

Safe Disposal of Pyrite Rich Waste Rock Using Alkali Phosphate Treatment

Authors : Jae Gon Kim, Yongchan Cho, Jungwha Lee

Abstract : Acid rock drainage (ARD) is generated by the oxidation of pyrite (FeS_2) contained in the excavated rocks upon its exposure to atmosphere and is an environmental concern at construction site due to its high acidity and high concentration of toxic elements. We developed the safe disposal method with the reduction of ARD generation by an alkali phosphate treatment. A pyrite rich andesite was collected from a railway construction site. The collected rock sample was crushed to be less than 3/8 inches in diameter using a jaw crusher. The crushed rock was filled in an acrylic tube with 20 cm in diameter and 40 cm in height. Two treatments for the ARD reduction were conducted with duplicates: 1) the addition of 10mM KH_2PO_4 3% NaHCO_3 and 2) the addition of 10mM KH_2PO_4 3% NaHCO_3 and ordinary portland cement (OPC) on the top of the column. After the treatments, 500 ml of distilled water added to each column for every week for 3 weeks and then the column was flushed with 1,500 ml of distilled water in the 4th week. The pH, electrical conductivity (EC), concentrations of anions and cations of the leachates were monitored for 10 months. The pH of the leachates from the untreated column showed 2.1-3.7, but the leachates from the columns treated with the alkali phosphate solution with or without the OPC addition showed pH 6.7-8.9. The leachates from the treated columns had much lower concentrations of SO_4^{2-} and toxic elements such as Al, Mn, Fe and heavy metals than those from the untreated columns. However, the leachates from the treated columns had a higher As concentration than those from the untreated columns. There was no significant difference in chemical property between the leachates from the treated columns with and without the OPC addition. The chemistry of leachates indicates that the alkali phosphate treatment decreased the oxidation of sulfide and neutralized the acidic pore water. No significant effect of the OPC addition on the leachate chemistry has shown during 10-month experiment. However, we expect a positive effect of the OPC addition on the reduction of ARD generation in terms of long period. According to the results of this experiment, the alkali phosphate treatment of sulfide rich rock can be a promising technology for the safe disposal method with the ARD reduction.

Keywords : acid rock drainage, alkali phosphate treatment, pyrite rich rock, safe disposal

Conference Title : ICEP 2019 : International Conference on Environment and Pollution

Conference Location : Zurich, Switzerland

Conference Dates : July 29-30, 2019