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Evaluating the cytotoxic potential of a panel of manufactured nanomaterials using the plating efficiency assay

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Statement of the Problem: The emergence of newly developed nanomaterials (NMs), with physicochemical features useful for innovative applications in consumer products and medicine, generated the need of fast- and cost-effective toxicology screening strategies for safety assessment. Overall toxicity can be evaluated using survival or cell death as an endpoint. However, in view of the NMs' specificities, many methods are vulnerable to interference of the NMs with the detection process. We analyzed the cytotoxic effects of a panel of 10 benchmark NMs in respiratory cells (A549) using plating efficiency (PE) assay, and compared with a spectrophotometric method.

Methodology: The NMs were used for PE assay in cells exposed for 7 days to silicon dioxide (NM-200 and NM-203), titanium dioxide(NM-100, NM-101, NM-103), silver (NM-300 k, NM-302), cerium oxide (NM-212), barium sulphate (NM-220), zinc oxide (NM-110) nanomaterials or carbon nanotubes (NM-401). For a core group of NMs, NM-212, NM-100, NM-101, NM-103 and NM-220, the MTT assay was also performed in 24 h exposed cells. In addition, the batch dispersions and their dilutions in the cell medium were analyzed by dynamic light scattering (DLS).

Findings: The size distribution of the dispersions showed that in general the NMs showed peaks around 100 nm, but a multimodal size-distribution was observed for NM-103, NM-200, NM-302 and NM-401. Considering the PE assay, NM-212, NM-101, NM-110, silicon dioxides and both silver NMs were cytotoxic. On the contrary, NM-100, NM-103 and NM-220 were not cytotoxic. In the MTT assay following 24h- exposure to the core NMs, no significant cytotoxicity was observed.

Conclusion & Significance: Overall, cytotoxicity determined in PE assay yielded positive results in the majority of the NMs, suggesting that this methodology may be more sensitive than MTT to NMs' induced toxicity. Furthermore, long-term exposure to NMs is possibly more relevant to address health impact of NMs.

Biography

Mariana Pinhão has worked mainly in genetic toxicology, focusing on the impact of several nanomaterials on the human genome, such as titanium, silicon, silver and carbon nanoparticles, among others. She has also studied the influence of mycotoxins on the DNA stability, as well as the antioxidant potential of natural extracts, using human digestive system *in vitro* cell models. Currently, she is enrolled in a multidisciplinary PhD program related to biological systems, where she is working with bioinformatic tools applied to human genomics.

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