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Biobriquette Characteristics of Mixture of Coal-Biomass Solid Waste Agro

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Abstract. Bio-briquettes are solid fuel made from a mixture of coal with biomass, solid fuel is an alternative fuel replacement for kerosene and gas are the cheapest. Biomass (coconut shells, sawdust and bark durian) chemically has a high carbon content and flammability. Biobriquet made from a mixture of coal - biomass using taro flour as an adhesive and a solution of 50% alcohol as an additive can be used as an alternative fuel economic value. Based on the analysis Proximate and Ultimate, this research data obtained karakteristik bio-briquettes with three variations of a mixture of a mixture of coal-coconut shell charcoal, coal-charcoal sawdust and coal-charcoal leather durian, of the three variations campuran which gives the best results is a mixture of coal-coconut shell charcoal at a ratio of 1: 4 with characteristics, Ash = 2,51%, Moisture = 4.83%, Volatile matter = 28.81%, Sulfur = 0.5445%, and calorific value = 6494 kcal / kg , maing gas emissions in all SO₂ = 103 ppm NO_x = 3 ppm

Keywords: Characteristics, Biobriquette, Coal, Biomass

1. Introduction

One attempt from South Sulawesi use of coal as a fuel is in the form of bio-briquette. However, in using relatively small compared with the use of other energy such as gas and oil. This is due to the low quality of coal, the difficulty of ignition in the combustion process early, so that combustion is less than perfect can cause harmful exhaust emissions (Kuncoro, 2003). As an agricultural country, Indonesia has the wastes produced abundant agricultural and plantation, the community is regarded as useless material, the material contains a high component of volatile matter so flammable and burns (Naruse 1999). If both types of fuel are combined into a bio-briquette the which is a solid fuel to form a Certain size made from a mixture of coal and biomass with little material that serves as an adhesive additive such as paraffin, tapioca flour undergone a process of compression with a specific press power Bio-briquettes as an alternative fuel capable of replacing most of the use of fuel oil and gas are now increasingly reduced.

This study aims to determine the effect of composition of the mixture of coal and biomass to bio-briquette characteristics. The expected contribution of this research is bio-briquette produced can be used as fuel for the secondary industry, small and household especially in Makassar. For local governments are expected as input to increase revenue, but it can provide benefits to science.



2. Research Methodology

2.1. Material

The main material used in this study comes from coal mining coal in the village of the District Pattukku Lappaiaja Bone regency of South Sulawesi and biomass obtained from around the city of Makassar.

Proximate and Ultimate analyzes performed in the Laboratory SUCOPINDO Makassar, and as for the results of the analysis are presented in Table 1 below:

Table 1: Comparative Table Characteristics of Coal and Biomass

Parameter	Value / Price			
	BB	ATK	ASG	AKD
<i>Proximate</i>				
Ash (%)	5,55	1,56	3,38	15,93
Moisture (%)	12,09	2,00	2,28	4,13
Volatile Matter (%)	43,96	21,30	25,59	26,50
Fixed Carbon (%)	38,40	74,17	67,51	51,36
<i>Ultimate</i>				
Total Sulfur (%)	3,15	0,032	0,341	0,027
Heating Value (kcal/kg)	6040	7282	6941	6299

BB= Coal, ATK= Coconut Shell Charcoal, ASG= Charcoal Sawdust, AKD = Charcoal Leather Durian

2.2 Observation Research

The variables were observed in this study are: Variations adhesive composition with a mixture of coal-biomass (K): 0%; 20%; 40%; 50%; 60%; 80%; 100% of the bio-briquette characteristics.

2.3 Research Procedure: Preparation and Characterization of Mixed Coal - Biomass

At this stage the coal prior digrinding then sisved to obtain a uniform particle size with a grain size between 50-100 mesh or (100 m) by filtration. While biomass (coconut shells, sawdust and bark durian) that have been drained, performed carbonization process. then crushed and sisved to obtain a uniform particle size as well as the coal is between 50-100 mesh were further characterized coal and biomass that include: proximate analysis (moisture content, ash, volatile matter and fixed carbon), ultimate analysis (composition C, H, O, N, S), sulfur content, heating value and specific gravity. This method follows the standard procedure of the American Society for Testing and Materials (ASTM, 1980).

