APPLICABILITY OF SURFACE AREA NORMALISED DISTRIBUTION COEFFICIENTS (K_a) IN INTERPRETING MEASUREMENTS OF RADIONUCLIDE SORPTION

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The mobility of radionuclides in the environment is a key issue in assessing the future performance of nuclear waste repositories and modelling the movement of radionuclides in contaminated sites. There have been numerous experimental studies of the adsorption of radionuclides, however, it remains difficult to model the uptake of radionuclides by soils and other complex multi-component geologic materials. Although it would be desirable to utilise mechanistic sorption models (such as surface complexation models) in environmental radionuclide transport modelling, these require a large amount of experimental data and involve considerable mathematical complexity. Therefore, they are not yet available for predictive modelling of complex systems. As a result, predictions of the mobility of radionuclides in the environment generally rely on descriptive measured parameters, such as the solid-liquid distribution coefficient (K_d value) for which various compilations of data values are available (e.g. Sheppard and Thibault, 1990). In order to better understand the mobility of radionuclides in the environment, it has been proposed to utilise a surface area normalised distribution coefficient (K_a value) in which the K_d values are normalised by the measured sample surface area (Pabalan et al., 1998). The concept is developed in this paper by analysing radionuclide sorption measurements from several data sets, including experimental data for well characterised geological materials that were obtained from candidate low-level nuclear repository sites in Australia. In addition, several data-sets summarised in the extensive RES^{3}T database (Brendler et al., 2003) are also utilised in determining whether the K_a would be an applicable tool to constrain the ranges of sorption values expected for natural materials in the environment. Finally, we discuss the conditions under which the K_a value provides useful insights into radionuclide mobility and possible limitations in its applicability.

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