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Analysis Of The Horse Feses Biochar Briquette With Variations Of Addition Of Starch As Adhesive

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Abstract – The need for energy on an international scale continues to increase from time to time in line with the increasing process of industrialization throughout the world. The economic pattern that was originally focused on the agricultural sector has become an economic pattern that is based on the industrial sector. So what needs to be considered together is how to make energy savings in addition to looking for alternative energy sources to reduce dependence on petroleum. So this requires creative efforts to utilize horse feses to become biochar briquettes. Biochar briquettes are a renewable and environmentally friendly alternative energy source. The raw material in this study used horse feses which has a raw moisture content of 26.4%. Furthermore, horse feses underwent several treatments, namely mixed with starch. The ratio between horse feses (B) and starch (A) or the ratio B/A is 3, 5, 7, and 10. The mixture is then pressed with a pressure of 10 bar to get biomass briquettes weighing 10 gr each. Then the biomass briquettes were dried in the sun for 3 days. After that, the biomass briquettes underwent a pyrolysis process using a retort at a constant heating temperature of around 300°C for 30 minutes to obtain biochar briquettes. The results showed that the average moisture content of the biochar samples was 3.1%, while the dry content was 96.9%. The high heating value experienced an average increase of 3.54% in line with the greater amount of starch contained in the biochar briquettes. Likewise with the low heating value there was an average increase of 3.69%.

Keywords – component; horse feses, starch, biochar, moisture content, heating value

I. INTRODUCTION

The need for energy on an international scale continues to increase from time to time in line with the increasing process of industrialization throughout the world. The economic pattern that was originally focused on the agricultural sector has now changed to an economic pattern that is based on industrial patterns. The increasing progress of the industrial sector can be seen from the number of factories that continue to emerge, both on a small scale and on a large scale. With the changing pattern of the economy, it is necessary to think together about how to make energy savings in addition to finding alternative energy to replace fuel oil. One of the efforts is to use horse feses to make biochar briquettes.

Biochar briquettes are defined as fuel that is solid and comes from the remains of organic matter that has undergone a compression process with a certain compressive strength. Biochar briquettes can replace the use of firewood, which is starting to increase in consumption. In addition, the price of biochar briquettes is relatively cheap and affordable by the community. One of the advantages of using biochar briquettes is that they are very cheap. The tools used for making biochar briquettes are quite simple and the raw materials are very cheap, you don't even need to buy them because they come from garbage, dry leaves, agricultural waste. Meanwhile, the disadvantage of biochar briquettes is that they are not time efficient because the manufacturing process takes quite a long time, at first the heat power of the fire is slightly slower compared to other fuels, they are used only once until they run out because the heat of the fire in the briquettes will not disappear until the briquettes become coals. Making biochar briquettes from waste can be done by adding adhesive, where the raw material is charcoaled first then ground, mixed with adhesive, printed with a hydraulic system or manually and then dried.

Horse feses contains a lot of carbohydrates, especially cellulose or fiber, in addition to protein and fat. These chemical compounds are very potential for carbon sources which are the main constituent of biochar briquettes. The way to get this carbon source is by burning organic matter in an anaerobic state or known as pyrolysis, this method is intended to increase the energy value and improve combustion properties [3].

Utilization of the potential of biomass as a source of electrical energy, has begun to be developed in several countries in the world. As is the case in China, with the potential of available biomass, it is possible to produce electricity with a capacity of 30 GW [4]. Likewise, in the European Union, even the demand for biomass raw materials exceeds the supply capacity that can be provided for the needs of power plants [1].

Analysis of the heat of a fuel is intended to obtain data on the heat energy that can be released by a fuel by the reaction / combustion process. The calorific value of fuel can be interpreted by carrying out tests on an adiabatic bomb calorimeter, various calorific value test results can then be used to form empirical / semi-empirical equations [2].

The research aim to investigate effect of particle size on mechanical and proximate properties of the briquettes. Particle size variation of jackfruit char are 40 mesh, 60 mesh, and 80 mesh. The result shows the briquettes made from 80 mesh jackfruit char has the best quality. Its heating value, fixed carbon, volatile matter, water content, and ah content are 5864 cal/gr, 58.401%, 25.065%, 7.981%, and 8.553%, respectively. However,maximum compressive stress of 0.68 N/mm^2 is observed in briquette with particle size of 60 mesh [5].

