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Photosensitized heterogeneous ozone reactions with organic coated particles

S. Net, L. Nieto-Gligorovski, B. Temime-Rousell, S. Gligorovski and H. Wortham

Laboratoire Chimie Provence, UMR 6264, Université de Provence-CNRS, 3 place Victor Hugo - Case 29, 13331 Marseille Cedex 3

The emissions of various type of biomass combustion such as natural fires, prescribed burns and residential wood burning contribute significant amounts of aerosol particulate matter to the troposphere. The particle's surface serves as a substrate which can be either chemically inert or photocatalytically active. The surface of aerosols that emerge from the various combustion processes can contain polycyclic aromatic structures and carbonyl functional groups absorbing light in the range above 290 nm which can actually potentially serve as photosensitisers.

In addition, the atmospheric oxidizing agents such as OH and O_3 can react with organic compounds adsorbed on the aerosol surface particles.

In this study, dried solid organic coated particles in rotary evaporator were exposed to the simulated sunlight emitted from a broadband light source such as a xenon lamp (300 W) and to ozone concentrations of 200 ppb in air, for a time period between 2 hours and 12 hours.

The heterogeneous photosensitised reactions taking place on the aerosol surfaces can significantly influence not only the surface bound product formation, but could also affect the gas phase chemistry by releasing volatile reactive products from the aerosol surfaces.

GC-MS and PTR-MS were applied as analytical tools for detection and identification of the surface bound products and gas phase products, respectively.

It is now clear that the variation of the adsorbed organic material on aerosol surfaces

due to the aging processes of the aerosols plays important role on the direct and indirect climate changes, effects on cloud droplet chemistry, and ozone production.

On the other hand, particle surface coatings are likely to play an important role in the toxicity and corresponding safety assessments of atmospheric particulate mater, especially of those nanoparticles.