

Lecture: 7th cosmetics amendment – can all goals be achieved in time?

Reduction of animal testing by development of a novel exposure chamber to expose cells to nanoparticles at the air-liquid interface

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Due to the wide range of potential applications, the use of nanoparticles will increase dramatically in the near future and by this also occupational and public exposure. Screening strategies have been developed to assess nanoparticle toxicity by *in vitro* and *in vivo* studies. Traditionally, *in vitro* exposure experiments have been performed which incubate cells with particles in liquid suspensions (“submerged”). Recently, more advanced air-liquid particle exposure systems have been introduced that more realistically mimic exposure via inhalation. In these systems cells are exposed to airborne particles, but they typically require profound technical skills for nanoparticle generation/characterization and the nanoparticle deposition rate (onto the cells) may be very low (2% for diffusional deposition). In order to minimize the need for animal testing it is desirable to find a simpler and economic, but still reliable *in vitro* exposure method for nanoparticle toxicity. We have developed such an exposure chamber in which a human epithelial cell line (A549; other cell lines could also be used) is exposed to nanoparticles at the air-liquid interface. Nebulization of a nanoparticle suspension forms micron-sized droplets containing nanoparticles that deposit onto cells via sedimentation (not diffusion). This method is technically simple and it allows both accurate nanoparticle dosimetry and a very efficient use of expensive test materials (30-70% deposition efficiency).

First evaluations with a cylindric prototype device showed a highly uniform and reproducible particle deposition on the bottom of the chamber with a total base area of 225 cm². Nebulization of 1ml of a 10% NaCl solution yielded a deposited mass of 1.327±0.047 mg/cm² (±3.5%) corresponding to about 60% deposition efficiency. When the A549 cells, were placed in the chamber and exposed to 0.9% NaCl, the cells did not show any reduction in cell viability. This is a first hint that it is possible to use this chamber for cell exposures without damaging them.

The prototype of this novel exposure chamber shows very promising features but needs to be further improved.

Keywords: nano-zinc particles, air-liquid interface, novel exposure chamber