Atmos. Chem. Phys. Discuss., 13, C2772–C2775, 2013
www.atmos-chem-phys-discuss.net/13/C2772/2013/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Real refractive indices and volatility of secondary organic aerosol generated from photooxidation and ozonolysis of limonene, α-pinene and toluene" *by* H. Kim and S. E. Paulson

H. Kim and S. E. Paulson

hwajinkim0116@gmail.com

Received and published: 24 May 2013

Please note that a revised manuscript is also attached to is reply

Overall Response We appreciate the insightful and helpful comments of the referee concerning this manuscript. These comments have helped us clarify and substantially improve the manuscript. We have also conducted additional work requested by the reviewer, and have addressed each of the points raised by the reviewer as discussed in detail below. Reviewer 2 Specific Comments 1. Page 1958, lines 6-10: Since your

gravimetric mass measurements are always significantly higher than the SMPS mass it would probably be a good idea to try using a Teflon filter, which does not adsorb organics, to be certain that adsorption is the reason for the difference and not something else.

Thanks for the comments. We will consider using Teflon filters in the future.

2. Page 1963, lines 14-17: I do not understand why the observed TD behavior indicates the formation of SOA layers or the decomposition of oligomers. Please elaborate.

On thinking about this more, we decided to remove the statement altogether. While the mostly reversible behavior observed upon heating seems to support a simple explanation such as layering and lack of mixing or irreversible reactions that then readily return to their original state, such an explanation requires more careful consideration of the timescales involved, and ideally, more chemical composition data. As a result, we have removed the discussion from the manuscript. It now reads "While the observed TD behavior is consistent with a model for aerosol growth in which more volatile species are deposited on lower volatility species as the experiments progress (Cappa and Wilson, 2011 and references therein), other explanations, such as reversible in-particle reactions and reversible internal mixing are also quite plausible." Reviewer 2: 3. Page 1965, lines 20-24: Since light scattering is sensitive to particle size, and this is also highly uncertain in atmospheric models, I suggest stating what difference in particle size would change light scattering by an amount comparable to a difference in refractive index between 1.44 and 1.55 (the thermo-denuded SOA), and between 1.35 and 1.61 (the original SOA). This will give readers a better sense for the accuracy with which refractive index needs to be known.

It is an excellent question, and like a lot of such questions, the answer is "it depends". We have expanded the paragraph in an effort to express this clearly, as follows: "Changing the refractive index from 1.4 to 1.5 decreases the asymmetry factor by 0.067, which in turn changes radiative forcing by at least 12-19 % for non-absorbing

ACPD
13, C2772–C2775, 2013

aerosol (Marshall et al. 1995; Andrews et al. 2006; Kim et al. 2010). Aerosol extinction in the atmosphere is a function of several parameters, including size distribution, mass concentration, and the mixing state of particles, in addition to the optical properties of the components, as demonstrated by Yu et al. (2012). For sizes smaller than about 0.4 μm, extinction is much more sensitive to size than refractive index or other properties. Nevertheless, for particles of fixed size in the 0.3 μm – 0.4 size range, Yu et al. (2012) found that changing the refractive index from 1.33 to 1.53 changed aerosol extinction by about a factor of 2, for both particles with black carbon cores and particles without cores."

Technical Comments 1. Page 1953, line 17: I think this is supposed to be "both O3 and OH"

Thank you. This has been corrected.

2. Page 1961, line 25: I think this should be "generated from"

Thank you. This has been corrected

3. Page 1962, line 20: I think this should be "consistent with"

Thank you. This has been corrected C863 4. Table 2, bottom sentence: I think cyclohexane suppresses reactions of OH with the alkene but does not suppress OH formation

Thank you. This has been corrected

Andrews, E., P. J. Sheridan, M. Fiebig, A. McComiskey, J. A. Ogren, P. Arnott, D. Covert, R. Elleman, R. Gasparini, D. Collins, H. Jonsson, B. Schmid and J. Wang (2006). "Comparison of methods for deriving aerosol asymmetry parameter." Journal of Geophysical Research-Atmospheres 111(D5). Kim, H., B. Barkey and S. E. Paulson (2010). "Real refractive indices of alpha- and beta-pinene and toluene secondary organic aerosols generated from ozonolysis and photo-oxidation." Journal of Geophysical Research-Atmospheres 115: 10. Marshall, S. F., D. S. Covert and R.

ACPD

13, C2772–C2775, 2013

J. Charlson (1995). "Realationship between asymmetry parameter and hemispheric backscatter ratio - implications for climate forcing by aerosols." Applied Optics 34(27): 6306-6311.

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/13/C2772/2013/acpd-13-C2772-2013-supplement.pdf

---

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 1949, 2013.