International Journal of Scientific Engineering and Science
Volume 2, Issue 3, pp. 26-29, 2018. ISSN (Online): 2456-7361

Utilization of Waste Sawdust Mango Wood for Fuel Briquettes as Alternative Energy Sources

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Abstract*—In present work, briquettes are produced from waste sawdust mango wood.Briquettes have a sized cube shape 5x5x5 cm. The purpose of this research is to know the quality of sawn mango waste briquette waste composed of particle of 10 mesh, 20 mesh, 30 mesh and 3% adhesive variation, 4%, 5%, 6%, 7%. based on SNI Standard (Standar Nasional Indonesia) Wood Charcoal Quality Standard No.1 / 6235/2000.The result of the research based on the variation of particle size of briquette making agent of sawn timber waste briquette, showed optimal result according to SNI Standard, on briquettes composed of 30 mesh particle size, water content 2.04%, ash content 6.65%, heating value 6135.35 cal / g. While based on adhesive variation showed optimal results on briquettes composed of 30 mesh particle size with 6% adhesive, which resulted in water content 2.07%, ash content 7.52%, heat value 6198.41 cal / g, was in accordance with SNI Standard.*

Keywords *— Briquettes, manga wood, sawdust.*

I. Introduction

At this time most of the energy used by the people of Indonesia comes from fossil fuels, namely fuel oil, coal, and gas. The disadvantages of using fossil fuels are not only destructive to the environment, nor are they nonrenewable and unsustainable, and over a period of time will be exhausted. In addition, fluctuations in the price of fuel oil (BBM) in Indonesia is still unstable, due to the absence of clear price benchmarks between one region with other regions, making it more difficult for consumers. In addition to fuel, energy sources also experience an increase in price is LPG gas. Therefore it is necessary to create another energy source that can be used to replace the role of fuel and gas.

Several types of waste such as wood cutting industry waste can be utilized as alternative energy source of replacement of fuel and gas. According by [1] to treat the waste becomes more useful and economic value, it needs an alternative technology that is made charcoal briquettes. Mango sawdust waste is the choice as raw material of briquettes due to the utilization of mango wood as logs in Indonesia is quite large, let alone Indonesia as one of the suppliers of log supply. Besides, Indonesia is also one of the countries with the highest level of mango production number 6 worldwide in 2007.With the harmonious quantity of mango production and high roundwood production, mango wood is one of the preferred wood cutting industries to be used as raw material for furniture and handicrafts.

The purpose of this research is to know the quality of sawn mango waste briquette waste composed of a particle size of 10 mesh, 20 mesh, 30 mesh and 3% adhesive variation, 4%, 5%, 6%, 7%. based on SNI Wood Charcoal Quality Standard No.1 / 6235/2000 [2].

II. Material And Method

Some research has been done on charcoal briquettes by using some materials: already done by [3] and [4] that is using rice husk with variation of adhesive material and tested Proximate yield ash 1.502%, water content 8,031%, volatil mater 89,11% carbon content of 0.183% and heat value of 4270.90 calories / gram. Conducted heat test on briquettes made from botom ash waste Steam Power Center and coffee shell biomass with different variations of adhesive type composition, yield average heat value is 2498,27 cal/gram by [5]. Tested the heat value of briquettes from corn cobs and rice husks for 6078 cal/gram and Fix carbon 34.64% [6]. Conducted briquette research from leather jackfruit waste with variety of grain size tested Proximate with best result is briquettes prepared particle size 80 mesh yields heat value 5864,275 kal/kg, ash content 8,553%, moisture content 7,981%, Volatil matter 25,0655 and Fix carbon 58,401% [7].

(a) Pyrolisis (b) Extrusion
(c) Particle (d) Briquettes
Fig. 1. Briquettes production.

This research phase begins with the removal of sawdust sawn mango waste from one of the mango slaughtering business in Bantul, Yogyakarta. The next process is the sterilization of sawn waste waste until the water content is 11.28% and followed by pyrolysis process at ± 300 ° C. so that waste sawdust mango wood turns into charcoal. Then charcoal is crushed to be used as a grain of particle with a size of 10 mesh, 20 mesh and 30 mesh. The next stage is a grain of charcoal with a variety of sizes mixed with water and 5% adhesive, then printed with a briquette printing machine. Then tested the moisture content, ash content and calorific value to determine the quality of the most optimum briquettes or approaching SNI Charcoal Wood Briquette Quality Standard No.1 / 6235/2000.Based on the optimal result of briquette according to the size of the particle size, continued the production of briquettes again using tapioca adhesive with variations of 3%, 4%, 5%, 6%, 7%.Against the resulting briquettes conducted testing of water content, ash content and heat value.

III. Resul and Discussion

A. Result of Water Content Analysis to Particle Size

TABLE I. The results of briquette testing based on variations of particle size.

