

The submitted manuscript Hohaus et al.: “A new aerosol collector for on-line analysis of particulate organic matter: the Aerosol Collection Module (ACM)” describes the setup and working principle of a new instrument which combines state-of-the-art techniques (GC/MS-techniques) with a particular kind of aerosol sampling method. The instrument focuses the sampling of aerosol particles and specification of aerosol organic matter, thus the instrument has high potential to provide interesting features concerning OA studies in the laboratory as well as for field measurements. This introduction, consisting of detailed technical description as well as the comparison results with other aerosol measurement techniques in the laboratory and during field experiments, is recommended to be published after some corrections and clarification.

General:

The title of the manuscript contains the phrase: “on-line” which could be an issue for intensive discussion considering that the sampling of aerosol and the analysis happen in separate steps. The authors re-qualify the measurement to be “quasi-online” in the abstract (P 1362, L 9). For the method described here it would be also an overstatement to call it “off-line” method (as filter or impactor samples usually are labeled with). However, for my understanding, the expression “on-line” is related to a continuity of sampling and measurement and does not fit to the working principle of the ACM-GC-MS.

The introduction section could work out in more detail: what are the current “state-of-the-art” techniques for OA specification, their advantages/disadvantages – making the development of new techniques such as the ACM-GC-MS so essential.

The collection surface is regularly cooled to -30°C and heated up to 270°C which might cause some material stress. Additionally there might be aerosol components that simply remain on the surface because they are not vaporizable even at cleaning mode temperatures (which are not further specified in the manuscript). Is this surface regularly cleaned or replaced from time to time? Furthermore this non-vaporizable inorganic substances may adhere onto the collection surface, and although this surface is chemically passivated this accumulating inorganic substances could cause interaction with the fresh aerosol sample – or does this Silcosteel work like a Teflon coating in a pan and the backflush cleaning mode is able to remove also the inorganic from the surface? If yes this should be clearly stated.

Concerning the procedure described in section 4.2: Comparing measurements by simultaneously varying two parameters (here the vaporizer temperature of the ACM-GC-MS and the aerosol loading into SMPS and ACM-GC-MS) has the risk that two effects could interfere with each other. It might have been tested previously that this is no issue for this particular case but there should be a comment on that in the text.

What is really missing in section 5.4 is a correlation between the mass spectra (MS) of both instruments while the AMS from Aerodyne (not mentioned which type) definitely is capable to provide mass spectra of OA - dependent on the AMS type in lower (C-ToF) or higher (HR-ToF) resolution. Furthermore, particularly this instrumental comparison appears to a reader to be half-finished. Not clear to me is why here arbitrary dimensions are given for the ACM-GC-MS while for the filter comparison the measured mass was possible to be calculated. Thus the correlation unfortunately doesn't allow for further conclusions than the linearity of two measurements with a coefficient of 0.97 but a comparison between resulting MS could probably provide more indication of

the ACM-GC-MS performance. Thus the conclusion section 6 should be rephrased significantly or other data should be shown to confirm those conclusions. At current state the capability of ACM-GC-MS to perform “quantitative measurements of ambient aerosol mass loading” is not shown.

Specific:

-P1362, L 5: “However, current analytical methods are far from full speciation of organic aerosols and often require long sampling times.” This is a very general statement and could be related to the sampling times the ACM needs.

-P1362, L 11--12: “...and transfer gasified atmospheric aerosol particles.” The word “particle” should be replaced by “components”. After sampling and vaporization it is not an aerosol particle anymore which is analyzed but its chemical composition.

-P1362, L 15: Here, after the sentence is finished, it could be stated very concretely what are the shortest (or most reasonable) sampling times of the ACM. What is the temporal resolution that can be reached with the ACM-GC-MS?

-P1363, L 19: “such as loss of compounds due to volatilization” as this statement is kept very general this is an issue for the ACM-GC-MS as well (particularly in the aerodynamic lens), isn't it?

-P1363, L 20-22: “uncertainties exist as to how representative these samples are for the atmospheric aerosol composition” this is valid for any instrument.

-P1363, L 28 --P1364, L 1: “Therefore today an important focus lies on the on-line measurements of aerosol chemical composition in real time with high time resolution.” Very general statement containing further “eye catcher” superlatives of which no one necessarily fits to the ACM-GC-MS as well.

