

## **Study on Metal Removal Efficiencies Resulted from Treatment of AMD & ARD from Abandoned Mine Sites Using Apatite.**

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### **ABSTRACT**

The apatite drain system developed by author is a new method for AMD treatment. A naturally occurred material was sought which will remove metals from AMD, produce insoluble and powdery precipitates, have buffering capacity or at the least maintain the pH after reaction, and dissolve slowly so that it lasts several years or several decades. Apatite from Florida satisfied these conditions. Laboratory and field experiments showed that this technique is quite effective for the removal of high concentrations of iron and aluminum in the AMD with pH less than 4.0. The apatite drain system removed iron up to 4,200 mg/l, aluminum up to 830 mg/l, sulfate up to 13,430 mg/l, and acidity up to 8,900 mg/l during the nine month monitoring period. The removal rates of iron ranged between 20.0 and 58.3 percent, and aluminum removal rates ranged between 20.8 and 58.6 percent. The variation of removal rates seems to be resulted from the variation of flow rates. Flow rates measured at the gabion structure ranged 3.0 to 4.5 l/m. In addition, this system removes both ferric iron and ferrous iron whereas constructed wetlands systems remove only ferric iron when it is converted from ferrous iron in the wetlands. Apatite also remove heavy metals in AMD(Acid Mine Drainage) and ARD(Acid Rock Drainage) from abandoned metal mines. The laboratory experiment for removal of arsenic in ARD using Florida apatite from the Goro lead/zinc abandoned mine located at Gyeongsangbuk-do, South Korea. As a result of the laboratory experiment, pH, arsenic removal ratio, and dissolution amount of apatite are inversely proportional to flow rates, and apatite removes 100%(0.174 mg/l) of arsenic at 0.6

ml/min/kg flow rate. Average pH was also increased from 6.29 to 7.21. A field experiment using Chinese apatite was performed to remove heavy metals such as As, Fe, Pb, Al, Cd, Cu and Zn, in AMD from the Ilkwang abandoned copper mine located at Busan, South Korea. Concentrations of these metals of inlet waters are 2.00, 126.4, 0.12, 17.88, 0.12, 10.39 & 18.52 mg/l, respectively. Results of average removal rate of these metals using Chinese are 84.17, 91.43, 92.43, 35.72, 38.02, 20.90 and 14.88% respectively. Average pH was also increased from 2.87 to 3.53. Therefore, apatite will be used as a precipitant for mine drainages having wide range of pH based on these studies. However, further research on the apatite drain system is necessary to define the actual mechanism of the precipitation process and the constituents of those precipitates in order to optimize design of the apatite drain system.

Key words: Apatite, Precipitate, AMD, ARD, Heavy Metals