Evaluating Leaching Behavior of Non-Anthropogenic Heavy Metals in Soil and Rock

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1. Background and objectives

Non-anthropogenic heavy metals are distributed widely in Japan in soils and rocks due to geologic processes. Therefore, after excavation of such soils and rocks during construction works, heavy metals are often leached and its concentrations exceed the criterion of contaminated soils. Although the standard method prescribed in the the Japanese law is widely applied as a common one for contaminated soils, this method can give only a concentration at shaking of material and solution. This present condition does not allow for proper judgement and has facilitated the need to develop various evaluation methods for leaching of heavy metals from contaminated soils. However, the effect on the leaching behavior of such heavy metals derived from nature is dependent upon the experimental conditions and method used, and this has resulted to incomprehensive information about the leaching behavior of heavy metals. Given such backgrounds, the objective of this study is to enhance the understanding of existing leaching tests by comparing results from existing method with that obtained from this study.

2. Materials and methodologies

In this study, the leaching behavior was evaluated under testing conditions similar to practical field conditions using large scale column test equipped with a waterdrop system (hereafter, waterdrop column test). the columns of 15 cm in diameter and 90 cm in height were used for soil and rock containing arsenic, respectively. Granodiorite, Quartz diorite and sandy soil were used in this study (Table 1). First of all, the rock samples were crushed and an unifying particle size specimens were prepared. After that samples were test with up-flow and waterdrop column tests. Also the pH properties were evaluated.

Table 1 Basic properties of materials

	unit	Granodiorite	Quartz diorite	Sandy soil
Particle density	Mg/m^3	2.646	2.750	2.640
Fines [< 0.075 mm]	%	0.60	0.90	4.0
Sand [0.075 to 2 mm]		7.9	15.2	96.0
Gravel [> 2 mm]		91.5	83.9	-

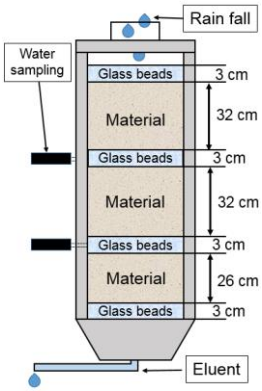

Fig-1 Waterdrop column figure

3. Main achievements

The main results obtained from this study are discussed below:

(1) With the granodiorite, the arsenic concentration from the up-flow column test became higher, although contact time of materials was longer in the waterdrop column test.

(2) pH and rock-solution contact time affect the arsenic leaching based on the results of a series of experiments (Fig 2). The maximum value of the arsenic concentration during test period was 0.6 mg/L and 0.1 mg/L in the up-flow column test and the waterdrop column test, respectively.

(3) For the sandy soil, the results of the up-flow column test and the waterdrop column test were similar. The leaching behavior close to the real field could be observed by the up-flow column test.

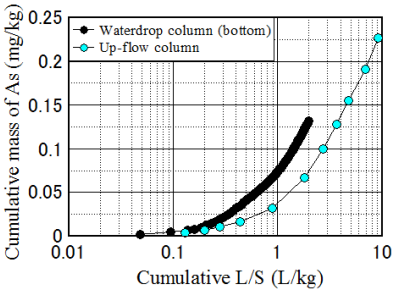

Fig 2 Arsenic concentration in both column tests (Quartz diorite)