INFLUENCE OF ACID COAL MINE ROCK ON THE QUALITY OF RIVER WATER AND SEDIMENT

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1. Introduction

Coal mining operations disturb large volumes of geologic material and expose them to the environment. Trough this exposure to air and water, sulfide minerals commonly associated with coal and metal deposits are oxidized and hydrolyzed resulting in acid mine drainage (AMD). River and sediment are impacted by AMD, and enable streams receive AMD from old, abandoned surface and deep mines (Skousen, 1987).

Due to the problem of AMD pollution, was carried out comparison of acid mine rock as a source AMD with river water and sediment as an affected area.

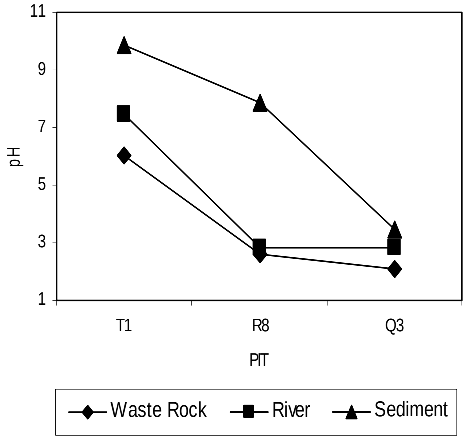

Figure 1. pH in different location

2. Site Description and Samples

Original sample is taken from PT. Berau Coal Mining, East Kalimantan, Indonesia. The mine waste (waste rock) originated from 3 pit mine dumps which has different dumping time. T1 is fresh overburden, R8 is less than 1 year dumped, and Q3 is more than 1 year dumped. River water and sediment samples were also taken in the surrounding of each pit mine dump.

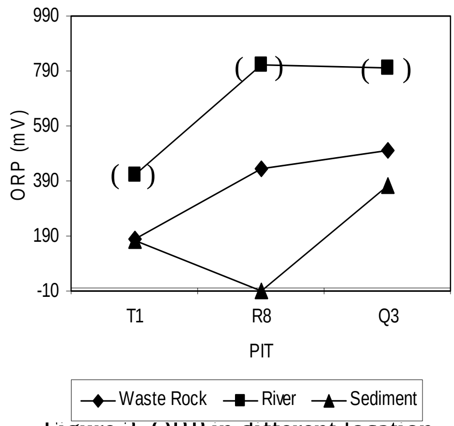

Figure 2. ORP in different location

3. Methods

Leaching test was carried out with 500 ml of dilute H_2O are blended with 50 gram of the sample (crushed and sieved < 4 mm). The mixture is shaken for 6 hours in accordance with JLT No. 46 of the Japan Environment Agency (L/S ratio: 10; shaking time: 6 hours; filtration: 0.45 μm). The pH, electrical conductivity (EC), Oxidation Reduction (ORP), anion (SO_4^{2-}), and metal of the filtered solution were measured. Metal concentrations (Fe, Cd and Zn) were quantified by inductively coupled plasma spectroscopy (ICP) after pre treatment with nitric acid. The SO_4^{2-} concentrations was determined by Ion Chromatography.

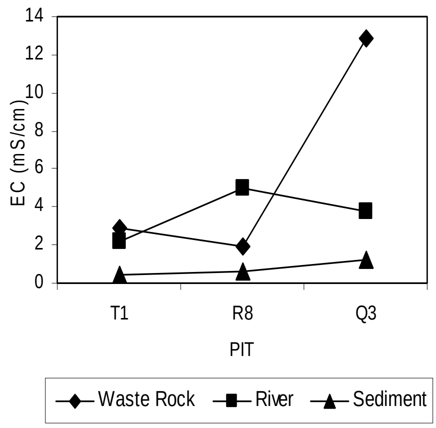

Figure 3. EC in different location

4. Result and Discussion

Figure 1 shows pH of waste rock was affected pH of river water. pH of sediments present more better condition in pit T1 and R8, but still low in pit Q3. As contaminated streams flow into river water, dilution occurs making the sediment less acid.

