Physicochemical characterization and behavior of manufactured cerium(IV) oxide nanoparticles in aquatic systems

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Abstract

Nowadays engineered nanomaterials (ENM) are widely present in different areas of our life. Large application of ENM in daily used customer products leads to its released into the environment. The fate of ENM in aquatic system isn’t clearly understood that pose the threat for leaving organisms and for human health. Before making the risk assessment and the toxicity tests ENM should be fully characterized, also their behavior in the environment should be studied. By considering cerium(IV) oxide (CeO2) nanoparticles (NPs) we investigated the fate of ENM in aquatic environment. First, we characterized CeO2 NPs, and the point of zero charge was defined and the stability of CeO2 NPs versus pH was assessed. Then, the influence of physicochemical properties of aqueous medium as ionic strength, pH, and presence of natural polyelectrolytes on the CeO2 NPs behavior was investigated. We found that natural organic matter and electrolytes are modifying the surface of CeO2 NPs. Our results indicate that the effect on stabilization / destabilization and aggregate formation is due to the water chemistry. This study covers the […]

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Physicochemical characterization and behavior of manufactured cerium(IV) oxide nanoparticles in aquatic systems

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Nowadays engineered nanomaterials (ENM) are widely present in different areas of our life. Large application of ENM in daily used customer products leads to its released into the environment. The fate of ENM in aquatic system isn’t clearly understood that pose the threat for leaving organisms and for human health. Before making the risk assessment and the toxicity tests ENM should be fully characterized, also their behavior in the environment should be studied. By considering cerium(IV) oxide (CeO\textsubscript{2}) nanoparticles (NPs) we investigated the fate of ENM in aquatic environment. First, we characterized CeO\textsubscript{2} NPs, and the point of zero charge was defined and the stability of CeO\textsubscript{2} NPs versus pH was assessed. Then, the influence of physicochemical properties of aqueous medium as ionic strength, pH, and presence of natural polyelectrolytes on the CeO\textsubscript{2} NPs behavior was investigated. We found that natural organic matter and electrolytes are modifying the surface of CeO\textsubscript{2} NPs. Our results indicate that the effect on stabilization / destabilization and aggregate formation is due to the water chemistry. This study covers the interdisciplinary domains between colloidal, physical and environmental chemistry and contribute to the further studies for elimination of ENM from aquatic systems and risk assessment.

Figure 1: Schematic representation of the behavior of manufactured nanoparticles in aquatic systems