Parting control on coal seam quality based on ash content and total moisture, North Musi Rawas, South Sumatera

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Abstract. In its utility, coal is measured by how much the quality values contained inside such as ash content and total moisture. One of the factors that affect the value of coal seam quality is the existence of partings. Partings is an inorganic material that is formed in coal syn-depositional. Therefore, this study aims to identify the extent influence of the presence of the parting layers that in comparison of the laboratory test results from two sampling techniques. The application of the methods used was channel sampling where the coal sample was taken without partings and include partings. Coal seam thickness become the object of the research was 9.01 m with the presence of the four partings that have a thick layer of 6-8 cm. Comparative laboratory test result show ash content include partings more bigger than without parting with a difference of 2.7% adb. Deviation ash content the most indicated on ply 5. Suggesting parting layer has form of tuffaceous sandstone. Characteristic tuff is a volcanic deposits contain a high fly ash thus increasing ash content. While the total moisture include partings more smaller than without partings with a difference of 0.3% ar, It was suggested that partings just control the ash content, this is due to the type and character of lithology parting.

1. Introduction
Partings is the layers of rock between the coal seam formed in coal syn-depositional. According to Li et al. (2017), if coal and partings are mined simultaneously will increase the volume and affect the coal quality, so that will increase the cost of production. In addition, parting layers which mined will improve the pollution of environment due to high flying substances (Li et al., 2017). Therefore, with the presence of partings greatly affect coal mining results, efficiency, and give a negative effect to productivity of coal.

As has been explained previously that partings can affect the quality of coal. The quality of the coal is good to poor levels of degrees a coal that is composed of several components in it such as the ash content, total moisture, volatile matter, and calorific value. According to Anriani et al. (2014), quality of coal seam is very important as a basic factor for the consumer in selecting the appropriate coal with its utility. Coal quality change caused by partings in the study used aspects of ash content and total moisture.

Ash is the element impurities in coal seam and also a remaining material after coal is burned perfectly. Ash sourced from mineral matter in coal seam and pollutant elements from sandstone, soil etc. from roof, floor, or partings layer in coal seam. The larger of ash content then the smaller value of calories, because it takes more calories to burn coal in the polluter (Sulistyana, 2012).

Total moisture is the water content contained within coal seam. Moisture is also one of the elements of impurities, which is the same as like ash in coal seam that is was the coal-forming components that
could not be burned. So that is can decrease the calories value and causes a lack of economic value in the coal. The statement reinforced by Sukandarrumidi (2009), that the higher of moisture content requires more calories to vaporize the water.

This research aims to identify how much influence the presence of partings toward the value of coal quality based on ash content and total moisture. In addition it is also useful as a guide and advice about the influence of partings for quality of coal seam based on ash content and total moisture that can be relied upon to consider the damage that may occurred in the activity of coal production.

2. The Scope of the Research Area
In the administration, study area located in Beringin Makmur II Rawas Ilir, North Musi Rawas, South Sumatra. To reach these locations takes approximately ten hours drive from Palembang city by using ground transportation line (Figure 1).

Collecting data as research material was conducted in the mining area of ongoing production process. Pit first began operations in 2015 and has continued until now. The mining site had not mine with a limit of SR 2, has a length of 1.2 km (north - south) and a width of 500 m (east - west). This pit has reached a depth of 35 meters.

In time and space of the geologic process that work simultaneously with the coal sedimentation called syn-depositional. Process on syn-depositional affecting coal layer i.e. coal bearing formation (Muaraenim Formation). Subsequent geological process that work after the coal sedimentation called post-depositional. Post-depositional component such as geology structure and erosional that influence geometry of coal seam and quality value

Muaraenim Formation is a part of South Sumatra Basin Stratigraphy. This Formation is a coal bearing formation that sourced of coal seam became object of this study. Muaraenim Formation deposited conformity above the Airbenakat formation. Has a thickness between 450-1200 meters with the upper Miocene-Pliocene age which deposited in shallow marine environments, the delta and non-marine. Constituent rocks in this formation in the form of sandstones, claystone, and coal seam. De Coster (1974) interpreted that, this formation was the late Miocene-Pliocene, based on the stratigraphy position. This formation is also a carrier of coal formations can be distinguished into four members consisting of the oldest to the youngest, i.e. M1, M2, M3, and M4 (Figure 2).
Coal seam in study area is a part of the coal seam M2 Muaraenim Formation, with a companion in the form of claystone, chocolate-brown colours, sandy clastone, brown-grey fine sandstones, some of green-grey fine sandstone at the bottom, and a minor component.

Figure 2. Stratigraphy Muaraenim Formation as coal bearing formation [4]

3. Data and Methods Research

Coal seam became the object of this study has characteristics i.e. black color with black scratch, dull luster, fragile, uneven fractions, with the impurities such as amber and tuffaceous sandstone partings, slightly weathered with the big intensity of a cleat. The coal seam has thick 9.01 meters and there are four layers of tuffaceous sandstone partings with thick each 8 cm, 6 cm, 8 cm and 7 cm (Figure 3).

