strength test that the addition of bentonite has a significant effect on the compressive strength of the briquettes. In this research, the highest value and the lowest value are known, the highest value is obtained in the treatment of adding 40% bentonite with a value of 135.82 (N/cm2). While the lowest value was obtained in the treatment of 0% bentonite or without bentonite which obtained a value of 39.79 (N/cm2).

The amount of bentonite addition given is directly proportional to the increase in compressive strength produced. Here it can be seen that the more even the mixture and the higher the addition of bentonite, it can have a very big influence on the compressive strength of the briquette. Bentonite can be used as an ion exchanger and adhesive in this case. This is very good for covering the pores between carbons so that the addition of bentonite can increase the physical strength so that it can be more effective. can increase the physical strength so that it can better withstand the compressive load Press. The higher the compressive strength of the briquette, the better the combustion time (Supeno, 2005). This research is able to obtain the optimal bentonite addition variable to meet the strength standards. meet the strength standard. Here are the briquettes with the addition of bentonite that made has met the standard in the UK of 12.7

kg/cm2. In this study obtained The highest compressive strength test results at 40% bentonite addition amounted to 135.82 (N/cm^2).

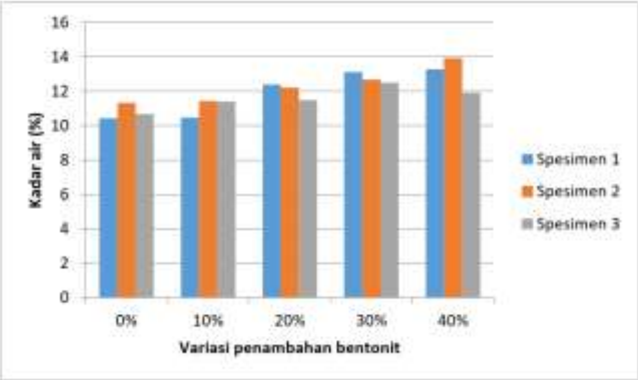

Fig. 2. Water content graph

Based on the graph shows the results of the water content test on briquettes with addition of bentonite which tends to rise. Caused by water trapped in particles particle of corn cob charcoal and teak leaves that come out less than the maximum at the time of printing, the highest water content is obtained in the variation of 40% bentonite addition of 13.03%. The highest water content was obtained in the variation of 40% bentonite addition of 13.03% and the lowest value was obtained in the variable without bentonite of 0%. in the variable without bentonite 0% at 10.79% (Patandung, 2015).

A good briquette is one that has a low moisture content because if it has a low moisture content, the briquette will be more durable. water content, the briquettes will have difficulty igniting or the burning rate will be less than optimal. is less than optimal. Because high water content is very influential on burning so that it can reduce the calorific value (Hamzah, 2015). can reduce the calorific value (Hamzah Dkk, 2017). However, when compared to the standard SNI 01-6235-2000. In the research conducted this time, the resulting water content still does not meet the standard because the standard value of SNI 01-6235-2000. has not met the standard because the standard value of SNI 01-6235-2000 is a maximum of 8%.

The figure 3 beyond is a bar graph of the results of testing the ash content of briquettes with varying percentages of bentonite addition. in the research that has been carried out in the energy conversion lab, from the graph above, it can be seen that the results of testing briquettes with the addition of the lowest ash content was obtained with the treatment without bentonite which obtained a value of 4.86% and the highest result with 40% bentonite treatment which obtained a value of 22.41%.

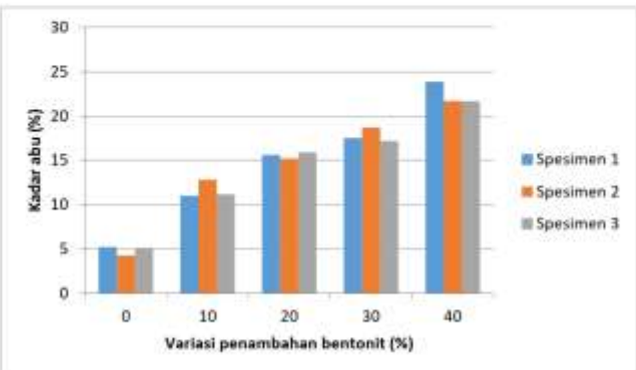

Fig. 3. Ash content graph

The increase in ash content obtained in this study was influenced by the composition of bentonite. composition that was too high so that it could give a bad influence on the ash content of the briquettes. The higher the bentonite addition to the briquettes, the higher the ash content of the briquettes. The higher the addition of bentonite to the briquettes, the higher the ash content produced in the briquettes. without the use of bentonite which obtained a value of 4.86% while the highest treatment was at 40% bentonite addition with a value of 22.41% (Patandung, 2015). In addition, the high ash content ash content is caused by the adhesive material, the more adhesive material that is given to the briquette dough, the ash content of the briquettes will automatically increase. High ash content can cause a decrease in calorific value. Low ash content is considered to have good quality because if the briquettes have high ash content, it will cause cracking. briquettes have high ash content will cause crusting in the briquette combustion furnace. ash content can also affect the heating value, the higher the ash content, the lower the heating value. calorific value produced. When compared to the Indonesian national standard, this research on variation of 0% bentonite can meet the standard (SNI 01-6235-2000) while the variation of 10% and so on does not meet the standard (SNI 01-6235-2000). 10% and so on do not meet the standard (SNI 01-6235-2000).

