

## ***Interactive comment on “Chemical characterization of oxygenated organic compounds in gas-phase and particle-phase using iodide-CIMS with FIGAERO in urban air” by Chenshuo Ye et al.***

**Anonymous Referee #1**

Received and published: 17 December 2020

Review for “Chemical characterization of oxygenated organic compounds in gas-phase and particle-phase using iodide-CIMS with FIGAERO in urban air” by Ye et al.

This manuscript describes the deployment of a FIGAERO-ToF-CIMS with iodide ionization to a polluted urban environment, namely a mega-city (Guangzhou) in China, as part of a coordinated measurement campaign. The authors detail their experimental set up and go into each class or source class of compounds they measured. It is primarily an exploratory paper as urban studies, particularly with a FIGAERO which can measure the chemical composition of the gas and particle phases, are generally un-

C1

derrepresented. In my opinion, the experimental design was well thought out and the measurements were carefully and deliberately performed. For example, performing humidity calibrations is often not done but provides high-quality measurements, and voltage scanning for calibrating unknown compounds goes above and beyond typical studies. Overall, it is a well-written manuscript. The introduction is concise yet informative, and I liked the way the results and discussion section were formatted, with a sub-section for each class of compounds. However, I do have two general comments. First, please read over the paper carefully for grammatical errors. For example, “The systematically interpretation” in the abstract should be “systematic interpretation”, and connector words are missing throughout, like “of”, “the”, and “and”. Second, I would suggest re-visiting the figures. 17 main-text figures makes it difficult to discern the message of the paper, and many can be moved to the SI. Further, I think some figures could be included, for example on line 486-487, “The analysis of the OSc - nc space indicates. . .” could include an accompanying figure that could be discussed throughout section 3.8. And I think the way the results/discussion is written, where the spectra is broken down by types of compounds and their origins would lead nicely to a pie chart, stacked bar, or similar showing the relative contributions of each source (maybe in place of Fig. 1).

This is a novel study using the FIGAERO to analyze urban air and will be of interest to the readers of ACP. After addressing these comments and the specific comments below, it will certainly be suitable for publication.

Specific comments

1. Throughout the manuscript “~” is used when it should be “-“ to identify ranges of values. For example lines 33 & 156.
2. Line 30-31, “installed with a Filter Inlet for Gases and AEROSols (FIGAERO-I-CIMS) in both gas-phase and particle-phase”: this section is worded confusingly. Do you mean that the FIGAERO was utilized to measure both the gas and particle phases?

C2

3. Line 81-82: the use of the word “coatings” here is misleading. The FIGAERO can measure any organics that will evaporate, whether they are coatings, homogeneously mixed, etc.
4. Line 80-85: the FIGAERO is not the only inlet system that could be described as a “thermal desorption inlet”, for example the Micro-Orifice Volatilization Impactor (MOVI) is another example. Please either reword to indicate you’re specifically talking about the FIGAERO, or add other examples.
5. Line 86-90: actually, much of the published work utilizing a FIGAERO-CIMS has been done in chambers or the laboratory. Please include references to these works or indicate that you are referring to different types of ambient studies.
6. Line 149: I think “complicated” could be removed here or should be explained. Complicated how? Structurally?
7. Line 158-159: how far did the lines protrude out the window? Far enough from the building edge to extend beyond the building laminar layer?
8. Line 193: the (5) is confusing to me, I don’t understand the use of parenthesis? Did you calibrate to 5 lower volatility compounds? If so, please list the compounds here or provide a reference to the section or table that lists the compounds.
9. Line 260 (or 326): how can you be confident you have two nitrogens and not simply a compound with 0 nitrogens, as they would both lie on even masses? Please provide some supporting information to prove this chemical identification—maybe a peak fit in the SI and/or reference to previous measurements of dinitrates?
10. Line 298: should Fp be defined explicitly here as “the fraction in the particle phase”? Not sure the abbreviation would be commonly understood by all readers.
11. Line 381-382 (and throughout results & discussion section): what if these ions have multiple sources? Or different sources produce different isomers of the same composition?

C3

12. Line 490-508/ section 3.8: noticeably lacking is a discussion of small compounds (C4 or less) with a high OSc which have been shown in several publications to be a result of thermal decomposition during desorption. For example line 492-494, please indicate that these C2-C3 compounds that make up 55% of the particle phase signal do not actually exist in the particle-phase as C2-C3, but rather thermal decomposition products, likely arising from the decomposition of very low volatility material such as accretion products or ELVOC. This was first shown by Lopez-Hilfiker et al 2016 (<https://pubs.acs.org/doi/abs/10.1021/acs.est.5b04769>), and others since.
13. Line 556: should the aerosol concentrations of the FIGAERO correlate with the concentrations of the same ion an AMS would measure? Doesn’t the AMS decompose compounds when vaporizing, so that what they measure is not what would be in the aerosol phase, in contrast to the FIGAERO which would (typically) measure the parent compound?
14. Line 559: can you provide values for “moderate and strong”?
15. Line 561-564: this rationale doesn’t make sense to me. Decomposition in the FIGAERO, the AMS, or both? Requires references. And the heaviest compounds with m/z 400+ should not be evaporating, and if they are you would expect much higher evaporation rates of everything less than m/z 400. Please reconsider this justification.
16. Line 586: doesn’t the FIGAERO typically explain ~50% of the AMS-detected OA (e.g. Lopez-Hilfiker et al. ACP 2015, the FIGAERO accounted for ~25-50% of OA measured by the AMS)? Is 24% standard for the urban atmosphere? Can you please compare to previous studies?

---

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2020-1187>, 2020.

C4