Effect of Iron-Containing Mineral Dust on Photodegradation of SOA

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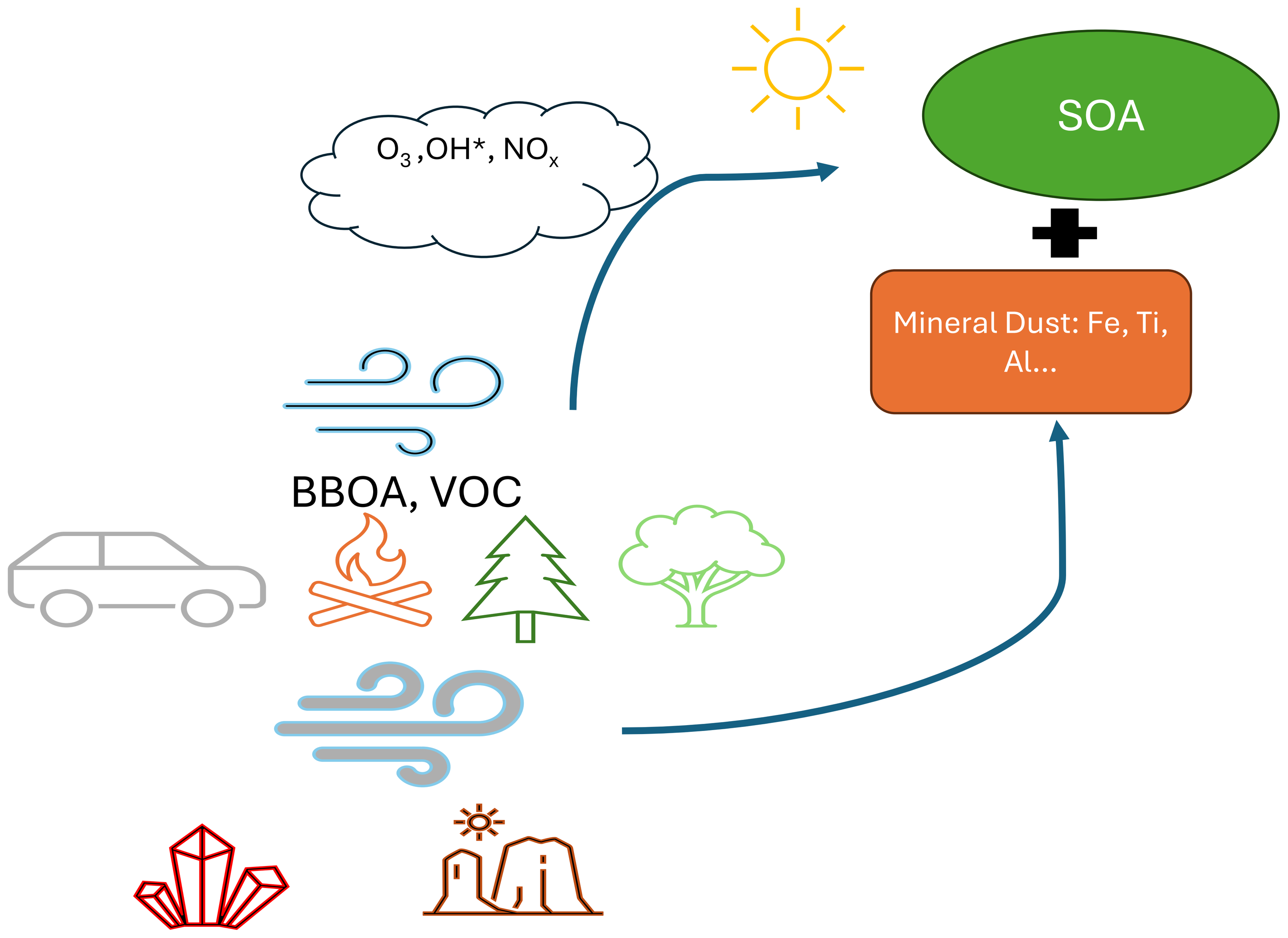
Abstract

Mineral dust acts as a source of transition metals in the atmosphere. Iron is a common component in mineral dust particles, for example, in the form of iron (III) oxide[2-5,8,9]. Secondary organic aerosol (SOA) compounds can react with iron and the oxidizers it produces by catalytic and photocatalytic processes[2-5]. These photo-catalyzed reactions can result in changes to the SOA molecules, from oxidation to smaller compounds to oligomerization[5,6]. To better characterize the effect of iron containing particles on SOA, hematite, titanium dioxide, and Arizona Test Dust (AZTD) are mixed with SOA particles in aqueous solutions and irradiated with UV light. Analysis is performed via UPLC-HRMS to identify any major differences in the product profile after photoaging.



