

Laboratory Evaluation of a Commercial Spot Sampler

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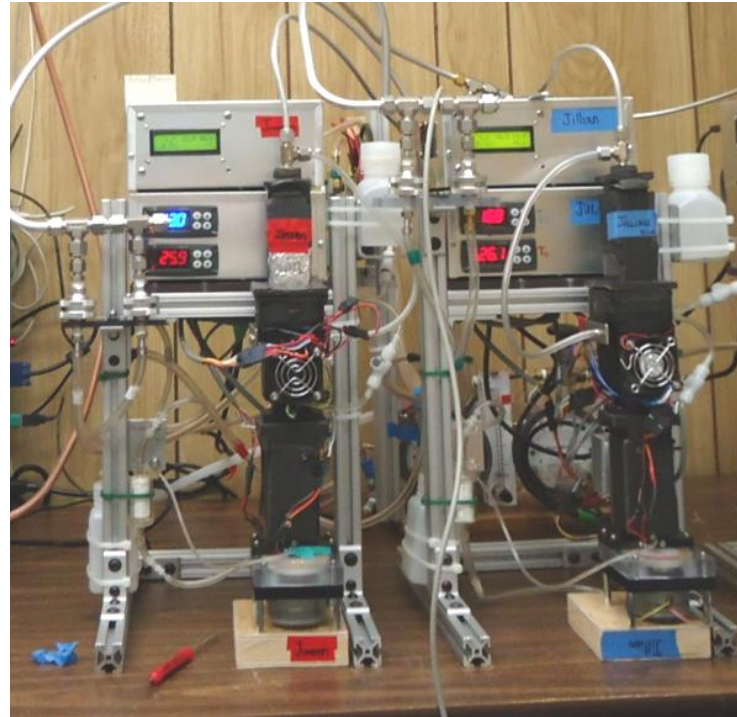
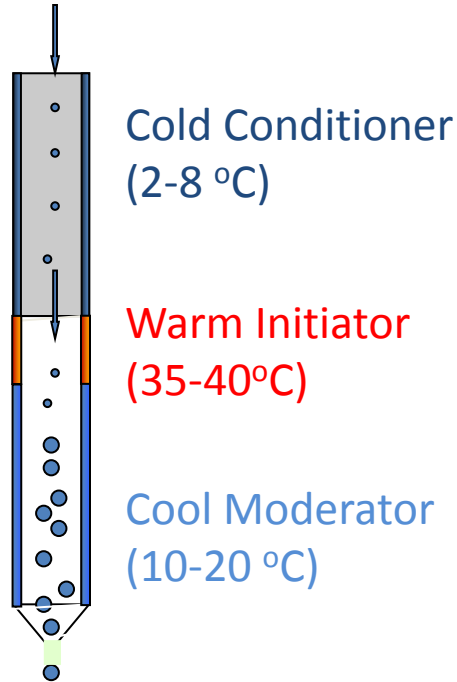
² *Aerosol Devices Inc, Fort Collins, CO*

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Minneapolis



BACKGROUND AND DEVELOPMENT

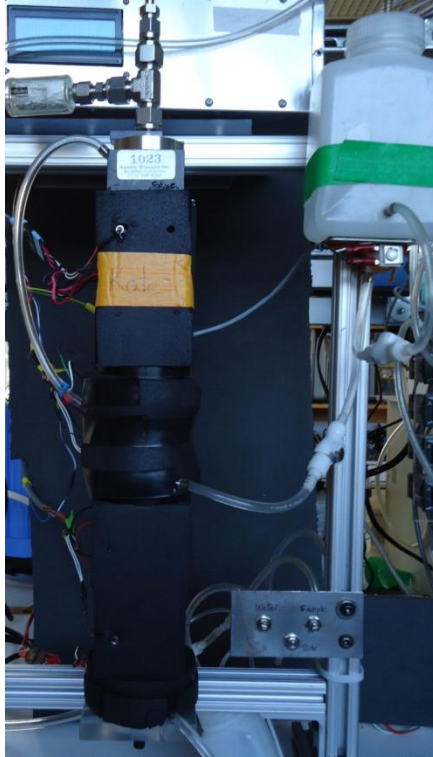
- In 2011 the first ADI Prototype of the *Sequential Spot Sampler (S³)* was presented at the AAAR conference



