



P20

Dry Cover Method to Prevent Acid Mine Drainage Generation in Coal Mine Site: Oxygen and Water Behavior Field Measurement

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Abstract

In this field measurement, observation of dumping method construction was firstly carried out in order to determine the characteristic of physical condition of overburden dumping site. Prior the measurement, geochemical characterization was also conducted to understand the capacity of acid production in the rock material of dump. The oxygen and water behavior then was observed by using MIJ 03 (E.M.J. Co. LTD.) and SM 300 (Delta-T) sensor, recorded with data logger. Based on the result, layer with potentially acid forming rock has lower value of oxygen level compared to non-acid forming rock layer. Unlike the non-acid forming rock layer, where the increasing depth has concordance value in the decreasing oxygen concentration, potentially acid forming (PAF) rock showed unconformity which possibly happened because of the heterogeneity of capacity in producing acid. In the contrary, water moisture showed similar behavior between the PAF and non-acid forming (NAF) rocks. This behavior suggested the important of NAF thickness in dry cover method to reduce oxygen and water infiltration, since the acid mine drainage reaction is less relied on the depth, highly depend on its sulfide minerals concentration within the rocks.

1. Introduction

Acid mine drainage (AMD) is infamous environmental problem in mining site. This issue is prominent due to its large scale effect that can pollute surrounding water environment in mine, thus negatively alter the adjacent water bodies in the same water system. For minimizing the negative effects of AMD to the environment, prevention method is mandatory to be conducted in the mine site.

Oxygen and water play prominent role in the AMD generation, therefore their behavior is important to be understand. As example, in small scale of kinetic test, it was found out that flushing rate of water will either increase or decrease the rate of AMD generation (Kusuma, 2012). Oxygen behavior is also interesting study to be carried out, as several studies (Mbonimpa et al, 2003; Miller, 2010) have already attempt to find out the behavior of oxygen in regard with AMD generation, however many aspects still need to be investigated.

This research attempts to investigate the behavior of oxygen in both PAF and NAF layer on the on-going dry cover construction, especially its relationship with the moisture in both layers. As preliminary study, observation was conducted in the coal overburden dumping site in order to find out oxygen concentration within the layer as well as the

water moisture. Both of PAF and NAF layer were measured from the surface and 150 cm depth, where the layer has not been covered. Hence, the behavior of oxygen and moisture highly depend on the physical and chemical reaction of rocks. Furthermore, the field data of geochemical capacity of rock is also provided to understand the relationship between rocks, oxygen and water.

2. Materials and Methods

Field observation was conducted in PT Bukit Asam (PTBA), coal mining company situated in South Sumatera Province, Indonesia. There are three mines under the possession of this company, Tanjung Air Laya (TAL) mine, Muara Tiga Besar (MTB) mine and Banko Barat mine. AMD problems could be found in all of the mine, while the worst was faced by Banko Barat mine. Dry cover method by segregation of PAF and NAF rock is applied in one of the overburden dumping site in Banko Barat. Therefore, the observation was chosen to be carried out in Banko Barat mine.

2.1. Materials

Rock materials in Banko Barat dumping site consists of various claystone, siltstone, sandstone and tuff. The mixture of various rocks creates heterogeneous physical geochemical properties, thus the only difference was the acid producing of

each layer, depends on the PAF or NAF layer rocks.

2.2. Methods

Following is the illustration of oxygen and soil moisture sensor configuration in PAF and NAF rock layer (see Figure 1). Prior the measurement, rock samples were taken from 50 cm, 100 cm and 150 cm depth then its geochemical properties measured.

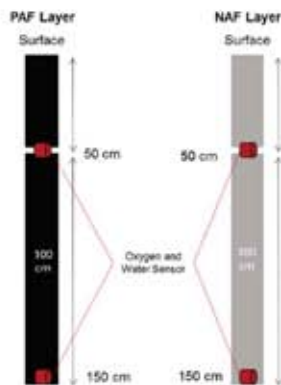


Figure 1. Sensor installation in dumping

3. Results and Discussions

From the geochemical result based on data of Geological Engineering division in PTBA (see Figure 2), Banko Barat shows an indication to produce AMD problems in the highest possibility among all of mines. Various capacities of rock in producing and neutralizing acidity were also shown.

