

Atmos. Chem. Phys. Discuss., referee comment RC1
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Comment on acp-2021-20

Anonymous Referee #1

Referee comment on "Formation and evolution of secondary organic aerosols derived from urban-lifestyle sources: vehicle exhaust and cooking emissions" by Zirui Zhang et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-20-RC1>, 2021

Review on article <https://doi.org/10.5194/acp-2021-20> by Zhang et al., Formation and Evolution of Secondary Organic Aerosol Derived from Urban Lifestyle Sources: Vehicle Exhaust and Cooking Emission

This article characterizes secondary aerosol formation potential from vehicles and cooking that are two very important aerosol sources in urban areas. The secondary aerosol formation potential from these sources remains poorly characterized, so the topic is timely and important. Experiments done in laboratory and field seem to be comprehensive and novel in many aspects. The article is nicely written and relatively easy to follow, however it would be important to revise the English language. Also, the experiments done and instruments used need to be described better. Also, the PMF results (e.g. how the number of factors was decided, how they were identified, how many factor solutions were tested and why they were not chosen etc) needs to be described better in order for the reader to understand the results.

Detailed comments

L20-21: is the source of SOA the traffic and cooking or city dwellers? please clarify sentence

L24: define POA

L24: what instrument was used to measure SOA/POA in this case? AMS or SMPS?

L26: define "vehicle group" and "cooking group"

L35: replace could with can

L36: I propose reformulating: POA is directly emitted into ambient air through **several sources such as** coal combustion, biomass burning, vehicle exhaust, cooking procedure.

L39: change to: but **models typically fail** to simulate..

L47-49: Please reformulate by changing "would -> can be".

L52: I am not sure if Manchester meets the definition of a Megacity.. please check..

L52: replace lifestyle source with SOA source.

L65: replace Lab with laboratory all through the manuscript

L83, 102: define China V

L102: Is this vehicle or engine that you are using to produce the exhaust? describe the engine/vehicle (manufacturer, model, engine size, aftertreatment, mileage, year, fuel, lubricant oil) in detail. All these have a major impact to SOA formation. Also, if engine, maybe add information that this is not exactly same as vehicle, assuming there is no catalysts (like nowadays almost all have). Please add discussion about the differences between engine produced SOA and vehicle produced SOA.

L102. Acronym GDI should be Gasoline direct injection

L104: please, describe the used sampling and dilution setup in detail. How the dilution air was cleaned? dirty dilution air can be major source of SOA. Was the vehicle exhaust taken directly from tailpipe? and cooking fumes from the room air? if so, what is the influence of this extra dilution/aging in the room air in the case of cooking fumes? For the cooking, maybe explain how the boiling water acts as a blank. Was a blank/zero measurements done for the vehicle? Also, I find it hard to find how these measurement points were

taken. According to table there was 6 points with different OH concentrations, and 3-5 repetitions for each. Please clarify how long each point was, were the results of repetitions averaged? if so, maybe give standard deviations to values in figures/tables to describe the variability between repetitions.

L117: This chapter is quite unclear and missing quite many details. Please, explain the AMS and GoPAM in more detail, e.g. in separate chapters and the rest shortly like it is now.

L120: I think the reference describing Aerodyne instrument should be:

L120: I think the reference describing Aerodyne instrument should be: DeCarlo, Peter F., Joel R. Kimmel, Achim Trimborn, Megan J. Northway, John T. Jayne, Allison C. Aiken, Marc Gonin, et al. "Field-Deployable, High-Resolution, Time-of-Flight Aerosol Mass Spectrometer." *Analytical Chemistry* 78, no. 24 (December 2006): 8281–89. <https://doi.org/10.1021/ac061249n>.

L128: I think this should state that the measured CO₂ concentrations (Model 410i, Thermo Electron Corp.) were used to conduct CO₂ correction for AMS data in order to reduce the CO₂ interference to organic fragments in mass spectra of HR-ToF-AMS.

L125-126: You are saying that "The SMPS-1 determined the mass concentration of POA, while the SMPS-2 determined the mass concentration of aged OA, and their mass difference could be regarded as the SOA.". are these results shown in somewhere?

L143: The ionization efficiency (IE), relative ionization efficiency (RIE) and collection efficiency (CE) were determined individually before data processing. How were these determined? please give the results.

L146-147: please give the range of CE values and average CE value

L147: SOA was defined earlier as SMPS2-SMPS1. How does this results gained from PMF compare to SMPS results?

L177: I don't really understand what this means. Please clarify the sentence: "The mixing and wall loss conditions have already met our experiment needs."

L183: should this be secondary aerosol formation potential?

L184: How do you know the functionalization increased as the photochemical age increased?

L184-185: How the SOA is defined here? is this all mass (POA+SOA) after the go:PAM or is it the SOA separated by PMF or calculated from the SMPS? please, define the terms you use and use them systematically. Include the same information to the figure captions.

L186: define term "mass growth potential"

L191-194: are these aromatics, cycloalcanes, fatty acids etc compounds you measured or found from literature? if literature, please formulate the sentences so that it is clear that this is information found from literature.

L219: please define f43 and f44

L222: remove apparently

L247-249: are the fx fractions average fractions for all measurement points with different OH-exposure and different speeds? maybe give range or standard deviation to describe the variation within the dataset.

Figure/table captions: please, add all necessary information to figure/table caption. E.g. is the shown data average values, are the shown bars standard deviations, which instrument was used to measure data, etc.

Figure 2. Define what data was used for SOA/POA in the figure.