Nanocomposites and nanomaterials

Controlled synthesis of potassium nickel hexacyanoferrate nanoparticles on the surface of polypropylene fibers

Y. Bondar[1], D.H.Han[2]

[1] *Institute of Environmental Geochemistry, 34a Palladin ave., Kiev 03142, Ukraine, juliavad@mail.ru*

[2]*School of Chemical Engineering and Technology, Yeungnam University, 214-1 Dae-Dong, Gyeongsan 712-749, South Korea*

Insoluble divalent transition metal hexacyanoferrates are important inorganic compounds that have been intensively investigated due to their interesting properties such as electrocatalysis, electrochromism, adsorption, and charge storage capabilities. Because of many unique characteristics of nanosized hexacyanoferrates the development of new methods of nanocomposites synthesis and investigation of their properties are of significant interest to a wide range of research areas.

New composite fibers covered with a layer of potassium nickel hexacyanoferrate (KNiHCF) nanoparticles were synthesized through a two-stage experiment, which involves radiation-induced graft polymerization of acrylic acid monomer onto the polypropylene (PP) fibers followed by in situ formation of KNiHCF nanoparticles within the grafted chains.

The grafting process was intended for covalent anchorage of grafted polyacrylic acid chains to the PP fibers' surface, so that the fibers' surface became covered with cation exchange groups. The grafted chains of nano/micro-sized length with cation exchange groups serve as precursors and nanoreactors for KNiHCF nanoparticles formation. Variation of the main characteristics of grafted chains (density and length) makes it possible to control the density of distribution, size, and morphology of nanoparticles as well as to stabilize them within the grafted chains.

The main aim of the current work is to study the influence of grafted chains on KNiHCF nanoparticles size and morphology and to check chemical stability of the synthesized nanocomposite fibers in waters with a wide pH range. Three groups of PP grafted fibers were chosen for investigation, namely, fibers with low degree (50-90%), medium degree (100-180%) and high (200-300%) degree of acrylic acid grafting. It was found that PP fibers with medium degree of acrylic acid grafting is most suitable for synthesis of stable nanocomposite fibers.