Research Question

Does Mineral Dust provide a surface for extensive photocatalytic reactions, changing the product profile of SOA in the atmosphere?

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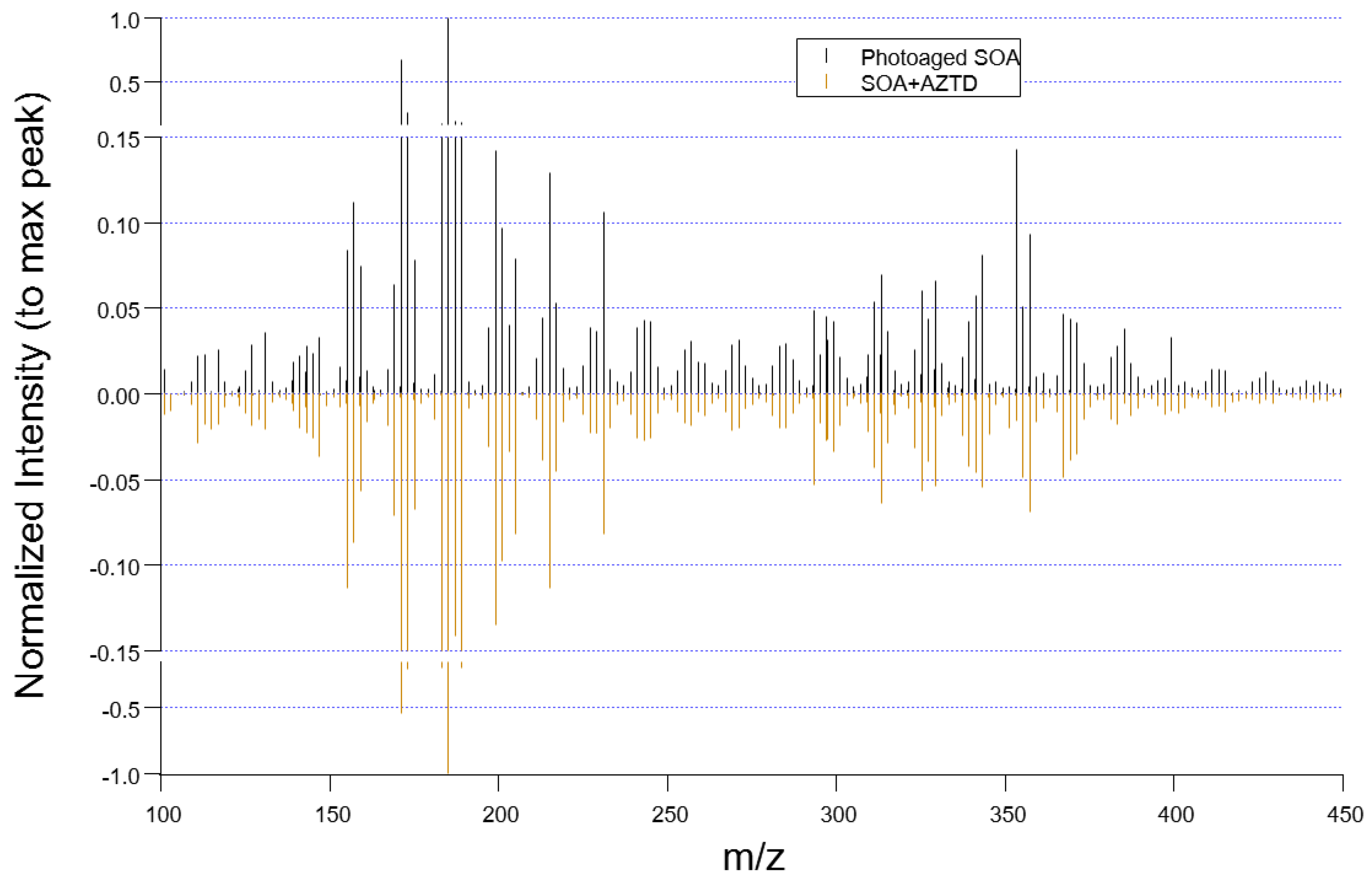
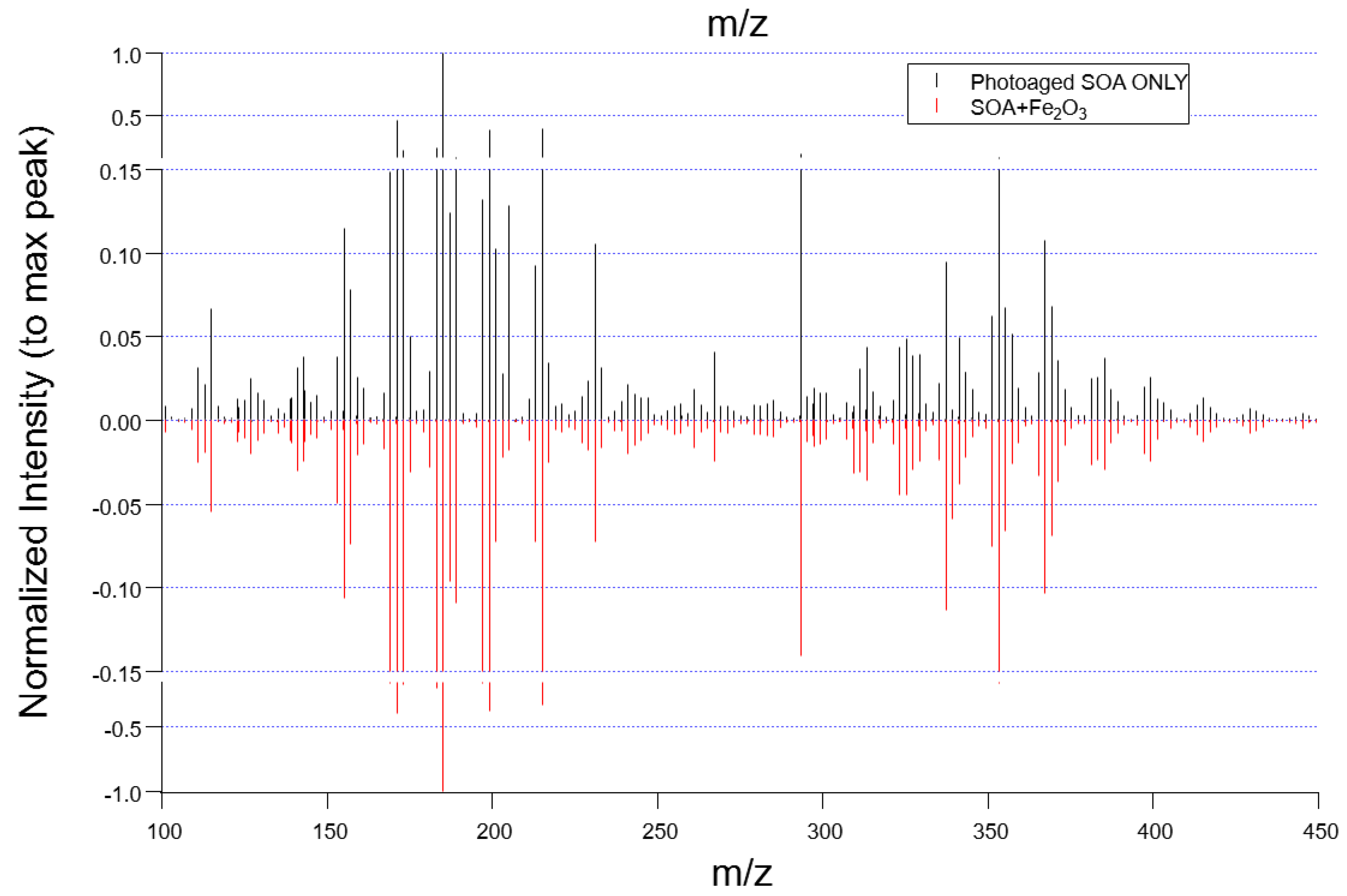
