

## ***Interactive comment on “Photooxidation of cyclohexene in the presence of SO<sub>2</sub>: SOA yield and chemical composition” by Shijie Liu et al.***

### **Anonymous Referee #4**

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This manuscript presents interesting new results on atmospheric reactions of photooxidation of cyclohexene in the presence of SO<sub>2</sub>. Unfortunately the quality of the presentation is not suitable for publication in ACP regarding scientific discussion and interpretation of results. The manuscript must be rewritten to discuss the results from a more objective, scientific point, which to a higher degree takes data uncertainty into account before reaching conclusions. Furthermore, there are many grammatical errors.

In the following I have explained some of the major points.

**Introduction** The introduction should include more references to relevant previous work. One example is in line 23 page 1, where only one study (on measurement methods for VOC from vehicles) is used as reference for the general statement about emission of alkenes from biogenic and anthropogenic sources. The reference Jimenez et al.

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(page 1 line 28) on reactions of polyfluorinated compounds is not relevant for a general statement on SOA formation in the atmosphere, and it should thus be removed. On page 2 (lines 27-30) it is stated that a substantial amount of organosulfates have been observed. Most measurements estimate up to 10% of aerosol mass, and typically much lower in most places, which in my opinion is not a "substantial amount". Why so much focus on organosulfate formation from MBO, which is typically not found in high concentrations? Page 2 lines 11-21: This section has a good number of relevant references.

Experimental Page 4 line 8: The VOC/NO<sub>x</sub> ratio was not about 5, but varied from 4.4 to 7. Section 2.3: Why were only aerosols in the range 108-650 nm collected? Were samples for FTIR and SOA analysis collected right after each other? What was the limit of detection of the IC analysis?

Results and discussion Section 3.1 should be moved to the experimental section.

Section 3.2 Page 6 line 22. The trend is not clear, especially regarding maximum particle number, which shows quite some scatter. Page 6 line 26-32: The conclusions in this section are beyond what I see in the data, given the scatter. Why are some of the experiments not shown in Figure 1? Only 11 out of 17 experiments can be seen. Page 7 lines 1-4: This discussion is very unclear.

Page 7 line 11: It is of course difficult to reproduce concentrations of VOC and NO<sub>x</sub> in an experiment, which is also clear from the present work. Therefore the statement of "similar" conditions is too strong. VOC concentration varies from 472 to 665 ppb, which also affects SOA formation to some degree (seen by plotting the data presented here). Page 7 line 18-19: This seems speculative. Page 7 line 22-23: This meaning is unclear.

Section 3.3. Page 7 line 30: According to your data in Table S1 the SOA yield without SO<sub>2</sub> present was 2.7-3.4%, not 2.5-2.7% as stated here.

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Page 8 line 10: The ratio was 4.4-7 according to Table S1, not 5 as stated here.

Figure 2. The SOA yield shows a trend, but only to some degree, since the values for low SO<sub>2</sub> concentrations are somewhat scattered, while experiments at high concentrations have not been repeated. This means that conclusion about a trend in the data is based on very few data points at high SO<sub>2</sub> concentrations. The discussion e.g. on page 8 lines 23-31 should be revised considerably with this in mind.

page 9 line 1-3: Which experiments were with NO and which with NO<sub>2</sub>?

Section 3.4 Please distinguish between sulfonate and organosulfate and make this more clear in the text. Figure 3: The line for ratio should be removed as it is based on very few data points. Figure 5: This figure is very confusing. Some data points are placed on top of each other. Information on the secondary axis (scale + label) is missing. Furthermore the uncertainty on the measurements should be presented. I suggest to make two figures instead of one.

Page 10 line 30- and Figure 6: Did the composition and response of organosulfates vary between samples?

In conclusion, some of the results are interesting, but the quality of the presentation and discussion is not adequate for publication of this work in ACP.

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