DETERMINATION OF SEDIMENT POND ANALYSES STEPS ON MINING ACTIVITY OF BAUXITE ORE IN ACTION OF THE ENVIRONMENT CONSERVATION, CASE STUDY IN PT. XY

[1]RENDHIE SUSWANTO, [2]RISNAL AFFANDI ZEGA

[1,2]Mining Engineering Department, Universitas Sriwijaya, Indonesia
E-mail: [1]rendhiesuswanto10@gmail.com, [2]risnal.affandi@gmail.com

Abstract- Bauxite is an ore that mainly contains minerals aluminium oxide, such as Gibbsite ($Al_2O_3.3H_2O$) and Boehmite ($Al_2O_3.H_2O$) with clay and minimum of ferrous oxide (Fe_2O_3) as gangue minerals. The preparation of Crude Bauxite (CBx) is did by using washing method in washing plant to loose the clay from CBx. PT.XY produced 435,1158 m^3 clay (tailing) per day and pumping 3287,7158 m^3 of water, with 11 segment of sediment pond with each variation of sedimentation. The results of the research and field observation showed that there are steps to analyse the sediment pond. First, calculate the amount of slurry (tailing and water) from washing plant. Second, sampling (before and after of segment). Third, analyse samples by measuring and calculating the percentage of sediment. Fourth, calculate the amount of totally actual sediment of each sample by comparing the percentage of sediment in sample to totally slurry. Fifth, calculate the actual amount of sedimentation on each segments of sediment pond by comparing actual amount of sediment at before segment and actual amount of sediment at after segment. Sixth, testing the sample from the last segment of sediment pond by TSS, TDS, and turbidity test. The result of that steps will got the amount of sedimentation on each segments of sediment pond and value of TSS, TDS, and turbidity.

Keywords- Analyses, Bauxite, Environment, Sample, Sedimentation, Sediment Pond

I. INTRODUCTION

Bauxite is an ore that is mainly contains minerals aluminium oxide, such as gibbsite ($Al_2O_3.3H_2O$) and boehmite ($Al_2O_3.H_2O$) with clay and minimum of ferrous oxide (Fe_2O_3) as gangue minerals. Generally, bauxite contain 45 - 65 % Al_2O_3, 1 - 12 % SiO_2, 2 - 25 % Fe_2O_3, >3 % TiO_2, and 14 - 65 % H_2O. (ESDM, 2012).

Table 1: Bauxite classification based on Al_2O_3 content

No	Classification	Al_2O_3 content (%)
1	*High Grade* (HG)	>50
2	*Medium Grade* (MG)	46 -50
3	*Low Grade* (LG)	40 – 46
4	*Waste*	< 40

Source: Quality Control Department, PT. XY, 2016

The preparation of Crude Bauxite (CBx) is done by using washing method in washing plant to loose clay from CBx. The combination of water and clay (tailing) are called as slurry will be treated in the sediment pond before dischareged into the river and also before the water used again for washing plant.
Generally, sediment pond has function to process the water from mining activity and surface water in order to appropriated with the Environment Quality Standard (EQS/BML). Generally sediment pond consist of two main parts, segments of sedimentation pond and V-Notch. Segments of sedimentation pond arrests the suspended materials, but water will keep flowing. V-Notch sets the rate of water flow.

The government determined the requirement of the treated water in parameters of TSS (Total Suspended Solid), TDS (Total Dissolve solid), and DO (Dissolve Oxygen). The term of Total Dissolve Solids (TDS) are refer to materials that are completely dissolve in water. These solids are filterable in nature. It is defined as residue upon evaporation of filterable sample. The term of Total Suspended Solids (TSS) are can be reffered to materials which are not dissolved in water and non filterable in nature. It is defined as residue upon evaporation of non filterable sample on a filter paper.
This article is observed to show the steps to analyse sediment pond as the conservation action in environment sector on bauxite ore mining activity.

II. DETAILS EXPERIMENTAL

2.1. Materials and Procedures

This reserach is done in 25 days start from February 20 to March 17 2016 in PT. XY bauxite ore mining bussiness unit Tayan, West Kalimantan, Indonesia.



Fig. 1. Location Map of the research, 2016

At first, this research is done by directly observations of field condition before take the data, such as the observation of washing process of bauxite ore at washing plant and observation of the condition of sediment pond.



Fig. 2. The observation of sediment pond

After the observations, the datas is taken from that process. Primary datas such as the samples of slurry from the washing plant on every segment of sediment pond. Secondary datas such as the data of dimension of sediment pond, feeding of Crude Bauxite (CBx) into the washing plant per day, pumped water for washing process, production of Washed Bauxite (WBx) per day.