Particle size (mesh)	Test parameters		
	Water content (%)	Ash content (%)	Heating value (cal/g)
SNI 01-6235-2000	8	8	5000
10	2,03	7,98	5757,26
20	2,01	6,11	6057,85
30	2,04	6,65	6135,35

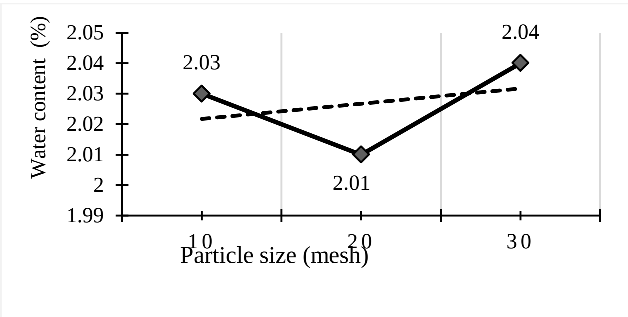

Fig. 2. Graph of the relationship of water content to particle size

Based on Table I and Fig. 2, the lowest water content of 2.01% is found in sawn mango waste briquettes composed of 20 mesh particle size, while the highest water content of 2.04% is on briquettes composed of particle size 30 mesh. According to Fig. 1, the larger the grain size of the particle, the smaller the moisture content, and also in terms of the particle size of the briquette constituents, there is a difference between the pores between the particles capable of storing water.

When the drying process, on briquettes composed of 10 mesh particle size have a lower density than the size of 30 mesh that has a higher density, so that with a low density makes the pores larger so that evaporation of water is much easier than with a more density high. This is what causes the water content on the briquettes are arranged particle size 10 mesh less water content compared with the particle size of 30 mesh.

B. Analysis of Ash Content to Particle Size

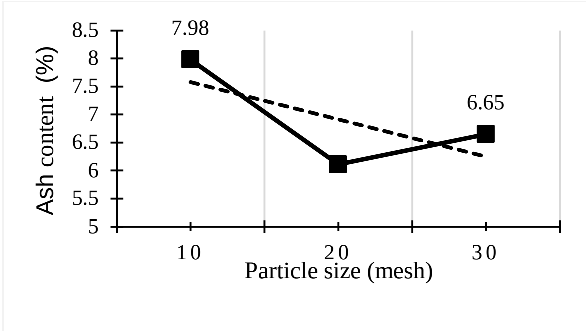

Fig. 3. Graph of the relationship of ash content to particle size.

Based on Table I and Fig. 3, the lowest ash content of 6.11% is in briquettes of sawn mango sawdust waste composed of particle size of 20 mesh, while the highest ash content of 7.98% is on briquettes composed of particle of 10 mesh. According to Fig. 2, the larger the size of the particlesize used to make the briquettes, the higher the ash content. Thus the size of the grains of particle has a significant effect on the ash content.

In terms of particle size, high-density briquettes show density values, compressive strength, ash content, bound carbon and higher heating values compared with low-density briquettes. This is due to the tapioca flour used as a glue has a volatile nature, so the pores become larger but the tapioca further evaporates and cannot be perfected in the combustion process, so the briquettes are not completely burned as a result the ash produced is quite high.

C. Result of Heat Value Analysis to Perticle Size

Based on Table I and Figure 4, the lowest heating value of 5757.26 cal / g is in the waste briquettes of mango sawn plywood composed of 10 mesh particle size, while the highest heat value of 6135.35 kal / g is on briquettes arranged in particle size 30 mesh. This means the smaller the size of the particle size on the waste briquettes sawn mango wood powder will be the higher the heat value

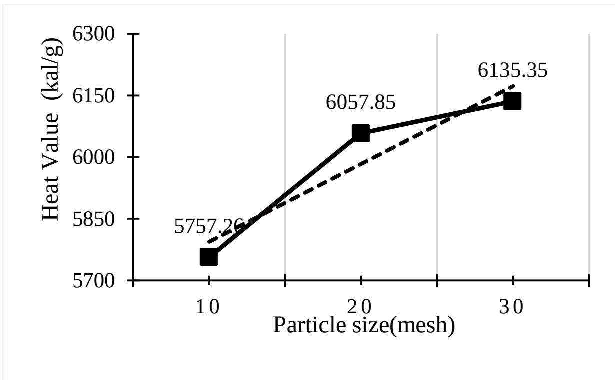

Fig. 4.Graph of heat value relationship to particle size.

The results of research shows that the heta value of briquette charcoal which is composed of all the charcoal sizes turned out to have exceeded the heating value of SNI No.1 / 6235/2000 Wood Charcoal Quality Standard which is 5000 cal

/ g.Viewed from the size of the particle will affect the briquette density, and from this density will affect the heta value of briquettes.

D. Result of water content analysis to variation of adhesive quantity

Based on Fig. 5, the lowest water content of 2.01% is contained in sawdust waste briquettes of mango wood with 7% adhesive amount, while the highest moisture content of 2.31% is found in briquettes with 4% adhesives, lowest moisture content and highest still in accordance with the water content in SNI Charcoal Wood Briquette Quality Standard No.1 / 6235/2000.

TABLE II. The results of briquette testing based on variations in the number of adhesives.

