

## EXPOSURE SYSTEM for Bioassays

### *Toxicity measurement of airborne nanoparticles*

**Category:**
**C. Particle Characterisation in and ex-situ**
**D. In-vitro toxicity studies**
**Institute:**
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### Technology description

The biological effects of airborne nanoparticles are quantified by a bioassay in an exposure system. The aerosol streams above the surface of biological cultures and induces a dose related response as for example inflammatory effects by the deposited particles. Simultaneous the deposited particle dose per surface area is monitored by a quartz crystal microbalance. The biological response is measured in the toxicological laboratory and correlated with the particle dose. By the in vitro test system the correlation between particle diameter, material properties, number concentration and the biological response is investigated.

#### *Process steps*

- Aerosol sampling by passing a size selective inlet (cut off diameter = 1  $\mu\text{m}$ )
- Conditioning of the aerosol similar to 37°C and up to 85 % relative humidity
- Exposure of cell cultures at the air-liquid interface
- Online dose determination by quartz crystal microbalance

#### *Advantage of the system*

- Standardised reproducible technique.
- Online measurement of deposited particle dose in  $\mu\text{g}/\text{cm}^2$ .
- Measurement at particle source, no sampling and dispersion of particles necessary.
- Reduction of number of animal tests.

### Fields of application

#### *Analysis of the biological effect of*

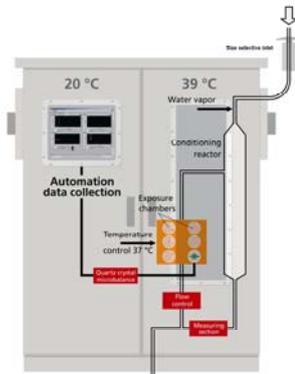
- Nanoparticles in production processes.
- Ultra fine particle emissions in industry.
- Airborne nanoparticle immissions in the environment.
- Gas mixtures.

### Main Features (Equipment Capabilities):

- Volume flow rate 2.7  $\text{m}^3/\text{h}$

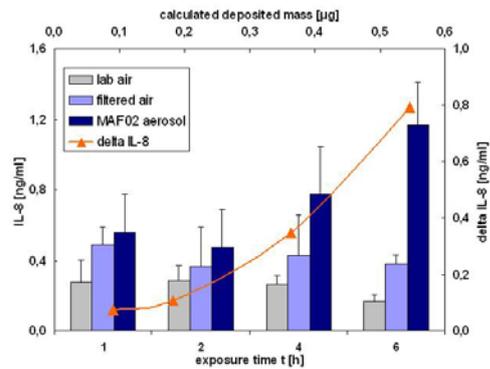
- Exposure of 6 membrane inserts with biological assays
- Exposure times up to 24 hours
- Applicable at nanoparticle production processes, combustion processes

**Flow chart:**



Scheme of the Karlsruhe Exposure System with the size selective inlet, the conditioning reactor for a constant aerosol with 37°C and 85% r.h., and the VITROCELL® exposure chambers containing the Transwell® membrane inserts as well as the QCM sensor for the online dose measurement.

**Typical Result:**



The increase of the protein Interleukin-8 (IL-8) after exposure to fly ash from a municipal waste incinerator. IL-8 is a marker for inflammation in the cell culture.



Photographs of the fully automated and temperature controlled prototype of the **Karlsruhe Exposure System** during an outside measurement of environmental aerosols (left) and at a technical plant (right).

Any further Information: