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Stability, transformation and toxicity of engineered nanomaterials in biological systems

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The increasing production volume of Engineered Nano-Materials (ENMs) has raised concerns about possible toxicological and environmental issues. For this reason, there is a need to assess the interaction of ENMs with biological systems for early prediction of their cytotoxicity. Adequate physicochemical characterization of ENMs prior to the toxicity assessment and selection of appropriate doses in toxicological studies are paramount to correlate their properties with biological action. In the context of respirable NPs, the interactions with both lung lining fluid components and local cell populations will determine the effects on cell metabolism and lung function. There is a lack of information in the literature about the interactions between silver nanomaterials (AgNMs) and pulmonary cells. In particular, data on cellular uptake, measurements of particle dissolution or intracellular chemical transformations to the AgNMs are missing, making it difficult to separate the roles of the particle and Ag⁺ ion release effects in mediating biological effects and hence to predict the long term bio-persistence of this class of nanomaterial. Our studies aim to highlight the need to consider the interaction of AgNPs with different sizes and surface coatings, access the pulmonary tissues which can be linked to the pulmonary's disease. Interaction of AgNMs with pulmonary cells, as well as their uptake, cytotoxicity and processing inside cells were investigated using different correlative imaging techniques. The findings demonstrated that interaction between Ag⁺ ions and sulphide species leads to transformation of the surface chemistry of AgNMs, limiting short-term toxicity effects in the cellular environment. In order to manipulate and optimize particular NPs features with favorable bio-availability and bio-distribution, not only NP uptake into cells, but also a fundamental understanding of the NPs-protein complex is necessary.

Biography

Leo Bey Fen is a senior lecturer at the Faculty of Medicine, University of Malaya (UM). She obtained her PhD from the London Centre for Nanotechnology (LCN), Imperial College London (UK) in 2015. She is the current consultant at the Electron Microscopy Services, Central Unit of Advanced Research Imaging (CENTUARI), UM. She is also an associate research member at Nanotechnology and Catalysis Research Centre (NANOCAT). Her research interest includes synthesis and characterisation of nanomaterials, functionalisation and applications of nanomaterials (e.g. biosensors for pathogen or toxin identification, antimicrobial agents, drug delivery, nanomagnetic gloves) and nanosafety & toxicology assessment of nanomaterials.

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