Behaviour of bentonite colloidal particles in aqueous system

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Smectite-rich clays, such as bentonites, are considered as a primary "buffer" material for isolating canisters containing high-level radioactive waste in many countries. Bentonite provides many important properties including e.g., low hydraulic conductivity and high sorption and swelling capacity. However many experiments have proved that colloids may be formed during the interaction of bentonite with water. It is crucial to study the behaviour of these particles, because stable colloidal particles may affect the migration capability of radionuclides and the functionality of bentonite buffer may be significantly reduced [1].

The aim of this research was to study the stability of bentonite colloidal particles in aqueous system under various conditions. The effects of concentration of the electrolyte (NaCl), the type of the electrolyte (KCl, $CaCl_2$, $MgCl_2$) and bentonite saturation time on the stability of colloids were studied. Colloidal stability was investigated by conventional sedimentation tests. As a testing material was chosen Czech Sabenil bentonite, a sodium-activated type of bentonite. The suspension of bentonite with deionized water was prepared in the ratio S:L = 180. The amount of sedimented colloidal particles and its time evolution was measured.

The general results have shown that sedimentation of colloids occurs in three phases. The most significant point is the start of the second phase, where the amount of sedimented colloids rapidly increases. The time of the start of the second phase significantly differs depending on the conditions and the effect of the conditions on the stability is the most evident at this point. The results demonstrated that the stability of colloids decreases with increasing concentration of NaCl. The addition of KCl and $MgCl_2$ has a greater impact compared to addition of the same amount of NaCl and $CaCl_2$. The stability also decreases with increasing bentonite saturation time. It was also found that several layers in suspension were formed during sedimentation. The granulometric analyses have shown that the layers have significantly different particle size and concentration.

[1] Alonso, Missana, Geckeis, García-Gutierréz, Turrero, Möri, Schäfer, Patelli & Rigato (2006), *Journal of Iberian Geology* **32**, 79–94.