velopment_of_Coal_Blending_Method__A4-ADIARSO_MF_Sisest_2009.pdf

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Development of Coal Blending Method for Better Characteristics

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ABSTRACT

Coal blending is an attractive solution for substitute coal as it is simple to apply, and considered to be cost effective. It is widely used either in coal mining to enhance its market acceptance or in coal power plants to meet the boiler fuel specification. The conventional coal blending system does not mostly consider the importance of size and distribution of the parent coals. The properties of blended coals will vary due to wide range of their parent coals' size and their distribution leading to unexpected blended coals characteristics. A better homogenity of the blended cols characteristics is particularly needed for a better performance of pulverized boiler in a power plant. This paper describes our preliminary development on coal blending method for achieving better characteristics of the blended coals. A small scale continuous coal blending unit has been developed to investigate the validity of the blending method. Our preliminary results indicate a better homogenity of the blended coals when the parent coals are in uniform and smaller sizes prior to blending.

1. INTRODUCTION

Indonesia is fortunate in having an abundant coal reserve. However, most of the Indonesian coal, i.e. about 60 %, is categorized as a low rank coal. Mean while, properties of the coal varies over wide range. More specifically, low rank coal is characterized by greater fractions of moisture and volatile matter, contains less fixed carbon and heating value.

Strategies for increasing the added value of this kind of coal have been the main attention. Technical assessments on upgrading the low rank coal is one of our concerns. Coal blending is an attractive solution because of some reasons. For one thing, coal blending is generally speaking simple and has been applied widely either in coal mining or coal power plants. Second, it also considered to be a cost effective as it consists mostly of simple mechanical equipments.

Coal blending is generally concerned by the coal miners when their coals are out of market specification. Also, the coal is often not technically suitable as fuel used in the boiler of power plant since the design of coal fired boiler usually refers to the use of a narrow range of coal characteristics (Stultz & Kitto, 1992). This will lead to the requirement of a substitute coal, which is either still in form of single coal or blended coals.

For practical consideration, heating value (HV) and moisture (TM) content are normally to be the major parameters for the coal blending. Sulfur (S) and ash contents are also sometimes considered mainly due to tight environmental limitations. In general, the resulted contents of the above parameters in the product of blended coals are simply calculated proportionally. Our previous studies (Adiarso, et. al., 2008) as seen in Figure 1 and 2 show that the above assumption is practically accepted at the deviation level below 5 %, and can be used as a tools for making coal blending decision.

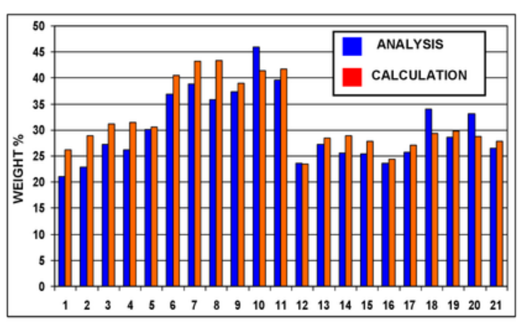


Figure 1. Differences in Moisture Content of

Blended Coals Obtained from Proportionally Calculation and Laboratory Analysis.

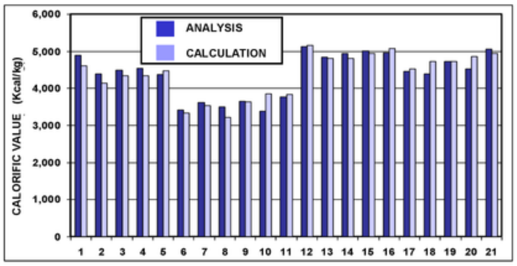


Figure 2. Differences in Calorific Value of Blended Coals Obtained from Proportionally Calculation and Laboratory Analysis.

Fusion temperature of ash in coal (AFT) is also an important parameter, particularly when concerning the operability of the running boiler, regardless using single or blended coals. AFT refers to the fusing temperature of the ash that remains after coal combustion, and is identified as four deformation temperatures, i.e. initial deformation (IT or ID), softening (ST), hemispherical (HT), and fluid (FT) temperatures. To avoid ash deposition, coal should have AFT higher than furnace exit gas temperature (FEGT) in the pulverized boiler, which is usually designed up to 1,200 °C. Due to practical consideration, AFT of blended coals is also simply calculated proportionally.

However, our understanding is that AFT of the blended coals is not always proportional with the AFT of the parent coals ratio. Qiu, et. al. (1999). reported that the blended ash softening temperatures do not change linearly with blending ratios. It could lie between or lower or higher than that of the individual parent coals. The results of our previous study as seen in Figure 3 and 4 also confirmed to previous studies that the resulted AFT of the blended coals did not lye between the AFT of individual parent coals. Blending of the coals was considered to give synergistic effect on IT (Figure 3) or antagonistic effect (Figure 4) of the blended coals at certain blended coals ratio.

