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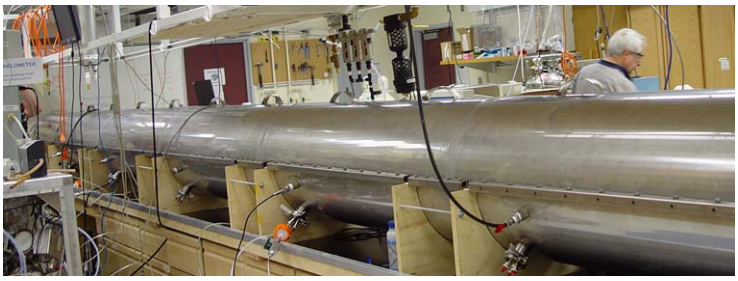
EMSL In Brief
Environmental Molecular Sciences Laboratory

Secondary Organic Aerosol in the Spotlight of Climate Change

The organic fraction of atmospheric particles (aerosols) previously cast in a minor role is now in the spotlight of climate research. Scientists from the University of California at Irvine, the Environmental Molecular Sciences Laboratory and Pacific Northwest National Laboratory are shining a spotlight on previously unrecognized processes that produce secondary organic aerosols, which are a significant fraction of the atmospheric aerosol mass. Because little is known about the formation of SOAs, the measured and predicted levels differ by an order of magnitude, stymieing research on how to control these aerosols to mitigate their environmental impact.

The research team began their work at EMSL, mixing gases and particles inside large, specially coated bags to simulate atmospheric conditions. The resulting particles were characterized by Alla Zelenyuk, Liz Alexander, and Chen Song using three of EMSL's sophisticated mass spectrometers to obtain detailed, real-time data.



Researchers used EMSL mass spectrometers to help conduct experiments in the University of California at Irvine 20-foot-long aerosol flow tube.

To understand gas-particle reactions in an environment similar to our atmosphere, the team shipped three mass spectrometers to UCI to conduct experiments in the university's new aerosol flow tube reactor, which stretches 20 feet in length and is studded with instrument ports. Building up one component at a time, the researchers completed the experiments by combining α-pinene—an organic chemical vapor emitted by many varieties of trees and plants—sodium nitrate, and light. Studies using oxides of nitrogen and ozone generated by photolysis of the nitrate were also carried out. Using the suite of instruments, the researchers measured the size, density, shape and mass of the resulting particles as well as the changes in gas composition. A preliminary analysis revealed that the data contain extremely exciting results.

"New insights into potential mechanisms of particle formation and growth, particularly as a result of nitrate ion photochemistry in particles, are already emerging from these data," said Barbara Finlayson-Pitts, Director of UCI's Atmospheric Integrated Research for Understanding Chemistry at Interfaces and an EMSL user. The team is in the process of analyzing the large volume of data using software developed at EMSL.

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