The charcoal briquettes from banana peel and banana bunch wastes from dried banana industry for household heating were characterized and evaluated. It was found that the percent yields of charcoal and wood vinegar from pyrolysis of banana peel and banana bunch were 57%, 7.53% and 58.6%, 6.76%, respectively. The calorific value of both charcoal briquettes decreased with increasing ratios of clay and ash content. The values range from 5,115.51 to 6,396.66 cal gr^{-1}. The hardness obtained with 5% clay binder is 23.31 kg and 25.90 kg for banana peel charcoal briquette and banana bunch charcoal briquette, respectively. Both charcoal briquettes containing 5% clay are smokeless during combustion and result in red-brown ash after combustion. The dust and total CO emissions of banana peel charcoal briquette and banana bunch charcoal briquette during combustion are 15.38 µg m^{-1} and 3463 ppm and 11.97 µg m^{-3} and 1568 ppm, respectively. The maximum temperatures of water are 88 and 84°C and the times needed to reach the maximum temperatures were 36 and 48 min for banana peel charcoal briquette and banana bunch charcoal briquette combustion, respectively. The maximum burning times and combustion efficiencies are 114 min and 9.10% and 92 min and 8.38% for banana peel charcoal briquette and banana bunch charcoal briquette, respectively [6].

This study has explored the possibilities of using briquettes made from biochar and cow-dung at various proportions for energy-intensive processes. 4 groups of samples were created, out of which, the one made with cow dung and biochar derived from mango peel showed the highest calorific value and carbon sequestration of around 7300.56 Kcal/kg and 31.8 mg/kg respectively [7].

II. RESEARCH METHODS

In this study the experimental method was used, namely direct biochar briquette testing. The test material used is horse feses biomass mixed with starch which is formed into biomass briquettes. The ratio between horse feses (B) and starch (A) or the ratio B/A is 3, 5, 7, and 10. Then the mixture is pressed with a pressure of 10 bar to get biomass briquettes with a weight of 10 gr each and then dried. under the sun for 3 days, then the pyrolysis process is carried out using a retort with a constant heating temperature of around 300^{o}C for 30 minutes to get biochar briquettes.

Table 1. Tools and materials

Tools and materials	Specification
Biomassa	Horse feses
Adhesive	starch
Briquette press	10 bar

Analytical balance	0,1 mg
retort	100 – 500°C
Adiabatic Bomb Calorimeter	Model-IKA C2000

The stages of the research procedure were to make biochar briquettes by mixing starch with enough boiling water until the mixture turned into glue. Mix the dried horse feses with starch glue in a ratio of 10 grams of starch to 30 grams of horse feses, 6 grams of starch to 30 grams of horse feses, 4.3 grams of starch to 30 grams of horse feses and 3 grams of starch and 30 grams of horse feses. Furthermore, the mixture is formed or pressed with a pressure of 10 bar into biomass briquettes with a weight of 10 grams each. Then the biomass briquettes were dried in the sun for 3 days. After that, the biomass briquettes underwent a pyrolysis process using a retort at a constant heating temperature of around 300°C for 30 minutes to obtain biochar briquettes. In this study the variables studied were the moisture content of the biochar briquettes, the dry weight of the biochar briquettes, the calorific value of the bottom of the biochar briquettes and the heating value of the top of the biochar briquettes. Testing for water content and dry matter used proximate analysis, while for testing the high heating value and low heating value using the Model-IKA C2000 bomb calorimeter (fig 1).

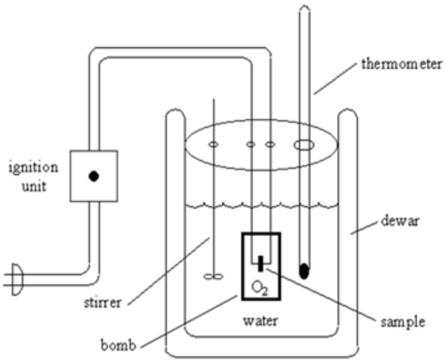

Figure 1. Adiabatic Bomb Calorimeter

III. Results And Discussion

This research was conducted to determine the characteristics of briquettes carried out several analyzes, namely proximate analysis and calorific value. The effect of using starch glue for the manufacture of horse feses biochar briquettes is shown in Fig 2. The more starch glue content in the horse feses biochar briquettes, the more water content contained in the briquettes. This is because the porosity of the biochar briquettes decreases as the amount of starch glue contained in the biochar briquettes increases. Greater porosity will cause water vapor to escape or evaporate more easily from the biochar briquettes. The factors that affect the water content contained in biochar briquettes are the amount of moisture in the air, the drying process time, and the hygroscopic nature of the briquettes. The average water content of the biochar samples was 3.1% while the dry content was 96.9%. The greater the water content in the horse feses biochar briquettes, the lower or less dry the biochar briquettes, this is as shown in Fig 3.

