Reviewer 1

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.

We are grateful for the positive and constructive comments to our manuscript by this reviewer and have fully addressed the issues raised by this reviewer below

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.

We have now moved the detailed method information from SI to the main text now. Specifically, we have incorporated the SI methods for **Chamber experiments**, **analytical methods**, **uptake coefficient calculation**, **COO yields**, and **SOA mass concentration and yield** into the **Experimental Methodology section**.

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.

Pi represents the ith generation products and accounts for the various species detected by ID-CIMS. The formation of Pi is connected by the chemical mechanism of m-xylene photo-oxidation (Figure S2b). We have now clarified this by providing a sentence and a figure for detailed mechanism linking the formation, uptake, and wall loss of P1 to P3, "Note that P$_n$ represents the lumped product of the nth generation, which is related the sequence of OH addition for m-xylene photooxidation and accounts for the various species detected by ID-CIMS (Figure S2b)." on p. 14.
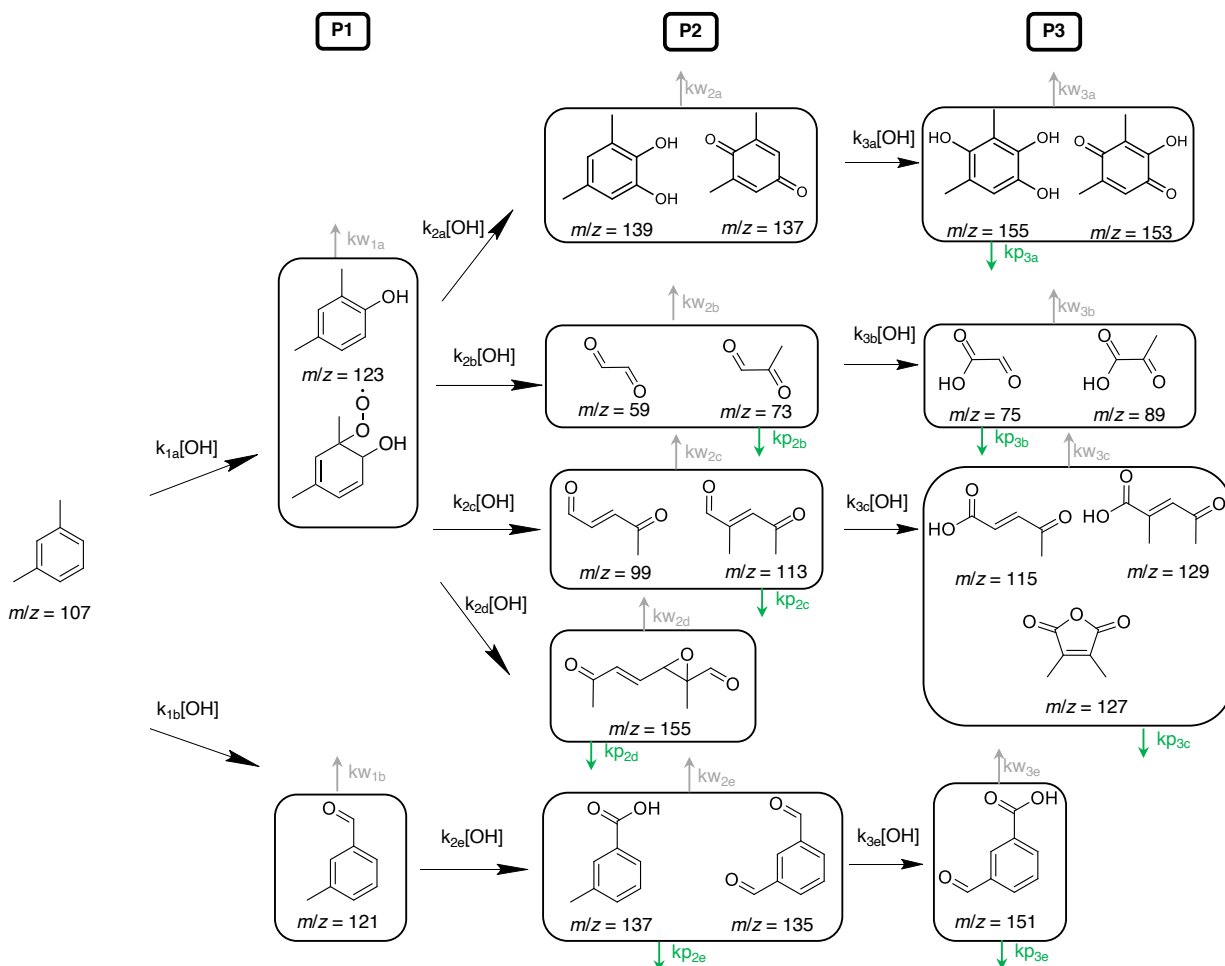
Figure S2b. Multi-generation products from *m*-xylene-OH photooxidation. The letters of P1, P2, and P3 denote the products of first, second, and third generation of reactions with OH, respectively. The species in each box are lumped in the kinetic simulation with their rate constant with OH (k_i), wall loss rate constant (kw_i), and uptake rate constant (kp_i) listed in Table S1. The numbers denote the mass to charge ratio (*m/z*).

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.

According to Seinfeld and Pandis 2016, the correction factor for non-continuum diffusion and imperfect accommodation (f(Kn, α)) are applied for calculation of mass transfer from gas to particles for a transition regime flow when accommodation coefficient of gas is not unity (α<1). In our study, the measured uptake coefficient for each type of COO (γ_i) is directly derived from the measured particle growth (Eq. 9), which implicitly includes the correction for non-continuum diffusion and imperfect accommodation.

We have now clarified on p. 21, "In our study, the measured uptake coefficient for each type COO (γ_i) is derived from the measured particle growth (eqs. 9 and 10), which implicitly accounts for non-continuum diffusion, imperfect accommodation, and evaporation (Zhang et al., 1994; Ravishankara, 1997)"