Nanocomposites and nanomaterials

Magnetic nanocomposite mineral sorbents

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An effective magnetic nanocomposite sorbents based on saponite clay for the removal of different pollutants from wastewater were created [1]. Synthesis was carried by impregnating of clay matrix by nanomagnetite in the form of magnetic fluid [1]. In this way samples of magnetic composite sorbent containing Fe_3O_4 in amount of 7 % (MCSp-7) and 10 % (MCSp-10) were received. The aim of this work was to study the magnetic characteristics of obtained magnetic nanocomposite sorbents.

The synthesized sorbents based on saponite and magnetite were characterized by X-ray powder diffraction and Mössbauer spectroscopy at standard temperature 298 K. The crystallite sizes of magnetite in magnetic composites were calculated by XRD and totaled 2.4 nm for MCSp7 and 7.4 nm for MCSp10. The Mossbauer parameters for pure saponite indicated the existence of one Fe^{3+} doublet with relative spectral area (RA) 33.0 %. Mössbauer spectrums of nanocomposites were compared with the spectrum of native saponite and it was found that the one sextet (RA = 42.0%) and three sextets (RA was 21.4%, 8.3% and 19.6%) corresponding to magnetite in MCSp-7 and MCSp-10, respectively. In addition, Mössbauer spectrums of magnetic nanocomposites were characterized by presence of two doublets. This confirms that the magnetic modifier particles of magnetic composite sorbents are in nanoscale range (less than 10 nm) and have super paramagnetic properties. RA of MCSp-7 second doublet (36.6 %) was higher compared with MCSp-10 (29.5 %). Reducing of the intensity of Fe_3O_4 doublet was associated with increasing the size of its crystallites from 2.4 nm to 7.4 nm. For Mössbauer spectrums of magnetite with particle size more than 50 nm the presence doublets is not typical [2]. Thereby, magnetic nanocomposite mineral sorbents were characterized by superparamagnetic properties which were primarily determined by the size of magnetite nanoparticles.

1. *Makarchuk O., Dontsova T., Astrelin I.* Magnetic Nanocomposites as Efficient Sorption Materials for Removing Dyes from Aqueous Solutions // Nanoscale Research Letters. - 2016. **- 11:161**. – P. 1-7.
2. *Goya G.* Static and dynamic magnetic properties of spherical magnetite nanoparticles // Journal of applied physics. – 2003. – **94**. - P. 3520-3528.