# Toxic effects of nanoparticles from biomass combustion

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Increasing prices for petroleum and natural gas as well as the rising interest in the application of $CO_2$-neutral raw materials for an energy extraction, lead, in the case of heat generation, to an increased application of biomass. The emitted nanoparticles have a high dwell time in the atmosphere and can penetrate as a component of the particulate emission *via* the airway or the alimentary canal into the human body. However, the main transportation path is the airway, thus the lung. The particulate matter is too small to be detained in the nasal mucosa and the trachea as it is the case for greater particles. This results in cough, an increase in asthmatic attacks and eventually lung cancer. Correlations with cardiovascular diseases have been observed. It has been demonstrated that fine (<2.5 µm) and ultrafine (<0.1µm) particles cause stronger adverse health effects than larger particles.

The consequences of the toxic effects of different particulate matter for example resulting from combustion engines or combustion plants resp. fireplaces with wooden biofuels are still not completely understood. Hence, it is essential to clarify which particulate emissions from combustion processes have a deep toxic influence on human body to optimise these firing processes.

This aspect is investigated in this project on the base of an *in vitro* model for a human lung. This should serve as basis for the development of technical innovations (filter systems) for combustion plants, which minimise or eliminate the emission of soot in order to assure a better protection of humans.

For the air-liquid interface exposure of cell cultures towards aerosols the Karlsruhe exposure system (Mülhopt et al) is used. After sampling the aerosol from the combustion off gas stream, particles above 1 µm are removed by a size selective inlet. The gas humidity is adjusted to 85% by injection of steam. A549 human lung cell cultures are subjected to a constant flow of the conditioned aerosol. After exposure, the responses of the cells are analysed to measure the biological responses such as viability, inflammatory or oxidative stress. An online dose measurement technique monitors the deposited particle mass per cell culture area.

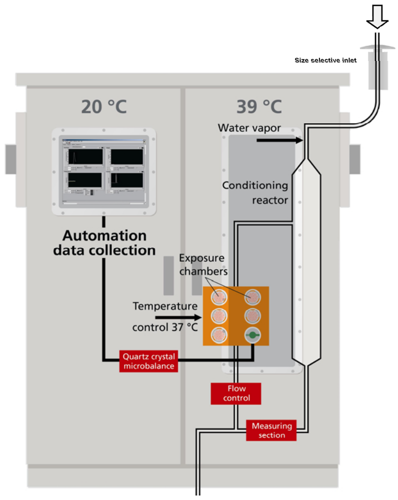


Figure 1. Karlsruhe exposure system for *in vitro* testing of airborne nanoparticle emissions from industrial processes.

The toxicity of particulate matters, from the incomplete combustion of biomass in fire places, will be investigated. The correlation between the incinerator charges, chemical composition, particle emission and toxicity considering various operation parameters will be analysed. The future goal is to contribute to the clarification of particulate matter and its toxicity potential. Hence, we will contribute to fundamentals of technological innovations which will provide a base for the optimisation of the firing process.

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Mülhopt, S., Paur, H.R., Diabaté, S., Krug, H.F. (2007). *Advanced Environmental Monitoring*, Y.J. Kim and U. Platt, eds. Springer Netherlands, pp. 402-414.