Colloid Stability of Clays Using Photon Correlation Spectroscopy

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Abstract: Photon correlation spectroscopy (PCS), a dynamic light-scattering technique for particle size measurement, was used to determine the coagulation rates of aqueous dispersions of relatively mono-disperse South Carolina Peerless kaolinite, Silver Hill, Montana, illite, Wyoming montmorillonite, and Florida palygorskite. This technique allows quantitative measurement of the rate of coagulation for clay particles where the traditional turbidity method gives only a qualitative measure. The critical coagulation concentrations for KCl at pH = 10.0 were: 0.199 M for kaolinite, 0.202 M for illite, 0.290 M for montmorillonite, and 0.034 M for palygorskite. The effective Hamaker constants, calculated using Derjaguin-Landau-Verwey-Overbeek theory, were: 3.1×10^{-20} J for kaolinite, 2.5×10^{-20} J for illite, 2.2×10^{-20} J for montmorillonite, and 1.63×10^{-19} J for palygorskite. Stern potentials at the critical coagulation concentration at pH 10.0 were: −42.7 mV for kaolinite, −40.7 mV for illite, −21.2 mV for montmorillonite, and −66.9 mV for palygorskite.

Key Words: Coagulation rate • Hamaker constant • Illite • Kaolinite • Light scattering • Montmorillonite • Palygorskite • Photon correlation spectroscopy • Stern potential

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