Geophysical Research Abstracts
Vol. 21, EGU2019-3342, 2019
EGU General Assembly 2019

Photochemical aging of atmospherically reactive organic compounds involving brown carbon at the air-aqueous interface

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To better understand the reactivity and photochemical aging of organic coating on the aqueous aerosol surface, we have simulated photosensitized reaction of organic film in a Langmuir trough with or without irradiation. Imidazole-2-carboxaldehyde, humic acid, atmospheric PM2.5 sample and secondary organic aerosol sample from chamber were used as photosensitizers. Stearic acid (SA), elaidic acid (EA), oleic acid (OA) and phospholipids (1,2-distearoyl-sn-glycero-3-phosphocholine (DSPC) and 1,2-dioleoylsn-glycero-3-phosphocholine (DOPC)) with the same aliphatic length and different degree of saturation were chosen as film-forming species. The nature of double bond (trans and cis) in unsaturated organic compounds have effect on the surface area of organic monolayer. OA monolayer possessing cis double bond in alkyl chain was more expanded than EA monolayer on artificial seawater containing photosensitizer. The change in the relative area of DOPC monolayer indicated that DOPC did not react with photosensitizers under dark condition. The photochemical reaction initiated by the excited photosensitizer and molecular oxygen can generate hydroperoxidation in DOPC monolayer, leading to an increase in the molecular area. The polarization modulation-infrared reflection absorption spectroscopy (PM-IRRAS) spectra of DSPC monolayer indicated DSPC did not yield any oxidized products under the same conditions. The conversion from hydrophobic film into more hydrophilic products in the aqueous aerosol may have the potential influence of hygroscopic growth of organic aerosols.