

Role of anions on smectite colloids stability

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In a contaminant transport scenario, it is quite important to follow colloid behaviour. In particular, the modifications of the particle size (aggregation or disaggregation processes) are very important, because colloid size controls Brownian motion, filtration, retention and settling phenomena, leading to different interactions with the host rock, and therefore, in the end, to a different fate of colloids (and adsorbed contaminant) in groundwater.

To define the stability of a colloidal system, parameters like the critical coagulation concentration, CCC, the point of zero charge, PZC, or the isoelectric point, are adopted and often derived only from electrophoretic measurements. Furthermore these parameters are usually determined in simplified systems using indifferent (non-sorbing) electrolytes. For this reason, they may not be totally representative of the real behaviour of colloids in nature. DLVO theory, widely used to assess the stability of colloidal particles, mostly neglects the role that chemical forces may play in a system. Ion adsorption, in fact, may change colloid surface properties in a critical way.

In particular, the effects of anion adsorption on clay colloid stability have not been analysed before.

The main aim of this study is to evaluate the effects of the adsorption of inorganic anions on smectite clay colloid stability. Results showed that highly sorbing anions like selenium and sulphate clearly affects the stability of clay particles. Moreover, the zeta-potential measured in the presence of anions did not reflect the stability behaviour of clay colloids. In spite of the higher (in absolute value) zeta-potential value, the smectite in the presence of anions is less stable under acidic pH.

In conclusion, the presence of anions, frequently obviated in stability studies, must be accounted for, otherwise assessments on smectite colloid stability and colloid-driven contaminant transport in real systems might be strongly biased.