Abstract

Arsenic is one of the most widespread inorganic pollutants worldwide and represents a significant potential risk to human health and the biosphere. Arsenite and Arsenate species are commonly found in groundwater, which is used as drinking water, this has been considered a serious problem worldwide. It is well known that arsenic is highly toxic and carcinogenic; at present exist reports of diverse countries with arsenic concentrations in drinking water higher than those propoused by the World Health Organization (10 µg/L). It has studied various methods of arsenic removal but many of them have various problems such as generating a lot of waste, low removal efficiency and the use of large amount of adsorbent material. Nanomaterials and nanotechnologies inspire new possible solutions to major environmental issues in actuality; there are reports of new strategies using adsorption iron oxides and oxyhydroxides nanoparticles. Some of this nanoparticles are; magnetite, hematite and goethite, which proved to be very efficient for the removal of arsenic in drinking water. However, the adsorption mechanism is not yet clear. In order to shed light on this subject, we attempt to study the interactions between arsenic species and nanoparticle surface, in aqueous media.

The iron magnetic nanoparticles (magnetite) were prepared using a co-precipitation method, the hematite by a solvothermal method and nanobarrillas from goethite precipitation method. Magnetite, hematite and goethite nanoparticles synthesized were put in contact with As_2O_3 and As_2O_5 solutions at room temperature to pH 4 and 7. The nanoparticles were characterized by FTIR, TGA, XRD, TEM, UV-vis, ICP, XRF, vibrational magnetometry and XPS. The results showed that synthesized magnetite had an average diameter of 11 nm and a narrow size distribution, for hematite was 30 nm and goethite 30 nm wide and 410 nm long. Also, it was checked that at room temperature the nanoparticles exhibit superparamagnetic behavior. On the other hand, after adsorption experiment, it was evident from FTIR and XPS that once arsenic species interact with the surface of the nanoparticles form surface complexes mono- and bidentate and mono and binuclear.