Sampling method in this study using two different methods, namely channel sampling and grab sampling. Thomas (2013) stated that channel sampling is used to represent the characteristics of the coal seam without the influence of roof, floor, and between layers in coal seam. In this method, coal taken vertically. While the grab sampling is a method of coal sampling by taking a vertically without regard to coal parting layer and weathering. In this method, sampling is limited by the top and bottom of the coal without roof and floor (Thomas, 2013). Each these method of coal sampling taken per ply in same coal seam with parting layers as a segmen boundary (figure 4). In this study, the presence of the four layers of partings split into five ply and on both the sampling methods obtained five samples from five ply.
Figure 3. Coal seam for object of study

Then was followed by proximate analysis of each sample. This analysis was performed to obtain the ash content and total moisture in coal seam in the study area. Furthermore, the comparison of the quality values obtained from two types of sampling method.

![Figure 3](image)

| Without Parting | Include Parting |
|-----------------|-----------------|
| (Channel Sampling) | (Grab Sampling) |

Figure 4. Sampling Method

The last stage in this study is making the synthesis of the results from data analysis is obtained. Data synthesis i.e. comparison model between the quality of coal seam without partings and taken with partings. Making the model aims to find out how much the influence of partings on coal seam quality.

4. Result and Discussion

The results of the laboratory analysis of both sampling method with the parameters of the ash content and total moisture shows indicate a change of value (table 1). Ash content of coal seam include partings is bigger than coal seam without parting, while in total moisture value is immeasurable.

Table 1. Comparisons of the ash content and total moisture from both sampling method.
The parameters that controlling the quality of the coal seam in study area in the form of parting layers. Parting layer has characteristics i.e. gray (sand) and white (tuff), grain size is medium sand, closed fabric, rounded, massive sedimentary structures, poorly sorted, bad permeability, non carbonates, medium hard, sharp contact, composed by fragments of quartz and tuff are dominant. The thickness of the partings sequentially from top, namely 8 cm, 6 cm, 8 cm, 7 cm. The content of tuff at respective parting layer has a different level.

In general, ash content of coal seam from laboratory test result indicate that coal included partings more bigger than coal without partings. Based on the parameters used, ash content with partings has increased on average. Ash content increase from 5.25% adb (without partings) to 7.95% adb (include partings). Values included into Steel Grade I (Classification by National Coal Board). While the total moisture has not change significantly. The total moisture without partings on average of 34.76% ar and include partings of 34.46% ar.

Ash content in table 1 shows the change in the value of each ply on both sampling methods. There is a high increase of ash content in the ply 1 and ply 5, low increase in ply 2 and ply 4 and decreased ash content on ply 3. A comparison of the ash content is seen in Figure 5. In Figure 5 shows there is a change of ash content is not constant. This is due to the characteristics of different each parting layers in the coal seam. Characteristics that are instrumental in the change of the ash content is the presence of tuff materials in the parting layers.

![Figure 5. Difference of ash content](image-url)
High increase of ash content seen on ply 1 ply and 5. This increase is caused by the parting layers characteristics that are part of the each ply i.e. partings 1 and 4. The characteristics of this parting has tuff levels are present in abundance as fragments of sandstone. A very rich of tuffaceous will be fly ash in coal combustion process. The low increase is found in the ply 2 and ply 4. Characteristics that affect change in this value in the 2nd and 3rd partings layers. Both have very little tuff levels thus increasing the value of the ash is not too high. The increase in value is only affected by partings 1 where became part of ply 2 and partings 4 that part of ply 4. While in Figure 5, the value of ash on 3 ply is decrease. This is caused by parting that became part of ply 3 that partings 2 and 3 contain very little tuff. The presence of more dominant sandstone material causes an increase in volume in the ply 3. So that the percentage will be lower ash content. It was suggested that ash content is influenced by the tuff level in the sandstone parting layers. This is in line with research conducted Dianshi et al. (2018) in Huainan Coalfield, North China.

In total moisture shows the variation of the variety in each ply. There is an increase in the value of the coal with partings on the ply 1 and 3, while the ply 2, 4, and 5 has decreased (Figure 6). These condition is influenced by the lithological characteristics of parting layers that controls the total moisture in coal seam.

![Figure 6. Difference of total moisture](image)

In Figure 6 shows the variation of the value between total moisture without partings and include partings. The increase happened on ply 1 influenced by lithology of partings is tuffaceous sandstone with 8 cm thick, medium grains size of sand, so it make the rock porosity were slightly better than the lithology of partings on the other ply. This makes the total moisture in the ply 1 has increases. Furthermore, also a slight increase in the value of total moisture in the ply 3 which is controlled by the same partings before. However, lithology partings on 3 ply material is dominated by sandstone with tuff as fragments whose presence is very little.

Then, the ply 2, 4 and 5 experienced a slight decline. This is caused by lithology partings form tuffaceous sandstone with abundant tuff fragments, thereby reducing the ability of the rock to absorb (porosity) and release water (permeability). However, changes in the total moisture that occurs due to the influence of such partings not significantly affect coal seams without parting. So, parting with tuffaceous sandstone lithology does not control the total moisture in coal seam.

5. Conclusion
The results of comparative total ash content and moisture of both methods of sampling show that the parting layer only control the ash content. While the total moisture was not significant. This is caused by the characteristics of partings containing volcanic deposits tuff as fly ash and have a poor porosity properties.
In addition to the parameters total ash content and moisture, there are other parameters that can identify how much control on the quality of coal partings as volatiles matter and calorific value. The hope will do more research regarding the above parameters.

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