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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The effect of photochemical ageing and initial precursor concentration on the composition and hygroscopic properties of β-caryophyllene secondary organic aerosol" *by* M. R. Alfarra et al.

Anonymous Referee #1

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The authors present composition and hygroscopicity results from the photooxidation of beta-caryophyllene/NOx secondary aerosol formation. The beta-caryophyllene precursor is known to be very reactive and readily form secondary aerosol. The authors report photochemical SOA yields up to 45%. Gas-phase organic compounds are speciated with a CIR-TOF-MS. LC-MS/MS from filter extracts is used to identify condensed phase compounds. Elemental rations, O/C and H/C from AMS C-TOF measurements are also reported for condensed phase products. The authors conclude that O/C ratios

are dependent on initial precursor concentrations. Photooxidation reactions produce more complex SOA and are pronounced in studies formed at lower initial precursor concentrations. No significant measurable changes in SOA hygroscopic properties were observed.

The authors present a nice introductory overview on the importance of beta-caryophyllene studies to particulate mass formation and summarize the state of knowledge on SOA formation. The document is well written and provides some new evidence into the photo-oxidative chemistry of beta-caryophllyene SOA. However many of the species identified during the photo-oxidation process are similar to dark ozonolysis products; and direct correlations with previously published material is often not highlighted in the text. There are other significant lapses in information. The reviewer has a few concerns that once addressed will strengthen clarity and the quality of the paper.

MAJOR CONCERNS

P2442 L5 states "VOC measurements. . .were only made during two of the higher initial concentration experiments." How do the authors calculate VOC values in Table 1a for the lower initial concentration experiments? What is meant by Nominal Concentration? Is it the estimated/predicted concentration?

The discussion on CCN properties of the aerosol is significantly lacking. Where are Kappa values in Table 1a (P2455 L11)? It is not clear how kappa values are calculated or where they are presented. How do the authors calculate kappa from their Growth factors? The authors describe different supersaturations were applied (P2443 L 24) in CCN measurements. What were these supersaturations? Are these the calibrated values? Though the description maybe mentioned in another paper, it necessary to describe the protocol in light of the results presented here.

P2446 L25. "see Sect. 3.5 for further discussion." Where is the discussion of the pre-treatment of semi-volatiles in relation to DMPS and AMS mass results mentioned?

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Specifically, section 3.5 describes the semi-volatile effects on hygroscopicity and CCN measurements. Little or no discussion is provided on the discrepancies of the SOA yields. Are the DMPS and AMS sampled at different temperatures? Are the temperatures significantly different to cause such a bias (2 to 3 times larger in the AMS)?

P2452 L 27. The authors compare LC data from one high and one lower initial concentration experiment. The results are interesting and unique. However, are the ratios for these select experiments replicated in other combinations of high to low experiments? What is the standard deviation in these ratios? How much deviation exists between the experiments. It is mentioned that the authors check for consistency in daily variation but there is little or no discussion in the consistency between experiments. Which experiments were selected for the comparison presented?

MINOR CONCERNS

P2442 L1. Insert the word “after”? i.e., “in this case after 2 and 6h”

P2445 L23. Change “min” to “minutes”?

P2442 L15/ “subsequent experiments have achieved. . .” Which experiments are the authors referring to if not in this study? It is not clear to the reader why this statement is relevant to the current discussion.

Table 1. What is SD? Standard Deviation?

Fig. 6. It seems that the inset figure is a repeat of the larger figure. Is it possible to just zoom in on the pertinent data and have one figure? Does the entire “triangle” need to be seen?

Table 3. The authors should provide m/z or names of compounds listed in Table 3 to guide readers.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 2435, 2012.