Fig. 3. Sampling of slurry on each segments of sediment pond

2.2. Sampling and Analyses

Sediment Pond at PT. XY consist of 11 segment. Analyses of sediment pond is done by sampling method and comparison principle by take the samples of slurry in every segments of sediment pond by using the sampling media (bottle) with volume 600 ml and diameter 6.459 cm, as shown on Fig. 4. below.



Fig. 4. Media of sampling

For taking the volume of the samples, it is used the formula below:

$$\text{Volume sample} = 1/4\pi d^2 \text{ x h} \qquad (1)$$

For samples on the first and the last segment are tested by using TSS, TDS, and turbidity test. For turbidity analyses is used turbidimeter. For analyses of TDS and TSS are used the formulas below,

$$\text{TSS (mg/L)} = \frac{(A-B)\text{x } 1000}{\text{Volume of sample(L)}} \qquad (2)$$

Information:
A : Weight of filter paper with suspended solid (mg)
B : Weight of filter paper (mg)

$$\text{TDS (mg/L)} = \frac{(A-B)\text{x } 1000}{\text{Volume of sample(L)}} \qquad (3)$$

Information:
A : Weight of distillation cup with dissolved solid,mg
B : Weight of distillation cup (mg)

In addition, the calculations of the effectivity (%) of sediment pond are important by calculating the TSS, TDS, and turbidity on the first segment and comparing it with TSS, TDS, and turbidity on the last segment of sediment pond by using the formulas below, (Sugiarto, 1987):

$$\text{Effectivity (\%)} = \frac{(A-B)}{A}\text{x } 100\% \qquad (4)$$

Information:
A : Value of TSS, TDS, and turbidity (First segment)
B : Value of TSS, TDS, and turbidity (Last segment)

III. RESULTS AND DISCUSSION

3.1. The Calculation of Total Slurry

Slurry is consist of tailing and water from washing process of CBx in the washing plant. To know the amount of produced slurry, it is done by calculating the amount of tailing and water. This data will be used to know the total actual amount of sediment in every samples that is used to know the sedimentation in every segment of sediment pond.

Table 2: Data of Feeding WP (CBx) and Production of Washing Plant (WBx)

Data	Amount (ton/day)
Feeding WP/day (CBx)	1245,7347
Production WP/day(WBx)	763,2208

Volume tailing / day = Feeding WP –Production WP

$$= \frac{1245{,}7347 \text{ ton}}{1{,}45 \text{ ton/m3}} - \frac{763{,}2208 \text{ ton}}{1{,}8 \text{ ton/m3}}$$

$= 859{,}1274 \text{ m}^3 - 424{,}0116 \text{ m}^3$

$= 435{,}1158 \text{ m}^3$

The water that is used for washing plant is from waterpool by using the pumps,

Table 3: Data of Used Water for Washing

Days	Volume/day (m^3)
4/12/2015	2152,2
5/12/2015	1849,3
7/12/2015	2868,3
8/12/2015	2821,6
10/12/2015	3113,2

11/12/2015	2135
12/12/2015	2171,8
4/1/2016	3405,8
5/1/2016	3366
6/1/2016	4642,7
Total	28525,9
Mean	**2852,6**

Total Slurry/day = Volume tailing + Volume water
= 435,1158 m^3 + 2852,6 m^3
= 3287,7158 m^3

3.2. Sampling

Sampling is used to know the persentage of sediment and water in slurry in each segments. This percentage is used to know the amount of actual amount of sediment in samples by comparing with total slurry from washing plant.

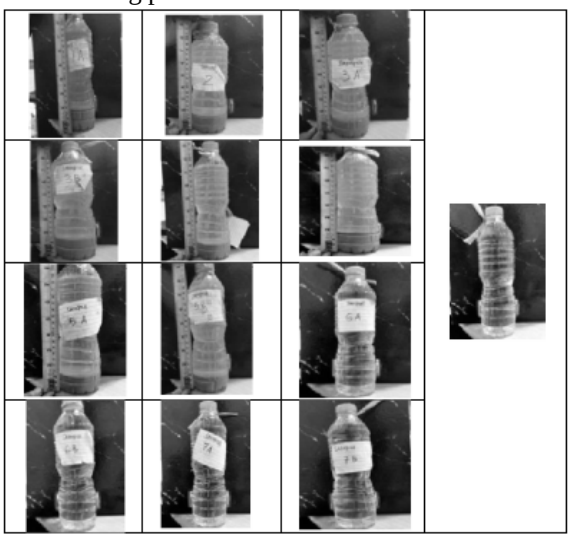


Fig. 5. Samples From Sediment Pond

3.3. Samples Analyses

The next step is samples analyses. From the samples, measured the high of sediment in media and by using the formulas of silinder the volume of sediment in media will be known. Sampling media has volume 600 ml and diameter 6.459 cm. Then, the percentage of sediment and water in every samples can be measured.

