Preparation and application of organo-modified minerals as sorbents of phenol, benzene, and toluene

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Nonionic organic contaminants (NOCs) such as benzene, phenol, and toluene from contaminated wastewater can be effectively sorbed by organo-modified minerals. Organo-minerals were prepared from Na - montmorillonite, sericite, and zeolite by exchanging quaternary ammonium cations with various molecular weights such as BDTDA (Benzyldimethyltetradecylammonium), Hyamine 1622^{R}, and BTMA (Benzyltrimethylammonium). The adsorption capacity of these organic cations onto these minerals is in the order of montmorillonite > zeolite > sericite, which is mainly dependent on the Ca/Mg CEC of each mineral. The interlayer expansion of the basal spacings of BDTDA- and Hyamine- montmorillonite increases from 12.5 to 30.8 Å as the amount of interlayer organic cation increases. BTMA-montmorillonite is characterized by less interlayer expansion. The aliphatic tale on the BDTDA ion apparently contributes to the multiple interlayer sorption in BDTDA in contrast to BTMAs reluctance to sorb a second interlayer. The exchange capacity of organic cations onto montmorillonite and the interlayer expansion of organo-montmorillonite correlate with the sorption of phenol, benzene, and toluene. BDTDA-, Hyamine-, and BTMA-montmorillonite complexes include benzyl functional groups and are effective sorbents for NOCs such as phenol, benzene, and toluene in aqueous solutions and may have practical applications in wastewater purification. The BTMA-zeolite complexes have potential for application as a sorbent for phenol. Organo-sericite complexes were the least effective sorbents of the three minerals tested.