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Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "Investigating the influences of $SO_2$ and $NH_3$ levels on isoprene-derived secondary organic aerosol formation using conditional sampling approaches" *by* Y.-H. Lin et al.

**Anonymous Referee #1**

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General comments

This manuscript describes field measurements aimed at understanding the potential role of ambient SO2 and NH3 concentrations in affecting the formation of isoprene-derived SOA tracers. Aerosol samples were collected for low and high SO2 and NH3 levels and analyzed by gas chromatography electron ionization mass spectrometry (GC/EI-MS) and ultra-performance liquid chromatography electrospray ionization high resolution quadrupole time of flight mass spectrometry (UPLC/ESI-HR-Q-TOFMS). Six isoprene-derived tracers were quantified and were found to be enhanced under high

SO2 conditions, which is suggestive that SO2 is supplying the acidity necessary for acid-catalyzed formation of the tracers. However, the tracers were not found to be strongly correlated to NH3 levels or to the calculated aerosol acidity itself. While these findings are somewhat less conclusive about the role of SO2/aerosol acidity than was probably the hope of this study at the outset, the result is quite important because it suggests that the nature of isoprene-derived SOA formation may be influenced by a number of factors. Because the findings are relevant to the construction of accurate chemical mechanisms for the formation of isoprene-derived SOA, the work has been carefully planned and executed, and the manuscript is clearly written, this study is quite appropriate for Atmospheric Chemistry and Physics.

Specific comments

Line 284: I didn't find any mention in the manuscript concerning the (lack of ) detection of IEPOX itself. It seems that the methods and sampling conditions are very similar to those described in Chan et al. 2010b in which IEPOX was first quantified in ambient SOA. It would be helpful for the authors to provide some insight (an upper limit concentration estimate, for example) regarding the lack of detection of IEPOX.

Line 391: The determination of aerosol pH could also benefit from some further elaboration. In particular, the method for the modeling of liquid water content should be described. It's quite surprising that only 6% of the SOA samples were calculated to contain any LWC, especially given that one would expect high RH values during the SOA collection period (the summer months in Georgia).

Line 393: For the pH values that could be determined from the few samples, the values were found to be quite low. For these samples, the IEPOX hydrolysis rate constants from Cole-Filipiak et al., (Env. Sci. Tech., 44, 6718-6723, 2010) indicate IEPOX processing times were less than 1 hour. Therefore, it seems that the acidity (and pH) data indicates that SOA was sampled both during conditions very conducive to IEPOX processing (low pH) and conditions not very conducive to IEPOX processing (neutralized), yet IEPOX was apparently not observed even for SOA that was neutralized (and the tracer product concentrations also seem to indicate significant IEPOX processing under neutralized conditions). Do the authors have an explanation for this apparent conundrum? I wonder if it is possible for a single SOA particle to be on average, neutralized, but to spend enough time as an acidic particle (depending on ambient SO2 and NH3 levels) to allow significant IEPOX processing?

Line 405: It would be helpful to provide some estimate of the SO2 to SO4- conversion time scale for the conditions at Yorkville, and then compare this number to the time scale of the sampling approach.

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Interactive comment on Atmos. Chem. Phys. Discuss., 13, 3095, 2013.