Figure 2 shows oxygen reduction (ORP) of leachate of waste rock, river water and sediment. ORP value of waste rock, river water and sediment in pit Q3 were higher than others point. ORP of river water was not measured on the sampling time; these data can be used as reference value only (■). Sediment had low ORP because in the bottom of river as sediment placed, oxygen relative had not produced. Figure 3 compares EC of waste rock, river and sediment. Waste rock in pit Q3 was very high EC, because pit Q3 was dumped more longer than others pit, it caused accumulation of acid (SO_4^{2-}). This condition also was affected river quality. Because in sediment area has less oxygen, high EC in waste rock and river was not affected sediment.

Table 1. Comparison of anion and metal concentration in pit T1 (mg/l)

Location	SO_4^{2-}	Fe	Cd	Zn
W. Rock	435	0.14	0.01	0.2
River	1100	0.01	0.01	0.06
Sediment	116	0.04	0.04	0.03

Table 1 shows alteration of metal concentration from waste rock as affected to river water and sediment. SO_4^{2-} concentration was increased in river water, which has high EC value. Metal concentration in river was diluted by water. In general condition, sediment adsorbs much metal ions in river water.

Figure 4, 5 and 6 present diagrams of element concentrations in pit T1, R8 and Q3. In pit R8, figure shows that diagram shape was not same in each sample. It is probably that relationship of waste rock, river water and sediment were very small. In pit T1 and Q3, figure show that diagrams shape of waste rock and sediment were very similar. It means relationship among waste rock, river water and sediment was very large.

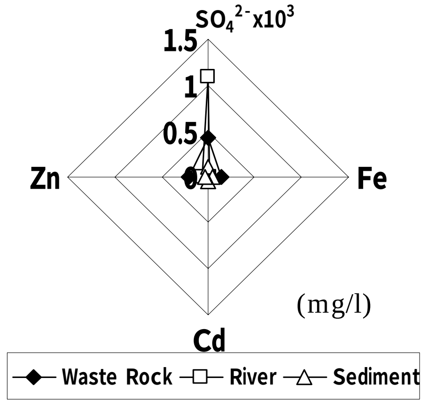

Figure 4. Concentration of elements (pit T1)

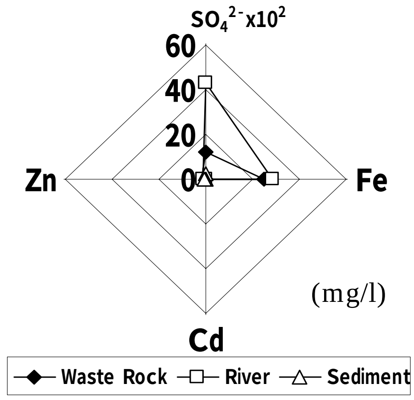

Figure 5. Concentration of elements (pit R8)

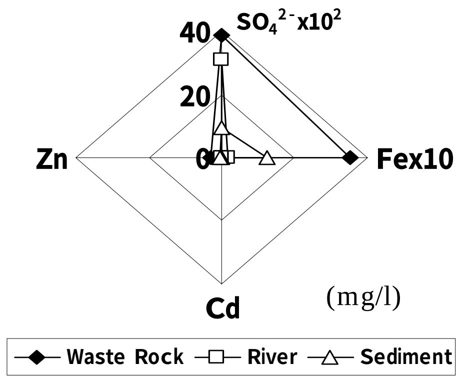

Figure 6. Concentration of elements (pit Q3)

5. Conclusions

Based on the results of the analysis, the following statements are concluded:

- Influenced of acid mine rock to river and sediment depend on characteristic of parameter and habitat itself.
- If dilution occurred in one area, concentration some elements would be decreased; metal concentration was low in river area.
- In condition no or low oxygen, oxidation process would not occur to produce others chemical compounds; in sediment area EC, ORP and SO_4^{2-} value showed lower than waste rock and river.
- Relationship among waste rock, river water and sediment was very large in pit T1 and Q3.

Reference

Skousen, J. G., et al (1987). A review of procedures for surface mining and reclamation in areas with acid producing materials. West Virginia University Energy Research Center, Pub. No. 87, Morgantown, WV.

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