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Coal Mixing Study in The Optimization of Coal Quality in PT. Alamjaya Bara Pratama Kutai Kartanegara Regency East Kalimantan Province

Studi Pencampuran Batubara dalam Optimalisasi Kualitas Batubara di PT. Alamjaya Bara Pratama Kabupaten Kutai Kartanegara Provinsi Kalimantan Timur

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Abstract

This research activity was carried out at PT. Alamjaya Bara Pratama with the aim of carrying out this activity is, calculating the volume and quality of coal produced from blending activities according to consumer demand, and knowing the factors that affect the quality of coal blending results. The results showed each barge whose specifications were used for the blending formula parameters. On the MV. Ye Huan with 2 barges with reference to AC <7%, TS <1.40%, and CV (gar)> 4700 Kcal/kg. Blending simulation results show the tonnage of coal usage according to the requirements is 217,700 MT, divided into high sulfur coal of 148,000 MT and Low Sulfur coal of 69,700 MT. The factors that affect the quality of coal blending are divided into two factors, namely technical and non-technical factors. Technical factors affect the quality of coal blending results, including the quantity of available coal, the parameters used as the benchmark for blending, adequate blending equipment, good communication between workers, and the availability of production tonnage with the blending plan. Meanwhile, non-technical factors that affect the results of coal blending are the weather during the blending and barging processes, this weather contributes to the ups and downs of the quality of the blended coal.

[*Kegiatan penelitian ini dilaksanakan di PT. Alamjaya Bara Pratama dengan tujuan melaksanakan kegiatan ini adalah menghitung volume dan kualitas batubara yang dihasilkan dari kegiatan blending sesuai permintaan konsumen. dan mengetahui faktor-faktor yang mempengaruhi kualitas hasil pencampuran batubara. Hasil penelitian menunjukkan masing-masing tongkang yang spesifikasinya digunakan untuk parameter formula pencampuran. Di MV. Ye Huan dengan 2 tongkang dengan referensi AC <7%, TS <1,40%, dan CV (gar)> 4700 Kcal/kg. Hasil simulasi pencampuran menunjukkan tonase penggunaan batubara sesuai kebutuhan adalah 217.700 MT yang terbagi atas batubara Sulfur Tinggi 148.000 MT dan batubara Sulfur Rendah 69.700 MT. Faktor-faktor yang mempengaruhi kualitas pencampuran batubara terbagi menjadi dua faktor yaitu faktor teknis dan non teknis. Faktor teknis mempengaruhi kualitas hasil pencampuran batu bara, antara lain kuantitas batu bara yang tersedia, parameter yang digunakan sebagai patokan pencampuran, peralatan pencampuran yang memadai, komunikasi yang baik antar pekerja, dan ketersediaan tonase produksi dengan rencana pencampuran. Sedangkan faktor nonteknis yang mempengaruhi hasil blending batubara adalah cuaca pada saat proses blending dan barging, cuaca inilah yang berkontribusi terhadap naik turunnya kualitas batubara hasil blending.*]

Keywords: Coal, Mixing, Quality, Optimization, PT. Alamjaya Bara Pratama

I. Introduction

The difference in coal quality in the same seam is very likely to occur either laterally or vertically. This situation can be caused by differences in the deposition process, the composition of the constituent, and the accumulation of impurities involved in the coalification process. In addition, the process of extracting and handling coal during mining activities also has the potential to cause differences in coal quality (Saputra et al., 2014).

Blending activities can be used as a way to control coal quality, because when talking about utilization aspects, each consumer has different quality standards depending on their needs. Coal which initially has low quality can be upgraded according to market needs and demands, so that no coal is left or not utilized. Each of these coal quality controls is a major aspect that must be considered and carried out before mixing (Sukandarrumidi. 1995; Ferguson, & McClay, 1997; Sukandarrumidi. 2006). Sampling is also based on the characteristics or characteristics of the sample because in the test, accuracy is needed in testing the precision and deviation of the analysis team's data and from the results of this test, we can only mix and calculate (Muchjidin, 2006; Geoservices, 2005).

