Title *

Inhalation toxicity of 5 – 10 nm cerium dioxide nanoparticles

Abstract *

Background and Aims

Cerium oxide nanoparticles (CeO_2NPs) used in the automobile industry to increase fuel efficiency have been detected in exhaust emissions, prompting concern over potential health effects. More research is needed to improve knowledge about the fate, transport and toxicity of CeO_2NPs after inhalation exposure. The aim of this study was to examine the lung toxicity induced by inhaled CeO_2NPs.

Methods

CeO_2NPs (mass concentration 1.8 mg/m^3, primary particle size 5 – 10 nm, aerosol count median diameter 40 nm) were delivered to male Sprague-Dawley rats by nose-only aerosol inhalation (3 hours per day, 4 days per week for 1 or 2 weeks). The negative control groups received aerosolised distilled water. Bronchoalveolar lavage (BAL) analysis of cell counts, lung histology and protein concentration in BAL were analysed at 3 and 7 days post-exposure. Elemental maps of lung tissue samples were produced using laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS). The cerium content of liver and kidney samples was analysed using ICP-MS.

Results and Discussion

The results of this study showed higher levels of infiltration of inflammatory cells in the lungs of CeO_2NP-exposed rats, compared to age-matched controls. The Inflammatory effects of inhaled nano-sized CeO_2 particles were greater than those seen in studies using micron-sized aggregates, thus emphasising the importance of particle size. ICP-MS analysis indicated the presence of cerium in kidney and liver samples indicating translocation from the lungs with the potential for interference in biochemical processes.

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