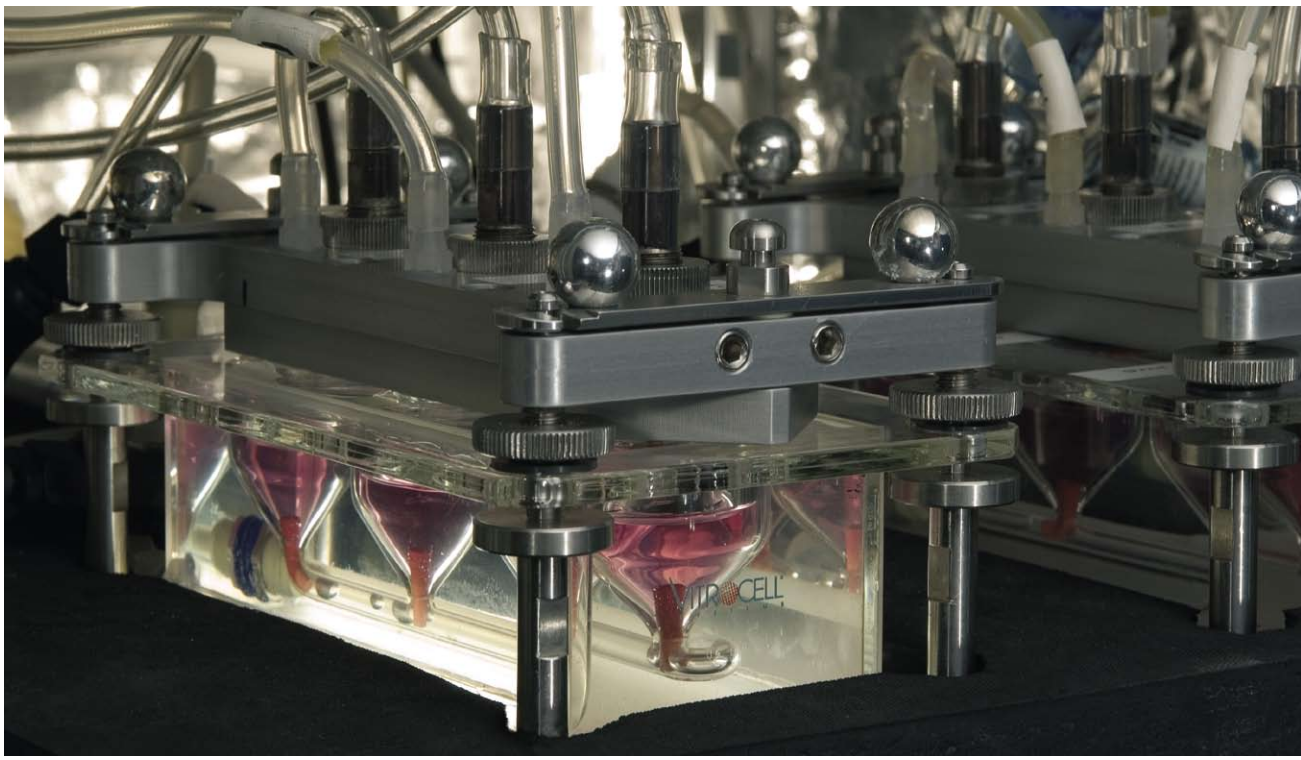
Forschungszentrum Karlsruhe
in der Helmholtz-Gemeinschaft

Exposure System for Bioassays

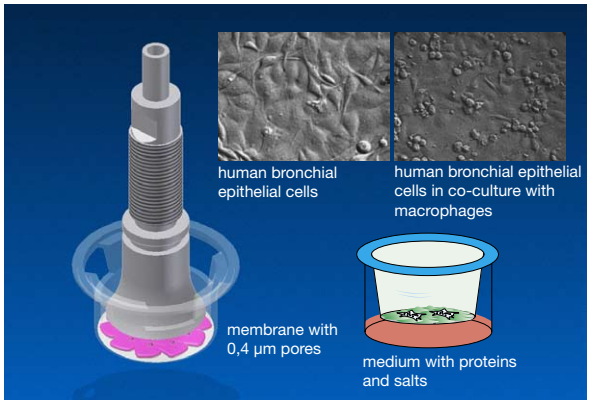
Measurement of the Toxicity of airborne Nanoparticles