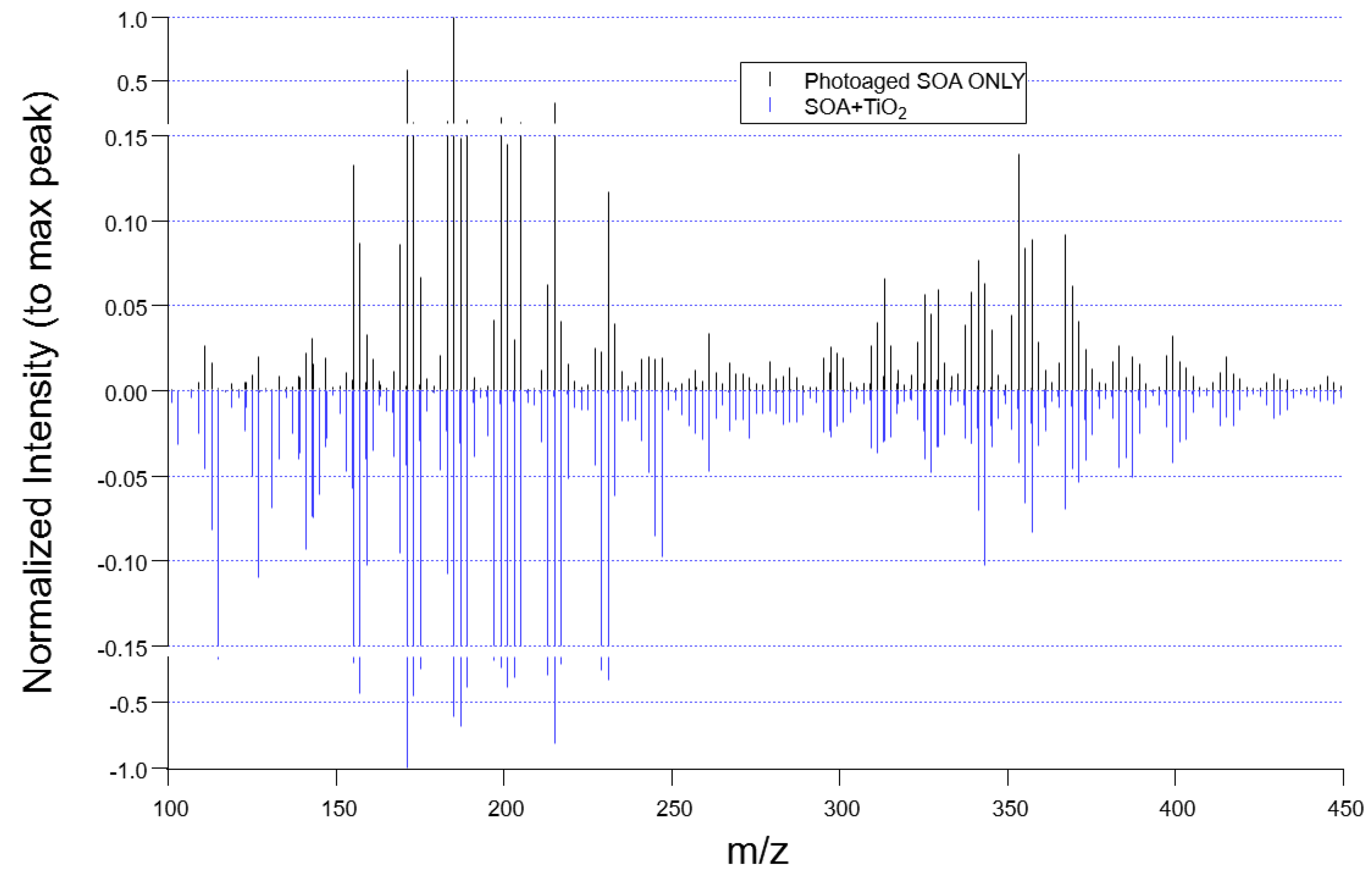
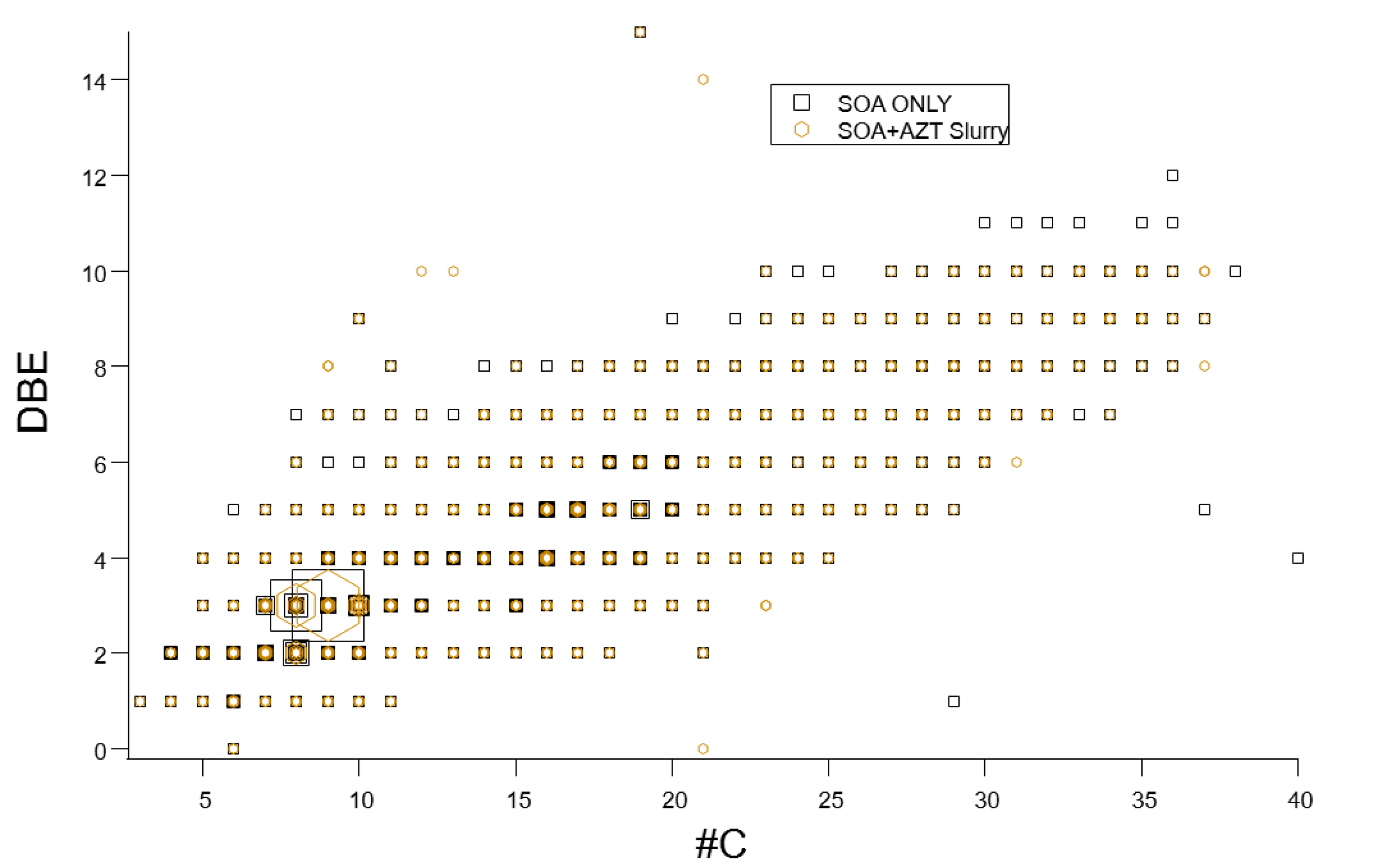
Results



