The Influence of Cast Ring Diameter toward Bagasse Biopellet Heat Value, Moisture, and Ash Content

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Abstract. Bagasse is the dry residue of sugarcane extraction that can be used as an alternative energy, it is as the material of bio-pellet. Before it is casted into bio-pellet, the bagasse is dried by 600^{o} C of temperature. Bio-pellet tested in this research is casted by horizontal pelletizer machine in determined time. The experimental research was conducted to bio-pellet to find out the effects of cast ring diameter toward heat value and water and ash contents. This research used experimental method with three variations of cast ring diameter. The data is obtained from the testing to variances of bio-pellet size. Result of the research shows that cast ring diameter influencing the three variables in bagasse bio-pellet. The significant influence shown by the smallest size of cast ring diameter. The small bio-pellet has minimum water and ash content, but it has optimum heat value. It shows that the quality of bagasse bio-pellet has met the SNI standard, but not with the quality of the ash content.

1. Introduction

Biopellet is an alternative solid fuel (densified fuels) as fossil fuel substitute (oil, gas, and coal) [1]. Biopellet manufacturing aimed to produce biobriquette is mainly made of biomass material. Biomass as biopellet material is generally abundant and is residual material. Moreover, biomass has renewable characteristic. The use of biomass materials is widely implemented on biopellet manufacturing [2][3][4][5][6]. These biomass materials is used to obtain the best qualified biopellet, whether in its mechanical characteristics or in its moisture and calorific value.

The quality of biopellet is influenced by the biomass material or by its production process. As solid alternative fuel from biomass it is also determined by several factors; density, carbon, moisture, ash, and calorific value. Each variable values are different on each biomass. The density value of biopellet influences the characteristics of biopellet as the density also influences the heat and ash [7].

One of biomass materials used as biopellet is bagasse. This biomass is the residue of sugarcane mill with minimum moisture [8]. Indonesia produces abundant of bagasse [1]. Therefore, the utilization of bagasse biomass can be conducted in many fields [9]. One of it is as an alternative energy.

Research on utilizing bagasse with temperature variation had been conducted to obtain good compressive strength [10]. This compressive strength is needed in producing biopellet to result the bulk density. Besides the density, the calorific value with different method of drying bagasse has also conducted [11][12]. This method was conducted to find out the difference of bagasse calorific value when it dried with furnace heating and sun-drying method.

In this research, the use of bagasse biomass as biopellet material is tested on its moisture, ash, and calorific value. Bagasse used in this research is processed without using adhesive material and other mixture. Testing on the three variables were conducted on the specimen with different cast ring diameter, 0.5 cm, 1 cm, and 1.5 cm. This testing was conducted to find out the quality of biopellet.

2. Method

This research uses experimental method by determining variation on biopellet size processed by using *ring die pellet Mill* machine. Variation on the size is aimed to measure the ash, moisture, and calorific value. Value of the three variables is obtained by conducting proximate analysis.

Procedure of this research is conducted by processing bagasse by using *ring die pellet Mill* machine. For this process, the machine is determined in the size of 0.5 cm, 1 cm, 1.5 cm to obtain size variation of pellet. Temperature to process the bagasse is 600^o C. The process is continued with densification for *briquetting* and *pelleting*.

Specimen resulted from *ring die pellet Mill* machine has 0.5 cm, 1 cm, and 1.5 cm diameter size with 3 kg of each weight. All specimen is treated with proximate analysis testing. This test is conducted to know the moisture, ash, and calorific value. From the result of this test, the best biopellet produced from sugarcane bagasse is obtained.

3. Result and Discussion

Test on the specimen is conducted in three times testing. Each is tested on its moisture, ash, and calorific value. On size variation, it shows the different result of testing. Figure 1 shows the average value of moisture from different cast ring diameter. On ring diameter 1.5 cm and 1 cm, the both shows difference on moisture, even it is not too high. Yet, the most significant difference of moisture value is shown by 0.5 cm size of diameter ring. This size resulted the smallest average of moisture. On this diameter, the moisture is slightly higher than biopellet of oil-palm biomass [3]. The difference on this result is caused by the different of compressive temperature on the specimen, where the specimen in this study used 600^o C of compressive temperature, while the oil-palm used 250^o C.

