REMOVAL OF URANIUM(VI) FROM MODEL SOLUTIONS WITH FIBROUS ION-EXCHANGERS UNDER DYNAMIC CONDITIONS

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Purification of natural and anthropogenic waters formed during the processing of poor uranium-containing ores from natural radionuclides, in particular, Uranium(VI) compounds, is an actual environmental problem. One of the main methods for removal of Uranium compounds from diluted aqueous solutions is sorption, so it is important to search for effective sorbents. Perspective sorbents are fibrous ion-exchangers FIBAN. Earlier [1-4], we showed that fibrous ion-exchangers FIBAN effectively remove Uranium(VI) compounds from model solutions under static conditions.

This work is devoted to a study of effectiveness of removal of Uranium(VI) compounds from model aqueous solutions using fibrous ion-exchangers FIBAN under dynamic conditions.

Uranium(VI) compounds were used as sorbates, they were in model 2.0×10^{-4} M solutions, which contained one of reagents (0.02 mol dm^{-3}): HNO_3, H_2SO_4 (pH 2) or $NaHCO_3$ (pH 8). Under these conditions, Uranium(VI) was in nitrate solutions mainly in the form of cations UO_2^{2+}, in sulfate solutions as a mixture of equal amounts of UO_2^{2+}, $[UO_2(SO_4)]$ and $[UO_2(SO_4)_2]^{2-}$, and in carbonate solutions - in the form of anionic complexes of the composition $[UO_2(CO_3)_2]^{2-}$ and $[UO_2(CO_3)_3]^{4-}$. As sorbents used fibrous materials FIBAN of different nature: monofunctional strongly acidic cation exchanger FIBAN C-1 with sulfo-groups; multifunctional anion exchanger FIBAN A-6 with strongly and weakly basic amino groups; multifunctional amphoteric ion exchanger FIBAN AC-22V with carboxyl, primary and secondary amino-groups.

Sorption experiments was carried out under dynamic conditions at 290 K in column with a diameter of 20 mm and a height of 200 mm. Weighed air-dry sorbent was 1 g, the height of the filtering layer was 35 mm, the flow rate of the solution through the column was 2.5 cm^3 min^{-1}. Concentration of Uranium(VI) in solutions after sorption was determined with a photometric method using Arsenazo III. The dynamic exchange capacity of the ion-exchangers for Uranium(VI) was the main mark of the sorption efficiency.

The conducted researches have shown that the investigated fibrous ion-exchangers are effective reusable materials for the removal of Uranium(VI) compounds from model solutions of various ionic composition under dynamic conditions. In order of decreasing dynamic exchange capacity for Uranium(VI), fibrous ion exchangers can be arranged in the following series:

- sorption of U(VI) from sulfate solutions: FIBAN A-6 > FIBAN C-1 > FIBAN AC-22V;
- sorption of U(VI) from carbonate solutions FIBAN A-6 > FIBAN AC-22V >> FIBAN C-1;
- sorption of U(VI) from nitrate solutions FIBAN C-1 > FIBAN AC-22V >> FIBAN A-6.

The dynamic exchange capacity of fibrous ion-exchanger FIBAN AC-22V for Uranium(VI) has maximum value when Uranium(VI) is removed from sulfate solutions and it has minimum value when Uranium(VI) is removed from nitrate solutions. The data obtained are explained by

different mechanisms of Uranium(VI) sorption by this ion-exchanger. In the case of nitrate and carbonate solutions, Uranium(VI) is sorbed by the ion exchange mechanism, and from sulfate solutions, also by the mechanism of surface complexation.

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