Table 4: Percentage of Water and Sediment

Samples Code	Sediment (cm^3)	Persentase (%)	
		Sediment	Water
Sample 1A 1B	155,7002	25,95	74,05
Sample 2	140,9497	23,49	76,51
Sample 3A3B	127,8381	21,3	78,7
Sample 5A	111,4486	18,57	81,43
Sample 4A4B	145,8666	24,31	75,69
Sample 5B	101,6149	16,94	83,06
Sample 6A	0	0	100
Sample 7B	0	0	100
Sample 7A	0	0	100
Sample 6B	0	0	100
Sample Akhir	0	0	100

3.4. Measure the actual amount of sediment

After the percentage of sediment and water in sampes are known. The next steps is calculate the actual amount of sediment in samples by comparing with total slurry (3287,7158 m^3) from the washing plant.

Table 5: Percentage of Actual amount of Sediment (m^3)

Sample	Persentase (%)	Actual amount of Sediment (m^3)
Sample 2	23,49	742,7948057
Sample3A3B	21,3	158,2152936
Sample 5A	18,57	137,9369954
Sample3A3B	21,3	158,2152936
Sample4A4B	24,31	38,46213788
Sample4A4B	24,31	38,46213788
Sample 5A	18,57	137,9369954
Sample 5B	16,94	23,36652702
Sample 5B	16,94	23,36652702
Sample 6A	0	0
Sample 7B	0	0
Sample (Final)	0	0

3.5. Calculation of Sedimentation Volume

From the actual sediment in samles, the sedimentation volume can be known in every segment of sediment pond, by comparing the actual amount of sediment at before segment and the actual amount of sediment at after segment.

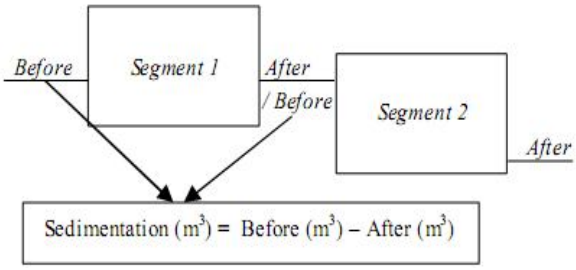


Fig. 6. Ilustration of Sampling Position

Table 6: Volume of Daily Sedimentation in Every Segment of Sediment Pond

Segment	Daily Sedimentation (m^3)
Ditch	77,7895
1	446,6425
2	43,9482
3	119,7532
4	114,5705
5	23,3665
6	0
7	0
8	0
9	0
11	0
Total	827,0998

Data above will be used for the analyses of digging schedules of sediment in every segment of sediment pond. By using it, the management of digging as the action for maintenance of sediment pond will be clear.

3.6. TSS, TDS, and Turbidity Test

For the samples of the fisrt and the last segment of sediment pond is tested by the TSS, TDS, and turbidity test to know the feasibility of the water based on water quality standard. According to PP No. 82 2001, the value of TDS must less than 500 mg/L, for TSS must less than 1000 mg/L, and for DO must less than 3-5 mg/L.

After samples are tested, calculate the TSS, TDS and effectivity (%) of sediment pond in those parameters by using the formulas below

$$\text{TSS (mg/L)} = \frac{(A-B)x\ 1000}{\text{Volume of sample(L)}}$$

Information:
A : Weight of filter paper with suspended solid (mg)
B : Weight of filter paper (mg)

$$\text{TDS (mg/L)} = \frac{(A-B)x\ 1000}{\text{Volume of sample(L)}}$$

Information:
A : Weight of distillation cup with dissolved solid,mg
B : Weight of distillation cup (mg)

$$\text{Effectivity (\%)} = \frac{(A-B)}{A} x\ 100\%$$

Information:
A : Value of TSS, TDS, and turbidity (First segment)
B : Value of TSS, TDS, and turbidity (Last segment)

ACKNOWLEDGMENTS

Praise to Allah SWT for His grace that makes this paper of research result entitled "Determination of Sediment Pond Analyses Steps on Mining Activity of Bauxite Ore in Action of the Environment Conservation, Case Study in PT. XY" can be completed on time. On this occasion, the writers would also like to thank to:

1. Our parents who always pray for our success,
2. Mrs. Hj. Rr. Harminuke Eko Handayani, S.T., M.T. as the Chairman of the Department of Mining Engineering at Sriwijaya University,
3. Mr. Ir. H. Hairul Alwani, HA, M.T. as the Vice Dean III of the Faculty of Engineering at Sriwijaya University,
4. Mr. Ir. H. Syamsul Komar, M.Sc, PhD as supervisors,
5. Colleagues who support this paper.

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