International Journal on Advanced Science Engineering Information Technology

Vol.4 (2014) No. 4
ISSN: 2088-5334

Characterization of Geochemical Disposal on Indicate and Mitigation Acid Mine Drainage at Coal Mining South Sumatera Indonesia

Aida Syarif [#], M. Said. A. Halim.PKS[#], EndangWiwik DH[*]

[#] *Polytecnic of Sriwijaya Palembang, Indonesia*
E-mail: Aida_syarif@yahoo.co.id, saidm_19@yahoo.com, halimpks@gmail.com

[*] *University of Sriwijaya Palembang, Indonesia*
E-mail: endanghastuti@gmail.com

***Abstract*— Acid mine drainage (AMD) is a term U.S. used to describe command infiltration of acid surface water in the mining areas. The study of process for formation acid mine drainage can't be approached by two methods, the static and kinetic test. In the static test can't determinate acid formation with characterization of rock, can't be approach by Acid base accounting (ABA) method. In the methods of rock is analysis contents of sulfur, pH, Acid Neutralizing capacity and Net Acid Generation (ANG). The Maximum Acid Potential (MPA) can't be approach percent's x 30.6 Kg H2SO4/metric ton. NAPP is difference between the MPA and ANC if NAPP positive the rock is PAF, while negative is NAF. Result of analyzed the Five samples had A,B,C,D and E each have NAPP is 22.48; 84.39; 13:83; 11.33 and -9.22 Kg H2SO4/metric ton. Analyzed samples From A, B, C, and D is category PAF and samples D is UC PAF. The last result property can't be describe command for all samples can't be united states to source of acid mine drainage. And then the future have to methods how to manage the rock for mitigation of acid mine drainage.**

Keywords*— *Characteristic Rocks, Static test, Acid Mine Drainage

I. INTRODUCTION

Coal is one of the sources of energy that is important to the world, which is used in generators plant to produce power nearly 40% in the whole world. In many countries these figures are much higher: Poland uses more than 94% for the power plant, South Africa 92%; China 77%; and Australia 76%. Coal is a source of energy that experienced a growth that most rapidly in the world in recent years - faster than gas, oil, nuclear, water, andreplacement resources.

In Industrial world record says that in 2009-2010, Indonesia is thesecond-largest coal exporter in the world, after Australia. Coal is needed for the power plant and a source of industrial fuel. Indonesian coal resources in 2011 is about 105,187.44 million tons with total coal reserve about 21,131.84 million tons, with the coal resource and reserve distributing area including 52,482.20 million tons in Sumatra, 52,326.23 million tons in Kalimantan, 233.10 million tons in Sulawesi, 128.57 million tons in Papua, 14.21 million tons in Java, and 2.13 million tons in Maluku. Coal production in 2005 is about 152,325.025 Ton with export capacity 93,758.806 Ton, the import 97,183 tons and domestic needs 36,081,734 Ton, at the end of 2011, the production increased to 353,383,341 tons.(source: Badan Geologi, Kementrian ESDM 2011)

The relation between mining activities and environmental issues has always been a hot issue today. One of the concerns is the water pollution caused by mining activities, such as Acid Mine/ Air Asam Tambang (AAT).Acid mine is runoff water which is caused from oxidation reactions rocks or soil containing pyrite (FeS2), or other produce sulfide with oxygen even oxygen from the air or in water. And also accompanied by hydrolysis reaction from rain or ground water in mine (Elberinget,al 2008).The problems caused by the water acid mine is one of the environmental impact on the mining industry. Water acid is usually characterize with the low pH, high content of heavy metals (Fe), aluminum (Al), manganese (Mn) in the water, and the water which are yellow. Acid mine drainage treatment needs to be done it aims to maintain the environmental conditions in the coal mining area so as to realize sustainable mining system in accordance with the Environment laws.

There are two methods that often done in the presence of AAT, static test and kinetic test. Static test is one of the ways in AAT resource managementis done by means of acid-forming rock geochemical characterization by determination of sulphur content, pHa nd NAG. From these result, rocks will get classify with calculating the balance Acidity

sheet or better known as Acid Base Acounting (ABA) from the calculation, they can be done classification is rock as a source of mine acid or neutralizer. Kinetic testistesting for acid rockf ormation by means of a column leaching in Lindos (leached Coulum Test) of this test can test the water quality of Leacheds the rock-forming acids and can be done based on thet est parameters Standard of Waste water Coal Mine or Acid mine drainage.

