PM2.5 System

Wen Xu, Philip Croteau, Leah Williams, Manjula Canagaratna, Timothy Onasch, Andrew Lambe, Eben Cross, Xuan Zhang, Wade Robinson, Douglas Worsnop, John Jayne
Aerosol Chemical Speciation Monitor (ACSM)

Aerosol Sampling – Reduce Inlet Losses


Particle Loss (%) vs. Particle Aerodynamic Diameter (µm)

Old Design: 21.0% at 2.5 µm
New Design: 3.8% at 2.5 µm
Aerosol Sampling – Reduce Inlet Losses


Straight path 3-way valve
No bends in 1/8” tube
Particle Beam Generation – How to measure losses

(a) Atomizer → Drier → Brechtel DMA → OPC

(b) Atomizer → Brechtel DMA → AMS/LS

Large Particles

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Particle Beam Generation – How to measure losses

(a) Atomizer → Drier → Brechtel DMA → OPC
   → AMS/LS
   → SMPS

(b) Atomizer → Drier → TSI DMA → AMS
   → CPC

Large Particles
Small Particles (ok)
Particle Beam Generation – How to measure losses

(a) Atomizer → Drier → Brechtel DMA → OPC
   Drier → AMS/LS

(b) Atomizer → Drier → TSI DMA → AMS
   TSI DMA → CPC

(c) Atomizer → Drier → TSI DMA → CPMA
   CPMA → CPC

Large Particles
Small Particles (ok)
Small Particles (better)
Particle Beam Generation – Measured Losses

QAMS
- NH$_4$NO$_3$ (SMPS Corrected)
- NaNO$_3$
- PSL
- mini-ToF-AMS
- NH$_4$NO$_3$ (w/CPMA)
- MS
- PToF

US EPA WINS
- Standard lens (Liu et al. 2007)
Particle Composition - Bounce

This is why we need to solve bounce to have a working PM2.5 system.
Particle Composition – Fixing Bounce

(a)  

(b)  

(c)  

Black arrows denote T/C attach points
Particle Composition – Bounce is fixed

(a) 300 nm $d_{max}$ (NH$_4$)$_2$SO$_4$

- CV (SO$_4$) 
- SV (SO$_4$) 
- 1:1 line

CV: 0.88 
SV: 0.37

(b) Measured NH$_4$ loading (µg/m$^3$)

- CV (SO$_4$) 
- SV (SO$_4$) 
- 1:1 line

CV: 0.88 
SV: 0.37

(c) Chemical composition dependent CIE (CDCE)

CDCE CV (This study) 
CDCE SV (This study) 
CDCE SV (Matthew et al. 2008)
Particle Composition – Fragmentation Comparison

![Graph showing the ratio of ion intensities for NH$_4$NO$_3$ and (NH$_4$)$_2$SO$_4$ under different conditions.](image)
Particle Composition – Optimum Vaporizer Temperature

![Graph showing normalized measured loading ratio vs. vaporizer temperature for different species: NO$_3$, NH$_4$, SO$_4$, and Org (α-pinene ozonolysis SOA).]