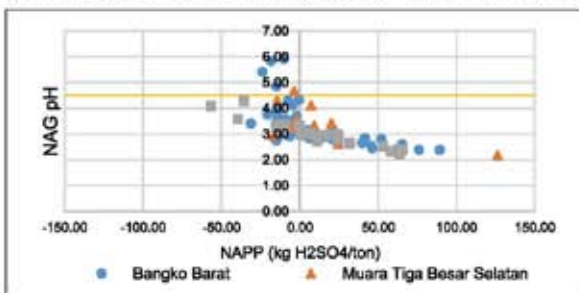


Figure 2. Geochemical results of PTBA mines

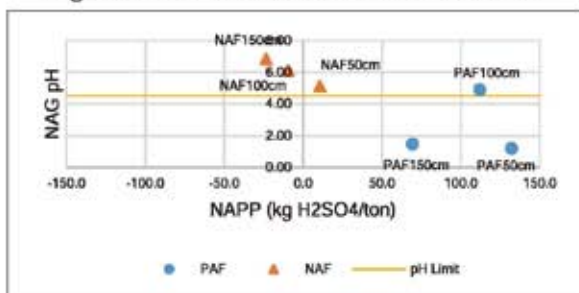


Figure 3. Geochemical characteristic for PAF and NAF layers

PAF layers showed the random order of capacity value of rocks (see Figure 3). This was understandable, since the dumping method. However, in the points of measurement, PAF 50 cm and PAF 150 cm showed large potential in producing acid. Different trend was shown by NAF layer, as the increasing depth seems to affect

neutralizing capacity to also increase. This may happened as the result of leaching process, where the carbonates are transported and accumulated in deeper location.

There is a large gap of oxygen measurement between PAF and NAF layer (see Figure 4). Therefore, with the similar condition, as both of the layer expose to the surface, the drastic difference suggests oxidation process that happened in PAF layer therefore consumption of oxygen occurs. Reduction of the oxygen level in the PAF is

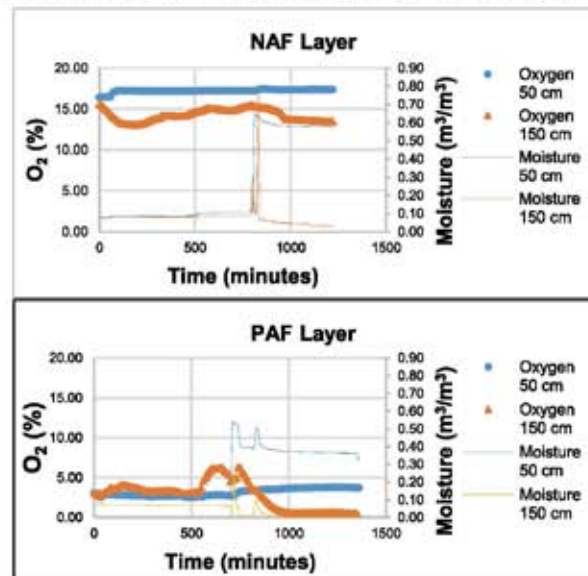


Figure 4. Oxygen and water moisture results

significant compared to NAF, thus acid production expected to be excessive and high. In contrary, similar behavior of water behavior was observed in PAF and NAF layer. Without special behavior or treatment, NAF layer is expected to reduce oxygen penetration that this function depend entirely to layer thickness. Sufficient availability of NAF layer to minimize the oxygen penetration is prominent key that need to be underlined.

4. Conclusion

Result of oxygen measurement between NAF and PAF layer indicates the oxygen consumption that occurring due to the pyrite and other sulfide mineral oxidation. Moreover, the unconformity of increasing depth to the oxygen behavior in the PAF layer might be happened because of the rock material heterogeneity, which result in various level of oxidation process with insignificant effect of depth.

Reference

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