Leaching Characteristics of Hexavalent Chromium from Cement Stabilized Soilunder Intermittent Wetting and Drying Process

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1. OUTLINE OF THE RESEARCH

Cement stabilization is a useful technique for ground improvement in construction works. Cement stabilized soil is subject to the leaching of hexavalent chromium (Cr (VI)) with its concentration higher than the environmental criteria (0.05 mg/L) in some cases. Previous researches have examined the effects of types of cement and soil on the Cr (VI) leaching concentrations based on the results of leaching tests[1),2)]. However, these researches did not investigate enough the long-term leaching behavior of Cr (VI) as well as its physical and chemical mechanism[3)]. In this research, Cr (VI) leaching behavior from the cement stabilized soil under intermittent drying and wetting process was examined with the laboratory tests to estimate the long-term leaching potential of Cr (VI) from the cement stabilized soil. In addition, its environmental impact was evaluated by simulating the diffusive leaching of Cr (VI) from the cement stabilized soil and its transport in the subsurface using the numerical analysis.

2. METHODS

(1) Laborabory experiments

Cr (VI) leaching properties of various specimens, two types of volcanic cohesive soil and alluvial clay stabilized with OPC, was examined with several leaching tests. Main focus was placed on the effects of 1) the intermittent wetting and drying, 2) shape of specimen (monolithic or crushed), and 3) types of soil on the Cr (VI) leaching behavior.

(2) Numerical analysis

Fick's second law was employed to determine the effective diffusion coefficients, which represent Cr (VI) dissolution and diffusive leaching in the cement stabilized soil. 2D advective-dispersive chemical transport analysis was conducted to evaluate the environmental impact caused by the Cr (VI) leaching by employing the effective diffusion coefficients determined.

3. RESULTS AND DISCUSSIONS

1) Intermittent wetting and drying process promoted the Cr (VI) leaching from the cement stabilized soil, particularly from the cement stabilized alluvial clay, whose Cr (VI) concentration in the core of specimen exhibited four times higher value.
2) Cumulative mass of leached Cr (VI) has a strong relationship between the pH decreasing propertyof cement stabilized soil due to the neutralization effects. The degree of neutralization can be the index of the enhancement of Cr (VI) leaching.
3) Effective diffusion coefficient experimentally determined for the specimen under the intermittent wetting and drying process was five times larger than that for the specimen cured in water-saturated condition.
4) Analytical results indicated that the cement stabilized soil subjected to the wetting and drying process has the higher potential for the subsurface contamination; almost four times higher Cr(VI) concentrations in the groundwater.

REFERENCES

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