The large amount of coal tonnage that will be mixed will determine the success of the blending process, especially with the different qualities of coal produced by the producers (companies) (Kusuma & Darin, 1989; Mulyana, 2005). This requires a technical study to optimize the use of coal owned by companies, both high quality coal and low-quality coal so that all types of coal owned by producers can be used as much as possible while maintaining the quality that consumers want and with maximum tonnage.

Based on the above background, research was carried out to determine the proportion of coal with different qualities in an effort to improve the quality of blending coal so that it can produce mixtures with optimum quantity and quality in accordance with market demand criteria.

II. Methods

Coal Sampling of PT. Alamjaya Bara Pratama

The sampling process in blending is carried out by manual sampling on the conveyor belt along with the loading time, i.e., each blended coal is part of the total lot (consisting of only one lot) or made one lot as a whole (Supriatna et al., 1995).

The standard used in blending sampling is ASTM (American Society for Testing Materials) using the following formula.

$$N = n \sqrt{\frac{\text{Tonase}}{1000}}$$

N is the minimum number of increments and n is a factor in the ASTM standard with the type of dirty coal (because the coal is not washed) for the minimum number of increments is 35.

III. Results

The grouping of coal types based on the total sulfur (TS) value is based on each coal seam produced by the company. The types of coal are grouped into 3 (three), namely:

a. Coal A or low sulfur coal, with a total sulfur (TS) value ranged from 0.10% - 1.00%.
b. Coal B or middle sulfur coal, with a total sulfur (TS) value ranged from 1.01% - 1.50%.
c. Coal C or high sulfur coal. to the total sulfur (TS) value range> 1.50%.

The grouping of coal types based on their placement in the stockpile area is divided into 2 categories, namely.

a. LS (Low Shulpur) is coal of type A which is a combination of several coal products from different seams as well as the initial coal blending stage in the stockpile. Usually separated into 2 places LS and LS 1
b. HS (High Shulpur) is coal of type B or C, or a mixture of types B and C which is a combination of several coal products from different seams as well as an early stage of coal blending in the stockpile. Usually separated into several places depending on blending needs, namely HS, HS 1, HS 2 and soon.

Table 1. Quality of Coal of PT. Alamjaya Bara Pratama

No	Seam	Total Moisture	Inherent Moisture	Ash	Volatile Material	Fix Carbon	Total Sulfur	Calorific Value (adb)
1	Seam 10 HS	26.62	20.51	10.64	34.94	33.91	0.72	4807
2	Seam 11 HS	24.06	18.16	6.67	40.65	34.52	2.42	5009
3	Seam 12 HS	27.12	20.67	6.14	36.45	36.74	2.23	5130
4	Seam 13 HS	25.70	21.10	4.15	38.25	36.50	2.10	5042
5	Seam 10 LS	27.38	22.73	8.30	35.57	33.40	0.40	4629
8	Seam 11 LS	26.45	21.18	8.98	37.19	32.65	0.69	4873
6	Seam 12 LS	26.40	21.14	4.87	37.58	37.32	1.26	5112
7	Seam 13 LS	25.09	19.25	4.29	38.60	38.50	0.84	5327

Coal Blending PT. Alamjaya Bara Pratama

The blending process at PT. Alamjaya Bara Pratama was carried out on the stockpile. The coal coming from the mine will be weighed to determine the tonnage of coal production, then the coal will be processed to the ROM Pile or directly to the Crusher to reduce the size to the same size of 50mm. Furthermore, coal which has uniform size will be poured into the stockpile, in this location the blending process is carried out by opening a hopper tunnel with sizes of 25%, 50%, 75% and 100%. After the blending process is carried out on the stockpile, the coal will be poured using a chute to the conveyor belt leading to the barging.

Coal Blending Mechanism of PT. Alamjaya Bara Pratama

Coal blending of PT. Alamjaya Bara Pratama is done by opening the hopper at sizes of 25%, 50%, 75% and 100%. After opening the hopper, a dozing process will be carried out from the stockpile. The following is the hooper opening width of each C.

