Supplemental Information for

Ultrasonic Nebulization for the Elemental Analysis of Microgram-Level Samples with Offline Aerosol Mass Spectrometry

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Included:

4 pages, 2 figures, expanded information on memory effects.

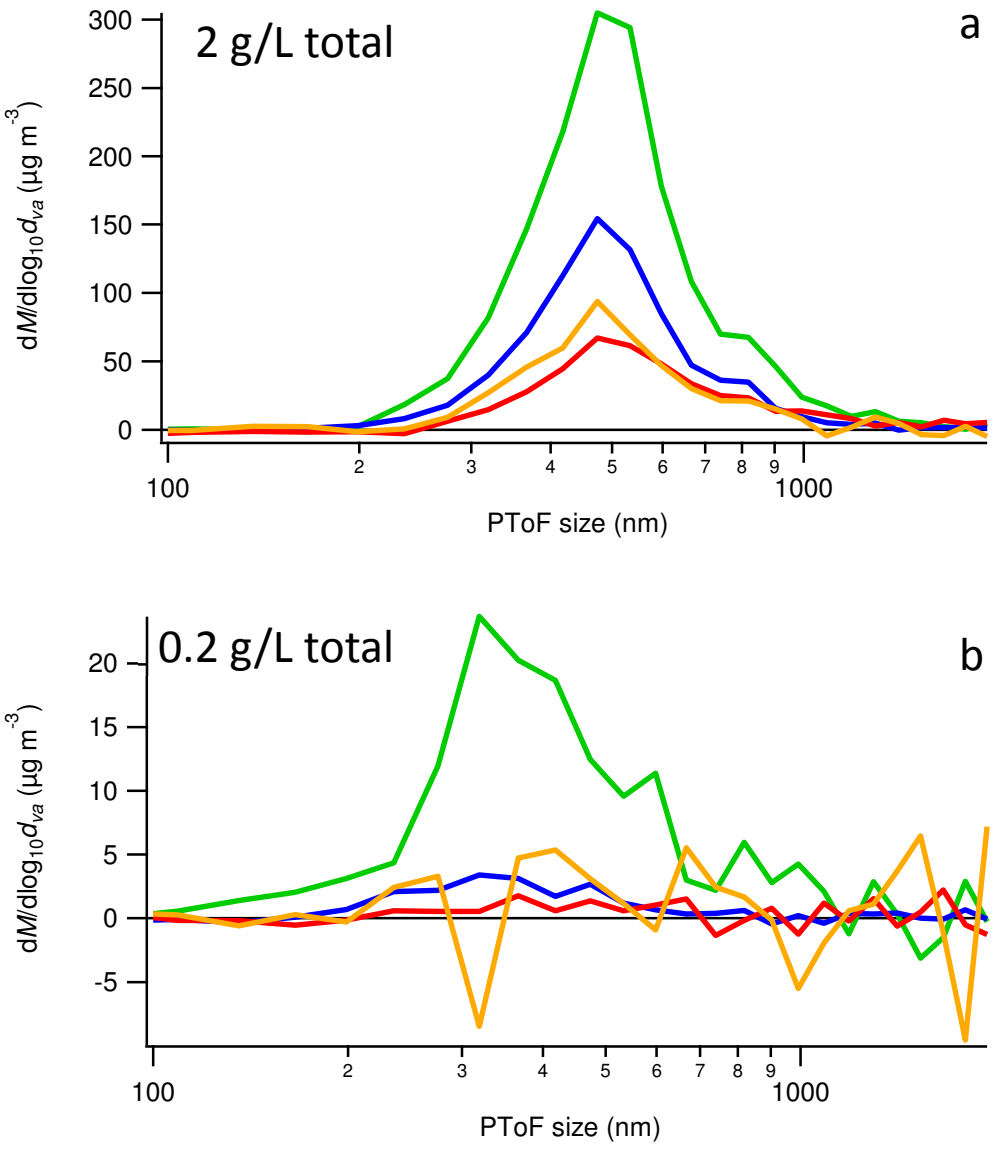

Figure S1. AMS pToF mass distributions from continuous injection of aqueous solutions of NH_4NO_3, $(NH_4)_2SO_4$, and mannitol. Measurable shifts in the distribution can be achieved for more concentrated solutions ((a) 2 g/L; size distribution centered at 200-300 nm) or more dilute solutions ((b) 0.2 g/L; size distribution centered at 100-200 nm). Thus, fine particles formed from nebulizing solutions with concentrations greater than ~0.2 g/L have an appropriate size distribution for direct measurement by the AMS.

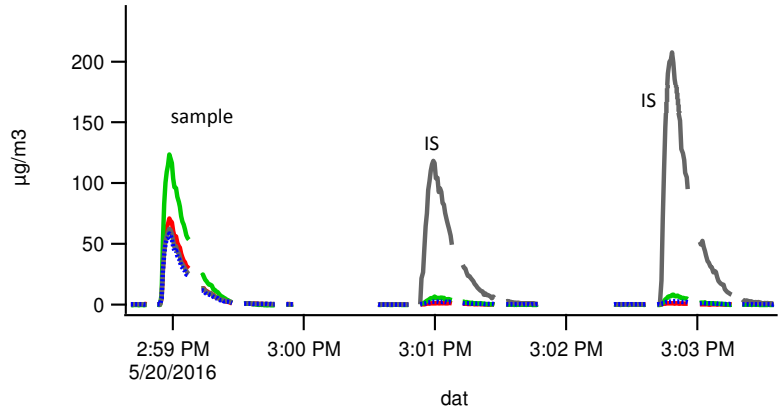

Figure S2. Discrete aerosol pulses for a solution with 0.125 g/L of each component (first pulse) followed by two nebulizations of 1 g/L solution of the internal standard (grey, $NH_4{}^{15}NO_3$) with no rinse on the Kapton surface.

Memory Effects

For typical solutions containing small polar organic molecules and salts, the sample mass that remains on the film surface after the nebulization is small. Figure S2 shows a time trace for a discrete injection of 4 µL of a solution of $(NH_4)_2SO_4$, NH_4NO_3, $NH_4{}^{15}NO_3$, and mannitol each at 0.125 g/L (first pulse). The two subsequent pulses are generated from 4µL drops of a 1 g/L solution of $NH_4{}^{15}NO_3$ placed directly on the same spot as the sample. The mass of SO_4, NO_3, and mannitol that remained on the Kapton film and that is observed in the next pulses is 1-2% of the original mass observed. These values are within 10% of the signal for a blank run on a freshly cleaned Kapton film. Thus, minimal cleaning of the Kapton surface was needed between runs for samples with composition similar to the one described above. To account for potential contamination, runs of the internal standard solution were included between samples.

No carryover from one run to the next has been observed due to droplets from previous discrete injections falling back down to the surface of the film after the sample has been loaded and the SVN sealed in preparation for nebulization. This is likely due to the fact that the surface area of the droplet is very small on the Kapton film and lies in the center of the film with only the open glass tube above it. Also, the time between injections is long enough for a large fraction of the droplet mass on the sides of the SVN to evaporate. However, some ejected droplets are observed to fall from the SVN sides and pool up on the film with continuous injection at 20 μL/min with an aqueous solution. This behavior has not been observed for continuous injections of solutions with more volatile solvents such as methanol.