"Nanocomposites and nanomaterials"

Multi-step sorption process of anionic surfactants by magnetite nanoparticles

Y.V. Lytvynenko, Yu.L.Zabulonov, V.M. Kadoshnikov

Department of Nuclear Physics and Power Engineering, State Institution "Institute of Environmental Geochemistry of the National Academy of Sciences of Ukraine". Akademika Palladina ave., 34ª, Kiev 03680, Ukraine.
E-mail: Yu.Lytvynenko@ukr.net

The problem of drain water cleaning from surface-active substances (SAS) is recently of particular relevance. It is caused by the widespread use of membrane technology for removal of heavy metal ions from industrial waste multicomponent waters.

In decontamination schemes of equipment and materials used in nuclear power plants, composites containing sulfanol or its analogs as mandatory components are widely used. Sulphanol is usually used for desorption of non-polar contaminants from the dispersion medium. At the same time, formation of colloids stipulates the formation of micelles, which include radionuclides and/or heavy metals. Similar processes occur during formation of significant amount of industrial waste at enterprises, which useing surfactants.

In the presence of drain waters or industrial effluents colloids virtually eliminate the possibility of membrane technology for removal of radionuclides and heavy metal ions. A significant amount of colloidal particles containing radionuclides and/or heavy metals in solutions, which are purified, reduces overall performance and service life of membranes used. In the case of drain waters for destruction of organic substances and, accordingly, colloids the methods of ozone oxidation are used.

To extract micelles of surfactants, which have a negative charge, we propose a method of heterocoagulation of magnetite that have positive charge by nanoparticles. During synthesis of magnetite nanoparticles from aqueous solution of Fe(II) and Fe(III) salts in 1:2 proportion, colloids, which electro kinetic potential is determinated by pH, are formed. As drain waters have pH greater than 8, the magnetite nanoparticles were synthesized at pH 8-11 and under sulphanol concentration of 1 g/l. Experiments have shown that the synthesis of magnetites in such conditions is highly effective for surfactants precipitations.