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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Technical Note: The application of an improved gas and aerosol collector for ambient air pollutants in China" *by* H.-B. Dong et al.

Anonymous Referee #1

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General:

This manuscript presents the performance of a gas and aerosol collector (GAC) in the laboratory and field measurements. Simultaneous measurements of aerosol compounds and their precursor gaseous species are essential for understanding the sources and processes of aerosols. While I acknowledge the numerous efforts made by the authors, I do not recommend the publication in the present form because of significant shortcomings in the evaluation, as outlined below. I also have a number of detailed, specific comments throughout the manuscript (I have listed some of them after the major comments), but I would prefer to wait for the resubmission of the manuscript

before going into details.

Major comments:

(1) Sections 2.1 and 3.1: Sampling inlet

The authors should pay more attention to the sampling inlet. In general, conductive or metal tubes should be used for aerosol sampling to avoid possible loss of particles due to electrostatic charges. On the other hand, Teflon or glass tubes (with very short residence time) should be used for the sampling of highly reactive gases to avoid chemical loss on the wall. These requirements make it difficult to use a common sampling inlet for aerosols and reactive gases. This point is very critical as the use of a common inlet is the basic concept of the GAC system.

Specifically, cares should be taken to avoid the loss of very sticky gases such as HONO, HNO3, and NH3. In general, quality of the measurements of these gases is often limited by the inlet design rather than the analyzer itself. I guess the 3-m inlet tube and 16.7 L/min sampling flow would not be an optimal condition for these gases.

(2) Section 2.2.2: Aerosol collection efficiency

The evaluation of the aerosol collection efficiency is not straightforward and the results are very ambiguous. Why did the authors use polydisperse aerosol particles? The evaluation of the penetration rate and collection efficiency should be size-resolved. The authors can easily generate monodisperse aerosol particles and measure the number concentrations using their DMA and CPC, which makes the interpretation much clearer.

(3) Sections 3.3.1 and 3.3.2: Intercomparison of gaseous species

The GAC system might be able to provide the concentration of HCl, HONO, HNO3, SO2, and NH3. The intercomparison for SO2 seems promising, but that for HONO seems problematic. Also, there is no intercomparison for the other species. In the abstract the authors claim that the instrument is proved "highly reliable," but this statement is valid only for SO2.

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(4) Section 3.3.4: Intercomparison of aerosol species

The intercomparison of aerosol species between GAC and AMS does not make sense to me. The cutoff diameters of the GAC and AMS are different, which introduces substantial uncertainties in the intercomparison. Furthermore, it is very confusing to discuss the quality of the AMS measurements (collection efficiency) based on this intercomparison. What was the relative humidity in the sample air for the AMS? What was the loss of particles in the Nafion tube? If the authors consider that the AMS measurements contain systematic errors, they should not use the data for the evaluation of the GAC system.

Other comments:

As I mentioned earlier, I have a number of detailed, specific comments throughout the manuscript. Here I list some of them. I would prefer to wait for the resubmission of the manuscript before going into details.

(1) Section 2.1: Aerosol trapper

The authors should present more details of the newly added components. I do not fully understand how they work. The "cycling cooling water" section should not be called "cyclone." The physical mechanism of a cyclone is totally different.

(2) Section 3.2: HNO3 and HCl

The authors claimed that the variations of HNO3 and HCl were controlled by the evaporation of nitrate and chloride. Is it true? Please check the budget.

(3) Table 1: Why is the LOD of SO4 much higher than the other compounds?

(4) Table 3 provides no useful information and should be removed.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 7753, 2012.