CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

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Project Number

36884

Project Title

An Analysis of SOA Produced from a Novel Liquid-Phase Reactor and Their Impacts on Climate

Abstract

Objectives/Goals

The goal is to determine the impacts that aerosols after ozonolysis have on climate.
One of the unresolved questions is to what extent can originally white aerosols become colored after ozonolysis and thus contribute to warming.
The objectives were to devise a valid novel, liquid-phase reactor for producing Secondary Organic Aerosols (SOA) from volatile and involatile compounds and to identify compounds that become more absorbing after ozonolysis. The liquid-phase reactor would be much cheaper, more accessible, and would expand the field of compounds available for ozonolysis in the laboratory compared to conventional methods.

Methods/Materials

Reacted 9 precursor compounds with ozone in a novel liquid-phase setup
Achieved this by using a flask filled with solvent for the reactor. Dissolved one of the 9 compounds into the solvent and bubbled ozone through it until the reaction was complete
System validation: Limonene and guaiacol SOA from the liquid-phase reactor were compared to a conventional flow tube through UV spectroscopy and mass spec.
Once validated, seven compounds were reacted with ozone and its SOA were analyzed using UV/Vis and mass spec.

Results

For the setup validation process, Limonene SOA from the two systems differed optically by 5.7% and Guaiacol SOA 13.3%. The mass spec results were comparable.
For all seven compounds, each increased in visible light absorption after ozonolysis with catechol and indole having the largest change in absorption and composition. MAC is used to quantify absorption.
Catechol SOA increased 10,000 MAC and Indole SOA increased 45,000 (1,000 MAC is significant).
Interestingly, Indole#s MAC values increased with higher concentrations despite the fact that MAC already factors concentration into the equation.

Conclusions/Discussion

The novel liquid-phase reactor is a valid method for generating SOA, making it more accessible, cheaper, and most importantly broadens the scope of compounds.
Every compound with a C=C increased in MAC after ozonolysis. This will significantly aid our understanding of aerosols and global warming.
Indole and Catechol SOA indicate that after ozonolysis, compounds can become significantly more

Summary Statement

This project analyzes aerosols, their reactions with atmospheric oxidants, and how this will impact the climate using a novel liquid-phase mechanism for SOA generation.

Help Received

Professor Sergey Nizkorodov from AirUCI was my PI and mentor, allowed me to work in his lab; Dian Romonosky, graduate student from AirUCI helped train me, supervise, and edit