

Peer-reviewed Conference Contribution

Experimental investigation on infiltration behavior of sodium ion in compacted bentonite

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Because of its high swelling capacity and low hydraulic conductivity, bentonite has been selected as the candidate buffer material in deep geological disposal project for handling high-level radioactive waste. In Japan, seawater infiltration is an important issue in the evaluation of buffer material, as disposal facilities are under discussion for siting in coastal areas [1]. Sodium ion, which is the main ion in seawater, has profound effects on the properties of bentonite, such as hydraulic conductivity and swelling behaviours etc. [2][3]. These changes may be closely related to the infiltration behavior of sodium ion in bentonite. In this study, for observing the infiltration behavior of sodium ion in compacted bentonite, infiltration tests were conducted on compacted bentonite specimens with thickness of 2 mm, where the specimens were wetted by NaCl solutions with a concentration range of 0 to 1 mol/L. In the testing program, wetting time, specimen dry densities and initial water contents were varied to investigate their effects on sodium ion infiltration. After the infiltration test, final water contents of specimens were measured and leached cations were obtained using benzyltrimethylammonium chloride (BTM) method [4].

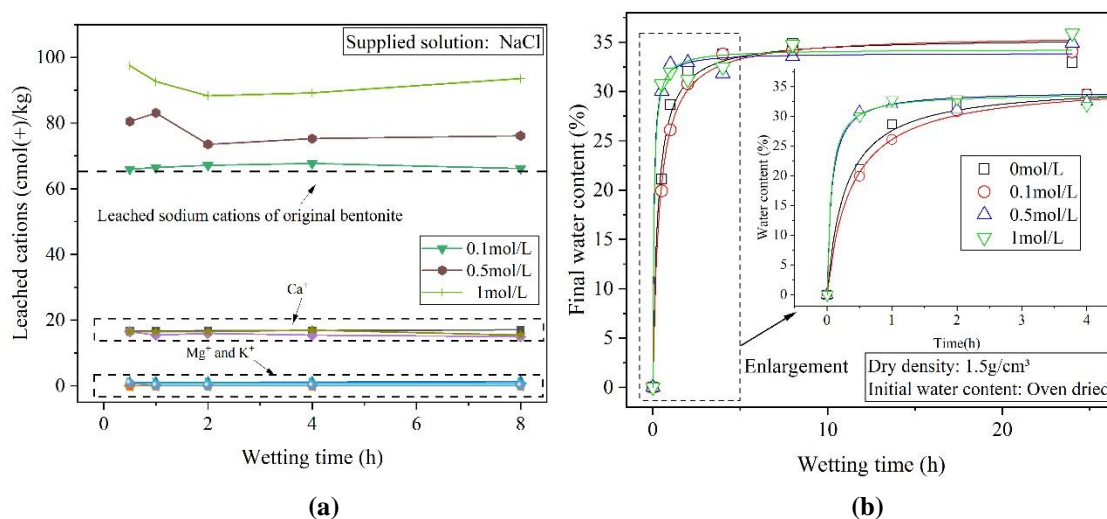


Figure 1: Results of leached cations and final water content of specimens with 1.5g/cm³ initial dry density for different wetting time: (a) Leached cation of specimens. (b) Final water content of specimens.

Figure 1 shows the results of leached cations and final water content of specimens with 1.5g/cm³ initial dry density for different wetting time. It is found that under the 0.1mol/L NaCl solution case, there is almost no sodium ion infiltration in compacted bentonite with a dry density of 1.5g/cm³ as shown in Figure 1(a). For the case of 0.5mol/L and 1mol/L NaCl solution, the leached sodium cation from specimens increases with the increase of concentration of supplied NaCl solution under the same wetting time. For other

exchangeable cations (i.e., Mg^{+} , Ca^{2+} and K^{+}), there is no appreciable difference among the varieties of NaCl solutions and wetting time. For the final water content measurement results, it is found from Figure 1(b) that the water content increasing speeds in 0.5mol/L and 1mol/L NaCl solutions are significantly faster than that in 0.1mol/L NaCl solution.

Contributor statement

Guodong Cai: Conceptualisation, Methodology, Writing-Original Draft; Hailong Wang: Conceptualisation, Review & Editing; Mika Yamada: Methodology, Review & Editing; Kunlin Ruan: Methodology, Review & Editing; Dachi Ito: Resources, Review & Editing; Hideo Komine: Supervision, Resources, Review & Editing.

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