

Understanding Air Pollution – Analysis of Chemicals in Atmospheric Particulate Matter

PROJECT DESCRIPTION

Atmospheric particulate matter (PM), also referred to as atmospheric aerosol, is a major component of air pollution which has become a serious environmental problem in many of the developing countries. Aerosol is introduced to the atmosphere not only through direct emission, but also form through atmospheric chemistry. Currently, our understanding of such chemistry is significantly limited due to the complexity of atmospheric organic chemistry. The objective of my projects is to improve our fundamental understanding of the formation and evolution of air pollutants. Specific focus will be placed on the characterization or the component and chemistry of organic aerosol using advanced analytical techniques.

Project 1: Chemistry of α -acyloxy hydroperoxides.

Organic peroxides play an important role in the formation and evolution of organic aerosol. In this study, a class of atmospherically relevant organic peroxides, α -acyloxy hydroperoxides, will be synthesized in the laboratory through liquid-phase ozonolysis of alkenes. The characterization of the synthesized compounds will be performed using nuclear magnetic resonance (NMR) spectroscopy. The chemistry of this class of compounds against the light (photolysis) and water (hydrolysis) will be investigated using direct infusion electrospray ionization mass spectrometry (ESI-MS).

Project 2: Development and optimization of an analytical method for organic aerosol components

Organic aerosol comprises a highly complex chemical mixture, and an efficient separation technique is a prerequisite for the characterization of the organic aerosol composition. Liquid chromatography mass spectrometry (LC-MS) is a promising technique for this task, achieving concurrent separation and detection. In this study, an LC-MS method will be developed and optimized for compounds in organic aerosol. Aerosol samples will be collected from the real atmosphere as well as generated in the laboratory. Once the method development is complete, this method will be further applied to understand the photochemistry of the organic aerosol components.

Required skills and Learning Consequence

These projects are suited for students with a background in Environmental Chemistry, Analytical Chemistry or related areas.

The students will enjoy an opportunity to operate a number of cutting-edge analytical instruments, such as LC-MS. Through these processes, the student will gain practical experience in laboratory techniques, science

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communication as well as data analyses. The student will work closely with an energetic assistant professor who is willing to provide personalized supervision.

FACULTY-DEPARTMENT

Science - Chemistry

DESIRED FIELD OF (STUDENT) STUDY

Environmental Chemistry or Analytical Chemistry

INTERNSHIP LOCATION

University of Alberta Main Campus - Edmonton

NUMBER OF INTERNSHIP POSITIONS

2

INTERNSHIP START DATE

July 3

INTERNSHIP END DATE

October 3

ARE THE DATES FLEXIBLE?

Yes, I am flexible regarding the internship dates. Selected students can contact me to request a date change.