

## ***Interactive comment on “Effect of relative humidity on SOA formation from isoprene/NO photooxidation: role of particle-phase esterification under dry conditions” by H. Zhang et al.***

**Anonymous Referee #1**

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This paper presents interesting results on the effect of humidity on the yield of secondary organic aerosol of isoprene and on composition. Formation of SOA under dry conditions leads to a higher SOA yield and seemingly more oligomers compared to higher RH conditions. On the other hand organosulfates were enhanced under high RH conditions. These experiments are interesting and deserve publication in ACP. Yet, I have some major concerns regarding data evaluation and interpretation which might put into question some of the conclusions of the manuscript. These issues have to be addressed by the authors before publication.

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SOA yield:

The authors determine the SOA yield from SMPS data. Figure 1B shows similar particle size distributions for the dry and humid experiment at the beginning of the experiment. In Figure 1A the time trend of the mass concentration of the particles is shown where the dry experiment exhibits a much larger increase. From the experimental description it is not clear if the SMPS measurements were done with dried aerosols. If not, increasing temperature during the experiment decreases RH and thus the water content of the particles. Therefore, starting with a similar size distribution for the dry and humid experiment, the size distribution of the high RH experiment would decrease with increasing temperature which results in a lower particle mass concentration. If the measurements were done without drying the aerosol, the determination of SOA mass concentrations is flawed as described. The authors claim to show wall loss corrected data. How was this done? Why does particle mass concentration decrease after the maximum? Is there a dilution flow? The numbers given in Table 1, reported in the text (Page 9, last paragraph) and observed from Figure 1 are not consistent. For example, the initial particle concentration of the experiment 2010OCT21N is 29.8  $\mu\text{g}/\text{m}^3$  in Table 1 and text but larger as seen from Figure 1. The maximum SOA mass concentration is 40.5  $\mu\text{g}/\text{m}^3$  (Table 1) but only 37.1  $\mu\text{g}/\text{m}^3$  (66.9 – 29.8) in the text.

Unknown tracer The large enhancement of the unknown tracer in the 2010OCT21N experiment could also be an artifact (Page 11, line 244). Looking at the other compounds one finds the ratio between high and low concentration experiments to be similar for dry and humid experiments respectively. Only the tracer compound strongly deviates. The tracer does not only correlate with 2-MG but with all other compounds (Page 13, line 296). Thus the correlation with 2-MG does not necessarily support the hypothesis of a C<sub>4</sub>H<sub>7</sub>NO<sub>6</sub> compound. Furthermore, the unknown tracer does not need to be C<sub>4</sub>H<sub>7</sub>NO<sub>6</sub> (Page 14, line 308) as e.g. C<sub>5</sub>H<sub>11</sub>NO<sub>5</sub> also has a MW of 165. This is a C<sub>5</sub> compound and would not be a product of MPAN chemistry. There is no proof that MPAN is the precursor of this unknown tracer as claimed on Page 15, line 336.

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Technical Comments: Page 4, line54: insert “of” at the end of the line Page 7, line 133: replace steam by stream Page 9, line 192: Figure 1A shows the second set of experiments not the first one

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