Number of adhesives (%)	Test parameters		
	Water content (%)	Ash content (%)	Heating value (cal/g)
SNI 01-6235-2000	8	8	5000
3	2,26	8,34	6034,56
4	2,31	7,77	6023,93
5	2,04	6,65	6135,35
6	2,07	7,52	6198,41
7	2,01	7,98	6093,68

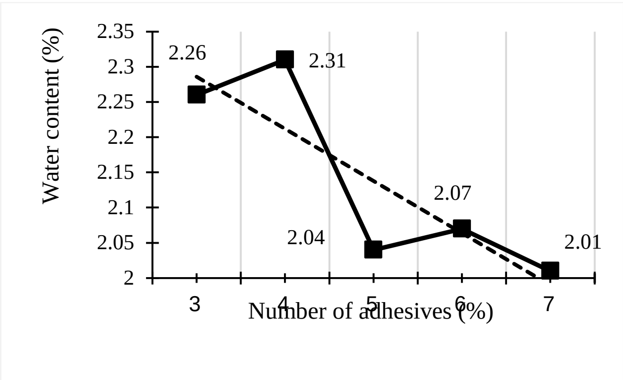

Fig. 5. Graph of the relationship of moisture content to the number of adhesives.

It can be said that the less the amount of adhesive used in the manufacture of briquettes, the higher the water content. This can happen because the amount of adhesive that is slightly presentasenya cannot absorb the water content in the grains of charcoal turned to the percentage of the number of more adhesives can more effectively absorb the water content in the grains of charcoal.

E. Analysis of Ash Content to Variation of Adhesive Amount

Based on Figure 6, the lowest ash content of 6.65% is contained in sawdust waste briquettes of mango wood with 5% adhesive amount, while the highest ash content of 7.98% is found in briquettes with 3% adhesive amount. The lowest and highest ash content is still in accordance with ash content in SNI No.1 / 6235/2000 Wood Charcoal Briquette Quality Standard.

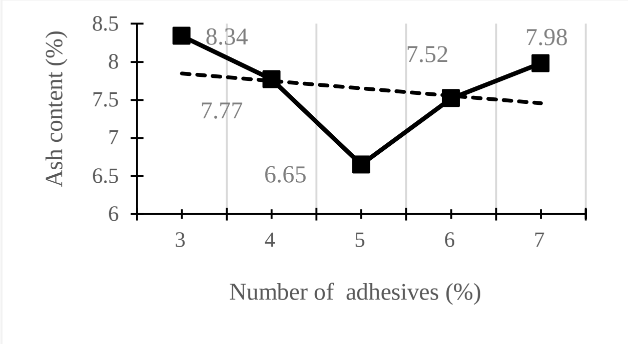

Fig. 6. Graph of the relationship of ash content to the number of adhesives.

So the less the amount of adhesive used the higher the ash content, due to the nature of the tapioca adhesive which tends to be easier for the process of combustion better and evenly so that the resulting ash less.

F. Result of Heating Value Analysis to Variation of Adhesive Number

Based on Figure 7, the lowest heat value of 6023.93 Kal/g is found in sawdust waste briquettes of mango wood with 4% adhesive quantity, while the highest heating value of 6198,41 cal/g is found in briquettes with 6%. So with the amount of adhesive addition on the waste briquettes sawn mango sawdust the higher the heating value. The lowest and highest value of calor has exceeded the heating value of SNI No.1 / 6235/2000 Wood Character Bricket Quality is 5000 cal/g.

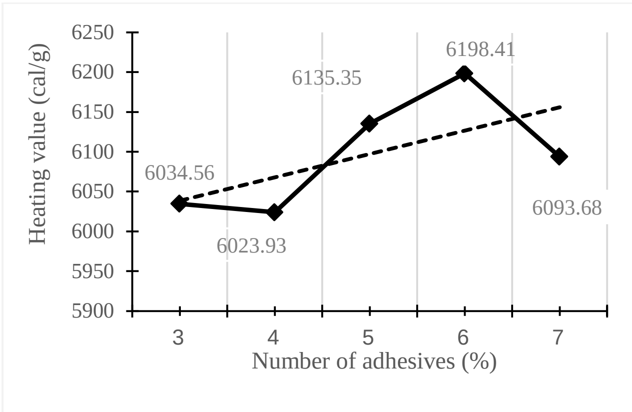

Fig. 7. Graph of the relationship of heat values to the number of adhesives.

IV. CONCLUSION

Mango sawdust waste waste can be reused as charcoal briquette material. Based on variation of particle size of mango sawn wood waste waste between 10 - 30 mesh with 5% adhesive mixing, the optimum result is obtained on the particle size of 30 mesh, contained 2.04% water content, ash content of 6.65%, and the heating value 6135.35 cal/g. According to grain and adhesive variations of 3% - 7%, the optimum yield is 6% adhesive, containing 2.07% water content, ash content 7.52% and heating value 6198,41 cal/g.

Briquettes from mango sawdust waste composed of 30 mesh particle with 6% adhesive, 23.3 grams of charcoal grains and 1.48 grams of tapioca glue, the result of water content

Volume 2, Issue 3, pp. 26-29, 2018. ISSN (Online): 2456-7361

analysis, ash content and heating value are in accordance with Charcoal Charcoal Quality Standard Wood SNI No.1 / 6235/2000.

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