Exposure system

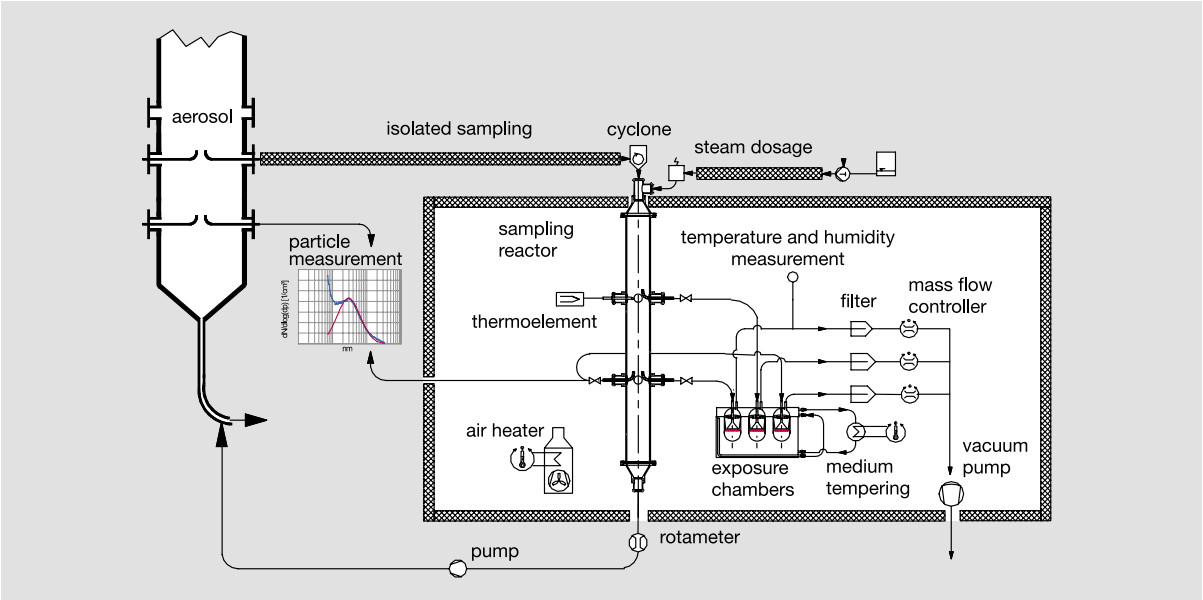
Epidemiologic studies for the effects of PM_{10} to the human have shown a relationship of the mortality and the rates of cardiovascular diseases to the concentration of the ultra fine particles in the environment. To define a risk the knowledge of the dose-response relationship is necessary.

The biological efficiency of nano particles should be quantified by a bioassay with an exposure system. In the exposure system the conditioned aerosol directly flows above the cell culture surface. By this „in vitro“-technique for the exposure of human lung cell cultures towards nano particles the correlation between particle diameter, material properties, number concentration and biological response could be determined.



Process steps

- Sampling of the aerosol
- Preseperation of particles >1 µm by means of a cyclone
- Humidification up to 80 % r. H.
- Exposure of cell culture lines at the air liquid interface
- Supplement of the cell cultures by medium
- Tempering of the system to 37 °C
- Measurement and control of flows



Scheme of the exposure system

Dose measurement in the range of microgram

- Exposure with fluorescein sodium aerosol
- Extraction of the fluorescein sodium from the membrane in sonic bath
- Analysis of the deposited mass by Fluorescence spectroscopy

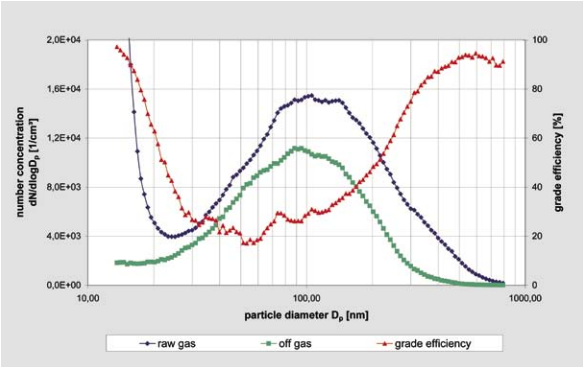
Applications

Analysis of the biological effect of

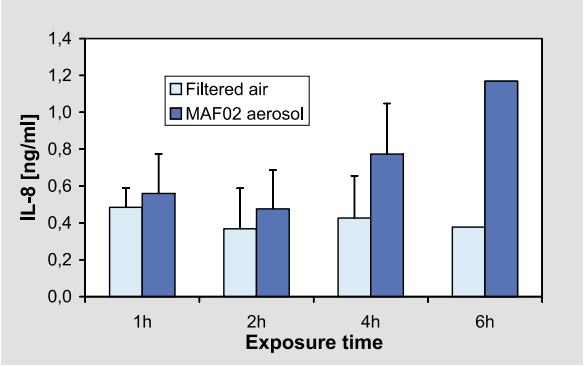
- nanoparticles in production processes
- ultra fine particle emissions in industry
- gas mixtures

Results

- Reproducible deposition of nano particles in the range of microgram
- Reproducible exposures of cell cultures for about several hours without damaging the culture by the procedure
- Reproducible toxic effects of fly ash from a municipal waste incinerator



Particle size distribution of raw and clean gas and grade efficiency from an exposure towards fly ash from a municipal waste incinerator



Effects of exposure to filtered air and MAF02 aerosol on the IL-8 release of human lung cells

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