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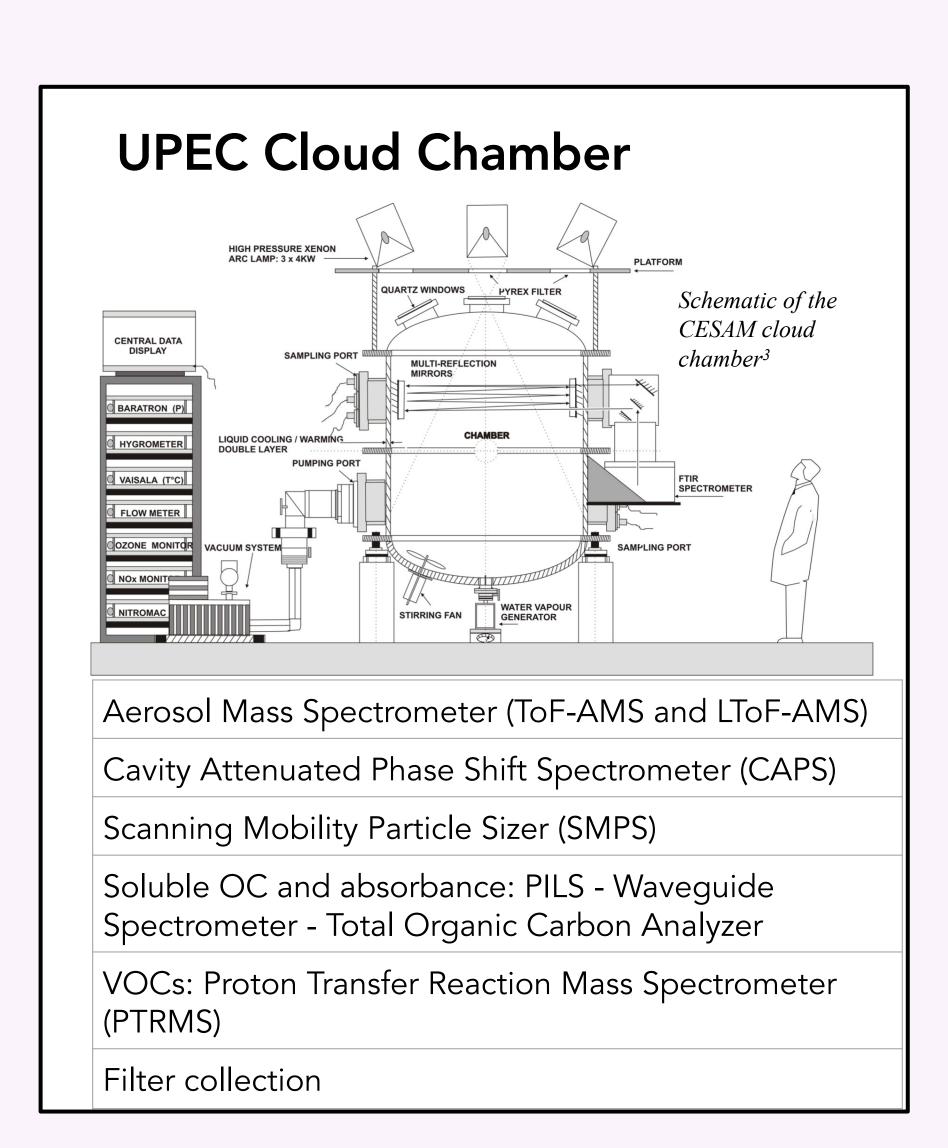
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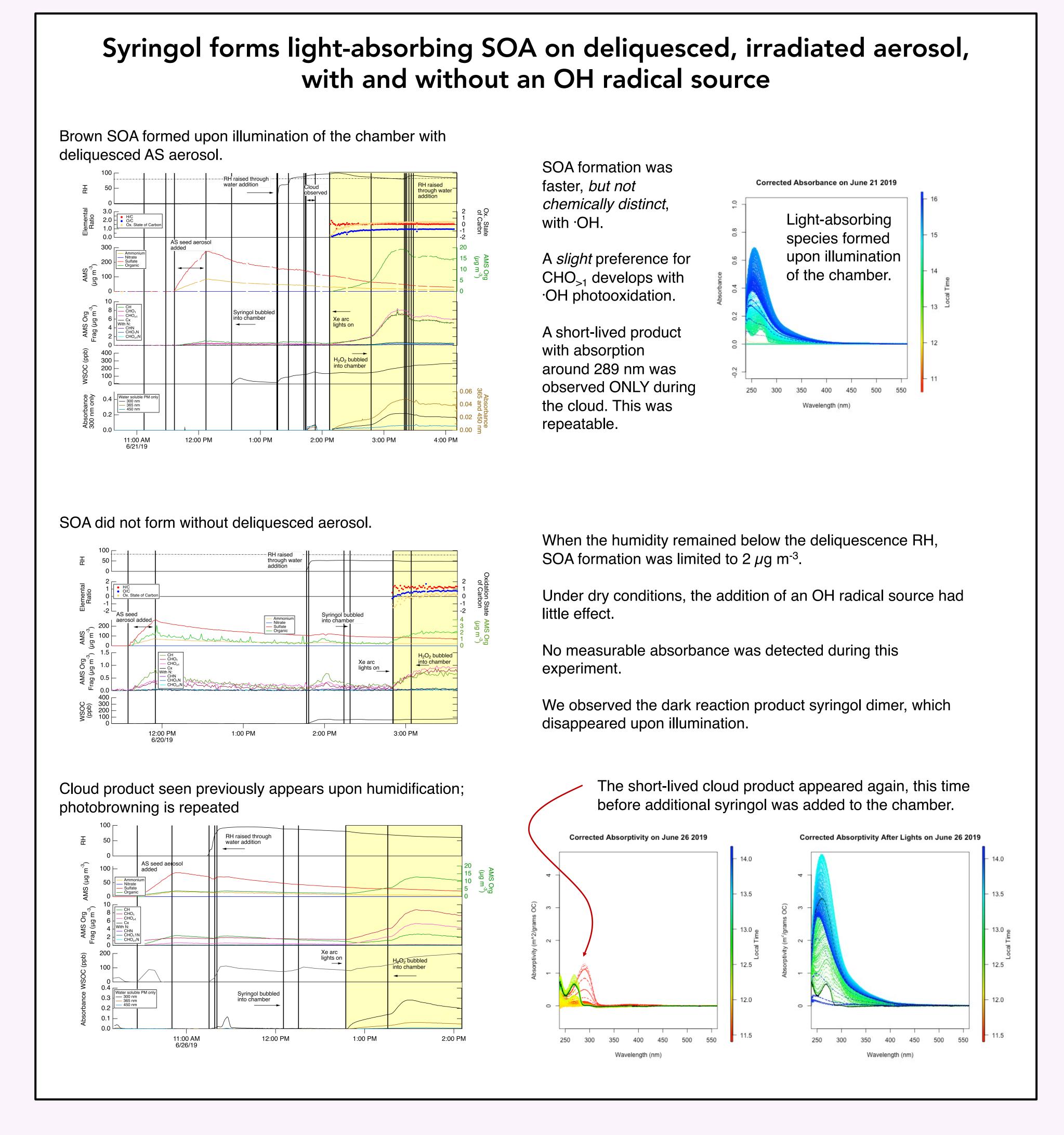
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Photochemical Production of Light-Absorbing Syringol Secondary Organic Aerosol (SOA) in Droplets using an Atmospheric Simulation Chamber

