
Hydrophobicity of Clay Surfaces: Sorption of 1,2-Dibromoethane and Trichloroethene

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Abstract: Sorption and desorption of two neutral, nonpolar organic compounds, 1,2-dibromoethane (EDB, a soil fumigant) and trichloroethene (TCE, an industrial solvent and common ground-water contaminant), by pyrophyllite, kaolinite, illite, and smectite were investigated. For sorption, vapors of the compounds in a stream of dry N₂ gas were passed through columns of the powdered clay minerals for different periods of time. The compounds retained by the days were extracted with methanol and analyzed by gas chromatography (GC). For desorption, N₂ was passed through the treated samples, and the desorbed compounds were collected in hexane traps and analyzed by GC.

Initially sorption was rapid for several hours but then proceeded at a slower rate for many hours. Surprisingly, the clays sorbed large quantities of these neutral compounds; for example, the pyrophyllite, kaolinite, illite, and smectite sorbed about 3, 5, 6, and 9% EDB, respectively, by weight. The amounts of TCE sorbed, which is more volatile than EDB, were somewhat less. Only a portion of the compounds sorbed over a period of time were desorbed in the same period of time. Desorption was rapid initially but then proceeded at a slow rate; slow desorption continued for over 100 hr from samples which had undergone sorption for only 1– 2 hr. A two-compartment efflux model was used to describe the sorption behavior. A rapidly desorbing component was considered to be present on the outer surfaces of the clay aggregates and a slowly desorbing component, in the interior pores of the aggregates.

Key Words: Diffusion • Halocarbons • Illite • Kaolinite • Pyrophyllite • Smectite • Sorption-desorption

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