Nanocomposites and nanomaterials

New approaches for synthesis and functionalization of bionanocomposites chitosan-silica

T.M. Budnyak[1], D. Kołodyńska[2], V.A. Tertykh[1]

[1] *Chuiko Institute of Surface Chemistry of National Academy of Sciences of Ukraine, 17 General Naumov Str., 03164 Kyiv, tetyanabudnyak@yahoo.com*
[3] *Maria Curie Skłodowska University, 2 M. Curie Skłodowska Sq., 20-031 Lublin, Poland*

Adsorbents of natural origin are widely used for industrial wastewater treatment in order to replace current costly methods of heavy metals removing from solutions. For that purpose, adsorption properties of mineral adsorbents could be improved by immobilization onto their surfaces appropriate substances with well-pronounced ion-exchanging and complexing properties.

Hybrid materials were prepared using various synthetic methods: adsorption and covalent binding of polymer on the carrier surface, partial crosslinking of aminogroups of adsorbed polymer, forming of inorganic matrix in polymer solution (sol gel method). Furthermore, nanocomposites based on chitosan immobilized on silica gel surface by reaction of aminomethylation with the following functionalization with thiourea and iodoacetic acid have been obtained. All obtained nanocomposites were well characterized by physicochemical methods.

Adsorption of microquantities of zinc, copper, cadmium, lead, iron, vanadium, molybdenum, and chromium from aqueous solutions by obtained composites has been studied in comparison with initial materials. Compare to all prepared composites, nanocomposite chitosan-silica gel with grafted acetic residues has shown the improved adsorption properties with respect to heavy metals anions. In particular, in the neutral medium the nanocomposite extracts Zn(II), Cu(II), Cd(II), Pb(II), and Fe(III) ions with maximum adsorption capacity 0.60, 0.33, 0.23, 0.14, and 0.41 mmol/g, respectively.

The research was funded by the Visegrad 4 Eastern Partnership Program of the International Visegrad Fund under the contract for financing Visegrad/V4EaP Scholarship No 51400001 and the People Programme (Marie Curie Actions) of the European Union's Seventh Framework Programme FP7/2007-2013/ under REA grant agreement No° PIRSES-GA-2013-612484.