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ORGANOSILICAS IN ANALYSIS OF ENVIRONMENTAL OBJECTS

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The determination of trace metals in various samples usually requires their preconcentration and separation from matrix constituents. For this purpose, several techniques; i.e. solvent extraction, ion-exchange, co-precipitation and solid phase extraction (SPE) are used. The SPE is most suitable for trace analysis. In the sorption method, activated carbon, porous polymers, cellulose, silica gel are used. The latter materials are preferred to the other adsorbents due to their excellent kinetic characteristics.

In this work rapid and sensitive Flame Atomic Absorption Spectrometry method has been developed for the determination of trace amount of Cd(II), Zn(II), Pb(II), Cu(II), Ag(I), Pd(IV) and Au(III) in various samples after concentration on silica modified with propylthioethyleamine ligands (SiO₂-SN).

The modified silica gel was characterized by IR and C, H, N elemental analysis, and methods pH-potentiometric and conductometric titration. It was found that two synthesized adsorbents contain 0.97 mmol g⁻¹ and 0.58 mmol g⁻¹ of correspondingly attached groups.

The effects of various parameters such as pH (ranging from 0 to 8), time of shaking, volume solution (ranging 0.025l to 0.5l) and concentration of metals in solution (ranging from 50 µmol to 1 mmol) were studied. The influence of types and least amount of eluent for elution of ions metals from phase of adsorbents were investigated. The result presented, that heavy metals could be quantitatively adsorbed by the SiO₂-SN from water solution at pH 6-7. The adsorption capacities of Cd(II), Zn(II), Pb(II), Cu(II) were 0.05 mmol g⁻¹, 0.14 mmol g⁻¹, 0.18 mmol g⁻¹, 0.22 mmol g⁻¹ of dry SiO₂-SN, respectively. Heavy metals eluted from SiO₂-SN easily and quantitative with a small volume of HCl solution. This became a basis of determination of the total concentration of heavy metals in natural objects.

In addition the SiO₂-SN is a very effective adsorbent for removal of noble metals. Their high sorption capacity (0.67 mmol g⁻¹ (pH≤2.5) – Au; 0.064 mmol g⁻¹ (pH≤2.7) – Ag; 0.18mmol g⁻¹ (pH≤1.8) - Pd) and coefficients of distributions (10⁵ mg g⁻¹) are evidence availability of their use for concentration and determination of these metals from various objects. The adsorbed metal ions can be readily desorbed with 10% thiourea in 0.1M HCl solution.

The analytical characteristics of the sorption-atomic-absorption methods developed have been checked up by the analysis of model solution (all metals), natural water (Cd, Zn, Pb, Cu, Hg), mineral water (Ag) and wastewaters (Pd, Au).