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# **The 2nd Forum in Research, Science, and Technology FIRST 2018 INTERNATIONAL CONFERENCE**



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# Potential of Clay in Coal Mining of Tanjung Enim Area as a Filler on Rubber Compound

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**Abstract.** The clay deposit in the coal mining area of Tanjung Enim has a deposit about five times its coal deposit. This clay has not been utilized except as glue on brick briquettes which are relatively small quantities. As a rubber filler, clay can be used, but the silica content is preferred in the clay. Therefore the composition of silica in clay must be known. This study aims to determine the content of silica in the clay contained in the coal mining area of Tanjung Enim. The research begins with clay drying, followed by the fineness of clay grain size to a size of about 10-50 microns. Furthermore, the analysis of the compounds there in is carried out using XRF. The results show that the silica content in the clay is about 53.74 - 75.29% and the highest content is in the Lower D layer 75.29% and followed by the Int B2-C layer 56.87% and Lower C 56.65 %. In general, the compounds in this clay are dominated by SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, MgO, TiO<sub>2</sub>, and K<sub>2</sub>O.

## 1. Introduction

Coal mining area in the Tanjung Enim, South Sumatra Province of Indonesian not only benefits coal mining companies in Tanjung Enim itself but also clay deposits located between coal layers are also quite promising to be explored and investigated. This clay is only a small portion used by PT Bukit Asam (Persero) Tbk. as briquette coal adhesive in addition to the reclamation of the surrounding mining area after the mining process. The total amount of clay deposits in the coal mining area is five times more than coal deposits.

In the design of rubber compounds, fillers are needed [1-4] especially to improve their physical properties and are very important. Research on the use of clay as a filler for rubber compounds has been widely practiced and includes modification of clay [5-32] but in Indonesia clay fillers for rubber have not been considered and most are still imported from abroad. Most of the clay in Indonesia is used as raw material for making pottery, cement raw materials and as an adsorbent [33-38]. Bond (1951), Schenck et. al. (1964), and Goodman and Riley (2012) [39-41] even patented local clay as a filler for rubber compounds. Another study of clay, as a catalyst in chemical processes, for example, was carried out by Adams et. Al. (1982), Xu et. Al. (2009), Nagendrappa (2011), Solak and Rutkowski (2014), Sirsam and Usmani (2015), and Bosco et. Al. (2016) [42-47]. Here it is seen that clay is very important to be investigated by paying attention to its compound content. The use of clay as a rubber filler can also reduce CO<sub>2</sub> emissions where carbon black which still dominates fillers in rubber products is produced with imperfect combustion process conditions of heavy fractions such as fluid catalytic cracking of tar, coal tar, ethylene tar crack, and with little comes from vegetable oil.



As a filler, the content of silica ( $\text{SiO}_2$ ) in clay needs to be considered, because silica can have a significant effect on rubber vulcanization and improve its physical properties. Thus, the silica content in clay is interesting to study.

## 2. Materials and methods

### 2.1. Materials

The main material used in this research is clay contained in the coal mining area of PT Bukit Asam (Persero) Tbk. Tanjung Enim, South Sumatra Province in seven layers of clay.

### 2.2. Methods

The research method consists of sample preparation and testing of elemental content or compounds contained in the clay. Drying of the clay at  $110^\circ\text{C}$  for about 2 hours and followed by smoothing the sample until the clay has a size of about 10 - 50 microns. Preparation of this sample is done in Chemical Laboratory of Chemical Engineering Department of State Polytechnic of Sriwijaya. Further analysis of compounds in clay is done by using Uniquant XRF Bruker S8 Tiger owned by PT Cement Indonesia (Persero) Tbk.

## 3. Results and discussion

Analysis of compounds contained in the clay at coal mining area of Tanjung Enim, South Sumatra Province using XRF according to its layer is shown in table 1.

