Use of magnetite/graphene oxide nanocomposites for acid mine drainage remediation

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Several rivers in Northern Chile have high concentrations of heavy metals derived from acid mine drainage (AMD) generation. Is common to find high concentrations of dissolved heavy metals like aluminium, manganese, iron, copper, zinc, among others. Heavy metals are highly recalcitrant and could generate major environmental consequences affecting the flora and fauna. In this study, we use functionalized graphene oxide (GO) sheets, with magnetite nanoparticles (Fe_3O_4) to uptake heavy metals from synthetic AMD waters taking advantage of the physico-chemical properties of the proposed materials.

The graphene oxide sheets were synthesized by the modified Hummers method and magnetite was added after synthesis. In order to determine the potential of magnetite/graphene oxide nanocomposites to remove heavy metals, adsorption tests will be carried out on single nanoparticles, graphene oxide, and functionalized graphene oxide. Transmission electron microscopy (TEM), atomic force microscopy (AFM), Fourier-transform infrared spectroscopy (FT-IR), Scanning Electron Microscope (SEM) and X-Ray Diffraction (XRD) were used in the nanoparticles characterization. The results shown that GO sheets can remove up to 90% of aluminium, manganese, iron, copper and zinc. The acidity of the model water was not affected by the presence of nanocomposites. In addition, GO/NPs have a high aluminium removal rate decreasing the initial concentration from 10 mg/L to 7 mg/L. These results can be useful to improve the development of technologies based in nanomaterials for the remediation of water contaminated with heavy metals.