

Cellular Toxicity of Airborne Particulate Matter and Dissolved Contaminants: Role of Environmental Speciation and Surface Interactions

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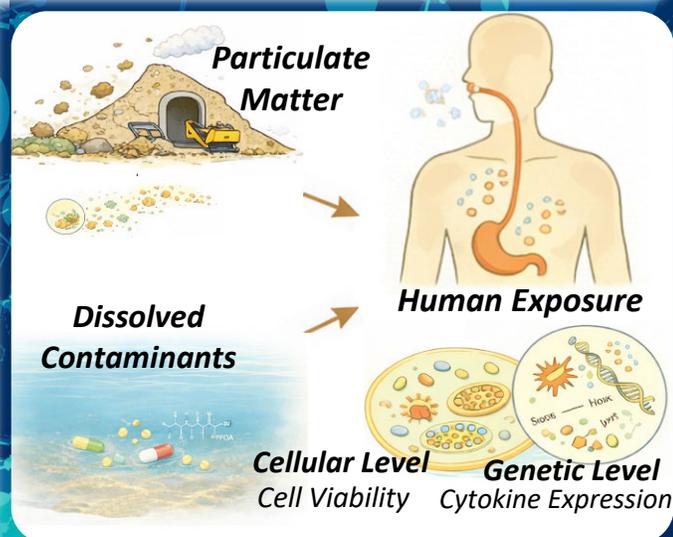
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Environmental pollutants exist either as particulate matter or dissolved in the liquid phase. When they come into contact with soil and water systems, these pollutants undergo environmental speciation primarily through surface interactions with soil particles, mineral surfaces, photocatalysts, and organic matter. Through these interactions, they undergo surface complexation, redox reactions, sorption/desorption, and aggregation, which can

change their mobility and bioavailability. These transformed species are then exposed to humans through inhalation and ingestion. This causes reactive oxygen species (ROS) generation, oxidative stress, and membrane damage at the cellular level, as well as gene expression alterations, DNA damage, inflammatory

signaling, and apoptosis through biochemical disruptions. Our work integrates environmental chemistry, surface science, analytical characterization, and toxicology to establish the link between environmental speciation and genetic-level toxicity, providing a unified framework for understanding the health impacts of particulate and dissolved pollutants.



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