2.3 Mixing Coal with Biomass

After all materials (coal, biomass and adhesive) further characterized the mixing is done with a certain ratio which further characterized return include: proximate analysis (moisture content, ash, volatile matter and fixed carbon), ultimate analysis (composition C, H, O, N, S), sulfur content (total, pyrite, sulfate and organic), calorific value and specific gravity.

2.4 Briquetting

Container inserted into a coal-biomass flour mixture with a certain ratio, the mixture is added into the adhesive 10-15% of the total mixture, given the warm water temperature of +60 ° C, stirring until becoming homogeneous. Then the mixture is put into a mold and then pressed / pushed until it reaches a certain pressure for 5 minutes. Furthermore, the briquettes are terbetuk removed from the mold and then dried, the drying can with sunlight or other dryer.

3 RESULT AND DISCUSSION

Bioquette characterization process, a mixture of coal-biomass briquette is based on two analyzes that Proximate analysis (Ash, Moisture, Volatile matter and Fixed Carbon) and Ultimate analysis (Sulfur, and Heating Value).

3.1 Proximate Analysis Biobriquette

3.1.1. Levels of Ash Biobriquette As a Function of Composition the Coal-Biomass Mixture

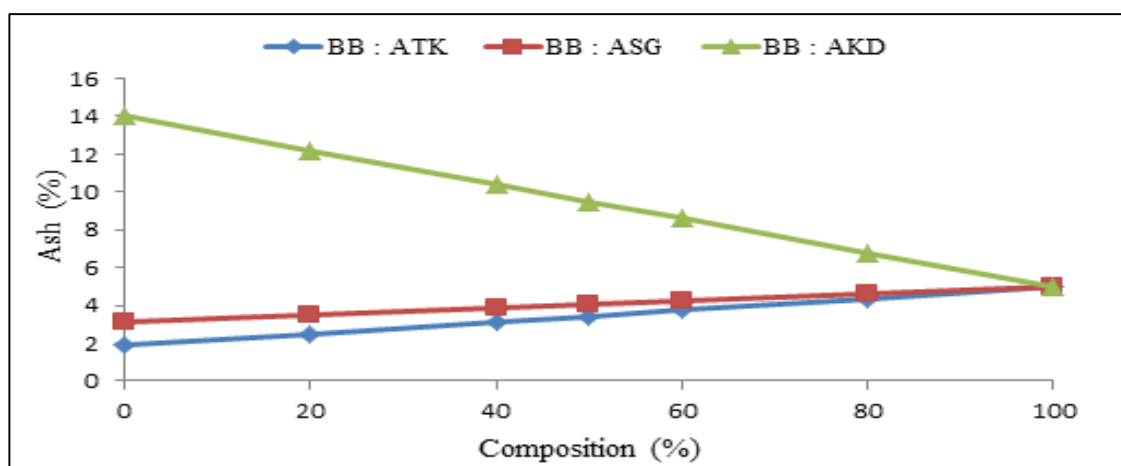


Figure 1a: Profile Levels Ash Bio-briquetteAs a function of composition Mixed Coal –Biomass

In the graph (figure-1a) is apparent that the ash bio-briquette increase with the composition of the coal in the mix, it is due to the chemical composition in the form of ash / ash in the biomass is lower than the coal that is less than 1%. While coal - quite the contrary durian skin charcoal ash / ash bio-briquette decreased with increasing the composition of the coal in the mix, this occurs probably due to the chemical composition of the durian skin is generally dominated by the carbon component in the form of compounds cellulose highly flammable, so that when the process is not properly controlled charcoal then consequently more durian skin burned, so that the ash produced bio-briquettes will increase, in addition to the increased levels of ash occurs because at no additional adhesive bio-briquette of 15% of the total weight of the mixture of coal – biomass.

