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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Ultraviolet and visible complex refractive indices of secondary organic material produced by photooxidation of the aromatic compounds toluene and m-Xylene" *by* P. F. Liu et al.

Anonymous Referee #1

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Review of "Ultraviolet and visible complex refractive indices of secondary organic material produced by photooxidation of the aromatic compounds toluene and m-Xylene" by Liu et al.

The authors report measurements of real and imaginary refractive indices for secondary organic matter derived from photooxidation of toluene and m-xylene with different levels of NOx. They find that the SOMs are somewhat absorbing even with zero NOx, but that the extent of absorption increases with NOx. Overall, the paper is

well presented and straight-forward. I can recommend publication, once the authors address the comments below.

My primary concern is that it is a bit difficult to tell when the derived refractive indices (in particular, the imaginary components) come from the ellipsometry measurements or the methanol extracts. This needs to be clarified. I am not certain that the methanol extracts are used at all.

Also, it should be noted more clearly that these measurements were made for SOM produced at very high mass loadings. There is some evidence in the literature that the refractive indices of SOM depend on mass loading (Kim et al., 2012;Kim and Paulson, 2013).

Additional comments follow below.

P20588/L18: I suggest also including the VOC/NOx ratio (ppbC/ppbNOx) for reference when discussion "high" NOx conditions. The "high" vs. "low" paradigm is really related to the fate of peroxy radicals: do they react with NO or with something else? This depends not on the absolute NOx, but more-so on the VOC/NOx ratio.

P20590: It is not clear if the uncertainty in k reported as 15% applies just to that derived from the UV-Vis spectroscopy of the extracts, or the ellipsometry measurements as well. If it does not apply to the ellipsometry, what is the uncertainty for that method?

P20591/Fig. 2: It is unclear if these k values are from ellipsometry or from UV-Vis of extracts.

P20594/L4: Should state "The FT-IR spectra. . ." not just "The spectra. . ."

P20594/L5: I suggest the sentence starting "This similarity. . ." be changed to "This similarity suggests that the oxygen-containing functional groups, excluding nitrogen-containing groups, are not substantially different between SOM produced at the different NOx concentrations."

Section 3.4: I find the figure associated with this section (Fig. 8) to be a bit confusing. The authors are assessing the optical effects of brown carbon from anthropogenic sources, but these need to be better understood in the context of the BC contributions. By plotting the SSA values separately for brown and black carbon (+ sulfate) it is difficult to really understand the importance of the brown carbon absorption. Just as the authors specify different BC/Sulfate ratios, I think that this might be better if the authors also specify different BC/OA mass ratios (or BC/BrC ratios) and plot the resulting overall SSA for the combined system. There will be some point where the BC/OA ratio is sufficiently large that the contributions of BrC start to become noticeable/important. The authors should be able to bound this based on their low vs. high NOx characterization. Put another way, if BC/BrC = 1, then BrC probably doesn't much matter. But if BC/BrC = 0.1, then BrC will alter the SSA. This is what doesn't quite come through in the current presentation. However, they might also want to consider that OA from urban sources does not only come from aromatics, but also from alkanes. Alkanes are likely to form SOA that is comparably much less absorbing.

Kim, H., Barkey, B., and Paulson, S. E.: Real Refractive Indices and Formation Yields of Secondary Organic Aerosol Generated from Photooxidation of Limonene and α-Pinene: The Effect of the HC/NOx Ratio, J. Phys. Chem. A, 116, 6059-6067, 2012, doi:10.1021/jp301302z.

Kim, H., and Paulson, S. E.: Real refractive indices and volatility of secondary organic aerosol generated from photooxidation and ozonolysis of limonene, α-pinene and toluene, Atmos. Chem. Phys., 13, 7711-7723, 2013, doi:10.5194/acp-13-7711-2013.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 20585, 2014.