

Responses of normal and diseased airway epithelia to different particle types at ambient concentration levels

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Outdoor air pollution remains a major factor for premature deaths, with particulate matter (PM) being clearly associated with adverse respiratory effects and increased susceptibility of persons with pre-existing lung disease. These particles mainly originate from combustion processes, i.e. wood, coal and fuel burning, via direct emissions of primary particles or from the atmospheric oxidation of vapors forming secondary particles. To unravel the causes for adverse effects of atmospheric aerosol particles to human health, the interaction of particles with the inner surface of the lungs as the main pathway of undesired particle uptake by inhalation needs to be understood. Since the use of *in vivo* animal models is limited for various technical, ethical or economic reasons, we have developed a realistic *in vitro* system to study inhalation toxicology. We use this mobile aerosol deposition chamber for deposition of particles to cell cultures mimicking closely the conditions in lungs to study acute effects on normal and diseased airway epithelia (Fig. 1).

We investigated primary and secondary particles from the exhaust of a gasoline car and wood combustion as well as from an urban environment. As shown in Fig. 1, combustion aerosols were injected into a smog chamber. Secondary aerosol was produced by photochemical reactions simulating atmospheric conditions before particles were deposited on the cell cultures. The aerosol was chemically and physically characterized by a suite of instruments.

The results obtained so far demonstrate that a single, short-term exposure to realistic doses of primary and/or atmospherically-aged particles impairs epithelial key-defense mechanisms, rendering it more vulnerable

to subsequent hazards. We established dose-response curves at realistic particle concentrations and found adverse effects even at the lowest level without evidence for a threshold value. Significant differences between cell models, i.e. between simplistic, single-cell type cell line and fully differentiated airway epithelia as well as between normal and diseased airway epithelia suggest the use of fully differentiated airway epithelia to be most appropriate in future toxicity studies.

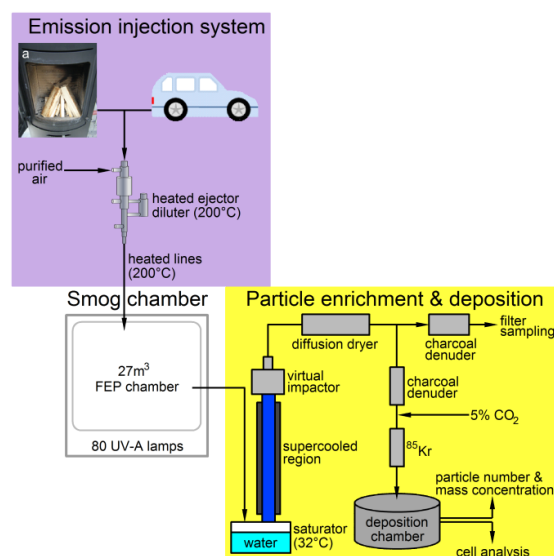


Fig. 1. Setup for smog chamber experiments. After injection of emissions into the smog chamber, they are photochemically processed. Particles are then withdrawn, enriched in the sample flow, and deposited on cell cultures.

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