

Health effects of PM: In vitro toxicological studies

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Fine and ultrafine particles generated by the combustion of fossil fuel and released into the atmosphere considerably contribute to the particulate matter content of ambient air and thereby constitute a potential risk factor for human health. The impact of the inhalation of different sources of particulate matter is studied by animal experiments, epidemiological surveys and more and more *in vitro* cell-based assays. *In vitro* assays are used because of their availability and their apparent simplicity as alternatives to more complex animal experiments. Both methods have limitations which have to be taken into account in evaluating the outcome.

This presentation deals with a comparison of two *in vitro* methods of applying particles to lung cells: (i) preparation of a particle suspension in medium and exposure of immersed cells or (ii) generation of an aerosol and exposure of cells at the air-liquid interface (ALI). Both methods exhibit advantages and disadvantages which will be discussed.

Particles derived from the combustion of municipal waste in an industrial facility have been used for both methods. Results obtained with the Karlsruhe exposure system (Paur et al., 2008, Diabaté et al., 2008) demonstrate the usefulness of the ALI method to study the potential toxicity of an aerosol. For studying the detailed mechanism of the cellular responses to particles suspensions in medium were applied to human bronchial epithelial cells BEAS-2B as well as to murine macrophages RAW264.7 and human monocyte-derived macrophages (Fritsch et al., 2006, Fritsch-Decker, 2009).

The fly ash particles induced oxidative stress, indicated by H₂DCF oxidation, increased intracellular glutathione contents and elevated amounts of the antioxidative protein hemeoxygenase-1 (HO-1) and the transcription factor Nrf-2. As part of cellular inflammatory responses we could observe an increase in the amount of free arachidonic acid in the macrophages. The signalling pathways leading to these responses were studied in detail. Taken together, one of the primary mechanism initiating inflammatory processes by fly ash particles seems to be the generation of ROS, which trigger the activation of downstream signalling and gene expression.

Reference List

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