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Investigation into the fate of organic films extracted from atmospheric particulate matter at the air-water interface in the presence of gaseous SO2

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Neutron reflectometry was used to study the interaction of gaseous SO2 and organic films at the air-water interface to determine whether a reaction occurred, resulting in a product film, or, removal of the film from the interface. Three different organic films extracted from particulate matter sampled from different atmospheric environments (woodland, urban, and wood smoke) and two pure proxy chemical films were studied. Exposure of SO2 to the proxy films confirmed that gaseous SO2 reacts with unsaturated material at the air-water interface. No reaction was observed between SO2 and organic films extracted from particulate matter sampled from woodland and urban environments. However, a change in the film properties was observed on exposure of gaseous SO2 to organic films extracted from wood smoke aerosol. Additionally, the fitting of the thick wood smoke film data suggested a possible three-layer structure at the interface consistent with a surfactant-rich layer in contact with the air-water interface, a middle layer rich in PAHs, and a third layer consistent with an aliphatic region. These findings indicate that gaseous SO2 does not remove organic films from the air-aqueous interface of atmospheric aerosol, but can impact film chemical composition with consequences for further reactivity and optical properties. Preliminary results also suggest that thick wood smoke films can form multi-layer structures at the air-water interface.

Significance

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