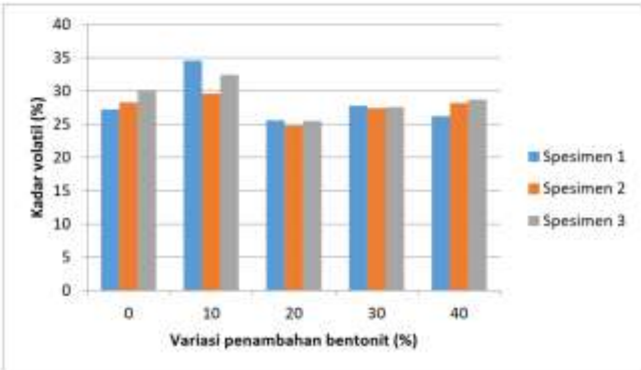

Fig. 4. Volatile matter graph

The graph shows the results of testing the volatile content of briquettes with the addition of bentonite which tends to decrease, but the high and low volatile substances are influenced by the type of material used in the manufacture of briquettes materials used in making briquettes (Vidia Safitri, 2022) . The highest treatment in The highest treatment in the 0% bentonite variation can get an average value of 28.55% while in the 40% bentonite addition variation it gets an average value of 27 72%. This can be caused by differences in the materials used because they are influenced by the volatile substances contained in the material. The high and low levels of volatile substances present in the briquettes are influenced by the materials at the time of making the briquettes. In this study, it shows that the more the addition of bentonite, the more the volatile content will decrease. In research conducted by (Rahmadani Faizah Hamzah, 2017). Shows that the higher the percentage of adhesive and the lower the percentage of charcoal given can increase the volatile matter content. From this study, the carbonization process can cause a decrease and increase in the level of volatile substances. The greater the temperature and the longer the time in charring it can cause a lot of vaporized substances to be wasted (Rahmadani Faizah

Hamzah, 2017). In this study, the reference is the Indonesian national standard (SNI) while the maximum volatile content value is 15%. So from the research that has been done, it can be concluded that the volatile content does not meet the standard (SNI 01-6235-2000).

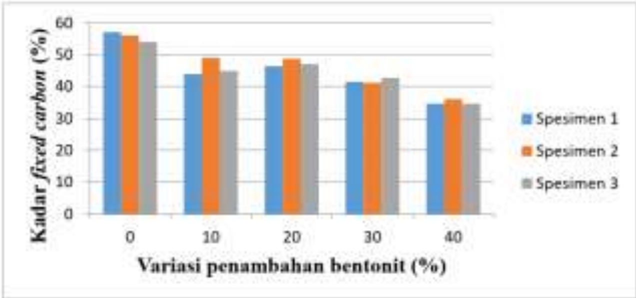

Fig. 5. Graph of fixed carbon

Based on the graph above the test results of bound carbon levels in each specimens that the more the addition of bentonite the more the value of carbon content decreases. carbon content decreases from 0% to 40% bentonite addition because the large carbon content is influenced by impurities through manual reduction (Almira, 2021). (Almira, 2021). The carbon content treatment that gets the highest value is in the treatment without bentonite 0% which gets a value of without bentonite 0% which obtained a value of 55.78% while the lowest value was obtained in the treatment of adding 40% bentonite with a value of 36.16%.

This is because carbon content is inversely proportional to impurities such as water content, ash content and impurities. such as moisture content, ash content and fly matter. The higher the carbon content obtained, the the better the quality of the briquettes produced. But on the contrary, the lower the carbon content obtained, the lower the quality of the briquette (Mokodompit, 2012). In this study, the reference is the Indonesian national standard (SNI 01-6235-2000), while the carbon content value is 78.5 percent. 2000) while the carbon content value is 78.35%. So from the research that has been done it can be It is concluded that the carbon content does not meet the standard (SNI 01-6235-2000).

V. Conclusion

The process of making briquettes from a mixture of corn cobs and teak leaves with several stages, including drying, carbonization, grinding, mixing, printing and drying. The briquettes that have been made are then tested to determine the chemical and mechanical characteristics. Tests applied are tests of water content, ash content, volatile content, carbon content and compressive strength. The variation of bentonite addition affects the quality of the briquettes made. The more the addition of bentonite can increase the compressive strength of the briquettes, the water content increases, the volatile content increases and the carbon content decreases. The quality of briquettes made in this study does not meet the standards (SNI 01-6235-2000) for moisture content, volatile content and fixed carbon content.

The process of making briquettes should be done carefully by paying attention to the existing parameters and equalizing each treatment so that the data generated is accurate. The tools used should also be prepared in advance in full before the briquetting process to facilitate the briquetting process in order to facilitate the manufacturing process. Efforts to find optimal parameters aim to produce quality briquettes according to existing standards. In addition to the addition of bentonite, there are many parameters that can still be researched to find optimal parameters in the briquetting process. Other parameters that can still be researched include the type of material, type of adhesive, carbonization process, charcoal particle size, and the addition of other materials for mixing briquettes.

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