

Molybdates and tungstates removal by organo-smectites – a function of time, initial concentration and pH

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Molybdenum (Mo) and tungsten (W), which are primarily present in the form of molybdates (MoO_4^{2-}) and tungstates (WO_4^{2-}) have been chosen for experiments due to their importance as environmental contaminants. Bentonite from the Jelšovky Potok in Slovakia, rich in montmorillonite phase, was used in the experiments of Mo(VI) and W(VI) removal. The smectite modification by quaternary ammonium salts causes conversion in sorption properties; consequently organo-smectite has a greater affinity in removal of anions.

Smectite was modified with 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 and 2.0 of smectite cation exchange capacity (CEC). The amount and the type of surfactant used in modification affects the sorption properties of the resulting organo-mineral complex. Smectites modified with DDTMA and DDDDMA in amounts of 1.0 and 2.0 of CEC are the most effective in removing of Mo(VI) and W(VI) from the solution. The unmodified smectite did not show any sorption capacity in terms of anionic forms of Mo and W.

Experiments of Mo(VI) and W(VI) sorption on organo-smectites were conducted in the function of time (1-1440 min); function of varying concentrations of Mo(VI) and W(VI) (0 – 20 mM) and as a function of pH (1-13). Sorption of Mo on organo-smectites is characterized by a very rapid reaction in the first 30 minutes of the process, while in the removal of W, the reaction was slower (50 min). The maximum sorption capacity of organo-smectites was significantly higher in terms of W(VI) than Mo(VI). With increasing concentrations of Mo and W, the sorption increases, and the maximum sorption capacity was 1700 and 5880 mM/kg, respectively. The pH effect on the Mo(VI) sorption is clearly visible – at pH 2-5 the Mo(VI) is most effectively removed, while above pH = 5 the sorption rapidly decreases. At pH 1-2, the W(VI) is removed in a small amount, the optimum pH range is 3-5, at pH > 5 sorption decreases and at pH 9-13 almost disappears.

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