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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Seasonal cycle and temperature dependence of pinene oxidation products, dicarboxylic acids and nitrophenols in fine and coarse air particulate matter" *by* Y. Zhang et al.

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Referee General Comment:

This is a very well-written paper with a good overall structure. The paper is original enough and scientiïňAçcally sound. I agree on the comment by the ïňAçrst reviewers, in addition to which I have a few very minor issues for the authors to consider.

Response:

We thank Anonymous Referee #2 for the review and the positive evaluation of our manuscript. The constructive suggestions for improvement are very welcome and will be implemented upon revision. Detailed responses to the individual comments are given below.

Referee Specific Comment 1:

Page 13255, line 8: I am pretty sure that dicarboxylic acid may constitute more than 1 per cent of total aerosol mass in some remote environments. Please check out.

Response:

The sentence "The total dicarboxylic acids account for 0.06–1.1% of the total aerosol mass and oxalic acid, malonic acid and succinic acid (C2–C4) are the most abundant species in the dicarboxylic acid group (Kawamura and Ikushima, 1993) (Kawamura and Ikushima, 1993)." will be revised as "The total dicarboxylic acids account for 0.3-11% of WSOCs (Pavuluri et al., 2010) and reference therein)and oxalic acid, malonic acid and succinic acid (C2–C4) are the most abundant species in the dicarboxylic acid group (Kawamura and Ikushima, 1993)."

Referee Specific Comment 2:

Page 13255, lines 27-28: Please specify explicitly which generation products the compounds referred to here are (ïňĄrst, second or higher up in the oxidation chain).

Response:

Because the full oxidation mechanism of α-/β-pinene is still not clear, it is difficult to exactly specify all first- or second-generation products. The statement "Further reaction of the ïňĄrst-generation oxidation products of pinene leads to highly oxidized, acyclic, polar compounds (Jaoui et al.,2005). Among the second-generation products of pinene photooxidation is 3-methyl-1,2,3-butanetricarboxylic acid (3-MBTCA), which is formed by OH-initiated oxidation of cis-pinonic acid (Szmigielski et al., 2007) and was ïňĄrst detected in aerosol samples from Amazonia and Belgium (Kubatova et al., 2000, 2002)." will be revised as "Further reaction of the initial oxidation products of pinene

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leads to highly oxidized, acyclic, polar compounds (3-hydroxyglutaric acid and 3-methyl-1,2,3-butanetricarboxylic acid (3-MBTCA)) (Szmigielski et al., 2007;Kourtchev et al., 2009;Jaoui et al., 2005). 3-MBTCA is formed by OH-initiated oxidation of cis-pinonic acid (Szmigielski et al., 2007) and was ïňĄrst detected in aerosol samples from Amazonia and Belgium (Kubatova et al., 2000;Kubatova et al., 2002)."

Referee Specific Comment 3:

Page 13260, beginning of section 3.1: Maybe one should emphasize here that this study does not report usually the most common dicarboxylic acids (oxalic, succinic and malonic acid). Otherwise, the reader may get the wrong impression that concentration levels of all dicarboxylic acid tend to be extremely low as compared, for example, the total WSOC concentration.

Response:

The phase "all dicarboxylic acids" will be revised as "a series of linear dicarboxylic acids with 5 to 16 carbon atoms as well as phthalic acid".

Referee Specific Comment 4:

The analysis of Arrhenius-type temperature dependence in section 3.3 is very interesting, especially since the author attempt to combine the inïňĆuence of temperature on emissions, reactions rates and gas-particle partitioning. The authors could elucidate a bit whether someone has made similar type of a combined analysis earlier, or whether this is the ïňĄrst analysis of that kind.

Response:

Thanks. For clarification we intend to reformulate the second paragraph of the conclusions section as follows: To our knowledge, this is the first study to explain field observations of pinene oxidation products (pinic acid, pinonic acid, 3-MBTCA) with a model analysis of the temperature dependencies of emissions, gas-particle partitioning and chemical reactions. The model calculations suggest that the OH radical concentration

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Reference:

Jaoui, M., Kleindienst, T. E., Lewandowski, M., Offenberg, J. H., and Edney, E. O.: Identification and quantification of aerosol polar oxygenated compounds bearing carboxylic or hydroxyl groups. 2. Organic tracer compounds from monoterpenes, Environmental Science & Technology, 39, 5661-5673, Doi 10.1021/Es048111b, 2005. Kawamura, K., and Ikushima, K.: Seasonal changes in the distribution of dicarboxylic acids in the urban atmosphere, Environ. Sci. Technol., 27, 2227-2235, 1993. Kourtchev, I., Copolovici, L., Claeys, M., and Maenhaut, W.: Characterization of atmospheric aerosols at a forested site in central europe, Environ. Sci. Technol., 43, 4665-4671, 2009. Kubatova, A., Vermeylen, R., Claeys, M., Cafmeyer, J., Maenhaut, W., Roberts, G., and Artaxo, P.: Carbonaceous aerosol characterization in the Amazon basin, Brazil: novel dicarboxylic acids and related compounds, Atmos. Environ., 34, 5037-5051, 2000. Kubatova, A., Vermeylen, R., Claeys, M., Cafmeyer, J., and Maenhaut, W.: Organic compounds in urban aerosols from Gent, Belgium: characterization, sources, and seasonal differences, Journal of Geophysical Research-Atmospheres, 107, 8343, doi:10.1029/2001JD000556, 2002. Pavuluri, C. M., Kawamura, K., and Swaminathan, T.: Water-soluble organic carbon, dicarboxylic acids, ketoacids, and alpha-dicarbonyls in the tropical Indian aerosols, Journal of Geophysical Research-Atmospheres, 115, D11302, doi 10.1029/2009jd012661, 2010. Szmigielski, R., Surratt, J. D., Gomez-Gonzalez, Y., Van der Veken, P., Kourtchev, I., Vermeylen, R., Blockhuys, F., Jaoui, M., Kleindienst, T. E., Lewandowski, M., Offenberg, J. H., Edney, E. O., Seinfeld, J. H., Maenhaut, W., and Claeys, M.: 3-Methyl-1,2,3-butanetricarboxylic acid: an atmospheric tracer for terpene secondary organic aerosol, Geophys. Res. Lett., 34, L24811, doi:10.1029/2007GL031338, 2007.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 13253, 2010.