Assessing the safety of manufactured nanomaterials

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The wide-range of nanomaterials industrial, biomedical and consumer uses have increased the likelihood of environmental and human exposure to these materials. Despite all efforts to establish the risks associated with nanotechnology-based products, there's still a considerable uncertainty about the safety of these materials. So far, nanomaterials risk assessment has been done on a case-by-case basis, which is not feasible considering the vast number of materials and their possible variations.

The application of the safe(r)-by-design concept along the innovation process of nanotechnology-based products has recently emerged as a promising tool to accelerate the capitalisation of the economic potential of nano-based products. Understanding how nanomaterials intrinsic properties (e.g. chemical composition, size, shape, surface chemistry) influence their interaction with biological systems will be decisive not only to accelerate the hazard assessment of the large number of already available nanomaterials but also to assist the industry in the safe design and provide reliable scientific evidence to support risk-related regulatory decisions.

Our group is involved in several research projects aimed at identifying gaps in knowledge of the manufactured nanomaterials (MNMs) effects upon the biological systems and establishing the link between MNMs physicochemical properties, dose and biological effects using both *in vitro* and *in vivo* models. ERA-NET SIINN NanoToxClass project aims to develop a comprehensive grouping approach based on the joint consideration of relevant physical, chemical and biological properties (mode of action) of the nanoparticles to prioritise their testing and support risk assessment. Through a systematic and targeted approach, it is expected to establish criteria for grouping based not only in conventional toxicity endpoints but also in Omics analyses (transcriptomics, proteomics and metabolomics), getting a more complete picture of the effects induced by different kinds of nanoparticles (e.g. TiO_2, SiO_2, graphene oxide) present in products already available in the market.

According to the European Agency for Safety Work and Health, nanoparticles and ultrafine particles have been identified as one of the strongest emerging risks. Considering that nanotechnology industries are clearly expanding, workplace exposure is a matter of great concern. The recently started ERA-NET SIINN CERASAFE project deals with the occupational risks associated with manufacture of nanomaterials in the ceramic industry. The project will assess workers exposure under different scenarios and characterize intentionally and unintentionally produced nanoparticles during different industrial processes. Our group will be in charge of the evaluation of the biological/toxicological effects of airborne nanoceramics in relevant *in vitro* and *in vivo* models.

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