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Comment on acp-2021-951

Anonymous Referee #1

Referee comment on "Functionality-based formation of secondary organic aerosol from *m*-xylene photooxidation" by Yixin Li et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-951-RC1, 2022

Li et al. proposed a functionality-based approach to predict the formation of secondary organic aerosol (SOA) from m-xylene photooxidation. Four condensable oxidized organics (COO) with distinct functionalities contributing to m-xylene-derived SOA were quantified by simultaneously measuring gas- and particle-phase components. Interfacial uptake, acid-base reaction, and oligomerization were investigated under 10% and 70% relative humidity. A kinetic model was developed to reproduce SOA formation from m-xylene photooxidation. The manuscript is overall well written, and the data analysis is comprehensive. The topic fits ACP, and the derived parameters (yields and uptake coefficients) will benefit the community. I recommend acceptance after some minor revisions.

1. Methodology
I think most of the SI sections can be moved to the main text. ACP has no length limit, and Section 2 should be expanded with details on methods for data analysis, e.g., quantification of products, OH concentration, wall loss, uptake coefficient, model framework, etc.

2. Chemical mechanism and model framework
Using P1, P2, and P3 to represent the products is confusing. At first, I thought Pi was a lumped species, but it turned out to be some specific species. Then the questions are: How does P1 connect to P2 in Table S1? For example, there are 2 P1s and 4 P2s, so there will be eight combinations. Which should be used? What are the corresponding differential equations that lead to Eqs S4 - S12? I would use a table to explicitly show the reactions by highlighting species with different colors corresponding to other generations. If possible, list all the differential equations, including all the processes (chemical reactions, particle uptake, and wall loss), before Eqs S4 - S12.

3. Eqs 2, S3, and S25 missed the correction factor for non-continuum diffusion and imperfect accommodation (Eq 12.43 in Seinfeld and Pandis 2016), which may lower the derived uptake coefficient. Please correct.