-P1364, L 11: “...cooled collection surface.” The readers would like to know concrete values – or at least a statement in which temperature range this cooling happens.

-P1364, L 12: “...heated the collection surface.” The same as mentioned before.

-P1364, L 12: “...transferred by a carrier gas...” which one? This gap would be less obvious by leaving out “by a carrier gas” if the authors want to keep this for the detailed instrumental description part.

-P1365, L 6: the aperture dimensions, as well as all further, should be given in SI dimensions.

-P1365, L 9: please state, at least in brackets, which volume flow rate (value) is ensured.

-P1365, L 12: There should be stated why it is necessary for this system that the vacuum system can be isolated.

-P1365, L 15: Is the kind of stainless steel (“316”) necessary to know for understanding the working principle?

-P1365, L 21: The new information is that the cooling of the collector surface happens with liquid nitrogen. Still open: to which temperature.

-P1365, L 21: “The cold nitrogen is...” - from “liquid nitrogen” in the sentence before the word “cold” becomes redundant.

-P1365, L 24: Here the accuracy is given to hold the cooling temperature – still the reader doesn't know the value of "set temperature".

-P1366, L 2: please replace, here and elsewhere, the imperial by SI dimensions.

-P1367, L 5: "The cartridge heater is heated..." to which temperature and with which heating rate ($^{\circ}\text{C s}^{-1}$)?

-P1367, L 10: "...a general rule is set in this stage to a higher temperature than the desorption..." how much higher?

-P1367, L 15: "This cleaning of the collector is performed after each measurement. The duration of the backflush mode can be set to meet the actual requirements regarding possible remaining contaminations." Is the state of cleaning checked with measurements that are part of the cleaning mode or how else is the duration for the cleaning mode set?

-P1368, L 3: "The coupling of the GC to the transfer line of the ACM was accomplished using a 1/16" Swagelok connector." Is this essential to know for understanding? If not it could be taken out.

-P1369, L 9: Here the first time a concrete temperature is mentioned for the collection surface, which seems to be quite late. Anyways the question comes up: why that low temperature? Why not close to zero or at room temperature? Does a temperature of -30°C not cause further problems (condensation of gas/vapor that still may be present in the aerosol sample, though in low quantities)?

-P1369, L 13 -- 20: In this section the reader gets the first time an impression about the time scales of a sample/analysis cycle. What is not really clear herein and in previous text: It should be stated explicitly if simultaneously to the analysis part with the GC/MS (or else) a new sampling cycle is started or if the analysis has to be completed before a new sample is initialized.

-P1370, L 2 -- 5: "The obtained mass spectra for each compound were compared with the EI spectra of the NIST library database. The comparisons achieve good results and the automatic search and compare algorithm of the MS data acquisition software (Masslab 1.4) identified all compounds with a high probability." For this comparison with results from a MS spectra database the quality of agreement should be demonstrated with values. Just with general comments like "good results" or "identified with high probability" the reader is not able to evaluate this.

-P1370, L 20: the "conversion factor" could be specified in more detail, please.

-P1370, L 20: "Note that no impurities or artifacts could be observed..." The phrase could be clearer in terms of possible impurities or artifacts which were present in quantities smaller than the detection limit of the instrument – if possible proven by a figure.

-P1370, L 25 -- 26: "The linear fit to the data shows that the slope is one." In fact it is not "one". Rephrase this, please, into e.g. <<slope is with 1.06 ± 0.04 very close to one>> which would be the most honest.

-P1370, L 26 -- P1371, L 2: "Possible losses of octadecane at all temperatures over the complete pathway of the ACM system were found to be minimal." What, in numbers, means "minimal" and what is this statement based on? Is this measured somehow? If yes it should be presented in this manuscript.

-P1372, L 11 -- 12: "The experiment was conducted at ambient pressure and temperature." And a few lines later (P1372, L 16 – 17) it is mention "The initial conditions inside the chamber after flushing were 27% relative humidity, a temperature of 20 °C...." but a few lines prior (P1372, L 4 – 6) "This is provided by a floor heating system which temperature periodically changed in the range of 30°C±4°C over the duration of 2 h." So either this heating feature of the chamber was not used and this sentence (concerning the chamber) could be taken out or this feature was used and the measurements did not happen at ambient temperatures (considering also that the relative humidity is affected significantly with temperature).

-P1372, L 13 -- 14: "The air flow through the chamber during flushing was 25m³h⁻¹." Is this essential to know for better understanding?

