Gas-borne particles for nanotoxicology studies

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3C.1

Aerosol emissions from silver nanotechnology consumer products. MARINA E QUADROS, Linsey C Marr, *Virginia Tech*

It is well established that inhalation of nanoparticles is associated with adverse health effects, yet the introduction of new consumer products that have the potential to aerosolize engineered nanoparticles is proceeding swiftly. Our objective was to characterize airborne particle emissions from consumer products that claim to contain silver nanoparticles or ions. We chose products based on their potential for generating aerosols during normal use: an anti-odor spray for hunters, a disinfecting spray, and a throat spray. We sprayed products into a polyethylene chamber and used a scanning mobility particle sizer and an optical particle counter to measure the resulting aerosol concentrations and size distributions. We collected aerosol samples onto filters using a four-stage cascade impactor, for quantification of silver by inductively coupled plasma mass spectrometry, and onto TEM grids using a thermophoretic precipitator. We then developed size-resolved emission factors describing the particle numbers and the silver mass emitted per spray action. The disinfecting spray produced bi-modal particle size distributions, peaking in the nucleation (<100 nm) and accumulation (~ 500 nm) modes. The hunter spray and the throat spray produced particles mostly in the accumulation and coarse (>1000 nm) modes. While all products had similar total silver concentrations in the liquid phase, the amount of silver aerosolized was much greater with the throat spray compared to other products. Results indicate that airborne silver generated by these products will likely deposit in the nasopharyngeal and alveolar regions if inhaled. Single-particle chemical and morphological properties are being determined through electron microscopy with energy dispersive x-ray spectroscopy. Results can be used to guide the selection of relevant particle doses in nanotoxicity testing, to predict exposure to nanoproduct emissions in indoor air quality models, and to develop regulations to ensure consumer safety.

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Gas-borne Particles for Nanotoxicology Studies. MARIA E MESSING, Christian R Svennson, Bengt O Meuller, Knut Deppert, Joakim Pagels, Jenny Rissler, *Lund University*

Although the belief in the great potential of nanoparticles is strong, major concerns with respect to their toxicology have been frequently discussed lately. It is well known that the properties of a specific nano-sized material are different from the properties of the same material in bulk form, and therefore toxicology regulations often based on mass might not be relevant for nano-sized materials. In order to improve the understanding of nanotoxicology and to learn how to handle nanoparticles in a safe way it is of utmost importance to use highly characterized nanoparticles for toxicology investigations.

In the present contribution we describe the generation and deposition of very accurately characterized nanoparticles with respect to size, shape, mass, surface area and crystal structure. The nanoparticles were generated by spark discharge and characterized online by differential mobility analyzers (DMA) and a DMA-aerosol particle mass analyzer (APM). Primary particle size as well as particle shape and crystal structure were evaluated by transmission electron microscopy (TEM). Particle surface area was calculated from the measured primary particle size combined with either the DMA-APM measurements or the idealized aggregate theory (IA) approach. Finally the deposited mass and surface area dosages were calculated for deposition in an air liquid interface (ALI) chamber and the alveolar region of the respiratory tract.

Gold particles were used to demonstrate the capability of the setup. From the measurements and calculations it is clear that a high enough mass and surface area reported for onset of inflammatory response can be reached in the ALI chamber, if a deposition time of roughly one hour is used. The possibilities to directly relate the toxicological response to surface area dose, when using particles of the same mass and number concentration and for a direct comparison of the effect of nanoparticle material offered by the setup is discussed.