In this study, the levels of ash low of 2.51% for the mixture of coconut shell charcoal, 3.47% charcoal sawdust to mix these conditions obtained on the composition of 20% coal and 80% biomass charcoal while ash / ash which is the highest obtained at 4.37% for the mixture of coconut shell charcoal, 4.61% for the mixture of sawdust charcoal, and this condition is obtained on the composition of 80% coal

and 20% biomass charcoal. As for the mixture of coal - durian skin, ash / ash a low of 6.79% was obtained at a composition of 80% coal and 20% charcoal durian skin and ash / ash is highest of 12.20% was obtained in 20% of coal composition and 80% biomass charcoal. Based on the standard specification of solid fuels for households that Nasinal Industry Standard (SNI) No. 01-6235-2000 namely ash / ash bio-briquette in mixture of coal - biomass is less than 8%, only bio-briquette from a mixture of coal-skin durian higher than 8%.

3.1.2. Moisture Bio-briquette As a Function of Composition Mixed Coal - Biomass

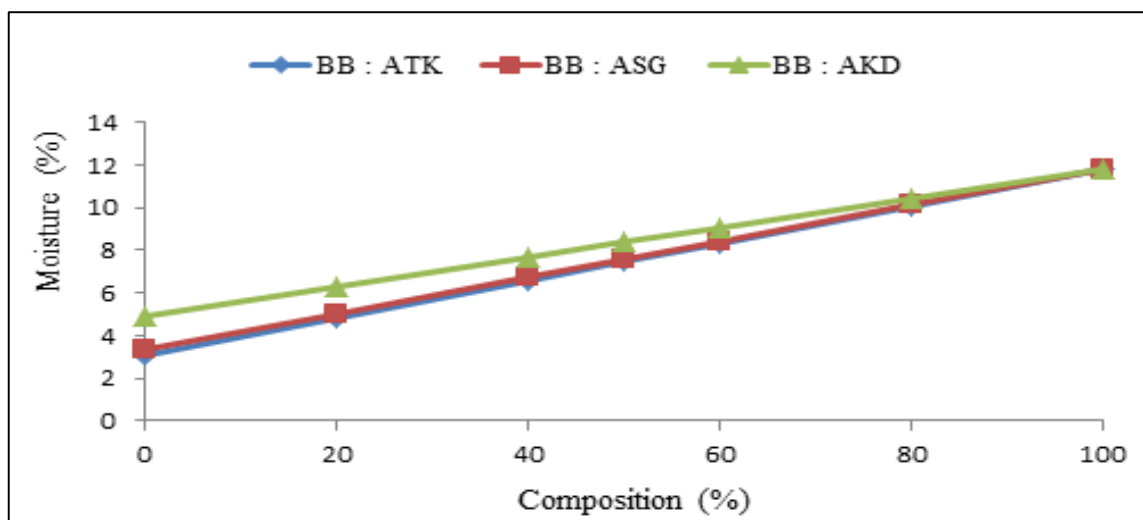


Figure 1b: Profile Moisture Bio-briquette As a function of composition Mixed Coal - Biomass

In the graph (Figure 2b) shows the water content / moisture on three types of bio-briquette increase with the composition of the coal in the mix. In this study, the levels of water / moisture a low of 4.83% for the mixture of coconut shell charcoal, charcoal mixture 5.02% to 6.32% sawdust and charcoal to mix durian skin, this condition is obtained on the composition of the mixture of coal 20% and 80% biomass charcoal. While the content of water / moisture highest of 10.09% was obtained for the mixture of coconut shell charcoal, 10.14% for mixed charcoal sawdust and 10.46% for durian skin and this condition is obtained on the composition of 80% coal and 20% biomass charcoal. Based on the standard specification of solid fuels for households that Nasinal Industry Standard (SNI) No. 01-6235-2000 the water content / moisture on the three types bio-briquette all meet the reservations is moister less than 8%.

3.1.3. Levels of Volatile Matter Bio-briquette As a function of composition Mixed Coal – Biomass

Volatile matters in the solid fuel serves as stabilisai flame and accelerate the initial combustion. The greater the volatile matter content in the fuel the faster burning fire and ignition time is getting shorter and conversely the smaller the volatile matter content of it will be difficult in the initial ignition.

