
Adsorption Kinetics of Pentachloroethane by Iron-Bearing Smectites

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Abstract: The oxidation state of structural Fe greatly alters surface chemistry, which may have a large influence on clay-organic interactions. The effect of structural-iron oxidation state on chlorinated hydrocarbons at the clay-water interface was examined. Pentachloroethane (5CA) was reacted with oxidized, reduced, and reoxidized forms of three different smectites: montmorillonite, ferruginous smectite, and nontronite in aqueous suspension under controlled-atmosphere conditions. Pentachloroethane was found to adsorb at different rates for the three smectites. A series of 5CA-adsorption rate constants in the presence of these clays showed a strong correlation with the Fe(II) content of the clay ($r^2 = 0.98$). The clay surface behaves as a Brønsted base and promotes 5CA dehydrochlorination. The adsorption kinetics at the clay-water interface were described by the formation of a precursor complex prior to 5CA dehydrochlorination.

Key Words: CMS Clay SWa-1 • CMS Clay NG-1 • Dehydrochlorination • Iron(II) • Iron(III) • Montmorillonite • Nontronite • Oxidation • Pentachloroethane • Reduction Reactions • Tetrachloroethene

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