Removal of heavy metal ions from water using combination of functionalized silicas with membranes

Sliesarenko V.V.¹, Fetisova Yu.S.^{1,2}, Dudarko O.A.¹, Zub Yu.L.¹

 ¹ Chuiko Institute of Surface Chemistry of the NAS of Ukraine, 17 General Naumov Str, Kyiv 03164, Ukraine. E-mail: sliesarenko@isc.gov.ua
² National University of "Kyiv-Mohyla Academy",

2 Scovoroda Str., Kyiv 04070, Ukraine.

The presence of complexing groups in the surface layer of solid carriers makes it possible to bind metal ions, which is promising for the purification of sewage and natural waters. Silica-based carriers have such advantages as hydrolytic stability, biocompatibility, and nontoxicity. In addition, they are not prone to swelling. The sol-gel method is the most effective method for obtaining functionalized silica, which allows the formation of highly porous structures containing approximately 3 mmol/g of functional groups. The essence of the method lies in the polycondensation reaction of trialkoxysilanes R-Si(OR'), (where R is a functional group and R' is CH, or C,H,) with a silica source, for example, sodium metasilicate Na SiO, or tetraethyl orthosilicate Si(OC, H_c), However, such materials are not convenient in use, because the size of the adsorbent particles is sometimes less than 1 µm, which leads to difficulties in the filtering [1]. The possibility of combining functionalized silicas with membranes was considered in this study. In one case, they were fixed on the membrane surface. In the other case, the membrane was used as a filter to separate the silica sorbents from the solution. It was found that water purification is realized by the sorption mechanism and depends on the concentration of complexing groups. The silicas with phosphonic groups had the best parameters: their sorption capacity to lead(II) and mercury(II) ions was about 0.3-1.0 mmol/g, cadmium(II) and copper(II) ions - 0.25-0.47 mmol/g.

¹ Wan Y., Shi Y., Zhao D. Designed synthesis of mesoporous solids via nonionicsurfactant-templating approach // Chem. Commun. - 2007. - 9. - P. 897-926