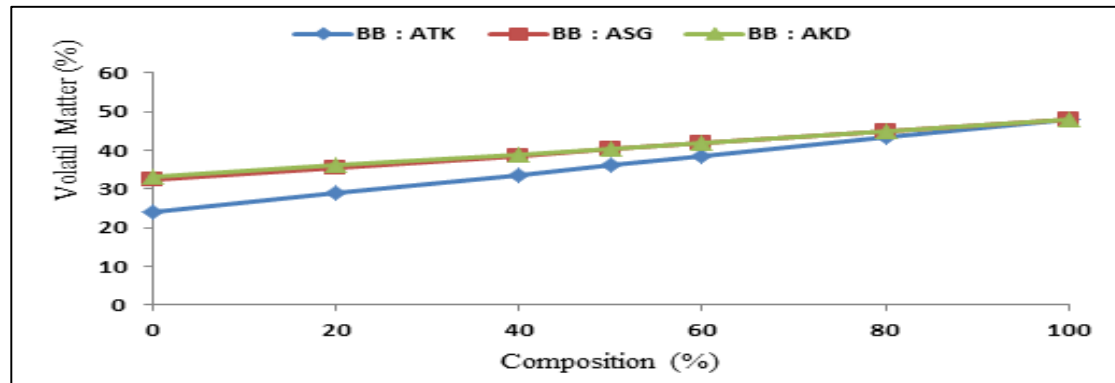


Figure 2c: Profile Levels of Substance Fly / Volatile Matter Bio-briquette

On the graph shows that the volatile matter in the three types bio-briquette, increases linearly with increasing the composition of the coal in the mix. This phenomenon occurs because the volatile matter of coal is larger than the three types of biomass.

In this study, a low volatile matter content amounting to 28.81% for the mixture of coconut shell charcoal, charcoal mixture of 35.45% to 36.02% sawdust and charcoal to mix durian skin, the condition is obtained on the composition of 20% coal and biomass charcoal 80%. When viewed from the reservations for solid fuels according to StandartNasinalIndustriss (SNI) No. 01-6235-2000 then the value is not yet meet the standards which must be less than 15%.

3.2 Analysis of Ultimate Bio-briquette

3.2.1. Levels of Sulfur Bio-briquette as a Function of Coal-Biomass Mixture Composition

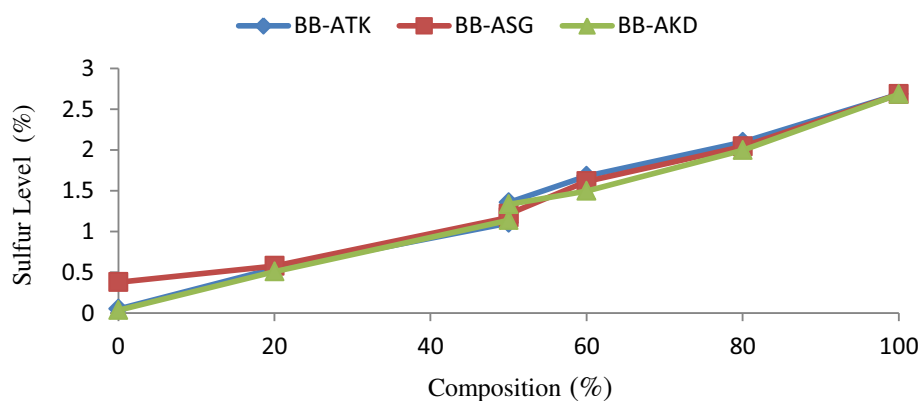


Figure 3a: Profile Levels of Sulphur content Bio-briquette: composition Mixed Coal – Biomass

In the graph (Figure 3a) shows the levels of sulfur in all three types of bio-briquettes are increased with the composition of the coal in the mix, it is because coal is used in this study has a high sulfur content is 3:14%, while blending with biomass Low sulfur, then automatically bio-briquette sulfur content will increase with the increase in the composition of the coal in the mix. Sulfur bio-briquettes obtained lows of 0.54 (%) for bio-coal briquettes mix - coconut shell charcoal, 0.57% for bio-coal briquettes mix - sawdust charcoal and 0.51% for bio-coal briquettes mix - charcoal durian skin, the condition is obtained on the composition of 20% coal and 80% biomass. While the highest levels of sulfur bio-briquette obtained at 2.10% for coal mixture bio-briquette - coconut shell charcoal, 2.042% for coal mixture bio-briquette - sawdust charcoal and 2.00% for coal mixture bio-briquette - charcoal durian skin and this condition is obtained on the composition of the coal 80% and 20% biomass charcoal. Under the second condition of a mixture of coal - biomass can be concluded that the most suitable for use as raw material for the manufacture of bio-briquette fuel is a mixture of K2 is 20% coal and 80% biomass charcoal on the grounds that the levels of sulfur was taken 1%.

