

Interactive comment on “Temperature and humidity dependence of secondary organic aerosol yield from the ozonolysis of β -pinene” by C. Stenby et al.

Anonymous Referee #1

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General Comments

The paper presents experimental investigations of the temperature and relative humidity effects on the formation of secondary organic aerosol (SOA) from ozonolysis of β -pinene in a flow tube reactor. A wrong representation of the temperature dependence of SOA yields has previously been suggested as one reason for the discrepancies found between field observations of organic aerosol and model predictions. Thus the topic is appropriate and interesting for ACP. One major finding of the paper is the difference of the temperature dependence of SOA yields when going from dry to humid conditions. While the results under dry conditions show a not explained oscillating

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and on average negative dependence on temperature, under humid conditions a positive temperature dependence was found. The authors conclude that SOA yields are affected by details in the chemical pathways which depend on temperature and humidity. These need to be taken into account in modeling SOA formation as well as the temperature dependence of gas-particle partitioning. The authors should consider the following points.

Since the b-pinene concentration seems to be measured in the gas mixture prepared for the experiments only, the concentration measurements there would deserve a more detailed mentioning in section 2.1. Together with exact flow measurements and ozone concentrations these are the crucial data for the determination of the consumed b-pinene.

The formula used to account for particulate water in the humid experiments (equation 4) was derived from experiments conducted at 50 % RH with SOA formation from photooxidation of b-pinene in the presence of seed aerosols in a smog chamber. The authors (Varutbangkul et al. 2006) had found indications that the GF changes with elapsed time which was interpreted as indication for oligomerisation and/or ongoing oxidation in the particulate phase. Furthermore the parameters for the GF had been determined for particles with 180nm diameter. The extent to which these results can be transferred to the situation in the flowtube, where oxidation is dominated by O₃, the residence time is at maximum 40s and the number distribution has a mode diameter of 20nm to 40 nm depending on temperature is questionable. Since one of the major conclusions of this paper is, that the SOA yields depend critically on the reaction mechanisms in the gas and particulate phase, one would expect the composition of the SOA to be temperature and humidity dependent as well. It should at least be mentioned that the approach of using one parameterization of the GF for all temperatures and humidities is a simplification. If possible the authors should justify this simplification with observations. Please also correct the formula used - the multiplication sign is missing.

The size distribution shown in figure 3 for 273K leads to a bimodal volume distribution

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reasons for this should be discussed in the text. The size distributions not only show a decrease in number with decreasing temperature but also an increase in geometric standard deviation. Together with the decrease in number concentration this can be used as constraints in the interpretation of why the number concentration decreases with decreasing temperature.

Specific Comments

Page 2094 line 11: reaction 2a was not defined, nor was a reaction1.

Page 2099 line 19: variable $i=2$ is designated to both low volatile and semi-volatile species.

Page 2105 discussion of discrepancies with Hoffmann et al.: if the main reason for the differences observed is a wrong determination of the consumed β -pinene in the data discussed here, the order of magnitude of corrections which have to be applied to receive the correct values from Hoffmann et al. can be given. Is it reasonable to assume that the uncertainty in KO_3 is large enough to bring the two experiments into agreement?

Page 2106 line 7: “figure 3” is wrong here.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 2091, 2007.

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