

Distribution coefficients of rare earth elements to microorganisms including uncultivated species in deep sedimentary groundwater

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In a safety assessment of geological disposal system of high-level radioactive waste, quantitative assessment of effect of microorganisms in groundwater on migration of radionuclides is an important subject. Distribution coefficients (K_d) of radionuclides to microorganisms can be a key parameter for the assessment. However, the K_d values presented in previous studies can be incomplete, because they have been evaluated only for cultivated microorganisms that can be minor in natural environments. In this study, K_d values of rare earth elements (REEs) for microorganisms including uncultivated species in deep sedimentary groundwater were indirectly evaluated from differences between the K_d values of REEs (*i.e.*, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu) for the unsterilized and sterilized particles.

The determination of viable count showed that a 91% of microorganisms in the particles is successfully sterilized with 2-propanol. A dry weight percent of the microorganisms to the particles was determined to be 34% by the gravimetric determination of the particles before and after the sterilization. Batch sorption experiments showed that the K_d values of REEs to the particles are slightly decreased after the sterilization. Based on this difference and the dry weight percent, the K_d values for the microorganisms were calculated to be $10^{2.6} \sim 10^{3.0} \text{ m}^3/\text{kg}$, which are comparable with the literature values ($10^{1.3} \sim 10^{4.2} \text{ m}^3/\text{kg}$) presented for cultivated microorganisms. This means that the K_d values for cultivated microorganisms can be also available for microorganisms including uncultivated species. Thus, this finding can be useful for setting the K_d values of trivalent radionuclides to microorganisms in deep sedimentary groundwater.

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