

Reducing toxicity of asbestos-containing waste slate using direct aqueous mineral carbonation

SUNWON RHA^{1*}, HWANJU-JO² AND HO YOUNG JO¹

¹Korea University, Earth and Environmental Sciences, Seoul, Republic of Korea, sunwon671@korea.ac.kr (*presenting author)

²Korea Institute of Geoscience and Mineral Resources, CO₂ sequestration Research Department, Daejeon, Republic of Korea

Direct aqueous mineral carbonation is a method to sequester CO₂ as a form of carbonates with aqueous phase. Waste slate is one of the potential alkaline industrial wastes for mineral carbonation due to its high content of alkaline earth metals (Ca and Mg). Waste slate primarily contains cement and asbestos material. The asbestos material is considered as a carcinogenic material due to its needle-like morphology.

The feasibility of the direct aqueous mineral carbonation to mitigate the toxicity of asbestos-containing waste slate was evaluated. Leaching and carbonation tests on asbestos-containing waste slate using ammonium salts (CH₃COONH₄, NH₄NO₃, and NH₄HSO₄) solutions with various concentrations (0 ~ 4 M) were conducted. The tests were conducted under ambient temperature and pressure conditions.

The Ca leaching efficiency was the highest in CH₃COONH₄ solution (17~35%), whereas the Mg leaching efficiency was the highest in the NH₄HSO₄ solution (7~24%), regardless of a solid dosage. The Ca and Mg leaching efficiencies increased with increasing a solid dosage. The carbonation efficiency for the 1 M CH₃COONH₄ and the 1 M NH₄HSO₄ solutions, which determined using CaCO₃ content of the reacted waste slate based on TGA analysis, was approximately 30% for the 1 M CH₃COONH₄ solution and 40% for 1 M NH₄HSO₄ solution. The carbonates were precipitated on the surface of needle-like chrysotile in the reacted waste slate obtained after the carbonation tests. This study results may suggest that the direct aqueous carbonation can mitigate toxicity of needle-like asbestos by changing morphology of asbestos.