Selective and efficient arsenic recovery from water through quaternary amino-functionalized silica

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The free-radical graft polymerization of acryloxyethyl-trimethylammonium chloride onto commercial silica particles was studied experimentally for extraction of arsenic ions from water. Two steps were used to graft acryloxyethyl-trimethylammonium chloride (Q) onto the surface of nanosilica: anchoring vinyltrimethoxysilane (VTMSO) onto the surface of silica to modify it with double bonds and then grafting Q onto the surface of silica with potassium persulfate as an initiator. The products were characterized by Fourier-transform infrared (FT-IR), the thermogravimetric analysis (TGA), scanning electron microscopy (SEM), 13C, 29Si nuclear magnetic resonance (NMR), and X-ray powder diffraction (XRD). The results showed that it is easy to graft Q onto the surface of silica under radical polimerization. The morphology analysis of silica and modified silica indicated that the silica decreased the size scale after modification. Q/VTMSO-SiO2 was tested for its ability to remove arsenic from drinking water. The results show that the new silica hybrid particles efficiently remove all arsenate ions. In addition, Q/VTMSO-SiO2 showed better sorption capacities for other metal ions (such as copper, zinc, chromium, uranium, vanadium, and lead) than a commercial water filter.

Arsenic

Graft polymerization

Quaternary ammonium

Silica

Vinyltrimethoxysilane

Arsenic

Chlorine compounds

Free radical polymerization

Free radicals

Grafting (chemical)

Metal ions

Metals

Nuclear magnetic resonance

Organic coatings

Potable water

Potassium chloride

Potassium compounds

Scanning electron microscopy

Silica

Thermogravimetric analysis

Water filtration

X ray powder diffraction

Fourier transform infrared

Functionalized silica

Graft polymerization

Morphology analysis

Nuclear Magnetic Resonance (NMR)

Potassium persulfate

Quaternary ammonium

Vinyltrimethoxysilanes

Chemicals removal (water treatment)