

Assessment of Arsenic and Heavy Metals Leaching Behavior in Contaminated Soils of Abandoned Metalliferous Mines, Korea

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ABSTRACT

The objective of this study is to assess chemical leaching behavior of arsenic and heavy metals in contaminated soils and tailings from various abandoned metalliferous mines in Korea. Eighteen samples including soils and tailings were taken at 9 representative mines with 5 Au and Ag(+ base metal) mines and 4 base metal mines in Korea. Various leaching tests including KSLT, SPLP, TCLP were examined. In addition, extractions of the elements in the samples with 0.1, 0.5, 1.0 and 3.0M HCl and aqua regia were also undertaken. After extraction of the elements, chemical compositions of As and heavy metals in the samples were measured by use of AAS. In general, the pH values of solution extracted from soils and tailings were decreased with increasing acid concentration. In spite of pH=1 for solution extracted by 0.1N HCl theoretically, it was in the range of 2.0 to 8.0 due to buffering effect of carbonates in the samples. As a result of chemical analysis, the concentrations of As and heavy metals extracted by various leaching reagents were increased in the order of KSLT < SPLP < TCLP < 0.1M HCl < 0.5M HCl < 1.0M HCl < 3.0M HCl < aqua regia. It is generally accepted that the strength of extraction reagent is one of the most important factor to evaluate metal concentrations in soils and tailings. In order to compare the variation of element contents between soil pH and concentrations of extraction reagents, 0.1, 0.5, 1.0 and 3.0M HCl, the samples were divided by three groups as their pH values; less than 5.0, 5.0 to 8.0 and over 8.0. The samples with less than 5.0 of pH were extracted a small amount of As and heavy metals, which are similar to those of extracted by SPLP and

TCLP. Extractions of arsenic and heavy metals, however, were rapidly increased with increasing the concentrations of acid. The samples with pH value between 5.0 and 8.0 were easily extracted than those of less than 5.0. In case of the samples with pH > 8.0, the amount of heavy metals were hardly extracted due to buffering effect of carbonate mineral at weakly acid. Leaching amount by strong acid, however, can be ignored buffering effect of carbonate mineral. In comparison to extraction ratio with aqua regia, the ratios for Cd extracted by SPLP, TCLP and 0.1 to 3.0M HCl were quite constant. The extraction ratio of As was increased at 0.5M HCl, but the ratio was less than 70% at amounts of heavy metals extracted by aqua regia. It is also found that extraction ratios for Cd and Zn are much higher than those for Cu and Pb due to differences in geochemical characteristic.

Key words: Arsenic, Heavy metal, Chemical leaching, KSLT, SPLP, TCLP