Antioxidant properties of cerium oxide nanoparticles in BEAS-2B cells

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Nanotechnology is an emerging interdisciplinary science with very promising future expectations. Working with particles comparable in size with intracellular molecules gives many possibilities translatable to an increasing list of applications. Among the different nanomaterials, cerium oxide nanoparticles (Ce-NPs) a rare-earth element, is becoming a very used element due to its interesting properties: this nanomaterial presents two different oxidation states that could result in an autoregenerative redox cycle. Thus, a potential application of Ce-NPs to quench reactive oxygen species (ROS) in biological systems is currently being investigated. In this manner Ce-NPs may represent a novel agent to protect cells and tissues against damage by its regenerative free radical scavenging property.

Several lines of evidence suggest that both oxidative stress and inflammatory responses play an essential role in the biological processes of different diseases, as those arising in the lungs from cigarette smoking. In this study we have used an epithelial lung cell line, BEAS-2B, as a model to study the possible antioxidant effect of Ce-NPs in the pulmonary-like system.

We have assessed the protective effect of the 24 h pre-treatment of Ce-NPs in front of a well defined agent inducing oxidative stress ($KBrO_3$), through different endpoints like: toxicity, intracellular reactive oxygen species (ROS) induction, genotoxicity and DNA oxidative damage (comet assay) and gene expression alterations.

The obtained results confirmed the antioxidant properties of Ce-NPs. Thus, its pre-treatment significantly reduced the intracellular production of ROS induced by $KBrO_3$. Similarly a reduction in the levels of DNA oxidative damage, as measured with the comet assay complemented with FPG enzyme, were also observed. Similarly, pre-treatment of BEAS-2B cells with Ce-NPs slightly increased the viability of cells treated with $KBrO_3$ as well as smoothly down regulated the expression of genes involved in the oxidative NRF2 pathway. As indicated, the confirmation of antioxidant properties of Ce-NPs over a lung cell line (lung-model), would suggest and interesting potential of these NP for the treatment of smoking-related diseases.