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Iron based nanomaterials for cadmium (II) immobilization in water and soil

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Cadmium in natural soils and water is correlated with a potential consumer's toxicity. Decreasing its bioavailability in agricultural soils and in contaminated water using nanomaterials has been found meaningful. In this study, iron-iron sulfide nanoparticles (Fe-FeS NPs) and sulfide modified Fe_3O_4 nanoparticles (Fe_3O_4 -sulfide NPs) were synthesized by chemical precipitation method, in free-oxygen solutions. Sizes of 10-20nm for the Fe_3O_4 -sulfide NPs and 40-80nm for Fe-FeS NPs were measured by transmission electron microscopy. X-ray diffraction and Energy-dispersive X-ray spectroscopy were used to characterize the chemical composition of the NPs. In addition, we demonstrate the effects of these nanoparticles as immobilizer agents of cadmium contained in water and in soil. The removal of Cd from aqueous solutions by the nanoparticles was investigated in batch conditions at $20 \pm 2^\circ\text{C}$. Also, it was evaluated the reduction of cadmium bioavailability in different agricultural soils from Ecuador coastal region in fixed-bed columns. The removal capacity of these NPs was 98% and 95%, for Fe_3O_4 -sulfide NPs and Fe-FeS NPs, respectively using a 20ppm Cd ion solution at pH 5. Five soils cadmium phases were investigated using Fe_3O_4 -sulfide NPs and after the treatment, cadmium content on the bioavailable phases showed a decrease of 68%. Hence, the as-prepared nanoparticles showed that effectively reduce the bioavailability of cadmium in different types of water and samples of agricultural soil.

Keywords: Cadmium removal, Iron nanoparticle, sulfide modified nanoparticle, nanomaterial's.

Biography:

Mr. David Esteban Carchi Maurat is a Student of MSc Program in Nanotechnology/Centro de Nanociencia y Nanotecnología/ Universidad de las Fuerzas Armadas ESPE. David Carchi Maurat obtained his degree of Chemical Engineer at the University of Cuenca in 2014. Work experience in research at private industry and teaching chemistry in public school. He is currently a student of the Master's degree program in Nanotechnology at the Universidad de Fuerzas Armadas ESPE and conducts his research in "Synthesis of nanomaterials for application as agents of immobilization of cadmium in agricultural soils" in the Center of Nanoscience and Nanotechnology CENCINAT. He also collaborates in the synthesis of silver, polymeric and other metallic nanoparticles with different purposes using chemical precursors and plant extracts.