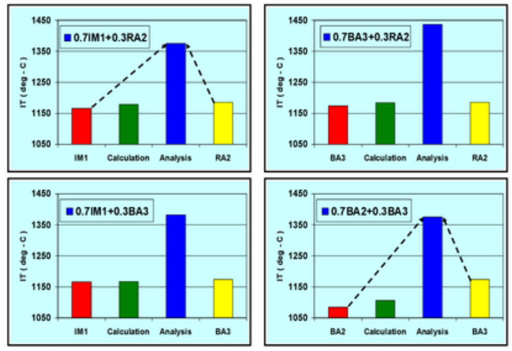


Figure 3. Synergistic Effect of Coal Blending

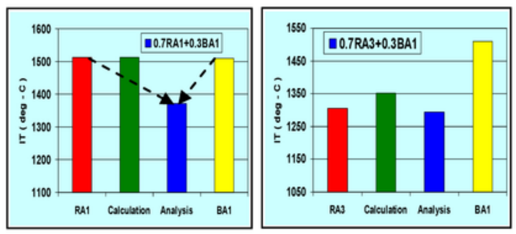


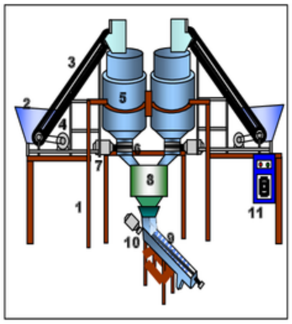
Figure 4. Antagonistic Effect of Coal Blending

To date, the application of coal blending system has been mostly on the mixing of two or more coals without considering the size distribution of the parent coals. In fact, the coal properties vary over wide range of its size. Our understanding is that blending the coals will achieve a better homogeneity of the blended coals when the raw coals are in uniform and smaller sizes prior to blending. This improved blending method is expected to give a better characteristics of blended coals and is therefore needed.

The objective of the study is to develop a coal blending method to meet the technical fuel specification and to enhance the market acceptance by considering the homogenity of the parent and blended coals.

2. EXPERIMENTAL

A calibrated coal blending unit as shown in Figure 5 with the capacity of approximately 300 kg/hr was used in this study. Two kinds of parent coals from South Sumatera Province in which a uniform particles size of 10 mm with 50/50 weight % ratio were used. Since the ash in the coal is considered as an inert material, it will be used as a tie component in evaluating the validity and reliability of the blending process and the blended coals products.



Remark :

1. Equipment Support
2. FeederHopper
3. Belt Conveyor
4. Feeder Motor
5. Silo
6. Rotary Valve Motor
7. Rotary Valve Motor
8. Mixing Tank
9. Screw Conveyor
10. Screw Conveyor Motor
11. I & C Panel

Figure 5. Schematic Drawing of the Equipment

The homogenity of the blended coals and validity of the coal blending unit were observed from the ash content obtained from the proportional calculation and laboratory analysis. All laboratory analysis of the coals refers to ASTM standards (ASTM, 2004).

3. RESULTS and DISCUSSION

Table 1 shows a preliminary result of the study. No significant difference in ash contents of the blended coals was found. The deviation of the ash contents obtained from proportional calculation and laboratory analysis was 1.42 %, which is within the experimental error. The investigation also gave a good results for the moisture, volatile matter (VM), fixed carbon (FC). However, a larger difference in moisture content was found, probably due to some unavoidable losses of moisture and VM during the experiment works and laboratory analysis.

Table 1. Characteristics of the Blended Coals

Parameter	Parent Coal		Blended Coals		Error (%)
	A	B	Analysis	Calculation	
Size (mm)	10.0	10.0	10.0	10.0	0.0
Moisture (*)	18.24	14.89	17.16	16.57	3.44
Ash (*)	4.66	6.41	5.62	5.54	1.42
VM (*)	38.24	38.69	37.94	38.47	1.36
FC (*)	38.86	40.01	39.25	39.44	0.48

(*) *wt % (adb)*

This results may imply that the uniform size of the parent coals may be important factor and needs to be taken into consideration when homogene blended coals is required. **S**uch condition leads to the neccessety for modifying the conventional coal blending method. The principle difference between the conventional blending system with the our proposed blending method is on how to crush the coals.

In the conventional method, coal crushing or pulverizing is normally carried out after blending the coals which is just at the upstream of boiler system. While, in the our proposed method the crushing is carried out prior to blending at a controlled speed for each parent coal, where smaller and uniform sizes of the parent coals is obtained at the required blending ratio. Since the proposed blending system is equipped with primary crushers, a trade off which involving investment and operating costs should be taken into account.

4. CONCLUSION

A preliminary development on coal blending method was carried out to achieve a better characteristics of blended coals. A new method for blending the coals was proposed in this study, where the results of our preliminary study confirmed a good homogenity of the blended coals. This will be particularly useful when guarranteed characteristics of the blended coals is required. Further study is on progress foccussing particularly on the detailed characteristics of the blended coals which covers the physical and chemical properties, and certainly the cost optimization of the unit before scaling up.

5. ACKNOWLEDGMENTS

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ORIGINALITY REPORT

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SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Qiu, J.R.. "The influences of mineral behaviour on blended coal ash fusion characteristics", Fuel, 199906 Publication	1%
2	Clean Coal Technology and Sustainable Development, 2016. Publication	<1%
3	Zhenyu Huang, Yan Li, Dan Lu, Zhijun Zhou, Zhihua Wang, Junhu Zhou, Kefa Cen. "Improvement of the Coal Ash Slagging Tendency by Coal Washing and Additive Blending with Mullite Generation", Energy & Fuels, 2013 Publication	<1%
4	Arita, Susila, and Eddy Ibrahim. "Evaluation of environmental effect of coal stockpile in Muara Telang, Banyuasin, Indonesia", Journal of Physics Conference Series, 2013. Publication	<1%