

Characterization of arsenic and lead in soils immobilized by stabilizing agent with sequential extraction method

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1. BACKGROUND AND OBJECTIVES

In recent years, excavation and removal of the contaminated soil has been most widely employed as a countermeasure for soil contamination in Japan. However, this method may raise economical and technical problems; thus, *in situ* stabilization/solidification technique has been also executed these years to immobilize the contaminants in soils, particularly heavy metals. When employing this technique, it is important to limit the leaching potential of heavy metals in a long-term perspective. Various chemical analysis methods have been developed to identify forms of heavy metals/metalloids in soil, and one of the typical methods is a sequential extraction method which can extract various forms of metals/metalloids sequentially by using appropriate solvents. In this research, two sequential extraction methods were applied to lead and arsenic contaminated soil, respectively, which is treated by Ca/Mg composite agent, to assess immobilization behaviors affected by soil types and metal contents. In addition, the effects of accelerated carbonation on the form of lead and arsenic in the immobilized soil were evaluated to understand the immobilization performances subjected to carbonation, which usually occurs in field.

2. MAIN ACHIEVEMENTS

- (1) A two-times extraction during the sequential extraction with each solvent is preferable to reliably identify the fractions in which the arsenic was bound. However, for the soil containing non-anthropogenic arsenic, the testing results on reducible and residual fractions did not provide sufficient reproducibility.
- (2) For arsenic contaminated soils, Fe-bound exchangeable fraction was increased by the immobilization treatment. After two weeks accelerated carbonation, pH drop did not occur and leaching potential was not increased, since Ca-bound exchangeable fraction was transformed to Al and Fe-bound exchangeable fractions. For the highly contaminated soils, the residual fractions was relatively reduced, and other exchangeable fractions were increased.
- (3) For lead contaminated soils, residual and exchangeable fractions were dominant in the sandy soil and clayey soil, respectively, before and after immobilization. However, immobilization treatment reduced the amounts of exchangeable fractions.
- (4) Different trends was observed in fraction of water-soluble compared with sand samples and clay samples, considering immobilization and accelerated carbonated samples. To conduct accelerated carbonation, about sand samples, water-soluble fraction was increased slightly, on the other hand, it decreased in clay. (Figure 1)
- (5) In a sequential extraction method for arsenic, the fraction of Ca-bound exchangeable fraction decreased both in sand and clay under conducting accelerated carbonation. Considering fractions of water-soluble fraction and Ca-bound exchangeable fraction as “Exchangeable and weak acid extracted fraction”, this fraction decreased both in sand and clay samples. This fact implies that the risk of extraction by easily happening changes of environment was decreased regardless of types of soil. (Figure 1)
- (6) In a sequential extraction procedure for lead, a clear difference was not observed between immobilized soil and accelerated carbonated soil. The difference may be got by subdividing the extracting operation of Step 1
- (7) There was no decrease in pH even under accelerated carbonation. The possible reasons were two points; 1) pH buffering effect of Ca/Mg composite or 2) carbonation wasn't occurred because of water deficit.

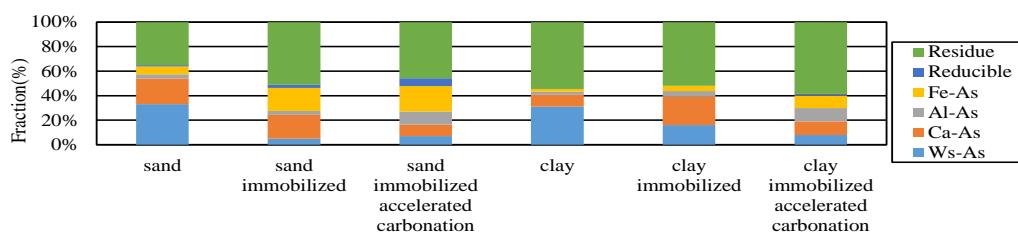


Figure 1 Results of sequential extraction procedure for 1.5 mg/g As-simulated contaminated soil