1. The S³ uses moderate temperatures for water-based condensational growth
2. Collection efficiency is >95% for airborne particles down to 10 nm
3. The concentrated nature of the dry samples allows short collection times
4. It runs uninterrupted and unattended for several weeks at a time, with sample intervals selected by the user
5. Sample extraction and chemical analysis is fully automated using a PAL autosampler

BACKGROUND AND DEVELOPMENT

- In 2014 we presented the prototype of the “*Liquid Spot Sampler*”



Collection into liquid



1. The collection in water or cell culture medium is highly efficient (>95%)
2. The system collects both soluble and insoluble particles
3. The small volume of liquid increases sample concentration
4. The liquid suspension does not require any extraction and pre-concentration steps prior to chemical or toxicological characterization

COMMERCIAL SYSTEM

- In 2015 we present the *commercial system* from Aerosol Devices Inc. ()

SEQUENTIAL SPOT SAMPLER



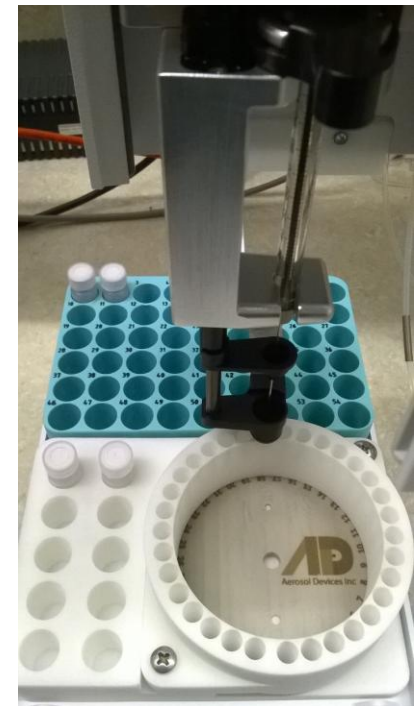
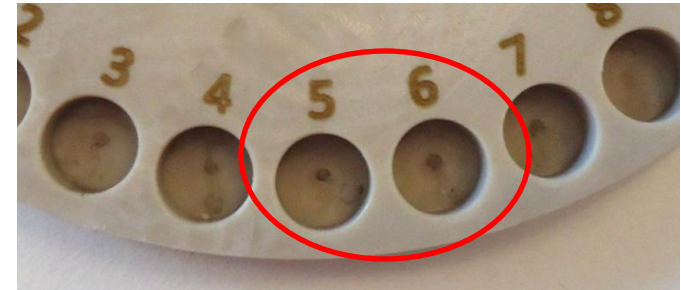
LIQUID SPOT SAMPLER



SYSTEM DESCRIPTION AND CAPABILITIES

1. SEQUENTIAL SPOT SAMPLER

- Collection of up to 32 concentrated samples (1-mm “spot”)
- Collection flow rate can be adjusted from 0.6 lpm to 1.5 lpm (internal pump)
- Automated water injection and extraction prevents flooding
- User-selected sampling intervals from 1 min to 24 hrs
- Sample plate may be made from a variety of solid materials, can be cleaned and reused
- Interface with a PAL3 autosampler for automated extraction and chemical analysis
- Small volume of solvent used for extraction (70 μL)



