Nanochemistry and Nanobiotechnology

Natural nanocomposite on the base of sludge from municipal wastewater treatment for land application

K.V. Kalinichenko[1], G.N. Nikovskaya[1], Z.R. Ulberg[1]

[1] *Colloidal Technologies of the Natural Systems Department, F.D. Ovcharenko Institute of Biocolloidal Chemistry, Natl. Acad. of Sci. of Ukraine. Vernadsky Blvd, 42, Kiev-03680, Ukraine.*
E-mail: KirKa_@bigmir.net

For artificial soils formation and exhausted soils enrichment / remediation the natural gel-like solids of municipal waste water treatment can be used. One may consider that sludge solids are the natural nanocomposite, which includes heavy metals compounds (in slightly soluble or unsoluble forms as phosphates, sulphates, carbonates, hydroxides, and so on) combined by biomaterial (cells and their metabolites, humic substances, and so on). At the same time, it contains variety of plant-essential nutrients such as micro- and macroelements, vitamins, aminoacids etc. The removal of heavy metals compounds from biogel nanocomposite depending on the pH value under the action of acids, alkalis and due to the activation of vital ability of sludge biocenoses was studied [1]. At this conditions swelling, loosening of the structure, weakening of the coagulation contacts between metal containing nanoparticles, microbial cells and metabolites in aggregates and heavy metals leaching can occur. The heavy metals are extracted from sludge gel as stable watersoluble or nano-sizing complexes – hydroxy carboxylic, humic ones, carbohydrates and so on. These compounds are eco-friendly. The desorption of bioelements from biogel nanocomposites can be realized under different dominant modes of exposition rather slowly (prolonged). Special investigations showed that under the influence of organic acids excreted by growing plants, the sludge bioelements can be gradually released from immobilized state into environment and are able to absorb by plants. Soil enrichment with specially treated sludge nanocomposite resulted in a faster growth of plants and substantial harvest increase as compared with control (unfertilized) soil [2].

1. *Nikovskaya G. N., Kalinichenko K. V.* Bioleaching of heavy metals from sludge after biological treatment of municipal effluent // J of Water Chemistry and Techn..-2013.-**35, N 2.**-P. 140-150.
2. *Kalinichenko K. V., Nikovskaya G. N.* Principles of sludge bioconversion into fertilizer // Int. J. of Chem. Mat. Sci & Eng.-2014.-**8**, N 1.-P. 5-7.