Preliminary study on colloidal partitioning and speciation of trace metals in acid mine drainage

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<Abstract>

Many researches in Korea have been performed to understand the pollution of stream waters by acid mine drainage. However, few studies have been conducted regarding the effect of particulate and colloidal fractions on the transport of trace metals. To estimate harmful effects of trace metals, it is important to evaluate the particulate and colloidal metals as well as dissolved metals, because particulate and colloidal fractions of trace metals play an important role in transport of trace metals and may adversely affect habitats and organisms in riverine system. Colloids are solids with effective diameters in size range from 0.001 μm to 1 μm. According to Jone et al. (1974), metals in surface water, like Al, Fe, and Mn, require filtration with pore-size membranes smaller than 0.45 μm to define dissolved concentrations. The main objective of this study is to understand the effects of particulate, colloidal, and truly dissolved fractions on the transport and fate of trace metals in acid mine drainage.

This study was conducted for the Onjeong creek in the Uljin mine area. Sampling was carried out in 13 sites, spatially covering the area from mine dumps to the downstream Onjeong reservoir. To examine the metal partitioning between particulate, colloidal, and truly dissolved fraction, we used successive filtration techniques consisting of conventional method (using 0.45 μm membranes) and tangential-flow ultrafiltration (using 0.001 μm membranes). Ultrafiltration may seperate much smaller particles from aqueous phase (Josephson, 1984; Hernandez and Stallard, 1988). The analysis of metals were performed by inductively coupled plasma - atomic emission spectrometer (ICP-AES: model Perkin Elmer OPTIMA3000XL). Anions such as SO_4, Cl and NO_3 were measured with ion chromatograph (IC: model Dionex 120). Sample analysis is still in progress.

The preliminary data show that the studied creek is severely polluted by Al, Fe, Mn, Pb and Zn. Toward upstream sites with relatively lower pH, less than 50% of Al and Fe occur in the sorbed form on particles or colloids, whereas more than 80% of Al and Fe occur in the sorbed form in downstream sites or tributaries with relatively higher pH. Less than 30% of Zn is present in particle

or colloidal forms in the whole range of creek. Truly dissolved fraction of trace metals is negatively correlated with pH. The Kd values for Al, Fe and Zn consistently increase with increasing pH and decrease with increasing particle concentration.