Biological effects of cerium nanoparticles using *Drosophila* as a model organism

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Due to the massive and continuous production of nanomaterials they inevitably reach the environment and, as consequence, human beings are certainly exposed. The different physicochemical properties of nanomaterials may suppose new biological properties that can interfere with crucial biological processes affecting human health. This means that a deep knowledge on the potential biological effects of nanomaterials is strongly needed. Although *in vitro* approaches are easily performed, *in vivo* studies lead to more relevant information. In this context, we promote the use of *Drosophila* as a suitable *in vivo* model to characterize the potential risks associated to nanomaterials exposure. *Drosophila* is the forefront organism in genetic studies and it is a strong candidate to detect the effect of nanoparticles due to its unique characteristics, especially that it share 60-70% homology to human genes and the counterparts of several genes responsible for more than 700 different human diseases are found in *Drosophila*.

Our aim was to determine the different biological effects of cerium nanoparticles (Ce-NPs) by using a wide battery of experimental approaches. Thus, egg-adult viability, particles uptake, gene expression, intracellular reactive oxygen species (ROS) production, genotoxicity and antigenotoxicity were the endpoints evaluated. Genotoxicity and antigenotoxicity were measured with the wing-spot assay. Ce-NPs >25nm were used in this study.

In spite of TEM images showing the internalization of CeNPs in intestinal and haemocyte cells, together with the significant expression of *Hsp* genes at the highest dose tested (10 mM), neither toxicity nor genotoxicity related to the both forms of Ce tested was observed. It is noteworthy that Ce-NPs significantly reduced both the genotoxic effect of potassium dichromate and the intracellular ROS production. No morphological malformations were detected after larvae treatment but, on the contrary, a reduction in the frequency of scutellum bristles duplication of the adults was found.

All results indicate that the Ce-NPs have neither toxic nor genotoxic effects, but contrarily show anti-genotoxicity and anti-oxidative stress properties. This study reflects the importance of *Drosophila* in studying different biological effects of nanoparticulated materials and, in addition, had developed a model to study the effects of nanomaterials on the gastrointestinal barrier.