Molybdates sorption on smectite modified by long-chain quaternary ammonium salts

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Bentonite from the Jelšovy Potok in Slovakia, rich in montmorillonite phase, was used in the experiments. After the initial preparation of the material the smectite was modified with long-chain quaternary ammonium salts such as dodecyl trimethyl ammonium bromide (DDTMA), didodecyl dimethyl ammonium bromide (DDDDMA), hexadecyl trimethyl ammonium bromide (HDTMA) and dihexadecyl dimethyl ammonium bromide (DHDDMA) in amounts of 0.5, 1.0, 1.5 and 2.0 of smectite cation exchange capacity (CEC). This modification leads to the formation of organo-mineral complexes characterized by positively-charged surfaces and sorption capacities for anions.

The experiments were conducted in order to delineate the effects of molybdate concentration, pH, contact time and the adsorbant dose on the sorption efficiency. Additionally, a test aimed at determining whether the presence of the WO_4^{2-} ions affects the efficiency of MoO_4^{2-} sorption has been performed.

The number and length of hydrocarbon chains substituted in organic surfactants affect the synthesis of organo-smectite and Mo(VI) sorption efficiency. The longer the carbon chain (HDTMA, DHDDMA), the more effective the sorption. Double carbon chains in DDDMA and DHDDMA surfactants improve the sorption properties of organo-smectites. The results show that WO_4^{2-} ions are adsorbed more than MoO_4^{2-} ions on smectite and organo-smectites. Molybdates sorption process is most efficient at pH 3-8. The increasing concentration of molybdates improves the sorption. The adsorption ability of Mo(VI) was based on the smectite's high specific surface area (79.66 m^2/g), cation exchange capacity (104 meq/100 g) and the total (0.109 cm^3/g) micropore (0.035 cm^3/g) and mesopore (0.036 cm^3/g) volumes of the smectite's adsorbents. Studies show that ion exchange and the chemisorption mechanism were involved in the adsorption process.

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