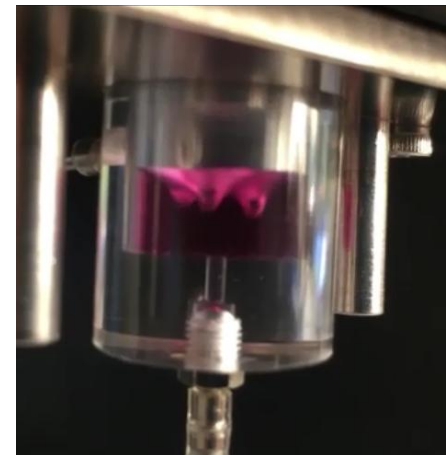
SYSTEM DESCRIPTION AND CAPABILITIES

2. LIQUID SPOT SAMPLER

- Direct gentle particle deposition into liquid
- No particle bounce or re-aerosolization
- Captures soluble and insoluble particles
- Particles are concentrated in a 0.5mL of liquid (water, broth, cell culture medium)
- Collection vial of polycarbonate (can be customized)
- The liquid vial can be user configured for on-line extraction and analysis

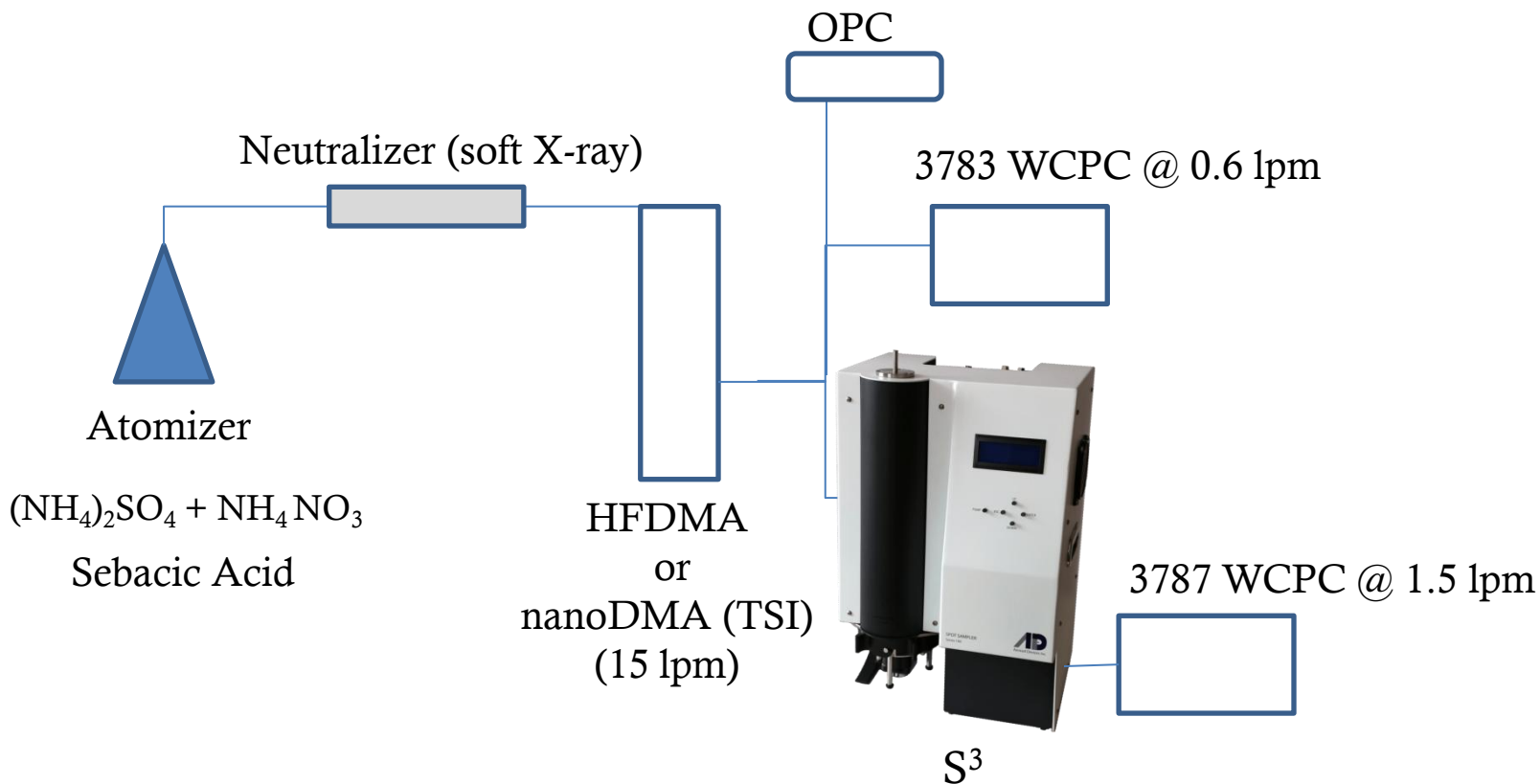


Collection in Water



Collection in DMEM

