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EXTRACTION OF TRACE METALS FROM SOLUTIONS USING SORBENT SEQUENTIALLY MODIFIED BY POLYHEXAMETHYLENE GUANIDINE AND TRILON B

Supramolecular sorbent, based on silica gel (SG) sequentially modified with polyhexamethylene guanidine (PHMG) and disodium salt of ethylenediaminetetraacetic acid (EDTA), was obtained. It is found that EDTA sorption considerably depends on the acidity of the solution and is maximum at pH of 2.7-3.0. Quantitative desorption of EDTA from SG-PHMG-EDTA surface occurs in a medium of 0.1 M HCl or HNO₃ solutions. This allows to desorb complexes of metals from SG-PHMG-EDTA surface and to conduct their following determination in eluate.

Investigated sorptivity of SG-PHMG-EDTA sorbent in relation to ions of copper(II), nickel(II), zinc(II), cobalt(II), cadmium(II) and lead(II) in static and dynamic modes. The optimal conditions for extraction of the studied metals from solutions are at pH 3-6. Upon that degree of sorption of copper(II), nickel(II), lead(II) and zinc(II) is more than 99%, and of cobalt(II) and cadmium(II) – 95%. The pH range of maximum metal ions extraction coincides with pH range of complex formation with EDTA in aqueous solutions. The pH value of 50%-sorption of Cu(II), Ni(II), Pb(II), Zn(II), Cd(II) and Co(II) are 1.8; 1.9; 2.0; 2.2; 2.4 and 2.5 respectively. This raises the investigation of sorption of transition metals over different concentrations of calcium and magnesium in static and dynamic conditions at various pH values, the volume of aqueous phase, the contact time of the phases and the sampling flow rate. Calcium and magnesium ions do not interfere with quantitative recovery of studied metals in dynamic sorption conditions at pH 3-4 if their total concentration is less than 0.25 g/dm³.

Our supramolecular sorbent based on silica gel impregnated with polyhexamethylene guanidine and functional groups of ethylenediaminetetraacetic acid is highly competitive with its sorption characteristics to chemically modified silica gel with iminodiacetic acid groups, but its advantage is the ease of synthesis without the use of toxic components and low cost of consumables.

Keywords: sorption, silica gel, Trilon B, transition metals.