Internalisation Mechanisms of Modified Titanium Oxide Nanoparticles in Skin Cells and Multicellular Living Specimens : Resulting Toxicity

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Nanotechnologies are of great interest from both academic and industrial points of view, with numerous applications in domains such as medicine, catalysis and material sciences. However, their nanotoxicology has also attracted the attention of public and governments' worldwide and established methods of chemical safety assessments have to be modified to address the special characteristics of nanoparticles and more especially to assess the biological effects of these highly reactive materials.

Most of theses manufactured nanoparticles have been produced for several decades on an industrial scale. There is an urgent need to evaluate the risks of these particles to ensure their safe production, handling, use, and disposal. Moreover, a comprehensive study is clearly needed to fully explore the toxicity of manufactured nanoparticles, which may help to better understand their deleterious health effects and create environmentally friendly and biologically relevant nanoparticles. In particular, the behavior of nanoparticles inside living cells is still an enigma, and no metabolic responses induced by these particles are understood so far.

This presentation concerns the potential toxicity due to exposure of TiO_2 NPs used in sunscreens and cosmetics. We propose to apply an original imaging methodology (Ion Beam Analysis, TEM, and Confocal microscopy) to in vitro studies, combining technologies for on one hand, the detection, tracking, and quantification of TiO_2 nanoparticles and on the other one, the use of indicators for ion homeostasis, cell metabolism, or cell fate.

The main goal is to precisely identify the molecular and cellular mechanisms involved in the nanotoxicity of TiO_2 nanoparticles in eukaryotic cells and in multi-cellular organisms such as *Caenorhabditis elegans* (*C. elegans*). This study addresses the current knowledge gap of human cells and *C. elegans* responses to TiO_2 nanoparticles exposure. Since the nematodes feed on bacteria and are considered as particle-ingesting organisms, the present study will offer new perspectives in nanoparticles-related risk assessment and food web accumulation modelling.