
Pentachlorophenol Sorption by Organo-Clays¹

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Abstract: Several clay organic complexes were prepared by placing organic cations on the exchange sites of smectite clays and studied as sorbents for pentachlorophenol (PCP). The organic cations used ranged from very hydrophobic in nature (e.g., dioctadecyldimethyl⁺ (DODMA⁺)- and hexadecyltrimethyl⁺ (HDTMA⁺)-ammonium) to those having minimal hydrophobic properties, such as tetramethylammonium⁺ (TMA⁺). In general, the more hydrophobic the cation on the smectite the greater the uptake of PCP from water. For the very hydrophobic clays (DODMA⁺- and HDTMA⁺-smectite) the uptake of PCP was via non-polar interactions between the alkyl (e.g., -C¹⁸) groups on the organic cation and PCP. In a mechanistic sense, this interaction appeared to be similar to a partitioning process between water and the organic phase of the clay-organic complex. The organic phases of DODMA⁺-smectite were about 10 times more effective than the organic matter of natural sediments for removing PCP from water. For those organo-clays containing small organic cations (e.g., TMA⁺), the organic phase consisted of separate small organic moieties, such as the methyl group. This phase did not act as an effective partitioning medium despite a significant carbon content, and very little PCP was taken up. Results from this study suggest the possibility of treating soils and subsurface materials with large hydrophobic organic cations to enhance the sorptive properties of these natural materials.

Key Words: Adsorption • Hydrophobicity • Organo-clay • Pentachlorophenol • Smectite • Toxic wastes

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