

## RESIDENCE TIME AND pH EFFECTS OF PENTACHLOROPHENOL SORPTION ON SOIL

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Recent studies have shown that field soils with long pollutant residence times have much larger linear partition coefficient ( $K_p$ ) values than would be predicted from lab equilibrium studies, and they also exhibit a desorption resistant fraction (1, 2). This has important implications for predicting the environmental fate of organic chemicals.

Lab studies often underestimate  $K_p$ . Rate-limited or nonequilibrium sorption has been implicated as the cause of slow and incomplete desorption. Different mechanisms have been proposed for the nonequilibrium sorption of the neutral and charged forms of organic chemicals (3). The neutral species will diffuse deep into the soil network and become less available with time. The specific bonding of the charged species could hinder the diffusion process. The mechanism of nonequilibrium sorption can play an important role in deciding on a remediation strategy.

Pentachlorophenol has a  $pK_a$  (4.75) within the common environmental pH range and can therefore exist in either the ionized (charged) or nonionized (neutral) form. Differences in the sorption mechanism for the two species of pentachlorophenol may result in different spatial distributions of the species within the soil matrix, and ultimately result in practical implications.

This study presents comparative sorption kinetic data of pentachlorophenol on soil at different pH values. The effect of pH and equilibration time on sorption isotherms is also explored. The extent of desorption hysteresis is investigated at different sorption times and pH values.

### References

1. Steinberg, S.M., J.J. Pignatello and B.L. Sawhney (1987) *Environmental Science and Technology*. 21:1201-1208.
2. Pignatello, J.J., F.J. Ferrandino and L.Q. Huang (1993) *Environmental Science and Technology*. 27:1563-1571.
3. Brusseau, M.L. and P.S.C. Rao (1991) *Environmental Science and Technology*. 25:1501-1506.



## Morphology of Water Dispersible Clays from Agricultural Soils of the Southeastern United States

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Current concerns about purity of ground and surface waters from agricultural areas is addressed in regional investigations focused on soil clays that may be involved in sediment mediated contaminant transport. Clay mineral analyses of soils are typically made on samples size fractionated after chemical and physical dispersion. To evaluate the properties of particles that may be dispersed by natural waters, nine soil samples were selected for clay mineral analyses based on their content of water dispersible clay. The samples were physically dispersed in distilled water and the clay (<2 micrometer) was separated by sedimentation. The clay suspensions with little or no visible turbidity were drop mounted on holey carbon films for examination by transmission electron microscopy with a JEOL 2010 instrument operated at 200kV. Mineralogical evaluations given here are estimates based on previous mineralogical analyses of the soils, particle shape, and behavior in the electron beam (beam absorbance, beam sensitivity, etc.). The wide range of particle sizes in the clay fraction was particularly evident in the Decatur Ultisol sample from Alabama. The roughness among silicate particle surfaces was evident in an Ultisol sample from Alachua County, Florida. The Cecil clay fraction (Ultisol) from Georgia contained plates of many sizes that were hexagonally shaped, typical of kaolinite. The layer silicate particles from a Crowley Alfisol from Louisiana were smooth and clean in contrast to particles in some other soils examined. The particles from a Hayesville Bt2 horizon (Ultisol) from North Carolina were diverse, ranging from thin layer silicates, to granular iron oxides to rectangular crystals believed to be gibbsite. The clay from a Heiden C2 horizon (Vertisol) from Oklahoma contained thin sheets suggestive of smectite, laths of iron oxides, and thick circular particles that may be quartz. The Nipe Oxisol of Puerto Rico was well aggregated and contained abundant lath-shaped and granular iron oxides. An Ultisol from Grand Junction, Tennessee contained weathered layer silicate particles and granular iron oxides in aggregates. A Boonville Alfisol clay from Texas contained wedge-shaped and rounded particles with textured surfaces suggestive of weathered quartz. This morphological survey points up the contrast in shape and roughness of soil mineral particles of clay size. The contribution of iron oxides to aggregation of particles is evident. The wide size range of kaolinite particles is evident in certain soils. These observations indicate the need for investigation of the qualitative and quantitative properties of each soil mineral in assessing chemical and physical behavior as potential contributors to contaminant transport. Soil clay particles are much more diverse than most reference minerals from commercial deposits.