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Interactive comment on “Impact of NO_x and OH on secondary organic aerosol (SOA) formation from β-pinene photooxidation” *by* Mehrnaz Sarrafzadeh et al.

Anonymous Referee #1

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In this manuscript Sarrafzadeh et al. conducted experimental studies of SOA formation from beta-pinene photooxidation. Specifically they controlled the levels of NOx and OH systematically and identified the role of each factor independently. NOx and OH are often coupled and it is generally difficult to separate the individual roles of these 2 species, but the authors have done so successfully and carefully in the work presented here. The end result is that after controlling for OH, NOx (and more likely NO) decreases SOA yield. The authors also investigated the role of NPF in contributing to SOA formation. The experiments are well designed and the results are thoroughly interpreted. I recommend that this manuscript be published in ACP after considering the following minor comments:

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- The authors postulate that OH increases SOA yield by accelerating the oxidation and leading to lower volatility products (page 12, lines 7-17). One way to investigate this hypothesis is to compare SOA yields at the same extent of reaction, or OH exposure. This will require repeating the experiments and adjusting the flow rates to achieve the same extent of reaction.

- In many instances (such in the abstract pg. 2 line 16-17), the authors mentioned that SOA yields decrease *because of* suppressed new particle formation (NPF). To be more precise, that should be reworded to “SOA yields decrease because of limited available particle surface area.”

- Also, the section on how to correct for ELVOC in the SOA yields is unclear. More details are needed in page 7 lines 13-20. How are the loss rates of ELVOCs on walls and on particles determined? Are they experimentally determined with CIMS?

- When controlling OH concentrations, the shortwave UV radiation is varied to change J(O1D). Is there any indication that changing the shortwave UV changes SOA? Many aldehydes can potentially photolyze in that range of wavelengths.

- Does NO3 play a role in the differences in SOA yields? In Section 2.1, JNO2 is computed. Similarly, JNO3 should be computed so as to ensure that NO3 plays a minor role, since changes in radiation or in O3 may result in differences in NO3, which can react with beta-pinene rapidly.

- pg. 9 lines 11-12: how are ammonium sulfate particles generated? Presumably using an atomizer? The apparatus should be mentioned.

- pg. 10 line 8: "differed" should be "different"

- I find this notation confusing: J(O1D) refers to the photolysis rate of O3 to form O1D (and not the photolysis rate of O1D), but J(NO2) refers to the photolysis rate of NO2. This notation seems inconsistent.

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