The effect of used lubricating oil volume as a binder on the characteristics of briquettes made from corn cob and coconut shell.

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Abstract. The use of agricultural solid waste is one alternative source of energy substitutes, generally made into charcoal briquettes. In making charcoal briquettes, binder is needed to bind charcoal particles. In this study used vehicle lubricating oil was used as an alternative binder. Charcoal briquettes 600 mesh from corn cobs and coconut shell waste are made on the composition of raw materials of 75% corn coke charcoal, 25% coconut shell charcoal with a total weight of 100 grams. In each mixture, SAE 40 used lubricating oil was given with variations of 5 ml, 10 ml and 20 ml. Then each raw material weighing 16 grams was put into a mold measuring 2.2 cm in diameter and 6.33 cm high and pressurized by using a hydraulic press for 15 minutes until the briquette was formed. The results of the study showed that adding 20 ml of used lubricating oil gave the best characteristics of charcoal briquettes.

1. INTRODUCTION

Supporting the continuity of national development, the energy sector has a very strategic role [1]. Fossil fuels are the most important energy sources and their consumption is increasing day by day, due to increasing population and industrial growth in developing and developed countries [2]. As a result, fossil fuel reserves such as petroleum, natural gas and coal which have been the main sources of energy are running low [3]. This decline in reserves of major energy sources raises concerns about the scarcity of fuel in the future. Therefore, the reduction in reserves needs to be found an alternative solution.

The used of agricultural and plantation solid waste is one alternative energy source [4,5]. Generally the solid waste is made into charcoal in the form or charcoal briquettes [6,7,8]. In the manufacture of charcoal briquettes made from agricultural and plantation waste, it is needed a binder to bind the charcoal particles to each other and not be easily destroyed. The binders can be organic or inorganic agents. Some of the identified binders of organic nature are heavy crude oil, starch and molasses. The inorganic binders include clay, sodium silicate and cement [9]. Various types of adhesives used in the study include tapioca flour [8], cornstarch, pectin [10], lubricating oil sludge [11], coal tar and coal tar sludge [12], sago starch [13]. The binder types, the number of binder agents and water addition, have significant effects on the thermal behavior and combustion of the briquettes [14].

Used motorized lubricant oil is very common and is sometimes not recycled again. This is bad for the environment. Therefore the use of used motorbike oil is an alternative that can be used as a binder as well as used material that still contains calorific value that may still be

used. For this reason, this study seeks to determine the effect of the use of used vehicle oil by varying its volume on the characteristics of charcoal briquettes made from a mixture of corncobs and coconut shells.

2. MATERIAL AND METHODE

2.1 Material

The materials used in this study are corn cobs from agricultural land in Karo land, Sumatra and coconut shells obtained at traditional markets in the city of Medan, Indonesia. Meanwhile the used motor oil used lubricant is SAE 40.

2.2. Method

Corn cobs and coconut shells are first made. The authoring is done by a simple method, namely by a heap. To facilitate the combustion process feed fuels such as wood are used. Furthermore, corn cobs and coconut shells are poured into the fire, then corn cobs and coconut shells are piled with soil. The pile is left for 5-7 hours. After getting the charcoal then it is ground and filtered with MESH 600.

Filtered corn cobs and coconut shells are then made into briquettes in the material composition of 75% corn cobs charcoal, 25% coconut shell charcoal with a total weight of 100 grams. In each mixture SAE 40 used lubricants with 5 ml, 10 ml and 20 ml were added. Then each raw material that has been mixed with used oil is then put into a mold measuring 2.2 cm in diameter and 6.33 cm high. Then 16 grams of charcoal flour is pressurized using a hydraulic press for 15 minutes until the briquette is formed. Each sample variation was made of 3 pieces and taken an average for the value of the briquette density, moisture content, ash content, volatile matter levels, bound carbon content and heat value.

3. RESULTS AND DISCUSSION

The results of the study include analysis of moisture content, ash content, volatile matter content, bound carbon content and heating value as presented in Table 1 below.

Table 1. Characteristics of Charcoal Briquette Mixture of Corn Cobs and Coconut Shell

Variable	Corn Cobs charcoal	Coconut shell charcoal	Corn cobs charcoal 75% : Coconut shell charcoal (25%)			
	Number of volume of used lubricants					
	0 ml	0 ml	0 ml	5 ml	10 ml	20 ml
Density (gr/cm^3)	1,25	1,52	1,39	1,45	1,62	1,81
Moisture content (%)	17,56	12,79	6,27	5,76	5,21	3,59
Volatile matter (%)	68	47,4	7,23	11,5	15,56	16,16
Ash content (%)	2,87	1,56	7,83	6,41	5,72	5,45
Bound carbon content (%)	11,57	38,25	78,67	76,33	73,51	74,8
HHV (kj/kg)	31617	35294	29779	32353	33455	35661
LHV (kj/kg)	28377	32054	26539	29113	30215	32421

Table 1 shown that the density of charcoal briquettes from coconut shell is higher than corncobs. However, in a mixture of 75% corn cobs and 25% coconut shell and the addition of

20 ml of used oil, the highest density of briquette charcoal is due to the higher bond between the charcoal grains.

Likewise for the lowest moisture content value of 3.59% found in the treatment of corncob charcoal composition with coconut shell charcoal mixed with oil (75%: 25% + 20ml). High moisture content in the treatment caused by the bond density between the grains on the charcoal is quite high.

Mixing of corn cobs charcoal and coconut shell charcoal causes a decrease in the value of the evaporation of the charcoal briquettes when compared to corn cobs charcoal briquettes and coconut shell charcoal briquettes. The addition of used lubricating oil will increase the levels of evaporating substances that are on the briquette mixture of corn cobs and coconut shell.

The lowest ash content value of 1.56% was found in the treatment of corncob charcoal composition with coconut shell charcoal (0%: 100%), while the highest value of 7.83% was in the treatment of corncob charcoal composition with coconut shell charcoal (75% : 25% + 0ml). Adding oil to the charcoal briquette mix with corn cobs with coconut shell turns out to reduce ash content.

The lowest value of 11.57% was found in the treatment of corncob charcoal composition with coconut shell charcoal (100%: 0%). With the addition of adhesives made from used lubricating oil, it turns out to be able to increase the levels of carbon bound briquettes.

The heating value greatly determines the quality of charcoal briquettes. The higher the calorific value of the charcoal briquettes, the better the quality of the charcoal briquettes produced. According to Aloysius Kahariayadi [15] the heating value is influenced by water content and ash content of charcoal briquettes. The higher the water content and ash content of charcoal briquettes, the lower the heating value of charcoal briquettes produced.

The lowest HHV calorific value is 29779.49 kJ / kg and LHV is 26539.49 kJ / kg found in the composition of corncob charcoal with coconut shell charcoal (75%: 25% + 0ml), while the highest HHV value is 335661 kJ / kg and LHV of 32421 kJ / kg contained in the treatment of corncob charcoal composition with coconut shell charcoal mixed with used oil (75%: 25% + 20ml). The increase in the heating value of the briquettes produced shows that the corncob charcoal with coconut shell charcoal with more adhesive does have a high heating value.

4. CONCLUSION

The results of this study have shown that, the briquettes charcoal produced from coconut sheel and corncobs with used lubricants as a binder would make good biomass fuels. The following observations were made during the investigation aids in faster combustion, as percentage of volatile matter is more, calorific value high enough to produce sufficient heat, as percentage of moisture content is less.

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