**Table 1.** Minerals content in clay layer located on an area of PT Bukit Asam (Persero) Tbk. South Sumatra Indonesian

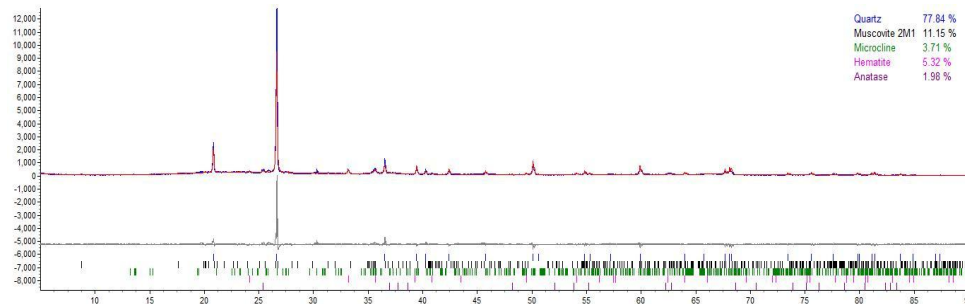
Component	Minerals content in the clay layer						
	OB A1	Int A1-A2	Int A2-B1	Int B1-B2	Int B2-C	Lower C	Lower D
<b>SiO<sub>2</sub></b>	53.74 %	55.22 %	50.83 %	54.31 %	56.87 %	56.65 %	75.29 %
<b>Al<sub>2</sub>O<sub>3</sub></b>	25.05 %	26.22 %	24.87 %	21.49 %	21.49 %	20.32 %	7.62 %
<b>Fe<sub>2</sub>O<sub>3</sub></b>	4.90 %	1.45 %	3.28 %	4.97 %	3.45 %	6.22 %	7.25 %
<b>TiO<sub>2</sub></b>	0.90 %	0.79 %	1.03 %	0.90 %	0.90 %	0.87 %	0.33 %
<b>MgO</b>	1.52 %	0.68 %	0.40 %	1.19 %	0.67 %	1.79 %	1.82 %
<b>K<sub>2</sub>O</b>	1.84 %	0.46 %	1.04 %	1.55 %	1.75 %	2.02 %	0.92 %
<b>CaO</b>	0.48 %	0.38 %	0.26 %	0.69 %	0.26 %	0.66 %	0.74 %
<b>Na<sub>2</sub>O</b>	0.12 %	0.07 %	0.06 %	0.12 %	0.13 %	0.39 %	0.44 %
<b>SO<sub>3</sub></b>	1.24 %	0.51 %	3.07 %	1.86 %	3.02 %	2.09 %	0.22 %
<b>MnO</b>	0.12 %	0.01 %	0.02 %	0.11 %	0.01 %	0.07 %	0.05 %
<b>P<sub>2</sub>O<sub>5</sub></b>	0.05 %	0.05 %	0.04 %	0.06 %	-	0.08%	0.10 %
<b>Cr<sub>2</sub>O<sub>3</sub></b>	0.01 %	0.03 %	0.03 %	0.05 %	0.05 %	0.07 %	0.16 %
<b>Others</b>	10.03%	14.13%	15.07%	12.70%	11.40%	8.77%	5.06%

Table 1. shows that the compounds contained in the clay are dominated by  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{MgO}$ ,  $\text{TiO}_2$ , and  $\text{K}_2\text{O}$  but in terms of quantity  $\text{SiO}_2$  is the most compound found in various layers in clay around 53.74 - 75.29% followed by  $\text{Al}_2\text{O}_3$  content of about 7.62 -26.22%, and the third largest was  $\text{Fe}_2\text{O}_3$  1.45

- 7, 25%. The highest  $\text{SiO}_2$  content is in the Lower D layer of about 75.29%, and the lowest in the Int A2-B1 layer is about 50.83% while the highest  $\text{Al}_2\text{O}_3$  content in the Int A1-A2 layer is in the range of 26.22% and the lowest in the Lower D layer in the range of 21.49%. The content of  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{Fe}_2\text{O}_3$  in this clay can also be compared with the results of analysis using SEM-EDS conducted by Hasan and Taufik in 2014 [48], Hasan et.al. in 2015 using XRD [49], and by Konta (1963), Herziq et. al. in 1998, as well as Muriithi et.al. (2012), and Jeong and Achterberg (2014) [50-53]. The results of these researchers showed different results depending on where the clay source was obtained. For comparison,

the quantitative clay mineral analysis using XRD is shown in figure 1. From this figure, the silica content is 77.84% as quartz mineral followed by another muscovite 11.15% and microcline 3.71%.

High silica content is very interesting, because silica is not only used as a filler on rubber but also for catalysts such as silica is used as catalyst support such as Min et al. (2003), Kababji et al. (2009), and Dixit et. al. (2013) [54-56] and as a catalyst mixture which included Irurzun et al. (2009), Ray et al. (2015), and Adamson et al. (2004) [57-59].



**Figure 1.** Quantitative analysis of clay using XRD performed by Hasan et. al. (2015) [49]

#### 4. Conclusions

The conclusion obtained from this research is the silica content of clay in the coal mining area of PT Bukit Asam (Persero) Tbk. in the Lower D layer is 75.29%. Not only silica, but the content of alumina and iron oxide is also quite high content. In general, the silica content in each layer ranges from 53.74 to 75.29%

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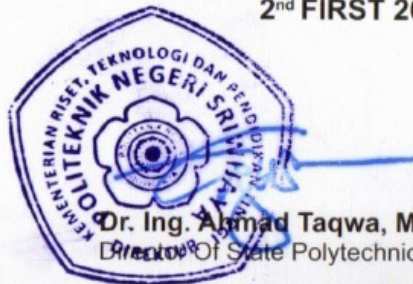
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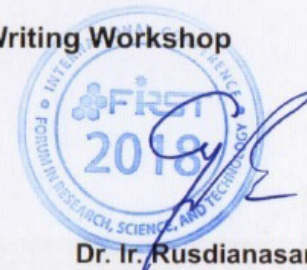
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