-P1373, L 1: "Note that the initial monoterpene and ozone concentrations are orders of magnitude above ambient levels..." Here it would be nice to have a concrete number of how many orders of magnitude.

-P1373, L 5 --6: "Hence the observed yields for products formed in this experiment not necessarily represent ambient yields." Either this is a contraposition to the cited statement of Atkinson (1997) then it should be much clearer. Otherwise it could be taken out as any reader can be assumed to be aware of this.

-P1373, L 14 --15: The CPC "cut-off" is a commonly used but not very proper laboratory-slang expression. Better is, and one can read that increasingly, the "50 % detection particle diameter" of a CPC.

-P1373, L 18 -- 19: "The SMPS was measuring the particle diameters between 14 nm and 750 nm." The SMPS usually measures the number concentration of particles of a selected particle (electromobility) diameter (with an uncertainty, the DMA-specific band width).

-P1374, L 6: "The filters were preheated for 10 h at 600°C before sampling" If there is a reason for that it should be stated.

-P1374, L 7 --8: "The sampling line of the filters was situated 3m away from the ACM-GC-MS sampling line." Does this mean that the aerosol taps were placed in the chamber with 3 meters distance to each other?

-P1374, L 15 --21: "ACM-GC-MS blank measurements were conducted regularly between the chamber samples. For the blank measurement a High Efficiency Particulate Airfilter (HEPA) was installed between the chamber sampling tubing and the ACM-GC-MS inlet. The same measurement cycle of the ACM-GC-MS was repeated with the installed filter. The blank measurement were used to check for contaminations or residues inside the ACM-GC-MS and for 20 adsorptions from the gas phase onto the collector." Unfortunately a figure showing those blank measurements comes later in the manuscript. You could place "c.f. section 5.6" somewhere in this paragraph. Do those blank measurements show a dependency on the duration of the cleaning mode? Is the cleaning state of the ACM measurable in this way?

-P1374, L 19 --20: either "...the blank measurements were..." or "...the blank measurement was..."

-P1375, L 1 --7: "The first approach..." is the beginning of one sentence. What is missing is the clear specification of the "second approach".

-P1376, L 4 --5: Either "index" is replaced by "indices" or "correspond" is replaced by "corresponds".

-P1376, L 25: The molecular weight dimension "Da" (Dalton) is not a SI dimension

-P1378, L 4: Either "3mm circular pieces were...." or "a 3mm circular piece was...."

-P1378, L 9: "A ND correction owing to the inhomogeneity of particle loading across the filter was done accounting for the overestimated nopinone concentration on the cut out filter piece." This suggests that the correction is particularly related to the nopinene. But the particle loading on a filter generally should be corrected for independent on the aerosol species. Thus the sentence should start with "A correction owing to the inhomogeneity...". Furthermore, for all of the mentioned corrections the correction factors could be stated in a way that the correction process is reproducible for a reader.

-P1378, L 14: "The nopinone concentration drop continuously..." it should be "drops" instead of "drop".

-P1378, L 25: That Billerica is located in Massachusetts is perhaps less important than the country "USA" which could be stated here.

-P1379, L 7: "...which in indicative of..." The "in" should be replaced by "is"

Figures & Tables

- Table 2: the dimension of M-SOA is given in μm^{-3} which is not a mass dimension as it should be according to the caption.
- Table 3: The RIs have no dimensions.
- Neither in Fig. 4 nor in the caption or in the text it is mentioned if the error bars come from repeated measurements (if yes how many) or if they result from the instrumental errors of the SMPS and the ACM-GC-MS. In fact the bars seem to display a constant percentage of sampled mass. The question is also if instrumental uncertainties like SMPS band width are considered? Or the particle losses inside the SMPS. Furthermore the Fig4 caption talks about "...a line through the origin...". In the same figure the fit intercept proofs the regression not to be a line through the origin.
- Figure 5: please add dimensions to the ordinate axis label.
- Figure 7: Instead of showing another time series of the ACM-GC-MS comparison with the filter samples (as shown already in Fig 6) the authors could think about showing the comparison of measured total mass with both methods fitted by a linear regression.
- Figure 8: It should be explained somewhere how to understand the increasing background for retention time < 33.8 min and constant values for retention time > 34min.
- Figure 9: The error of the total organic mass measured with the AMS could be easily implied as error bars into the graphic.