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S E M I N A R

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Application of online mass spectrometry to investigate aqueous-phase processing of atmospheric organic aerosols

by

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Abstract

Atmospheric aerosol has been found to exert pronounced impacts on human health, visibility degradation, and global climate. In particular, organic aerosol, which is a complex mixture of organic compounds, can contribute a significant fraction (20-90 wt%) of atmospheric particulate matter worldwide. Their formation pathways and properties are, however, not well understood. Aqueous-phase oxidative processing of water-soluble organics has been recognized as a potential mechanism that leads to oxygenated and low volatility secondary organic aerosol (SOA). The SOA produced through this processing can be hygroscopic in nature, thus possibly enhancing the cloud condensation nuclei activity of atmospheric aerosol. Aqueous aerosol/cloud chemistry has also been shown as a potential source of light-absorbing SOA materials.

This talk will focus on our recent research in the area of aqueous-phase processing of SOA and their potential precursors, in which new online mass spectrometry techniques have been used to augment the past studies. A photochemical reactor that qualitatively stimulates the formation mechanism of SOA via aqueous-phase reaction in wet aerosol/cloud droplet followed by water evaporation was coupled to a state-of-art aerosol mass spectrometer (AMS) and/or aerosol volatilization chemical ionization mass spectrometry (aerosol-CIMS). Results will be presented for the aqueous OH oxidation of glyoxal, cis-pinonic acid, and lab-SOA generated from α-pinene ozonolysis. Starting with an AMS-based observational framework, we show that aqueous oxidation of biogenic SOA in the presence of glyoxal can better represent observed atmospheric aging than when glyoxal is absent. We have also applied similar oxidation techniques to cloud water organics and the aqueous component of PM1 from a biogenic environment. We first experimentally demonstrate that aqueous oxidation of volatile cloud organics can be a missing source of highly oxygenated SOA in the current model. Furthermore, the formation of organic-nitrogen compounds and light-absorbing materials from the reactions between glyoxal and various inorganic salts will be discussed.

Biography:

Alex Lee obtained his BEng in Chemical and Environmental Engineering from the Hong Kong University of Science and Technology (HKUST) in 2001. He received his M.Phil and Ph.D, both in Chemical Engineering, from HKUST in 2004 and 2009, respectively. He joined the Department of Chemistry at the University of Toronto (UofT) as a postdoctoral fellow in Fall 2009. He is currently a Research Associates at UofT since 2011. His research focuses on both laboratory and field studies to understand the formation and evolution of secondary organic aerosol, in particular, aqueous-phase oxidative processing and reactive uptake of volatile organics by wet aerosols and cloud droplets, using different online mass spectrometry techniques. His research interests also include brown carbon formation, soot particle characterization, aerosol spectroscopy, and hygroscopicity of atmospheric particles.

Date: 25 March 2013 (Monday)

Time: 2:00pm

Venue: Room 1003, IENV (Lift 4)

~ All are welcome ~~