A LAB SCALE MEASUREMENT TECHNIQUE FOR THE AIR-LIQUID INTERFACE EXPOSURE OF HUMAN LUNG CELL CULTURES TOWARDS AIRBORNE NANOPARTICLES

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Most in vitro studies on aerosol health effects rely on submerged exposure of collected particulate matter, suspended in culture medium. However, this method does not represent the actual physiological processes in the human lung. It even may change the properties of the investigated aerosol. Research on exposure of cells at the air-liquid interface avoids these disadvantages, but requires a well-engineered system to guarantee reproducible conditions. Therefore, KIT and VITROCELL Systems developed a fully automated Exposure Station. It offers a lab scale measurement technique for parallel exposure of up to 24 human lung cell cultures towards aerosols. The exposure station provides direct aerosol sampling via a size selective inlet, a control system for flow, temperature, and humidity to simulate the conditions in the human lung and a programmable user interface leading the user through standard exposure protocols while recording all data. The deposited particle dose is monitored online. An internal negative control using humidified synthetic air is implemented as well as an electrostatic particle deposition to increase the particle dose per time. Several measurement campaigns were successfully performed with these systems: Aerosols from biomass heating and aerosolised industrial nanoparticles were characterised using classical toxicological methods, e.g. cytotoxicity and metabolic activity, as well as state-of-the-art -omics methods.

Fig.1 VITROCELL Automated Exposure Station equipped with 11 positions for the air-liquid interface exposure of cell cultures and one position for online particle dose determination.