Insights into Organic Aerosol Sources and Processes at T1

A. Setyan\textsuperscript{1}, Qi Zhang\textsuperscript{1}, M. Merkel\textsuperscript{2}, C. Song\textsuperscript{3}, Berk Knighton\textsuperscript{4}, Y. Sun\textsuperscript{1}, T.B. Onasch\textsuperscript{5}, J. Jayne\textsuperscript{5}, D.R. Worsnop\textsuperscript{5}, Scot Herndon\textsuperscript{5}, A. Wiedensohler\textsuperscript{2}, J.E. Shilling\textsuperscript{3}, B.A. Flowers\textsuperscript{6}, M.K. Dubey\textsuperscript{6}, D. Vovchuk\textsuperscript{1}

1. University of California at Davis
2. Leibniz Institute for Tropospheric Research, Leipzig, Germany
3. Pacific Northwest National Laboratory, Richland
4. University of Montana
5. Aerodyne Research Inc., Billerica
6. Los Alamos National Laboratory, Los Alamos
**CARES**: Carbonaceous Aerosol and Radiative Effects Study

**TD – AMS / SMPS**

- **Thermodenuder**
  
  - Ambient Temperature
  
  - Temperature Range: 35 – 200 °C

- **Aerodyne HR-ToF-AMS**

- **Nafion Dryer**

- **SMPS**

- **PM composition**
- **Volutality distribution**
- **Size distributions (number and chemical species)**
Organics dominate PM$_1$ composition

- Total mass loading: Avg = 3.03 [$\mu$g/m$^3$]
- T0: 67.55%
- T1: 0.37%

Organics: 76.5%
NO$_3$: 4.6%
SO$_4$: 13.5%
NH$_4$: 5.4%
Chl: 0.04%
Strong diurnal profiles due to SOA Production
Contribution to new particle growth: \textbf{Org} > \textbf{Sulfate}
Sulfate and organics are externally mixed, due to different sources and formation mechanisms.
PMF analysis of HR spectra → 3 OA factors

- Biogenic influenced SOA
- Urban transport SOA
- Component with biogenic influence (Ng et al., Atmos. Chem. Phys., 2010)
biogenic influenced vs. urban transport SOA
Particles appear not fully neutralized

Presence of organosulfates?

$r^2 = 0.9677$
Slope $= 0.8516 \pm 0.0010$
OS are mainly formed by oxidation of biogenic VOCs in the presence of acidified sulfate aerosols.
Presence of organosulfates?

Fragmentation pattern of sulfate deviated from \((\text{NH}_4)_2\text{SO}_4\)

Deviation more pronounced when photochemical VOCs ↑
Conclusions

• Organics (76%) are a major component of PM$_{1}$.
• Frequent new particle formation and growth events; contribution to PM growth: Org > Sulfate
• 3 OA components identified by PMF:
  - Biogenic influenced OOA
  - Urban transport OOA

\[ \text{SOA} \]
  - HOA (< 10%): combustion POA
• Indication of organosulfates
• Unique case studies may be performed to study interactions between biogenic SOA production and transport of urban plumes.
Acknowledgements

Financial support:

• Department of Energy (DOE)

• Atmospheric Aerosol Health (AAH) program of UC Davis