Flocculation and Coagulation of Ca- and Mg-Saturated Montmorillonite in the Presence of a Neutral Polysaccharide

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Abstract: The objective of this study was to observe flocculation of montmorillonite in the presence of a glucose polymer (dextran) and to observe the effect of saturating cation and coagulant addition on the flocculation process. Flocculation of montmorillonite was dependent on polymer molecular weight, polymer/clay ratio (w/w), nature of exchangeable cation, and ionic strength of the suspension to which the polymer was added. The T500 dextran (molecular weight = 5×10^5) caused enhanced sedimentation of Ca-montmorillonite suspension at a polymer/clay ratio of $\leqslant 0.01$. Increasing the polymer concentration above this level stabilized the suspension such that sedimentation was less than or equal to that of the control. The T2000 dextran (molecular weight = 2×10^6) caused a similar increase in the sedimentation of Ca-montmorillonite at polymer/clay ratios of <0.1. The ability of the T2000 polymer to cause flocculation at greater polymer/clay ratios as compared to the T500 polymer was attributed to the lower osmolic pressure between clay particles for equal concentrations of the two polymers. Flocculation of Ca-montmorillonite by dextran was enhanced when the clay had initially been coagulated by the addition of salt. Reduction of the diffuse double layer upon addition of salt permitted the polymer to extend beyond the electrostatic barrier of the clays. Dextran was not able to flocculate Mg-montmorillonite suspensions with or without the presence of coagulant. The displacement of water molecules at the clay surface rather than within the hydration shell of the more highly polarizing Mg cations by polymer segments resulted in a greater polymer collapse on the clay surface leaving fewer and shorter polymer loops and tails available for contacting adjacent clay particles.

Key Words: Coagulation • Dextran • Exchangeable cation • Flocculation • Montmorillonite

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