Assessing the Cytotoxicity of PM2.5 Generated by using Detergent

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Abstract:

Air pollution is a major global health issue, with fine particulate matter (PM2.5) linked to respiratory and cardiovascular diseases, oxidative stress, and inflammation. While outdoor PM2.5 sources are well-studied, indoor sources such as household detergents remain underexplored. This study evaluates the cytotoxicity of detergent-generated PM2.5 on human lung epithelial cells (A549) to better understand its health impacts. A549 cells were exposed to PM2.5 at concentrations of 25, 50, 100, and 200 µg/mL for 24 hours. qPCR showed a dose-dependent increase in pro-inflammatory cytokines (IL-1β, IL-6, IL-8, TNF-α), and Western blot analysis revealed elevated stress signaling proteins (p-p38 and p-JNK). Oxidative stress assays indicated increased reactive oxygen species (ROS), lipid peroxidation, and DNA damage, particularly at higher concentrations. These findings highlight the potential of detergent-generated PM2.5 to trigger inflammation, oxidative stress, and genetic damage posing risks in poorly ventilated indoor environments. The study underscores the need for safer cleaning products, improved ventilation, and further research on long-term exposure risks to enhance indoor air quality and protect public health.