Are engineered nanoparticles still toxic when they get old? Novel approaches in the safety assessment of engineered nanoparticles: the effect of ageing

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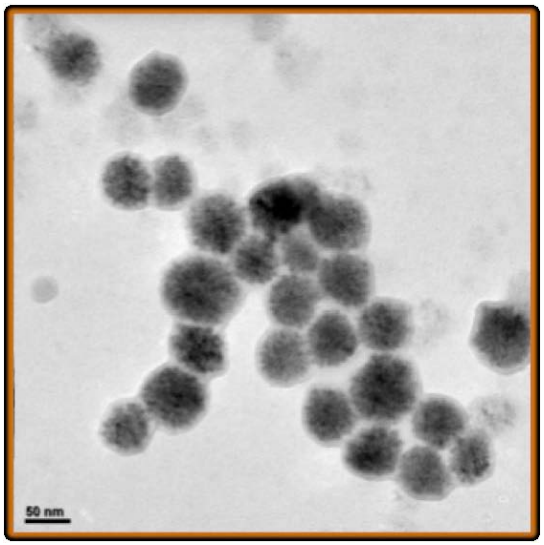
Abstract: Nanotechology has the potential to revolutionise modern living by creating novel materials and processes offering new technological advantages, medical solutions and helping rationalise the use of global resources. However, there have been concerns about the potential of these novel materials to also display novel mechanisms of toxicity. As a result, "nanotoxicity" has become a major research objective in the EU and internationally. Many aspects in the study of nanotoxicity remain poorly studied and challenging due to the difficulties in identifying, characterising and monitoring nanomaterials particularly after their release in the environment. The University of Birmingham is an international leader in this research area, with a number of projects at doctoral and postdoctoral level addressing different aspects of nanotoxicity. This project will specifically focus on the effect of ageing and environmental transformations of nanomaterials, and how this may affect their toxicity potential. The project is lab based and will involve making a range of nanoparticles and artificially ageing them in the laboratory to simulate what may happen in nature. Freshly synthesized and aged particles will be tested for their toxicity.

Background: Many new nanomaterials are already industrially produced and used in a variety of products, including cosmetics, sunscreens, textiles, food packaging and electronics. Many more are due to be developed and marketed in the near future, some of which will eventually involve second generation "smart" nanomaterials. However, concerns have been expressed that all these technological developments proceed without safety considerations and that there may be links between the novel properties displayed by nanomaterials and potential toxic behaviour. The proposed PhD project will fit in this area of research and will focus specifically in investigating structural transformations, which may occur to nanoparticles in aqueous media as a function of time ("ageing"). The project offers a challenging research programme and a great potential for novel discoveries.

Objectives: Synthesis and characterisation of a range of nanoparticles, focusing on Ag and ZnO; stable isotope labeling of these particles to enhance their traceability; assessment of physicochemical transformations of the synthetic nanoparticles as a function of time and temperature (as a proxy for time) in aqueous media; assessment of the kinetics of such transformations; assessment of the effects of transformations on toxicity.



The picture shows isotopically labelled ZnO nanoparticles imaged by Transmission Electron Microscopy (TEM). The label is "invisible" by TEM, but can be traced using analytical techniques such as Inductively Coupled Plasma Mass Spectrometry. This is one of the novel techniques we have developed at Birmingham in order to trace the fate, transformations and biological activity of engineered nanoparticles.

This PhD is competition funded at Home&EU level, and applicants should apply via http://www.birmingham.ac.uk/students/courses/postgraduate/research/gees/environmental-sci-risk-mgt.aspx where they should click on 'Apply now' and choose the option 'PhD in Department of Division of Environmental Health and Risk Management' and give the PhD title in the 'Funding details' section of the online application.