II. RESEARCH METHODS

This research was conducted in the laboratory Polytechnic of Sriwijaya, Department of Chemical and Energy Engineering and Laboratory Coal Mining of PTBA, Tanjung Enim, Which begin with rock sampling process, sample and equipment preparation, testing and analysis.
Samples of rocks taken from waste rock coal mine in South Sumatra as many as five samples at the disposal dump area by taking samples at some point ordinate can be seen in Table 1.

TABLE I
CODE SAMPLES

No	Listing Samples	X	Y
1	A	362257E	9589795N
2	B	362285E	9589817N
3	C	363205E	9590045N
4	D	363305E	9589772N
5	E	365800E	9589635N

Source: primary data December 2013

A. Tools and Materials.

1. Tool
   The tool used in sulfur test equipment (Furnace S-144 DR), balance sheet analytical, pH meters.
2. Material
   Materials used waste rock coal miners, sulfuric acid solution, Peroxide hydrochloric acid.

B. The Procedure

1. pH Paste

Measurements of pasta pH will be done with samples paste with the ratio samples: water distillate is 1:1. Exhaust the soil samples (disposal) first smoothed to obtain a paste mixture evenly so that the sulphide minerals contained in waste places (disposal) expected to be exposed and occur perfect oxidation reaction. From this test, we will get the value of pH.
Paste that is measured directly on the paste mixing results between samples with distillate water so will depend on the sensitivity and reactivity of sulfide minerals in the sample.

2. Total Sulfur (TS)

Measurements total S done by using burning at high temperature (high temperatures combustion) in the Furnace S-144 DR device. Total S stated in percent of the total weight of the declared content of total sulfur in the soil samples of the waste (disposal).

3. Consecutive *Acid Neutralization Capacity* (ANC) (SNI 7-13-2001)

ANC is determined by, Material that used: Exile samples Rock waste (disposal), Aquadest, HCl 0.1 N, NaOH 0.5 N, NaOH 0.1 N, HCl 0.5 N, HCl 0.1 N, HCl 1:3

TABLE. II
EXPECTED WEARING HCL AND NAOH

Reaction	Fizzing rate	Normality HCl (N)	Volume HCl (ml)	Normality NaOH (N)
Not to react	0	0.1	4	0.1
Little reaction	1	0.1		0.1
The reaction is	2	0.5	20	0.5
Strong reaction	3	0.5	40	0.5
The reaction is very strong	4	1.0	40	0.5

Source: *Test Charge d'Affaires Book, 2002.*

Tools used: erlemeyer tube, burette, hot plates, pH meters and Balance

Procedure

a. Put a sample 0.5 grams, a sample size 60 mesh in alluminium foil
b. Pour few drops one or two drops HCl 1:3 in the caco3 samples is marked with the foam (fizz)
c. Match foam with table , II
d. Weighing a sample as many as 2.0 grams (size 60 Mesh) enter into erlemeyer 250 ml
e. Slowly add HCl (as in the table)
f. Heat to boiling stir every 5 minutes until a perfect reaction was marked by the establishment of gas, and not having a solid settle in an orderly way at the bottom of the tube
g. Add water distillation to total sales volume 125 ml
h. Boil during one minute and chill to room temperature.
i. Titrasi with Na OH 0.1 N or 0.5 N to pH 7.0 Na OH concentrationadjusted with HCl
j. If Na OH added less than 3 ml to achieve pH 7 means solution HCl used less repeat by adding volume more.
k. Do testing to fill for each volume or acid concentratewith the steps 5,6.7,8 and 9 above
l. The Count

$$ANC = \frac{(N1xV1)- (N2xV2) \times 49}{W} \quad (H2SO4/ton)$$

4. NAG Testing (SNI 13-6599-2001)

Testing NAG in this research done by using single addition NAG. In addition this test is also testing NAG by using *multi-addition* NAG, *sequential* NAG, *kinetic* NAG and NAG suspended. This test is testing method of standard

NAG, by using hydrogen peroxide to make samples produced sulfide oxidation that contained in a sample. pH values NAG (pH NAG) and the acidity that can be titrated until the pH 4.5 and pH 7.0 determined after samples react and heat and cooled. During testing, the formation and major justification would be acid can happen again and again until at the end measurements will be acquired the formation of amino profit from sample. Static test was done on the exile sample (disposal).

