
Vapor-Phase Sorption and Polymerization of Phenols by Smectite in Air and Nitrogen

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Abstract: Reactions of smectite with phenols were investigated to understand the role of clay minerals in abating transport of these organic pollutants to ground water. Sorption of o-methylphenol, o-chlorophenol, and m-methylphenol by the clay with different exchange cations was accomplished by passing phenol vapors in a slow stream of air or nitrogen through the samples. The resulting products, extracted with methanol and analyzed by using mass spectrometry, included monomers, dimers, trimers, and tetramers of the parent phenol and of the corresponding quinones, the oxidation product of the phenols. In extracts from the Fe-clay-phenol complexes formed in air, traces of the phenolic pentamers were also detected. Both sorption and polymerization were much higher in air than in nitrogen. The greatly reduced polymerization in nitrogen suggests that anaerobic environment of the landfill sites may facilitate phenol transport to ground water. The degree of polymerization and its magnitude was in the order Fe- > Al- > Ca- > Na-clay.

Key Words: Adsorption • Mass spectrometry • Nitrogen • Phenols • Pollution • Polymerization • Smectite

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