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Reactive Oxygen Species Formed by Fine Particulate Matter in Water and Surrogate Lung Fluid

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Reactive oxygen species (ROS) play a central role in adverse health effects of air pollutants (Pöschl and Shiraiwa 2015). Respiratory deposition of fine particulate matter ($PM_{2.5}$) can lead to the formation of ROS in epithelial lining fluid, potentially causing oxidative stress and inflammation (Shiraiwa et al., 2017). Secondary organic aerosols (SOA) account for a large fraction of $PM_{2.5}$ (Hallquist et al., 2009), but their role in adverse health effects remain unclear (Tong et al., 2018). We quantify and compare the ROS yields of laboratory-generated SOA and ambient $PM_{2.5}$ in water and surrogate lung fluid (SLF). The laboratory-generated SOA from biogenic (α-pinene, β-pinene, limonene, and isoprene) and anthropogenic (naphthalene) precursors were found to produce 0-12% ROS (radicals and H_2O_2, molar yield) in water and SLF, with lower yield in the SLF. In contrast to SOA, ambient $PM_{2.5}$ samples from Beijing winter haze period had a ROS yield of 0-10 pmol μg^{-1}, which is several order of magnitude lower than laboratory-generated biogenic SOA. This is likely reflecting the atmospheric diluting and aging of redox active component in $PM_{2.5}$. Our findings suggest that SOA may play an important role in the ROS formation and adverse health effect of fine particulate matter.

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