2.047 OH-, ozone-, and nitrate radicals-initiated aging of secondary organic aerosol formed from the ozonolysis of limonene.

Early Career Scientist

Presenting Author:
SATHIYAMURTHI RAMASAMY, National Institute for Environmental Studies, Japan, sathiyamurthi@nies.go.jp

Co-Authors:
Tomoki Nakayama, Nagoya University, Nagasaki University
Takashi Imamura, National Institute for Environmental Studies, Japan
Kei Sato, National Institute for Environmental Studies, Japan

Abstract:

Formation of secondary organic aerosol (SOA) from the reaction of VOCs with atmospheric oxidants (OH, O_3 and NO_3) and OH-initiated aging (OH reactions of secondary products) are included in the volatility-basis set model. However, night time aging by NO_3 and O_3 are not included. Significant nitrate aerosol formation was reported in recent field studies conducted in limonene abundant area, suggesting that the reactions of NO_3 with the secondary products formed from limonene oxidation as well as the direct reaction of NO_3 with limonene might contribute to nitrate aerosol formation. In a 6 m^3 smog chamber we conducted light condition OH-initiated aging and dark condition O_3-, NO_3-initiated aging of limonene SOA to understand importance of daytime and night aging in SOA formation. Limonene SOA was produced from the ozonolysis of limonene. After SOA level became stable, OH-initiated aging was carried out by H_2O_2 photolysis and dark condition NO_3-, O_3- initiated aging were carried out by the injection of 1 ppm N_2O_5 and O_3 respectively. Gas phase reactants and products were monitored by using FT-IR spectrometer and proton transfer reaction mass spectrometer. SOA formation was monitored by Aerodyne aerosol mass spectrometer (AMS) and SMPS. SOA particles formed before and during aging were collected on a Teflon filter and analysed by liquid chromatograph-mass spectrometer (LC-MS). AMS results showed that all three oxidants used in the experiments produced similar levels of SOA after one-hour aging, suggesting that NO_3- and O_3-initiated aging have comparable SOA formation potentials with OH-initiated aging. LC-MS results shows that ozonolysis of limonene produced monomeric and dimeric products in particle phase. Further, it shows that increasing of oligomeric products upon O_3 aging whereas several new monomeric and oligomeric compounds with higher mass range were produced upon NO_3 aging.
This work was supported by JSPS KAKENHI Grant Numbers JP16H06305 and JP 17H01866.