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The combined use of plants and nano-oxides for the remediation of contaminated soils

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Phytostabilization of metal-contaminated soils through chemical stabilization combined with vegetation cover is the most-viable ecofriendly alternative that protects soil from erosion, improves its quality and prevents from contaminant dispersal. Oxides have been shown to be useful stabilization agents for trace elements (TEs), due to several immobilization mechanisms including sorption, surface complexation or co-precipitation. Engineered nano-oxides (particle size of 1-100 nm) are thus promising amendments for stabilizing contaminants in soils and sediments, due to their huge reactive surface areas (tens to hundreds of m2g-1). So far, a limited number of studies have been concerned with environmental and toxicological risks of nanoparticles (NPs). Mechanisms that allow NPs passing through root cells and membranes are as yet poorly understood. Possible interactions of NPs with plant roots include adsorption onto the root surface, incorporation into the cell wall and uptake by the cell, and more research is necessary to explore their influence on the transport of water through the roots, which has not been described yet. With soil solution and rhizosphere environment as a complex system, the processes at the soil-root interface play a key role and significantly affect the behavior of both NPs and contaminants. In fact, the immobilization of TEs by NPsis affected by the presence of other ions (nutrients, organic matter, etc.), which may influence the contaminant sorption efficiency. Detailed research of the soil-TEs-NPs interactions is still scarce, but is necessary in order to assess both beneficial and harmful effects of NPs on plants and contaminant mobility. The main objectives of the KGEVdepartment at CULS include to assess the behavior of NPs in the immobilization of TEs in contaminated soils during phytostabilization, to investigate the interactions of nano-oxides, nutrients and contaminants in the rhizosphere-plant system, and to study the consequences of NPs for plant physiology related to stress and water balance.

Biography

Domingo Martínez-Fernández, Postdoc at the Department of Environmental Geosciences (KGEV), Czech University of Life Sciences Prague (Czech Republic), has worked extensively in the field of plant physiology, obtaining his PhD from Polytechnical University of Cartagena (Spain) in 2012. Since 2011, he has published 9 articles in journals with IF and has been a co-investigator of 6 projects. His scientific specialization includes Mediterranean flora, soils and organic amendments, modelling, and the applicability of NPs for the chemical immobilization of TEs in contaminated soilsand consequences for the nutritional and physiological processes (water relations) in plants during phytoremediation activities.

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