The removal of tungstates from aqueous solution by organo-smectites

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Bentonite from the Jelšovy Potok in Slovakia has been used in the experiments. The material was subjected to technological processing and the clay-size fraction (< 2 μm) was separated from bentonite by a sedimentation procedure. The separated smectite concentrate consisted only of Ca-montmorillonite (XRD). The ion-exchange capacity was 104 meq/100 g (barium chloride method). The specific surface area was 79.66 m^2/g. The total pore, micropore and mesopore volumes were 0.109, 0.035, and 0.036 cm^3/g, respectively.

Sodium smectite was prepered by introducing sodium ions into the ion-exchange positions. Subsequently, Na-smectite was modified by surfactants:

DDTMA – dodecyl trimethyl ammonium bromide;

DDDDMA – didodecyl dimethyl ammonium bromide;

HDTMA – hexadecyl trimethyl ammonium bromide;

DHDDMA – dihexadecyl dimethyl ammonium bromide

in amounts of 0.5, 1.0, 1.5 and 2.0 of smectite cation exchange capacity (CEC). The experiments of tungstate sorption on smectite and organo-smectites were conducted with a range of concentrations of W(VI) (0-20 mM) and in the full range of pH (1-13). Based on the results it was possible to define the impact of various surfactants, its amount and the organo-smectites' properties order on the sorption capacity, the sorption mechanism, sorption kinetics, the pH effect and immobilization durability.

The smectite modification by quaternary ammonium salts causes a conversion of its sorption properties from the cation exchange for anion exchange. The amount and the type of surfactant used for modification affects the sorption properties of resulting organo-smectite and can be arranged in the series: (least efficient) DDTMA – HDTMA – DDDMA – DHDDMA (most efficient). The sorption efficiency increases with an increasing concentration of W(VI) in the solution. The most tungstates are removed from the solution at a pH about 7, at low pH (1-3), the sorption process is inefficient.

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