

Diffusion and sorption of ⁹⁹TcO₄⁻ in compacted SPV 200 bentonite using through diffusion methodYu-Hung Shih ¹, Liang-Cheng Chen ¹, Tsuey-Lin Tsai ¹, Chuan-Pin Lee ², Shih-Chin Tsai ³, Te-Yen Su ¹¹ Chemistry Division, Institute of Nuclear Energy Research, No. 1000, Wenhua Rd., Jiaan Village, Longtan District, Taoyuan City 32546² Department of Earth Sciences, National Cheng Kung University, No.1, University Road, Tainan City 70101³ Nuclear Science and Technology Development Center, National Tsing Hua University, Hsinchu City 30013

The characteristics of diffusion are essential to the transport of radionuclides through buffer/backfill materials, such as bentonite, which are commonly found in waste repositories. This study used through-diffusion techniques to investigate the diffusion behavior of HTO and ⁹⁹TcO₄⁻ on SPV bentonite of various densities. Diffusion rates were calculated by measuring the diffusion coefficients (D_e , D_a), plotting breakthrough curves, and interpreting experiment data. The apparent and effective diffusion coefficients of HTO ranged from 4.77×10^{-11} to 5.82×10^{-11} m²/s and 1.55×10^{-11} to 2.65×10^{-11} m²/s, respectively. The apparent and effective diffusion coefficients of ⁹⁹TcO₄⁻ range from 4.22×10^{-12} to 8.27×10^{-12} m²/s and 1.19×10^{-12} to 4.56×10^{-12} m²/s, respectively. The distribution coefficients of HTO and ⁹⁹TcO₄⁻ ranged from approximately 0.001 to 0.008 mL/g and 0.001 to 0.0077 mL/g, respectively. The D_e and K_d values were shown to decrease with an increase in the bulk dry density of compacted bentonite. Our results show that HTO and ⁹⁹Tc could be considered non-sorbent radionuclides. The data obtained in this study provide a valuable reference for the safety assessment of waste repositories.