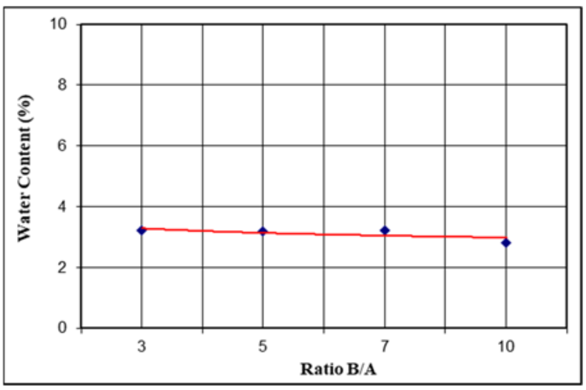

Figure 2. Graph of the relationship between ratio B/A that water content

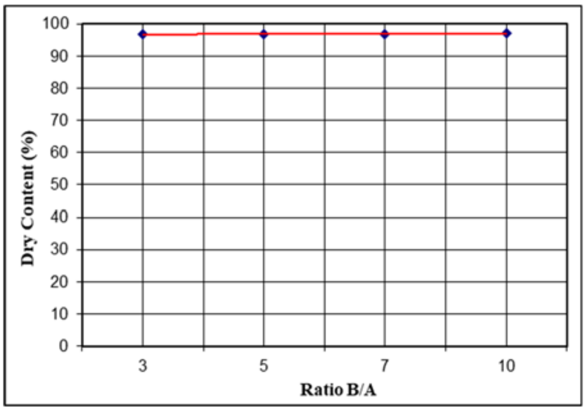

Figure 3. Graph of the relationship between ratio B/A that dry content

Figure 4 shows the quality of the horse dung biochar briquettes produced in this study had a calorific value below the standard quality standard, namely the quality standard of briquettes based on SNI-01-6235-2000 of 5000 cal/g. The greater the B/A ratio, the greater the content of horse feses in the biochar briquettes. Horse feses biochar briquettes have a high heating value along with the increasing content of horse feses in the biochar briquettes, as shown in Fig 4. The high heating value increases by an average of 3.54% for each increase in the B/A ratio. This happens because the content of volatile matter is very high in the biochar briquettes along with the greater the B/A ratio. It is possible that the volatile matter contained in the briquettes is flammable gases, causing a high heating value so great. In addition, it is also influenced by the content of carbohydrates and fats which function as a source of energy in biochar briquettes. Likewise with the low heating value there is an average increase of 3.69% for each increase in the B/A ratio (fig 5).

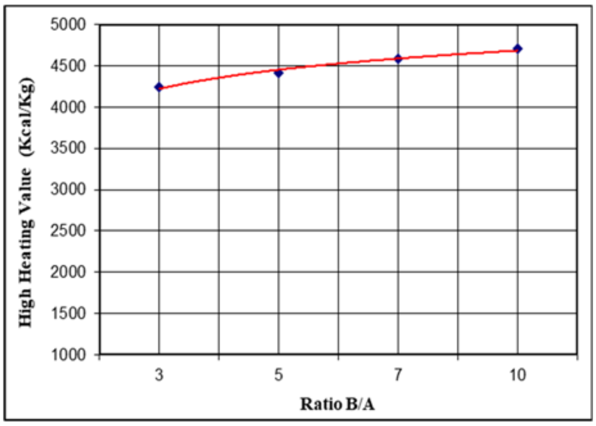

Figure 4. Graph of the relationship between ratio B/A that high heating value

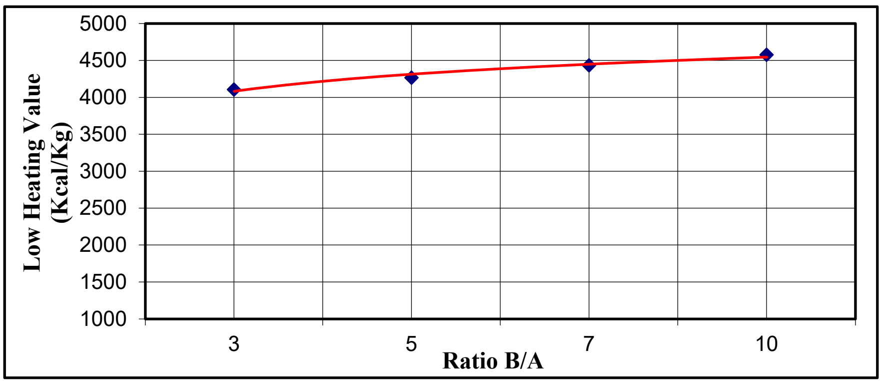

Figure 5. Graph of the relationship between ratio B/A that low heating value

IV. CONCLUSION

Based on the research results, it can be concluded that the average moisture content of the biochar samples was 3.1%, while the dry content was 96.9%. The high heating value experienced an average increase of 3.54% in line with the greater amount of starch contained in the biochar briquettes. Likewise with the low heating value there was an average increase of 3.69%. This implies that the less water content contained in the biochar briquettes, the higher the high heating value and low heating values.

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