Influence of Cation Valence and Concentration on the Results of X-Ray Analysis for Smectite Clay Mineral

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Abstract: XRD analysis is used to distinguish the type of clay minerals in soils. This is also a helpful method to investigate the microstructure of soils. Generally, the intensity and position of XRD peaks are a function of fabric of clay particles and the thickness of double layer. Therefore, this method can be used to evaluate the behaviour variations of clayey soils under different environmental conditions. This paper is aimed to focus on the influence of cation valence and concentration on the results of X-ray analysis for smectite clay mineral from micro-structural (by the use of x-ray analysis) and macro-structural (by the use of sedimentation and permeability tests) points of view. NaCl and Na₂CO₃ were used as a source of mono-valence cations and CaCl₂ and Pb(NO₃)₂ were used as the source of di-valence cations. Furthermore, the behaviour is investigated after addition of lead nitrate to the calcite treated smectite. The results indicate that after addition of salt and heavy metal to smectite samples, the position and intensity of XRD peaks will change. In addition, the fabric variations of samples are function of valence and concentration of salts. The micro-structural and macro-structural changes are distinguishable for samples through experimental investigation. The results of this paper show that the presence of carbonate for increasing the buffering capacity of soil has more impact on the interaction process of soil-contaminant than the influence of PDI ions in increasing the surface potential of clay minerals.

Keywords: Smectite; X-Ray; Permeability; Cation Valence; Cation Concentration.