



Environmental release, fate and ecotoxicological effects of manufactured ceria nanomaterials

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Abstract

Recent interest in the environmental fate and effects of manufactured CeO₂ nanomaterials (nanoceria) has stemmed from its expanded use for a variety of applications including fuel additives, catalytic converters, chemical and mechanical planarization media and other uses. This has led to a number of publications on the toxicological effects of nanoceria in ecological receptor species, but only limited information is available on possible environmental releases, concentrations in environmental media, or environmental transformations. Increasing material flows of nanoceria in many applications is likely to result in increasing releases to air, water and soils however; insufficient information was available to estimate aquatic exposures that would result in acute or chronic toxicity. The purpose of this review is to identify which areas are lacking in data to perform either regional or site specific ecological risk assessments. While estimates can be made for releases from use as a diesel fuel additive, and predicted toxicity is low in most terrestrial species tested to date, estimates for releases from other uses are difficult at this stage. We recommend that future studies focus on environmentally realistic exposures that take into account potential environmental transformations of the nanoceria surface as well as chronic toxicity studies in benthic aquatic organisms, soil invertebrates and microorganisms.

Impact

This critical review identifies the most critical data gaps that should be filled before comprehensive ecological risk assessments for nanoceria can be performed. It provides a review of the sources and sinks of nanoceria in the environment, detection and characterization methods, fate and transport processes and a review of the toxicity literature.

Reference

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