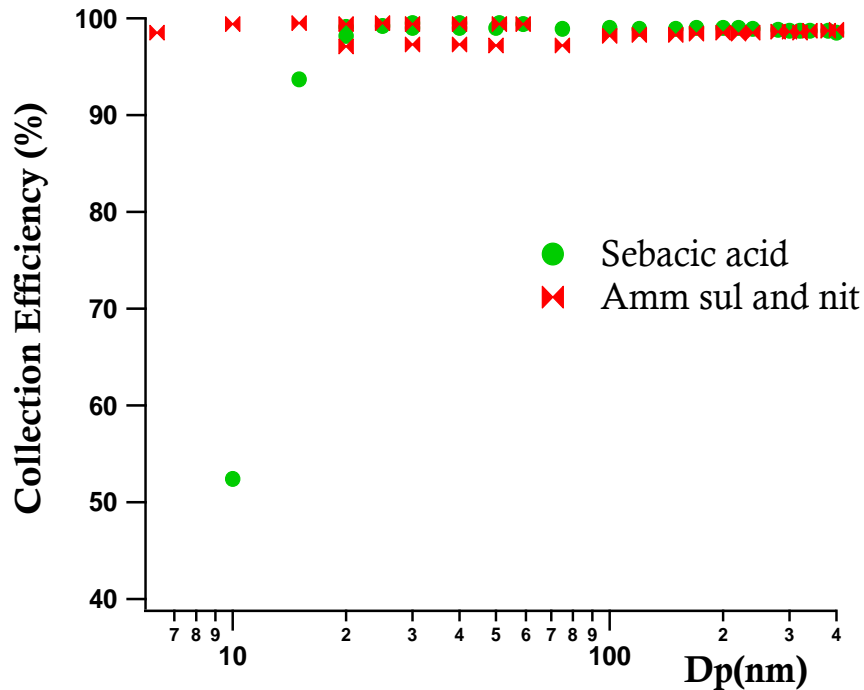
LABORATORY CHARACTERIZATION



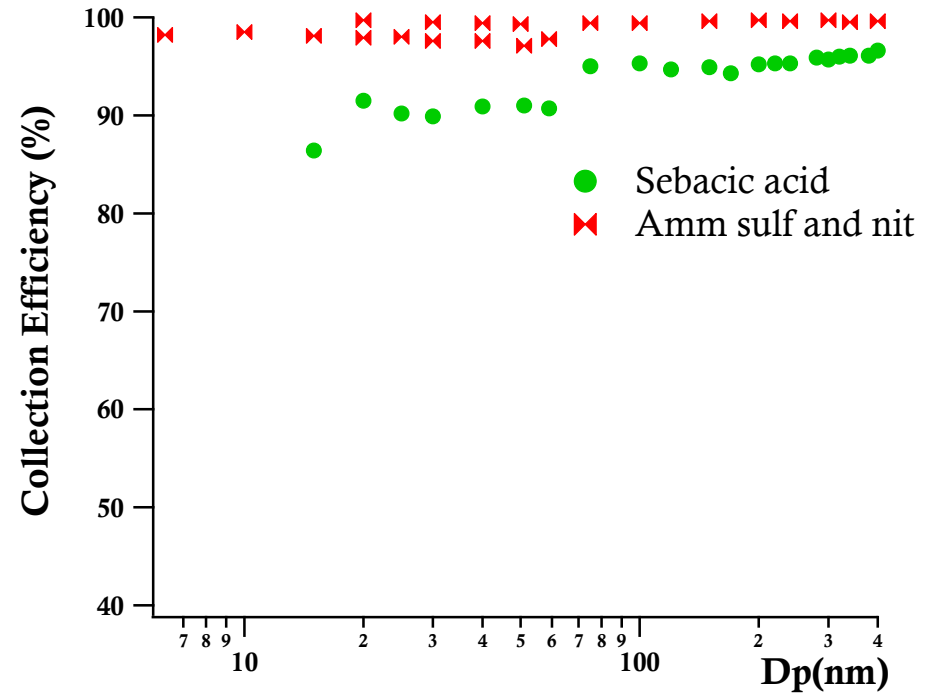
LABORATORY CHARACTERIZATION

1. Physical Collection Efficiency

Dry Collection



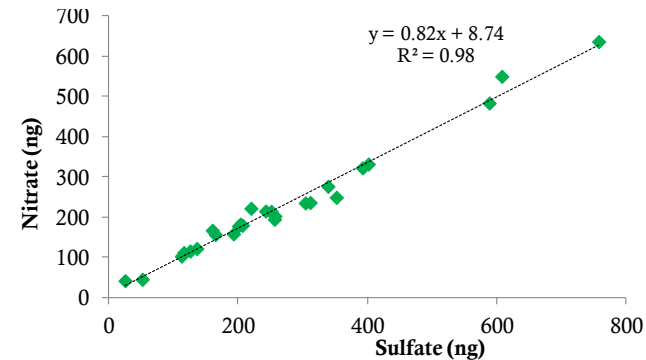
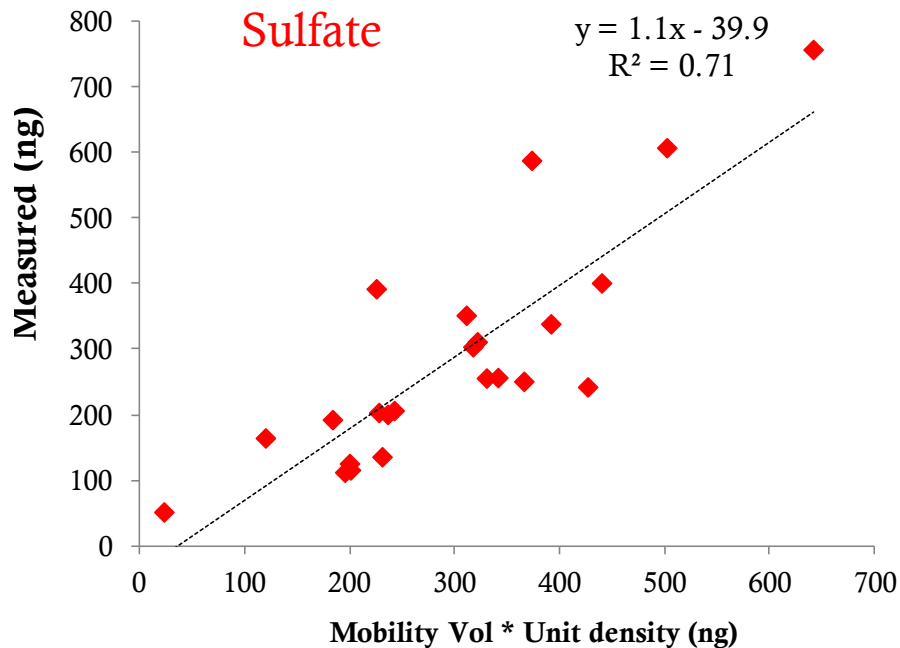
Liquid Collection