Table 2. Opening width of *Hooper* di P T. Alamjaya Bara Pratama

	Hooper Size			opening width of Hooper (m^2)			
Crushing Plant	(m)		(m^2)	25%	50%	75%	100%
CP 01	4	4	16	4	8	12	16
CP 02	3	4	12	3	6	9	12
CP 03	4	8	32	8	16	24	32

Blending methods include:

a. Dozing Process

In this process, the coal from the mine will be carried out in a production process and the resulting coal will be directed to each pile according to its quality. As for the shipping process, it will be carried out by a dozing process. At this time, the coal blending process will be carried out by pushing the coal in the stockpile to the hopper, using 2 dozers that are used simultaneously, then the coal will undergo a transportation process leading to the stacking conveyor. This is when the coal blending process

b. Dozing and Direct Process

In this process, coal from the mine will be produced at the crusher plant and will be directed directly to the hopper at each of the qualities of the coal using a tripper car, this process is called the Direct process. Meanwhile, in stockpile, there is a dozing process from other hoppers for coal with other qualities. So that in this process the coal will be mixed according to the mixing plan that has been prepared. For example, with 3,500 tons of coal taken from the stockpile and 4,000 tons of coal from the Direct mining process.

The results of blending calculations are obtained using parameters from coal specifications with consumers then a formula is made for blending simulations to get the desired results, then the blended coal is sampled for analysis in the laboratory.

The coal specifications demanded by consumers are based on the sale and purchase contract above, the blending calculation simulation is made using the following formula.

$$CV = \frac{(CV1.XT1)+(CV2.XT2)+........+(CVn.XTn)}{XTc}$$

$$XTc = XT1+XT2+.......+XTn$$

$$AC = \frac{(AC1.XT1)+(AC2.XT2)+........+(ACn.XTn)}{XTc}$$

$$TS = \frac{(TS1.XT1)+(TS2.XT2)+........+(TSn.XTn)}{XTc}$$

Notes:

CV : Calorific Value of coal blending (kcal/kg)

XTc : Total of coal blending pile (kcal/kg)

CV1,2… n : Calorific Value of coal blending from 1 until n(kcal/kg)
AC : Ash Content
AC 1,2… n : Ash Content of coal blending from 1 until n (%)
TS : Total sulfur of coal blending
TS 1,2… n : Total sulfur of coal blending from 1 until n (%).

Table 3. Product of blending simulation MV Ye Hun

No	Seam	Volume Crusher	Ash	TS	CV (adb)	CV (gar)
1	Seam 10 HS	2000	10.64	0.72	4,807.00	4437.51
2	Seam 11 HS	1500	6.67	2.42	5,009.00	4647.89
3	Seam 12 HS	1000	5.90	2.20	5,339.00	5031.16
4	Seam 13 HS	1100	4.10	1.68	5,239.00	4835.66
5	Seam 13 LS	1900	4.60	0.71	5,240.00	4819.52
Total		**7500**	**6.72**	**1.40**	**5,091.39**	**4713.41**

Information: AC = Ash Content, TS = Total Sulfur, CV =Calorific Value

Laboratory Analysis Results

From the results of the blending that has been carried out based on the coal sales and purchase contract specifications, then the barging process is carried out at the coal port. The barging process coal is sampled according to the provisions for analysis in the laboratory to determine the quality of the barged coal.

The data from laboratory analysis is then made a resume to make it easier to compare the data with the results of the blending simulation that has been done. The resume of laboratory analysis results is presented in the following table

Table 4. Resume of Laboratory coal product

No	Needed	Barge	Product of Laboratory			
			Tonnage	AC%	TS%	CV Gar
1	MV. He Yuan	Lintas Samudera 86	7500	6.71	1.40	4724.18
		MV. He Yuan YS 00	7500	6.72	1.40	4718.69

Information: AC = Ash Content, TS = Total Sulfur, CV = Calorific Value

From the resume of the laboratory analysis results above, it can be compared with the results of the blending simulation that has been done. The following is a description of the comparison of the results of the blending simulation with the results of laboratory analysis.

