SJSU | DEPARTMENT OF CHEMISTRY

CHEMISTRY Departmental Seminar

Spring 2022
CHEM 285/191 Schedule
Tuesday at 4:30-5:45PM
Duncan Hall 250

February 15th, 2022

Dr. Annalise Van Wyngarden
San José State University

Aging of Organic Species in Atmospheric Aerosol Particles: Implications for Climate

Atmospheric aerosol particles impact Earth's climate by absorbing and scattering radiation and by serving as cloud condensation nuclei. Currently the largest physical uncertainties in models of past and future climate change arise from the uncertainty in aerosol climate effects, which can range from cooling to warming depending on chemical composition, etc. Although organic molecules are ubiquitous in atmospheric particles, their effects are particularly poorly understood, largely because of our poor understanding of the chemical reactions that organic molecules undergo in atmospheric particles. Therefore, we examine how different atmospheric aging processes can drive chemical reactions of organics in aerosols and subsequently impact aerosol climate forcing properties. Bulk aqueous phase experiments were performed simulating two of these aging processes in two different regions of the atmosphere: 1) cloud processing of organic aerosols under tropospheric conditions and 2) the formation of colored organic species in or on sulfuric acid aerosols in the upper troposphere/ lower stratosphere (UTLS).

In the case of cloud processing, experiments examined the reactions of glyoxal and methylglyoxal monomers and polymers (common aerosol organics) upon dilution (simulating cloud formation) from aerosol to cloud droplet concentrations via High Resolution Electrospray Ionization Tandem Mass Spectrometry. The kinetics of reactions driven by cloud formation were found to be slow enough that climate models may require reaction rates.

In the case of colored organics in UTLS aerosols, experiments revealed the formation of colored solutes and surface films in/on solutions of propanal, glyoxal, and/or methylglyoxal in sulfuric acid. Our results identified the main chemical processes responsible for surface film and chromophore production. Furthermore, UV-vis absorption and refractive index measurements were used to quantitate changes in optical properties in order to allow evaluation of the potential impact on climate.

For more information: Prof. Muller at gilles.muller@sjsu.edu
or Prof. Wang at ningkun.wang@sjsu.edu

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