Deposition of Montmorillonite from Suspension During Flow Through Porous Media*

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Abstract: Sodium-saturated montmorillonite was used to prepare aqueous suspensions of varying concentration between 0.06% and 3.0%. Compacted columns of glass beads and carborundum constituted the porous media. The system was maintained under saturated flow conditions at hydraulic gradients of 2 and 4. In order to study the relationship of clay properties to those of the porous media, the zeta potential of both suspension and media was determined. A mathematical model of the system was developed that would predict the deposition of clay at various depths in the columns, given concentration and flow rate of the suspensions. In order to test this model, a procedure was developed for tagging the clay with ^{46}Sc, sampling the columns, and determining the amount of deposition using a single-channel gamma-ray spectrometer. Using an activity level of 0.15 microcurie per liter of a 1% suspension it was possible to detect reliably 10 mg of clay in a 40 g sample of the porous media. The results indicate two mechanisms operating in the process of removal of the clay from suspension. One of these, interstitial straining, operates at the surface of the porous media column; while the second, a combination of diffusion and gravitational settling, operates below the surface.

The results of this research have potential applications in the solution of engineering problems relating to water resources conservation such as reservoir seepage control, infiltration of sediment-laden water into the soil, and ground water recharge. Also, the results may be important for answering questions concerning pollutant movement into the water supply through porous strata. All the above are examples in which a colloidal suspension is moving into or through porous media; therefore, an improved understanding of the principles of flow of colloidal suspensions in porous media can contribute to the solution of these engineering problems.

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