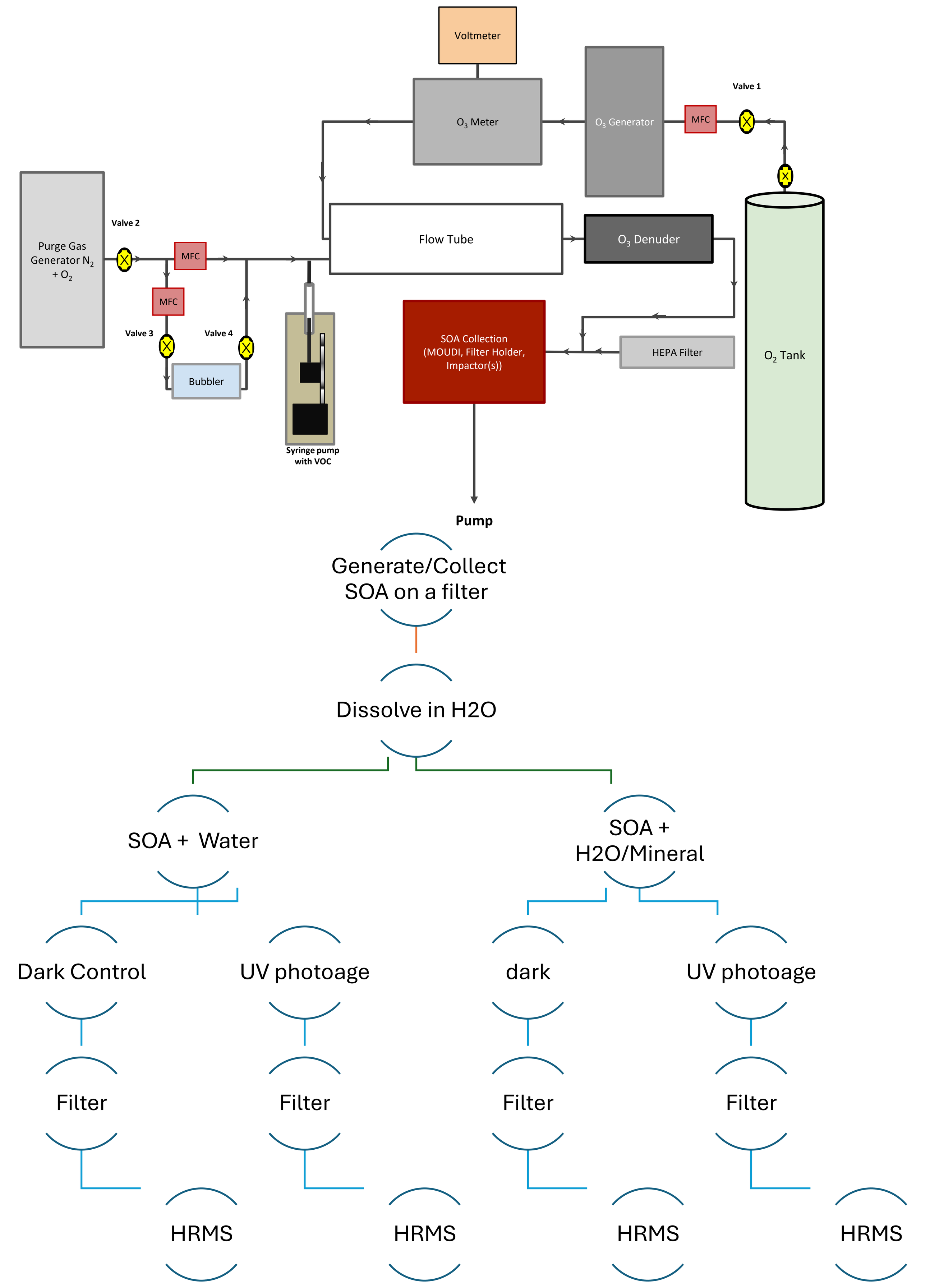






Materials and Methods

- SOA is generated from α-Pinene Flow Tube Ozonolysis and captured on filters
- Filter is extracted in Nanopure H_2O and mixed with mineral dust slurry. Sample is Photoaged
- Sample is filtered and processed in UHPLC-HRMS



Conclusions

- Titanium Dioxide, a known photocatalyst[1,7], shows a noticeable change in the "Dimer" region (250-450 Da) of the mass spectra, with a commensurate change in the "monomer" region peaks (100-250 Da)[10]
- Preliminary results suggest Iron oxide is not causing a large change in the product profile of SOA photodegradation with respect to changes in the monomer and dimer regions.
- Further study is necessary to increase parity with atmospheric conditions with a variety of different SOA and SOA precursor compounds

Acknowledgements

Thank you to all members of the Nizkorodov Group at UCI, and all members of Air UCI.
Thank you to Dr. Veronique Perraud for instruction and assistance with the UHPLC-HRMS
Funding: NSF Grant AGS-2334731