NAGTesting procedures

The count

NAG = (49xVxM)/

Where

V : Volume Na OH for titration (ml)

M : Na OH Concentration (mole/l)

W : Samples weight that react

49 : Equivalent H2SO4

5. Acid Base Accounting (ABA)

This method to evaluate the balance between the process of the formation of acid (oxidation minerals sulfide) and the major justification would be acid (dissolution carbonate alkaline, conversion bases that can be changed, and weathering silicate). The findings suggest that this method is the value of *Maximum Potential Acidity* (MPA), *Net Acid Producing Potential* (NAPP), *AcidNeutralizing Capacity* (ANC).

MPA is determined by multiplying percent of the total sulfur or sulfur sulfide (depending on a test) in samples with conversion factors (MPA = 30,625 × %S). ANC sulfuric acid maximum said that is needed to get an acidity as the samples. The amount is determined by adding acid in samples and titrated back to determine the number of acid that is consumed by or with titration acid directly from samples to a certain pH. The potential major justification would be profit (NAPP), is determined to reduce ANC and MPA (NAPP = (MPA - ANC). The ratio between ANC to MPA is also used. NAPP high-0 equivalent with the high-1 (Ferguson and Morin 1991). Unit results of the test static (MPA, which is done, and NAPP) is stated in the number of kg H2SO4/ton land exile (disposal).

If the difference between MPA and ANC is negative, so the potential of the land exile (disposal) is to form a acid. If high-risk positive, will be less.The prediction if NAPP are between 20 and 20 will be more difficult. In the use the ratio, if ratio potential major justification would be a sample of the potential acid production more than 3:1, experience indicates that the risk formation of drainages acid will be less (Bridie et al. 1991). For the ratio between 3:1 and 1:1, as trading range uncertainty, required additional tests kinetic. Samples with ratio 1:1 or more tend to produce low acid. Prediction of the quality drainages samples based on these values are like the assumption that the rapid reaction and minerals that consume acid will disintegrate. When repeat data for the test static, important consideration is the measure samples and how it is indistinguishable from waste or unit that is characterize.

III. Result and Discussion

A. Result of Acid Base Acounting, (ABA)

Results from statictests is a reference to determine classification of a sample rocks. Based on the result of the test static in a laboratory, is as follows: each sample test result can be seen in Table III

Rock classification method based on a static test can be done by using a different interpretation. One of the classifications is done by categorizing the sample with classification NAPP and NPR values (neutralization Potential Ratio = ANC / MPA)

TABLE III
MATERIAL CLASSIFICATION

	Potentially Acid Forming (PAF)	*Uncertain Zone*	*Non-Acid Forming*
ANC/MPA	<1	1-2	>2

Source:: (*AMD Book 2002)*

TABLE IV
DATA ANALYSIS RESULTS SAMPLES ROCKS OF STATIC TEST

No	Sample code	Parameter				
		TS	*MPA*/PKM	*ANC*/KPA	*ANC/MPA* KPA/PKM	*NAPP*/ PPAN
		(%)	Kg H_2SO^4/ton	Kg H2SO4/ton		Kg H2SO 4/ton
1	A	0.90	27.56	5.08	0.18	22.48
2	B	2.42	74.11	-10.28	-0.14	84.39
3	C	0.76	23.28	9.46	0.41	13.82
4	D	0.79	24.19	12.86	0.53	11.33
5	E	0.21	6.43	15.65	2.43	-9.22

Source: primary data (2013)

Continues

No	Sample code	Parameter			
		pH PASTA	*NAG*/PAN pH	*NAG*/PAN	
				pH 4.5	pH 7.0
				Kg H2SO4/ton	Kg H2SO4/ton
1	A	3.66	3.11	17.15	35.10
2	B	2.62	2.94	22.34	34.30
3	C	3.48	3.20	10.37	24.73
4	D	6.90	3.06	11.17	21.14
5	E	3.41	4.32	0.40	6.78

The Standard:

- % TS (Total Sulfur): Parameter American *Society for Testing and materials (* ASTM) D. 4239-11& BS ISO 19579-2006 *Solid Mineral Fuels - Treatment of Sulfur by IR Spectrometry*
- *MPA*Parameter (*Maximum Potential Acidity*) /

