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Comment

Interactive comment on “One-year observations of size distribution characteristics of major aerosol constituents at a coastal receptor site in Hong Kong – Part 1: Inorganic ions and oxalate” by Q. Bian et al.

Anonymous Referee #3

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In the manuscript by Bian et al., size distribution data of inorganic ions and oxalate at the HKUST supersite in Hong Kong is presented. A reasonably large set of aerosol samples has been obtained throughout one year using a 10-stage MOUDI impactor. In the first part of the results section the size distribution characteristics for all species are carefully evaluated, while in the next sections special attention is paid to the phase partitioning behavior of nitrate and the sources of sulfate.

The paper is generally well written and most of the conclusions drawn are justified

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by the presented data. Even though size distributions of the presented species have often been measured in similar environments in the past, the authors were able to extract some nice findings from their dataset and the manuscript is thus a valuable contribution to the area of PM composition and sources.

There are a couple of issues, however, which I would recommend to be addressed before publication in ACP:

- The introduction could be improved. Parts of it present too much general information (e.g. P1445 L21 to P1446 L10) not focused enough on the data presented later-on in the paper. The phase partitioning of nitrate for example is not motivated at all.

- The authors used quartz filters as impaction substrates, but present their size distribution data using the nominal cut-offs of the MOUDI. These, however, are valid for flat impaction substrates (aluminum foils, cf. Marple et al., 1991). Quartz filters can be expected to modify the size cuts of an impactor due to their different surface roughness (see e.g. Fujitani et al., 2006; Marjamäki and Keskinen, 2004). This should be discussed somewhere in the manuscript.

- Related to this, on P1450 L4 the authors state that they have used the known response function of the impactor for inversion. Has the response function been experimentally determined for quartz filter substrates? In case the manufacturer-supplied response functions were used: What would be the effect of modified size cut characteristics (i.e. response function) due to the quartz filters on the inversion results?

- Quartz filters are susceptible to blank values which might be significant when sampling relatively low amounts of PM with an impactor. Have the authors checked for blanks, maybe even field blanks? Has concentration data been corrected for blank values? This information should be given in the manuscript.

- P1451 L20-24: Experimental evidence on the semi-volatile behavior of dicarboxylic acids is available in the literature, thus a repartitioning of oxalic acid could indeed be a

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plausible explanation (which has, however, not only been suggested in the cited paper, see e.g. Yao et al., 2002; Mochida et al., 2003). However, it is not the only possible reason. Gas-phase formation of oxalic acid and subsequent preferential condensation onto more alkaline larger particles as well as a sea-salt source or a soil source of oxalic acid could both lead to a similar shift in the MMAD of oxalate. These sources can be expected to be high in summer (due to high photochemical activity and dry conditions), which would be consistent with Fig. 3. See e.g. van Pinxteren et al., 2014 and Rinaldi et al., 2011 for discussions on these sources.

- P1452 L22-23: What about other possible reasons for the bi-modality in supermicron particles, e.g. separate dust/soil and sea-salt modes? Can these be ruled out?

- P1455 L21-23 and Figure 5b: The fit of this relationship to the experimental data is rather poor. Below an x-axis value of about 20 (where actually the majority of data points lie), equation 1 does not fit the data at all and even at larger values the scatter is very large and the good R squared is only obtained due to few data points with relatively large values. I am not convinced this relationship is robust enough to be used in any models which questions the benefit of presenting it even in the abstract.

- Section 3.3.1: Why is only sulfate included in the PMF analysis? According to the equation given on P1458 L9 on the minimum sample size for statistically reliable results, the authors could easily include more of their measured species, especially if grouped into appropriate size ranges as done for sulfate. It would be interesting to see, how other measured species load onto the factors and more species might even help to resolve or identify more sources (see e.g. van Pinxteren et al., 2014).

- P1458 L7: Can traffic as a source of CO really be excluded at the HKUST site?

- P1460 L21-22: While coagulation is one possibility, heterogeneous chemistry and/or preferential condensation to more alkaline coarse mode particles could be further options.

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Technical corrections:

- P1446 L14: Opening bracket missing in front of URL
- P1450 L10: “droplet mode” instead of “condensation mode”?
- P1447 L25: Please include manufacturer and model of IC
- P1451 L27-28: as K^+ is chemically inert in a cloud, “in-cloud processing” is not an appropriate term here, in my opinion.
- P1454 L24: Change the arrow in R1 to appropriate equilibrium reaction arrows (two arrows above each other, pointing into opposite directions). The symbol shown is reserved for mesomeric structures in chemistry.
- P1454 L24 and L26: Change liquid to aqueous, as it is not synonym for aerosol particles
- Figure 2: Hardly readable in the present form. Please make sure it will be printed much larger in the final manuscript.
- Figure 4: Include dot in PM_{2.5} in x-axis label
- Figure 5b: Opening bracket missing in x-axis label

References:

Fujitani, Y., Hasegawa, S., Fushimi, A., Kondo, Y., Tanabe, K., Kobayashi, S., and Kobayashi, T. (2006), Collection characteristics of low-pressure impactors with various impaction substrate materials, *Atmos. Environ.*, 40(18), 3221-3229.

Marjamäki, M., and Keskinen, J. (2004), Effect of impaction plate roughness and porosity on collection efficiency, *J. Aerosol Sci.*, 35(3), 301-308.

Marple, V. A., Rubow, K. L., and Behm, S. M. (1991), A microorifice uniform deposit impactor (MOUDI): Description, calibration, and use, *Aerosol Sci. Technol.*, 14, 434-446. Mochida, M., Umemoto, N., Kawamura, K., and Uematsu, M. (2003), Bimodal

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size distribution of C-2-C-4 dicarboxylic acids in the marine aerosols, *Geophys. Res. Lett.*, 30(13), Artn 1672.

Rinaldi, M., Decesari, S., Carbone, C., Finessi, E., Fuzzi, S., Ceburnis, D., O'Dowd, C. D., Sciare, J., Burrows, J. P., Vrekoussis, M., Ervens, B., Tsigaridis, K., and Facchini, M. C. (2011), Evidence of a natural marine source of oxalic acid and a possible link to glyoxal, *Journal of Geophysical Research*, 116(D16).

van Pinxteren, D., Neusüß, C., and Herrmann, H. (2013), On the abundance and source contributions of dicarboxylic acids in size-resolved aerosol particles at continental sites in Central Europe, *Atmospheric Chemistry and Physics Discussions*, 13(12), 32093-32131.

Yao, X. H., Fang, M., and Chan, C. K. (2002), Size distributions and formation of dicarboxylic acids in atmospheric particles, *Atmos. Environ.*, 36(13), 2099-2107.

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