Kinetics and mechanism of sorption of Cr(VI) by nanoparticles of synthetic magnetite

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Abstract

The results of investigation of kinetics and mechanism of sorption of chrome(VI) by nanoparticles of synthetic magnetite in a model solution are presented. The model solution contained 400 mg/l of Na_2SO_4 and 50 mg/l of Cr(VI) (in the form of potassium chromate). Investigations were carried out at different temperatures and pH of the model solution. Particles of magnetite had the average diameter 32 nm and the specific surface area 36.3 m^2/g (it was evaluated by BET method). It was found that at sorption of chrome(VI) by magnetite two processes simultaneously proceed: (1) simple physical adsorption and (2) chemical reaction of interaction of Cr(VI) with magnetite (the chemisorption). The parameters of these processes at different temperatures and initial pH of the model solution were defined. The chemical reaction of interaction of chrome(VI) with magnetite was described by equation of reaction of the first order related to concentration of Cr(VI) in solution. Established relations allow evaluating the amount of magnetite for removal of chrome(VI) from polluted natural waters and sewage. For verification of the established relations additional experiments for cleaning sewage of some enterprise of Sverdlovsk region (Russia) from Cr(VI) by magnetite were carried out. As a result satisfactory coincidence of experimental and theoretical data was found.

Key words: sorption, nanoparticles, magnetite, Cr(VI), equation of reaction, sewage.