Atmos. Meas. Tech. Discuss., 3, C481–C484, 2010
www.atmos-meas-tech-discuss.net/3/C481/2010/

Atmospheric Measurement Techniques Discussions

Interactive comment on "A new aerosol collector for on-line analysis of particulate organic matter: the Aerosol Collection Module (ACM)" *by* T. Hohaus et al.

Anonymous Referee #3

Received and published: 21 May 2010

General Comments:

In the current manuscript, Hohaus et al. describe the Aerosol Collection Module (ACM), a newly developed instrument for the on-line analysis of laboratory and ambient organic aerosol (OA) composition. Essentially, the ACM collomates particles into a beam through the use of an aerodynamic lens system and a differentially pumped vacuum chamber that are the same as those used for the Aerodyne Aerosol Mass Spectrometer (AMS). Unlike the AMS, where the particle beam impacts upon a resistively heated vaporizor surface at the back of the detection chamber, particles in the ACM are collected on a cryo-cooled collection surface over an extended period of time. During analysis,

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

the particle sample is desorbed via heating of the collection surface and volatilized particle constituents are transferred to an interfaced detector, which was a GC-MS/FID system in this case.

The paper presents a novel instrument for near-real-time analysis of atmospheric OA composition and, as such, is within the scope of AMT. The overall presentation is well structured and clear although the grammatical structure of the text needs to be strengthened. As a result, I would recommend that the current manuscript be accepted for publication in AMT after the authors address the grammatical structure, in general, and specific concerns listed below.

Specific Comments:

This manuscript evaluates the performance and, in particular, the mass transfer efficiency of the ACM-GC-MS was under a variety of both laboratory and ambient conditions. The ACM-GC-MS was also used to analyze the composition of secondary organic aerosol (SOA) from the ozonolysis of beta-pinene in parallel with analysis of filter samples and also ambient OA in conjunction with parallel sampling by an AMS. The mass transfer effiency of the ACM-GC-MS was determined to be 100% in the case of laboratory-generated octadecane particles and the response was found to be linear over a wide mass range. However, in the case of beta-pinene SOA, the mass transer efficiency was found to be 6-11%, which was attributed to known compound detection limitations of the GC-MS system for higher oxigenated products which are produced in the reaction.

In the case of ambient measurements, ACM-GC-MS sampling was conducted at the Aerodyne labs in Massachusetts and the resulting measurements were compared to total OA measurements by an AMS. ACM-GC-MS and AMS measurements were compared with each set of measurements being highly correlated. The authors extend these results to assert that the ACM-GC-MS is capable of quantitative measurements of ambient aerosol mass loadings. Based on the information provided, this assertion

AMTD

3, C481–C484, 2010

may be an overreach. For example, Figure 9 compares ACM-GC-MS measurements in arbitrary units (presumably units of peak area) against AMS organic mass in micrograms. Making the claim of quantitative ACM-GC-MS measurements of ambient mass loadings would require the conversion of peak area to mass which is inherently very difficult as possibly indicated by the fact that the authors in this case declined to do so. Additionally, it is likely that at least a small fraction of OA in the vicinity of the Aerodyne labs is SOA. While the body of AMS literature shows that it is not biased in the detection of SOA, the same cannot be said of the ACM-GC-MS as indicated by <100% mass transfer efficiency in the case of beta-pinene. Therefore, it is likely that the ACM-GC-MS measurements of ambient aerosol mass are lower than those of the AMS and are not quantitative as a result. If the authors continue to insist on quantitative ACM-GC-MS measurements, this contention needs to be strengthened.

Technical Corrections:

p. 1362, l. 13: "places" should be "place".

p. 1363, l. 8-9: The sentences here are unclear. "After sampling the filter content is analyzed in the laboratory using standard analytical procedures. These include solvent extraction, supercritical fluid extraction or thermal desorption of these filter samples." The listed techniques, however, are not specifically speciation techniques but are essentially extraction techniques. These sentences should be clarified.

p. 1364, l. 14: Either remove "techniques" after "similar" or "instrument" after "TAG".

p. 1365, l. 5,6: Pluralize "pump".

p. 1365, l. 9,10: "chamber" should be pluralized and verbs in the sentence should be changed accordingly.

p. 1367, l. 6,7: The following sentence is not clear and should be corrected: "The carrier gas flushes the evaporated particles..." This should be changed to reflect the fact that it is not the particles that are flushed from the collection surface, but instead

AMTD
3, C481–C484, 2010

volatile, non-labile molecules are transported to the detector. This same expression of particles being transported to the detector is also a problem in the Conclusions section (p. 1379, l. 24) and should be corrected there as well.

p. 1369, l. 10: I would recommend using "maximum desorption temperature" in this context as the collection surface temperature is dynamic during sample desorption.

p. 1371, l. 8: Please add "response" following "ACM-GC-MS" as that is what is being discussed in this sentence.

p. 1372, l. 5: Although this sentence ("This is provided by a floor heating system which temperature...") is unrelated to the main focus of this paper, it is unclear and should be corrected for easier readability.

p. 1373, l. 6: Add "do" following "experiment".

p. 1373, l. 8: Change "extend" to "extent".

p. 1378, l. 14: change "drop" to "drops".

p. 1379, l. 7: change "in" to "is".

p. 1380, l. 1: Change "allows to study" to "allows the study of".

p. 1380, l. 11: Please add "response" following "ACM-GC-MS" as that is what is being discussed in this sentence.

Interactive comment on Atmos. Meas. Tech. Discuss., 3, 1361, 2010.