Lelia Hawkins, Lindy Conrad-Marut, Ellie Smith - Harvey Mudd College, USA; David De Haan, Christian Carmona, Duncan Ugland, Matthew-Khoa Tran, University of San Diego, USA; Jean-Francois Doussin, Mathieu Cazaunau, Aline Gratien, Paola Formenti, Claudia Di Biagio, Mike Giordano - University of Paris-Est Créteil, France; Frans E F Graeffe, Liine M. Heikkinen, Mikael Ehn - University of Helsinki, Finland; Peter De Carlo - Johns Hopkins University, USA; Matthieu Riva, Mario Contin - IRCELYON, France

Does syringol behave the same in a cloud chamber as in bulk studies? Previous studies have shown that SOA material produced with an OH source and with a photosensitizer shares chemical and optical features. Dark syringol reactions have produced a dimer that absorbs at 470 nm. H abstraction and OH addition pathways may produce different O/C ratios in products with different polarities and different optical properties, which each influence the atmospheric implications of these SOA products. Circled products indicate products seen experimentally





Photobrowning without ·OH

What mechanism is responsible for light-induced brown carbon formation in our experiments?

With HOOH, we observed similar O/C ratios, and broad visible absorbance, to previous studies.

Without HOOH, we also observed browning. Why?

Possible explanations:

- (a) Direct absorption of the Xe arc lamp radiation ~270 nm by syringol (little relevance to atmospheric processes but possible in the chamber)⁴
- (b) Trace impurities or rapid, trace syringaldehyde formation, with syringaldehyde behaving as a photosensitizer⁵
- (c) Red-shifted absorption of syringol, and greater quantum yield, at the air-water interface of deliquesced aerosol (a guaiacol redshift at the air-ice interface is attributed to the aromatic ring, not the substituents, which are common to syringol)⁶

Conclusions

Unexpected photobrowning in our experiments may imply an additional mechanism for this biomass-burning derived compound to influence BB SOA chemical and optical properties.

Further analysis of our mass spectra and end-of-day filters may provide insight into this mechanism.

In general, our observations support the previous bulk studies of syringol in terms of reactivity and brown carbon production.

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HMC Chemistry Staff

Leah Williams, Aerodyne Research Inc.

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Further information

Contact me at lhawkins@g.hmc.edu if you have a question or comment.









Information on the CESAM facility is available here.