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Validation of *Caenorhabditis Elegans* as an *In Vivo* Model for Nanotoxicological Studies of Mesoporous Silica Particles

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Extended Abstract

Nanotechnology applications are widespread in current industry areas. Specifically, in food industry the mesoporous silica particles (MSP) are a potential candidate as scaffolds for delivery systems. MSP have a high specific surface area (up to 1200 m^2g^{-1}), homogeneous porosity, large loading capacity and high inertness (Kresge et al. 1992). However the hazards associated to nanomaterials are not fully assessed.

Nanotoxicology studies are mainly based on cytotoxicity assays using cell cultures as *ex vivo* models; but there is a lack of animal studies based on particles intake. Moreover, the mammal evaluation models are long and require a lot amount of individuals to obtain an entire statistical analysis. In this context, *Caenorhabditis elegans* turns as an alternative *in vivo* model. The nematode *C. elegans* is a multicellular organism with a short lifespan, well-studied biological system and a fully sequenced genome (The *C. elegans* sequencing consortium, 1998), which made it a viable model for toxicological studies of nanomaterials (Chen et al. 2013).

This project validated *C. elegans* as an *in vivo* model for estimating the toxicity of MSP looking for correlation among oxidative stress studies, lifespan and healthspan (measure of healthy aging through a motor activity evaluation). Results were compared with previous *in vitro* studies on cell line HCT -116. We evaluated two different sizes of a defined MSP concentration. Nematodes were fed with each MSP solution for 21 days in lifespan assays, for 7 days in healthspan assays and for 5 days in stress studies. Results showed significantly differences depending on the particle size.

Thus, in case of microparticles (>500nm), *C. elegans* mean lifespan (time where 50% worms were death) was identical both in treated and control conditions (aprox.11.9 days). However, in the case of nanoparticles (<100nm) the mean lifespan of treated population decreased significantly compared with control ($p < 0.007$). In nanoparticle-treated nematodes, these results were supported by a decrease in healthspan (reduction of movement) and a significant survival reduction due a decrease of resistance of oxidative stress. Furthermore, these results are consistent with previous *in vitro* data, which showed a 60% reduction of cell viability in the HCT-116 treated with nanoparticles; while viability of HCT-116 treated with microparticles remain over 80%; within first 24h of assay.

Therefore, our study showed the potential of *C. elegans* as an in vivo model to evaluate the toxicity of silica particles; being possible to perform a pre-clinical screening before the studies in mammal models. Further studies to determine the molecular targets as well as genotoxicity of nanomaterials will help to elucidate the potential toxicity mechanisms of mesoporous silica particles.

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