Exposure of Mammalian Cells to Air-Pollutant Mixtures at the Air-Liquid Interface

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It has been widely accepted that exposure of mammalian cells to air-pollutant mixtures at the air-liquid interface is a more realistic approach than exposing cell under submerged conditions. The VITROCELL® systems, are commercially available systems for air-liquid interface exposures. The VITROCELL® 6 CF system was used to expose BEAS-2B cells to diesel exhaust (DE), smog, and ozone (O_3) for 1 hour. Markers of cytotoxicity, inflammation, and oxidative stress were assessed at 6 and 24 hours post-exposure. In order to use the system, extensive modifications to the aerosol delivery system were required to improve temperature and humidity control. DE particulate matter concentrations ranged from 0.5-2.0 mg/m^3. No cytotoxicity or inflammation was observed, whereas levels of Hmox-1 were elevated at the highest concentrations for the 6 and 24 hours post-exposure. Cells were exposed to a simulated smog atmosphere (325µg/m^3 SOA, 0.11ppm O_3, and 0.17ppm NO_X) generated using the EPA's Mobile Reaction Chamber. For this atmosphere, significant increases in IL-8 and TNF-α were observed at 6 hours post-exposure. Finally, cells were exposed to O_3 concentrations of 0.5, 1, 2.5, and 5ppm. Significant cytotoxicity (measured by LDH release) and inflammation (measured by IL-6 and IL-8) was observed only at concentrations of 5 ppm. These results indicate that, with respect to the conditions examined, high concentrations of DE and O_3 were needed to induce adverse effects, while lower concentrations of a reacted atmosphere were sufficient. A new in-house in vitro exposure system that accommodates 6-well and 24-well platforms is being developed to improve the delivery of both gas- and particle-phase pollutants to the cells. [Abstract does not necessarily reflect the views or policies of the U.S. EPA.]