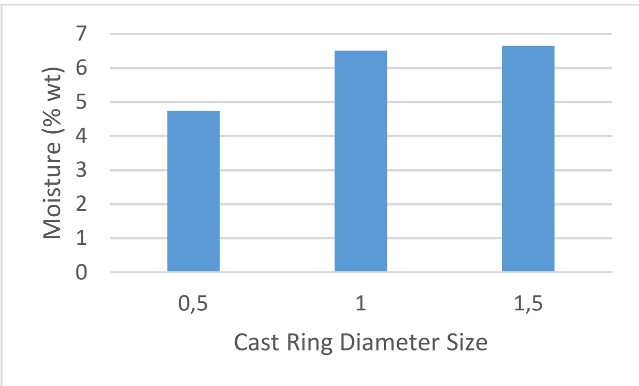

Figure 1. The average value of bagasse biopellet moisture

The ash and calorific value, result of both testing shows difference. On figure 2, it shows that specimen with 1 cm cast diameter ring size has higher ash than the 0.5 cm. However, their difference is slight. The highest ash is resulted by specimen with cast ring diameter size of 1.5 cm. Without determining the composition of biopellet mixture, the ash is different to biopellet with mixture in its composition [13][14].

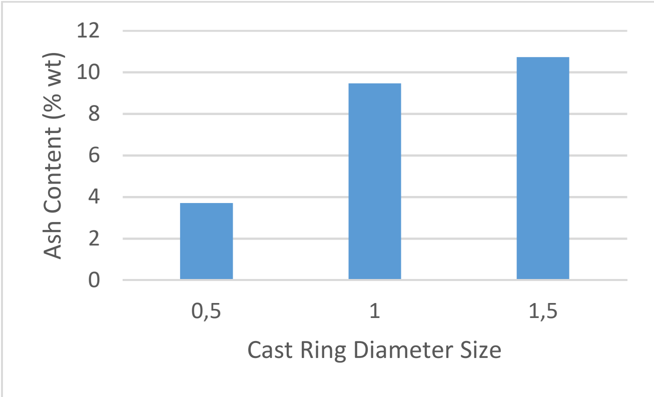

Figure 2. The average value of bagasse biopellet ash

Figure 3 shows the average of calorific value of the three specimen with variation of cast ring diameter size. The highest calorific value is on bagasse biopellet with the smallest cast ring diameter size, 0.5 cm. Result of this calorific value is also different on rubber seed and ater bamboo biomass material [15][16]. Meanwhile, the lowest calorific value is on the biggest cast ring diameter size. The smallest cast ring diameter size of bagasse biopellet shows the optimum calorific value.

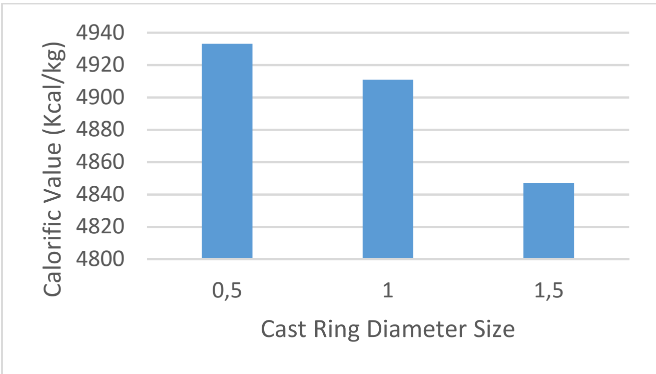

Figure 3. The average value of bagasse biopellet calorific value

4. Conclusion

Variation on cast ring diameter size influences moisture, ash, and calorific value of bagasse biopellet material. From the three variation of cast ring diameter size, there is difference on moisture, ash, and calorific value. The biggest cast ring diameter size has the highest moisture and ash. Yet, with this biggest ring diameter size, biopellet has the lowest calorific value. On the smallest cast ring diameter size, the moisture and ash are very low. Nevertheless, the smallest cast ring diameter has the highest calorific value. From the different value of the three specimen, the most optimum calorific value of bagasse biopellet is in the smallest cast ring diameter size.

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