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From the blending simulation process above uses a mixture of low quality and high quality to meet consumer requirements, so that low quality coal can be used properly. By using the blending plan above, the value of CV (gar) = 4713.31

Kcal/kg, TS = 1.40%, and AC = 6.72%. From the value of the simulation, it is known that in accordance with the terms of the sales contract with consumers.

However, the blending simulation results are different from the laboratory results of PT. ABP, namely CV (gar) = 4724.12 Kcal/kg, TS = 1.40%, and AC = 6.71%. The difference is still in accordance with the terms of the contractual agreement with the consumer, so it can be sent by the Shipping Department, with results. is 217,700 MT, divided into 148,000 MT High Sulfur coal and 69,700 MT Low Sulfur coal

The following is a resume of the comparison of the sales and purchase agreement contract specifications, the results of blending simulations, and the results of laboratory analysis of PT. Alamjaya Bara Pratama.

Factors Affecting the Quality of Coal Blending Results

Coal blending activities cannot always be in accordance with the plans that we have made, here are two factors that affect the quality of coal blending results, namely technical and non-technical factors:

Technical factors that affect the quality of coal blending include:

a. The quantity of coal available

Before mining activities begin, the company prepares a drill sample which will be analyzed in detail to determine the reserves owned by the company and from the analysis results it is used as a reference for daily production in accordance with the ongoing shipping activities.

b. What parameters are the benchmarks for blending.

The parameters used as benchmarks for blending activities will be used as a reference for making blending plans. These parameters are obtained from the terms of the purchase contract with the consumer. So that by knowing the reference value, the Quality Control team in the field will easily condition what seam coal should be produced during certain shipping activities.

c. Adequate blending equipment

Adequate equipment is needed for blending activities, because it is feared that anomalies will occur during production activities. For example, during the blending process when the coal was pouring out of ROM (rehandling), there was a problem with the bulldozer as a support feeding tool, so the process encountered problems and did not go according to plan.

d. Good communication between workers.

Good communication/cooperation is required between the supervisor (Quality Control department) and the workers in the field, both in terms of recording the amount of coal tonnage coming from the mine per pit/seam, during the process of moving coal from the stockpile to the feeder, calculating the blending , as well as processes taking blending samples at loading time, so that the blending mechanism that occurs can run/carry out properly according to the plan and the results meet the requirements of the buyer.

e. Availability of production tonnage with a blending plan

Some are suitable and some are not in accordance with the blending calculation, this affects the amount of coal tonnage required when blending is not in accordance with the blending calculation that has been planned, so that the results of the coal analysis experience a significant increase/decrease. To overcome this by making blending calculations, it should be adjusted to the availability of coal in accordance with the parameters of the purchase contract agreement or by reducing/adding the tonnage of coal that must be blended. In determining the success of a blending, it really depends on the availability of coal in accordance with the quality of each coal quality that is owned and the blending mechanism itself.

Non-technical factors that affect the quality of coal blended at PT. ABP is the weather, where the weather contributes greatly to the quality of coal blending, for example when it rains it increases the moisture value, the coal becomes cleaner and reduces impurities in the coal, when it is hot, moisture will drop, but the dust that is present during the mining process becomes additional impurity on the coal.

IV. Conclusion

In the blending process performed during the study, there were 8 (eight) sale and purchase contracts with each of the bargenas whose specifications were used for the blending formula parameters. On the MV. Ye Huan with 2 barges of approximately 217,700 MT, divided into High Sulfur coal of 148,000 MT and 69,700 MT of Low Sulfur coal with reference to AC <7%, TS <1.40%, and CV (gar)> 4700 Kcal / kg.

Factors that affect the quality of coal blending are divided into two factors, namely technical and non-technical factors. Technical factors affect the quality of coal blending results, including the quantity of available coal, the parameters used as the benchmark for blending, adequate blending equipment, good communication between workers, and the availability of production tonnage with the blending plan. Meanwhile, non-technical factors that affect the results of coal blending are the weather during the blending and barging processes, this weather contributes to the ups and downs of the quality of the blended coal.

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