

“Nanocomposites and nanomaterials”

Sorption of silver (I) and mercury (II) ions by silica (SBA-15 type) with thiourea ligand in the surface layer

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There is a rapid deterioration of water resources in Ukraine, due to the accumulation of metal ions which are considered the major pollutants of wastewater. Therefore, water treatment is an urgent task that can be solved through sorption materials [1]. Nowadays, for this purpose, we suggest mesoporous silica of SBA-15 type with thiourea groups in the surface layer. They are easy to produce in one-step synthesis, which has been achieved in the process of varying the synthesis conditions [2]. Such materials are characterized by well-developed porous structure, relatively high mechanical stability and significant sorption capacity.

It was determined, that sorbents synthesized at ratios (mol.) of TEOS/trifunctional silane 10:0.5, 10:1 and 10:1.5 have high kinetic characteristics to silver (I) and mercury (II) ions; sorption equilibrium is reached within 30 min. As expected, SSC increases with increasing concentration of functional groups in the samples. Maximum SSC for silver (I) is 153 mg/g, for mercury (II) - 322 mg/g. However, in all cases, the Metal/Ligand ratio is about 1/1.

Interestingly, according to IR spectroscopy the thione form is prevailing on the surface of pores of mesoporous samples with thiourea groups at all the mentioned TEOS/trifunctional silane ratios. However, during the sorption of silver (I) and mercury (II), probably thione form transforms into thiol with the formation of 1/1 sulfide complexes, as evidenced by the decrease of the pH value of the solution after sorption.

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2. *Nazarchuk G.I., et al.* Mesoporous silica containing $\equiv\text{Si}(\text{CH}_2)_3\text{NHC}(\text{S})\text{NHC}_2\text{H}_5$ functional groups in the surface layer // J. Colloid. Interf. Sci.-2013.- **89**.-P. 115-120.