Removal of arsenic on sorbents containing iron oxide and titanium oxide modified with lanthanide ions

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Arsenic is one of the major pollutants and a global problem due to its toxicity and harmful effects on human health. The paper presents the results of arsenic adsorption onto two adsorbents (Ferrix A33E and As500) with the previously adsorbed lanthanum, neodymium and cerium ions. The investigations included determination of adsorption parameters of arsenic, lanthanum, neodymium and cerium and finally comparison of the adsorptive properties of the unmodified and lanthanide(III)-modified sorbents. Sorption of the above mentioned ions was performed by the static method, studying the effects of pH, sorbent mass, phase contact time and initial solution concentration. The kinetic parameters were determined using the pseudo-first order (PFO), pseudo-second order (PSO) and intra particle diffusion models. The equations of Langmuir and Freundlich isotherms were used to determine the isotherm parameters. The sorption efficiency in the case of adsorption of lanthanide ions from the mixture was also examined. The optimal pH for the arsenic sorption was equal to 4 while for La(III) ions (as a model for the other lanthanide ions) the pH value was 6. The sorbents were characterized by the Fourier-transform infrared spectroscopy (FTIR) analysis and the point of zero charge was also determined (8.29 for Ferrix A33E and 5.59 for As500). In each case the previous adsorption of lanthanide(III) ions increased the arsenic removal efficiency of Ferrix A33E and As500. This process can contribute to a significant reduction in the amount of arsenic in the environment.