Potential-Distance Relationships of Clay-Water Systems Considering the Stern Theory

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Abstract: This paper deals with the use of Stern theory as applied to a clay-water electrolyte system, which is more realistic to understand the force system at micro level than the Gouy-Chapman theory. The influence of the Stern layer on potential-distance relationship has been presented quantitatively for certain specified clay-water systems and the results are compared with the Gouy-Chapman model. A detailed parametric study concerning the number of adsorption spots on the clay platelet, the thickness of the Stern layer, specific adsorption potential and the value of dielectric constant of the pore fluid in the Stern layer, was carried out. This study investigates that the potential obtained at any distance using the Stern theory is higher than that obtained by the Gouy-Chapman theory. The hydrated size of the ion is found to have a significant influence on the potential-distance relationship for a given clay, pore fluid characteristics and valence of the exchangeable ion.

Key Words: Cation Size • Clay Minerals • Diffuse Double Layer • Electric Potential • Stern Theory