



## **Stability and mobility of cerium oxide nanoparticles in soils: effects of humic substances, pH and ionic strength**

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Among the large number of types of nanomaterials used in the field of nanotechnology, cerium oxide nanoparticles ( $\text{CeO}_2$  NPs) are among the top five most commonly utilized by industry, agriculture and nanomedicine for their unique physico-chemical properties. They are used, for example, in the production of catalysts, as fuel additives, and as polishing agents. Therefore, the release and encounter of  $\text{CeO}_2$  NPs in the environment following their application, waste disposal, life-cycle and accidents is inevitable. It is critical to examine the behavior of  $\text{CeO}_2$  NPs released in the environment to assess the risk they pose to the environmental and public health. In particular, little is known about the fate and transport of  $\text{CeO}_2$  NPs in soils and groundwater. To assess the behavior of  $\text{CeO}_2$  NPs, it is important to investigate the factors that affect their stability and mobility. Humic substances are a major component of soils and have been shown to have the potential to impact the transport and retention of nanoparticles in soils. Consequently, our study characterizes the impacts of humic and fulvic acids on the stability and mobility of cerium oxides in model porous media under various pH and ionic strength conditions. Batch experiments conducted at various concentrations of humic and fulvic acids coupled with a wide range of pHs and ionic strengths were investigated. Selected parameters from these batch studies were then used as experimental conditions representative of environmental systems to perform column transport experiments to assess of the mobility of  $\text{CeO}_2$  NPs in saturated porous media, which is the first step in simulating their behavior in soil and groundwater systems.