- PKM Business: Indonesian National Standards SNI : 6-06-2011 : trial Static Identify Water asamtambang Acid Mine Drainage)
- Parameter NAG (*Net Acid Generation*) per PAN: Indonesian National Standards SNI : 6-13-2001 : Tata Determining The Formation of Amino Neto
- Parameter ANC (*Acid Neutralisisng Capacity*)/KPA : Indonesian National Standards SNI : 7-13-2006 : Determining capacity major justification would be acid (KPA) for Material mine
- Parameter NAPP *(Net Acid Producing Potential*)/PPAN : Indonesian National Standards SNI : 6-06-2011 Static Test To Identify A source of water Acid Mine Drainage)

C. Discussion

1. Acid Base Acounting, (ABA)

Based on data from the test result static analysis geochemistry rocks with the ABA method, data in hatching according to analysis methods Graphics on the basis the ratio SPOKES/MPA, NAPP and NAG pH is as follows:

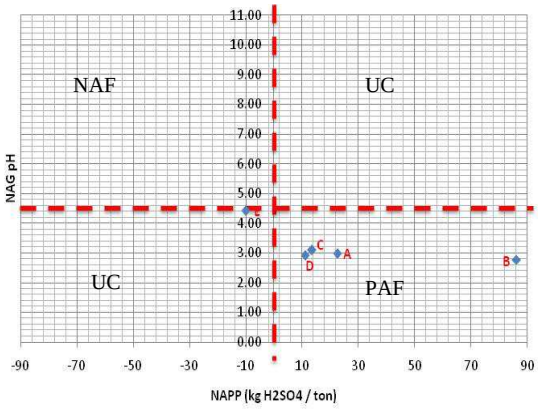

Fig 1.. Analysis of rocks Based Graphics

From results graph in the picture IV.3 then, that the result characteristic geochemical analysis to 5 (five) fruit samples of rocks obtained 4 samples are samples had A,B,C and D include intorocksclass with type *PAF* and a sample E that include class *uncertain (UC)*, in detail can be seen in table VI result of types of rock samples with test static. Samples advanced this will be tested kinetic and in test major justification would be with ash coal.

According to analysis of types of material acid above, from the five samples that has been tested static, it can be said that the samples that PAF strong, 3 samples include PAF are, and a sample uncertain PAF.

TABLE VI
RESULT OF CLASIFICATION SAMPLES ACID ROCK

No	Listing	Classification
1	A	PAF
2	B	PAF
3	C	PAF
4	D	PAF
5	E	UC(PAF)

IV. CONCLUSIONS

From the result of the research, it had taken some conclusions: The characteristics Geochemistry rocks with the method trial static can give classification of some samples of rocks that comes from coal miners. Characterization rocks with test static based Acid base Acounting (ABA). From the analysis of 5 samples of rocks that comes from disposal coal miners, and rocks can be categorized as a potential natural stone as the former acid mine drainage with the category is Strong, and low.

ACKNOWLEDGMENT

Author thanks for Head Laboratory and staff of Laboratory Polytecnic of Sriwijaya Department Chemical Engineering and Energy and the Head Laboratory PTBA on support for Research and analysis

REFERENCES

[1] Benzaazoua, M, Bussie 're,B, A.M, Dagenais, Archambault (2004), Kinetics Tests Comarissons and Interpretation for Prediction of the Joutel tailings Acid Generation potential, Journal of Environmental Geology 1086-101

[2] Hessley, R. K.,Reasoner J. W. (1986),, and Riley J. T. , Coal Science,John Wiley and Sons, New York, 81 - 87

[3] Journal of Nuclear Science and Technology,2001, Vol. 38, No. 9, p. 766-772

[4] Honrnbeerger, R, Brady, Chapter 5, Static Test for the Prediction of Mine drainage Quality, The Department of environmental Protection : Puttsville

[5] Rose, Arthur W, Cravotta, Chapter 1: geochemistry, of Coal Mine Drainage Department of Geoscience, Pen State University

[6] Tear, A, Schuler, Freeman W. J and Smith, R (1978) Field and Laboratory methods Applicable to overburdens and minesoils, (Virginia Morgantown Udayana University College of agriculture and forestry) economic partnership agreement (EPA) - 600/7-2-054, P-47.50

[7] _____1997 , TimikaEnviromental Laboratory, PT Freeport Indonesia Test Method- Acid Neutralising Capacity

[8] Smart, Roger, (2002), HIGH Test handbook: Project P387A Predection& Kinetic Control Acid Mine Drainage , Melbourne Australia: AMIRA International Limited

[9] U.S, EnviromentalPratection Agency (EPA) (2009), Static Test and Kinetic Test Methodes for Prediction of Mine Drainage Quality,