3.2.2. Value Caloriss Bio-briquettes As Mixture Ratio Function Coal - Biomass

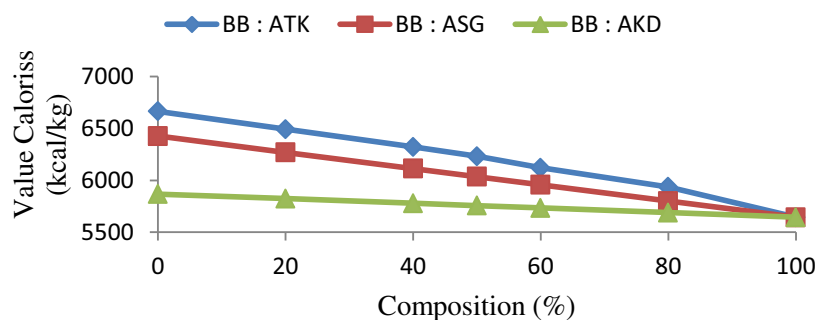


Figure 3b: Profile Value Caloriss Bio-briquettes as a function of composition Mixed Coal - Biomass

From the graph shows that the calorific value of the bi-obriquet third -biomassa coal mixture decreases with the increase of coal composition. Decrease the caloric value due to fixed carbon content in the biomass charcoal third higher than coal, biomass charcoal in addition there is also a third component that is bonded carbon in the form of chemical compounds in the form of compounds cellulose and carbohydrates. Differences in the chemical composition of coal with biomass charcoal is clearly the third carbon content in coal is lower than the third charcoal biomass and thus the calorific value of coal is also lower than in the biomass charcoal respectively calorific value of coal 6040.41 kcal / kg, coconut shell charcoal 7281.98 kcal / kg, charcoal sawdust 6941.00 kcal / kg and charcoal leather durian 6298.67 kcal / kg.

In this study, obtained the highest bio-briquette caloric value of 6493.69 kcal / kg that is bio-coal briquettes from a mixture of coconut shell charcoal in the composition (K2) yatiu 20% coal and 80% coconut shell charcoal and a low of 5688.75 kcal / kg is bio-coal briquettes from a mixture of charcoal durian skin on the composition (K6) or 80% coal and 20% charcoal durian skin.

4 CONCLUSION

Based on the analysis Proximate and Ultimate bio-briquette characteristics obtained with the composition of the mixture of 20% coal and 80% biomass as follows

4.1. Proximate:

4.1.1. Mixture of coal - coconut shell charcoal

Ash = 2.51%; Moisture = 4.83%; volatile matter = 28.81%; Fixed Carbon = 62.82%

4.1.2. The mixture of coal - sawdust charcoal

Ash = 3.47%; Moisture = 5.02%; Volatile Matter = 35.45%; Fixed Carbon = 55.26%

4.1.3. The mixture of coal - charcoal leather durian

Ash% = 12.20%; Moisture = 6.32%; Volatile Matter = 36.02%; Fixed Carbon = 44.02%

4.2. Ultimate:

4.2.1. Mixture of coal - coconut shell charcoal

Total Sulfur = 0.55%; Calorific value = 6494 kcal/kg

4.2.2. The mixture of coal - sawdust charcoal

Total sulfur = 0.58%; Calorific value = 6270 kcal /kg

4.2.3. The mixture of coal - charcoal leather durian

Total sulfur = 0.51% ; Calorific value = 5824 kcal /kg

Based on the standard specification of solid fuels for households that Nasinal Industry Standard (SNI) No. 01-6235-2000 that greater calorific values to 5000 kcal / kg, so the bio-briquettes from a mixture of coal - biomass charcoal is very fit for use as a solid fuel for the above calorific value of 5000 kcal / kg.

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