- Collection efficiency >95 % for *hydrophilic* particles down to 6 nm for dry and liquid collection configuration
- Collection efficiency >90% for *hydrophobic* particles as small as 15 nm when collection dry samples, and 20 nm for liquid collection

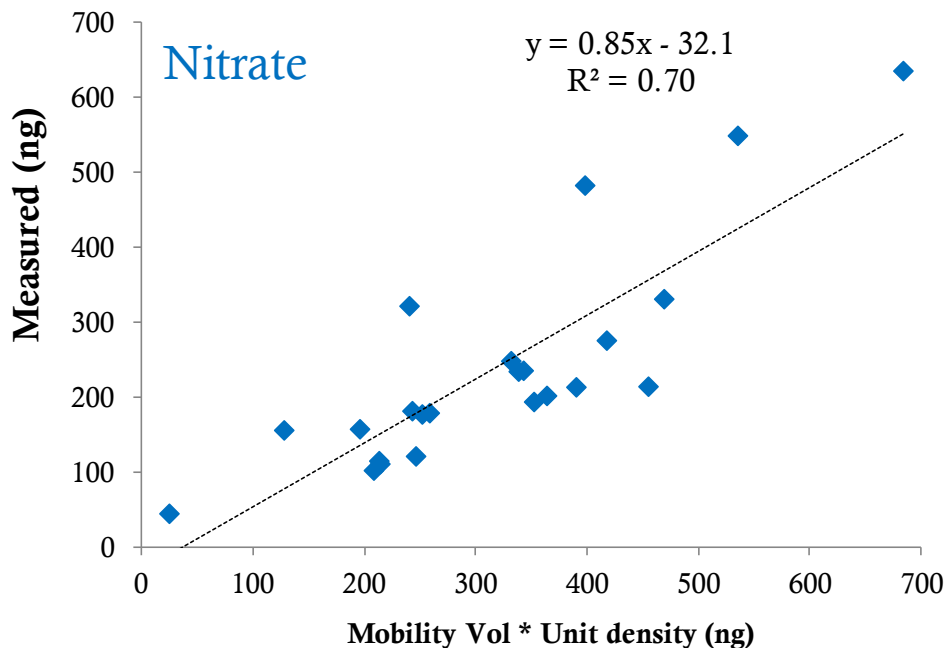
LABORATORY CHARACTERIZATION

2. Chemical Collection Efficiency



- Good agreement between collected and estimated mass for sulfate and nitrate

- Nitrate/Sulfate ratio consistent over time and collections



LABORATORY CHARACTERIZATION

3. Bioaerosol Collection Efficiency

1. **H1N1 INFLUENZA virus**: physical collection efficiency and viability

Stop by poster **8BA.9** (Thursday @ 12:15)

“Highly Efficient Collection of Viable Influenza Virus A/Mexico/4108/2009 (pdmH1N1)” MAOHUA PAN

2. **MS2 virus**: physical collection efficiency and viability

Attend platform **12BA.5** (Friday @ 12:15)

“A Novel Sampler for Viral Aerosols through Water-based Condensation Particle Growth” MAOHUA PAN

SUMMARY

1. The Sequential Spot Sampler and the Liquid Spot sampler are a novel tool for the **efficient collection (>95%)** of airborne particles both as dry spots or as liquid suspensions
2. The **concentrated nature** of the samples allows for short-time collections required for better characterizing changes in the physical, chemical and toxicological properties of the particles
3. Samples are '**ready to analyze**' and the **automated extraction and analysis** by the autosampler eliminates the need for time-consuming, and expensive prep steps
4. Liquid collection in small volumes (<0.5 mL) enables faster and **more direct characterization of the toxicological properties**, as well as detecting the presence of bioaerosols (see 8BA.9 and 12BA.5)
5. The Spot sampler is **portable** and **does not require personnel** in the field, which makes the Spot sampler an ideal collector for long field campaigns and time-resolved sample collections

These systems combine the **simplicity** of filter sampling with the **data completeness** of real time instruments