

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2021-228

Anonymous Referee #2

Referee comment on "Reactions of NO₃ with aromatic aldehydes: gas-phase kinetics and insights into the mechanism of the reaction" by Yangang Ren et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-228-RC2>, 2021

This manuscript presents the results of experimentally determined rate constants for the reaction of NO₃ with a series of aromatic aldehydes. The authors employ two methods of determining the rate constants. Results from the absolute and relative methods are in good agreement, lending weight to the authors' overall findings. The authors first compare results for systems with published rate constant values, and then extend the study to three new systems. Support for the suggested reaction mechanisms using isotope effects and BDEs are convincing. Overall, this study is well-conducted and well-presented. The manuscript is publishable after considering the minor revisions listed below.

Specific Comments

The absolute method of determining the rate constants was repeated four times for each system. The relative method was only duplicated. Another experiment repeating the relative method (n=3) would be preferred.

Line 130: For step one determining the dilution coefficient, were the SF₆ and air continually added to mimic the continual addition of air with N₂O₅ during the experiment? As written, the initial 30 minute observation would seem to determine diffusion. Some rewording could be useful here.

Line 168: Do the authors mean the residuals were minimized?

Figure 2: Panel b does not significantly add to understanding the system and might be removed.

Line 298-299: The overlap of combined error bars is not a valid statistical test or comparison. I recommend removing this statement.

Section 3.1.4: Table S5, which compares this work with previously published experimental values, contains key findings that are discussed in detail in this section. This data is also presented in graphical form in Figure 5 later in the manuscript. The reader would be assisted if immediate access to these data were presented in this section. Solutions could include the following options: the text could referred to both the figure and the table to eliminate continual flipping between the manuscript and the SI, or Table S5 could be relocated to the main text of the manuscript, or combine Table 1 with Table S5. It is also unclear why the authors have selected a different exponent for Figure 5 than what is used in the rest of the manuscript.

Figure 3: The caption is missing a description of the different colors/markers used in the figure. Could the authors please clarify.

Figure S1 (and Table S1): Please include the offset values in the caption as you have done with previous figures. Would it make sense to also list the R^2 values in Table S1? I am assuming the detection sensitivity listed in this table is the slope. It would also be useful to have the uncertainty listed here defined.

Technical Comments

Line 51: "their" is ambiguous in this sentence structure. I would recommend switching the placement of "their" and "aromatic aldehydes" to increase clarity.