Modification of silica gel with tetraphosphorylated calix[4]arenes and examination of Eu(III) sorption

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The upper rim phosphorylated calixarenes bearing reactive groups at the lower rim of macrocycle are used for modification of organic and inorganic porous materials. Due to presence of the P=O binding groups at their surface the modified material effectively and selectively adsorbs actinides and lanthanides from water solutions [1,2].

In this paper we present synthesis of the cone-shaped calix[4]arenes, modified at the upper rim of the macrocycle with metal-coordinating phosphonate and phosphine oxide groups. Simultaneously, at the lower rim, these calixarenes contain methoxycarbonylmethoxy groups that react with amino groups on the silica gel surface. The reaction is supposed to be the nucleophilic substitution of methanol and the formation of the amide bonds.



 $R = CH_2P(O)Ph_2, CH_2P(O)(OPr^{i})_2$

The structures of the synthesized phosphorylated calixarenes were investigated by X-ray diffraction analysis and NMR spectroscopy methods. The sorbents obtained are monodisperse with an average particle size of 50-100 microns. In the process of covalent fixation of the calixarenes on the surface, the surface morphology and dispersion of the silica gel particles are maintained.

It was also shown that silica gels, modified by the phosphorylated calixarenes effectively adsorb europium from aqueous solutions of nitric acid at pH 5-7. The initial segments of the adsorbtion isotherm are well described by the Langmuir model.

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- 2. E.M. May, A. Solovyov, Y. Guo, A. Drapailo, Y. Matveev, V. Kalchenko, H. Nitsche, A. Katz, Eur. J. Inorg. Chem. 28 (2016) 4542.