



## Implication of the illite layers collapse on Cs sorption by the clay colloids

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The influence of illite on caesium retention in the environment has been widely studied. In particular, radio caesium-illite interactions are of importance in the frame of radioactive waste geological disposals in argillaceous formations because illite is one of the main components of the host rock.

Many studies dealt with the interactions of Cs with different types of exchanged illite; however no previous studies considered the effects of the exchanging cation (and the ionic strength of the electrolyte) on the degree of accessibility of illite sorption sites. It is known, that illite interlayers are collapsed due to the presence of potassium, and that other alkaline metals favour the collapse as well. However, the presence of large hydrated cations may induce the opposite effect, i.e. illite layers expansion.

The collapse of illite increases the agglomeration of 2:1 layers stacks, reducing the outer basal planes and, as a consequence, the effective number of planar sorption sites. The effect of layer collapse on cation adsorption and the determination of selectivity coefficients will be discussed in this study, considering the case of Cs.

Cs sorption has been experimentally studied in illite from low to high Cs loadings (from  $6 \cdot 10^{-10}$  M to  $1 \cdot 10^{-3}$  M), and with ionic strengths from 0.01 to 1 M. The modelling was carried out on the basis of sorption isotherms with Ca-, Na- and K-homoionized illite. Data showed that specific electrolyte compositions (e.g.  $\text{CaCl}_2$  concentration  $> 3$  mM) favoured the Cs adsorption on illite reaching values much higher (up to 900 meq  $\text{Kg}^{-1}$ ) than those indicated by the cation exchange capacities reported commonly in the literature for illite (around 200 meq  $\text{Kg}^{-1}$ ). A novel approach for the Cs sorption modelling was used in this study taking under consideration the possible (de)collapse of the illite. The collapse factor would have important implications in the Cs retention and in the Cs colloid-driven transport predictions since environments with low concentration of alkali metals or/and with presence of large hydrated cation as  $\text{Ca}^{2+}$  would enhance the Cs sorption on the illite colloids to values much higher than those predicted by the models developed so far. In those environments, planar sites would play an important role on Cs sorption at medium Cs loadings.