ABSTRACT

Acid mine drainage (AMD) is one of the severe environmental problems associated with mining of Tertiary coal in various parts of the world. Although AMD from the Jaintia Coalfield of Meghalaya, India, is known for quite sometime, its detail manifestations are not well understood. This study is an attempt to carry out a detailed quantitative geochemical appraisal on generation of AMD, its effects on surrounding water and soil, besides exploring the possibilities of using locally available waste such as fly ash and clinker dust in its remediation.

The mine discharge is extremely acidic (pH: 1.6-4.8) with high concentrations of Fe, Al, Mn, Ni, Pb, Cd, Zn and REEs. The chemical composition of AMD is controlled by oxidation of sulfide minerals. Surface water is contaminated by AMD and classified into Na-SO_4^{2-} or Ca-Mg-SO_4^{2-} type whereas groundwater not being contaminated (most samples) is grouped into Ca-Mg-HCO_3^- type. The sediments and soil are moderate to highly contaminated due to AMD and metals are enriched in their exchangeable fractions due to the highly acidic environment. All water types including the AMD are saturated with Fe - oxyhydroxide mineral phases that agree well with the presence of ochre precipitates observed in the affected areas. From the acid-base accounting of coal, and mine waste it is concluded that blocky pyrites and pyriteferous sandstone contribute more intensely towards acidity than coal and carbonaceous shale. Among the mine wastes, the secondary sulfates and blocky pyrites have high potential to release metals into the environment while most of the metals in coal can become bioavailable under oxidizing conditions.

Metal concentrations are successfully removed from AMD by modified coal fly ash through chemisorption as established from the pseudo-second order kinetic process while the mixture of fly ash and clinker dust effectively encapsulated the pyrite grains through cementation.

Keyword: *Acid Mine Drainage; Hydrogeochemistry; Ochre; Acid Base Accounting; Jaintia Hills coalfield; Secondary sulfate; Metal Mobility; Remediation*.