Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.13118

Optimization of Sorption Capacities and Affinities on the Multiple Sorptive Sites for Illite-rich Clays

JEONGHWAN HWANG[1], WEON SHIK HAN[1], SUNGWOOK CHOUNG[2], WON WOO YOON[1], GYEONGMIN KANG[2] AND HYUNJEONG JEON[1]

[1]Yonsei University

[2]Korea Basic Science Institute

Presenting Author: hhy6351@yonsei.ac.kr

Understanding the multiple sorptive sites on illite (e.g., frayed edge, type II, and planar sites) is necessary to evaluate the geochemical ^{137}Cs transport in soil and groundwater environments. In this study, we investigated the diverse Cs sorption using 10 illite-rich clays under various concentrations of K and Cs. In addition, the cation exchange model was performed to simulate the best-fit sorption model and optimize the sorption capacities of multiple sorptive sites on the illite-rich clays. The best-fit sorption model exhibited that variable Cs sorption of 10 illite-rich clays was related to the individual capacities at the frayed edge sites (1.76×10^{-5} to 1.12×10^{-4} eq kg^{-1}), type II sites (1.59×10^{-3} to 9.76×10^{-3} eq kg^{-1}), and planar sites (2.14×10^{-2} to 1.51×10^{-1} eq kg^{-1}). The frayed edge sites predominantly contributed to Cs sorption at low aqueous concentrations, whereas the type II and planar sites sorbed Cs at relatively high concentrations. These sorption capabilities of multiple sorptive sites were correlated to illite contents and crystallinity of 10 illite-rich clays, implicating that such parameters could be significant indicators to evaluate the Cs sorption for illite-rich clays. Finally, the reactive 1-D transport simulations showed the severe and diverse Cs retardation at low Cs concentration, implying that the frayed edge sites could play more important role on Cs transport in legacy contaminated sites of radionuclides (i.e., low Cs concentration prevails), compared to the type II sites and planar sites.