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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Secondary organic aerosol formation from gasoline vehicle emissions in a new mobile environmental reaction chamber" *by* S. M. Platt et al.

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Response to Short Comment on "Secondary organic aerosol formation from gasoline vehicle emissionsin a new mobile environmental reaction chamber" by S. M. Platt et al.

General response:

Dear D.R: Gentner,

Thank you for your comments on our manuscript. As we state in the answer to Anonymous Referee 1, The scope of this paper is to present i) a new facility, the Paul Scherrer Institute mobile smog chamber and ii) demonstrate the utility of this smog chamber by

presenting results which are of value to the scientific community. We state clearly throughout the article that these are results from one vehicle and highlight only that these results clearly merit further study.

Major comments are addressed point-by-point:

(1) Comparison to diesel vehicles: Side by side tests to diesel vehicles would be much more convincing than a comparison to a different study that may have had signiïňĄcant differences in experimental parameters. Furthermore, in the discussion (p. 28365 line 25) and conclusion (pg. 28367, lines 8-9) sections it is not made clear that the diesel results are from a separate study. The comparison is also complicated by the comparison of vehicles from different generations of regulations (Euro 3 vs. Euro 5), added discussion may be helpful.

The fact that results from different studies are included will be made clearer in the revised manuscript. Note that different regulations exist for diesel and gasoline vehicles (as well as different regulations for vehicle size). Euro 3 diesel incorporated limits on PM emissions, while no such limits exist for gasoline cars, even for Euro 5. Furthermore since the diesel vehicle used in the comparison is older it may be expected to be a relatively polluting example., i.e. it may be expected that modern diesel vehicles are cleaner since more stringent regulations are now in place. So far no aging study on diesel exhaust emissions has demonstrated the same degree of SOA formation as is observed from gasoline vehicles (this study and now also Nordin et al 2013). Examples from other studies on exhaust emissions from other gasoline and diesel vehicles can be added to the discussion to the same effect in the revised manuscript.

(2) Sample size: The magnitude of emissions from motor vehicles has a large amount of variability between different vehicles. No single vehicle is "typical" (p.28362, line 10) and the differences between similar age and model vehicles can vary substantially. So, reporting emission factors as a main result and using them as representative values to base conclusions on regarding atmospheric SOA from all motor vehicles is a bit

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tenuous. For example, the statement on pg. 28365 (lines 1-2) is overly-extrapolated relative to the scope of the study

We agree that no single vehicle can be typical of the main fleet and this point will be removed. The statement at p. 28365 L1-2 is only that the results here do not contradict previous results.

Response to other comments

(1) Were the organic aerosol loading effects (shown indirectly in figure 4c as OA + BC) taken into account to get an appropriate SOA yield for comparison to the diesel SOA from the other study? The SOA "EF" shown is not at atmospherically relevant conditions; the partitioning of SOA will be much higher at 200 ug/m3 (shown in figure) than 1-10 ug/m3 in the atmosphere.

It is true that PM concentrations rarely reach such high levels, though in polluted areas they are observed. However even if we accept that partitioning may skew the results toward higher SOA concentrations in this study it would not be enough to account for the relatively high SOA formation observed for this vehicle.

(2) Emission factors shown in figure 4c as the right axis may be confusing for some as they show the EFs changing with age. Emission factors are typically defined at emission and not shown as variable over atmospheric processing. Consider revising.

The above comments address the same issue: that SOA formation is a complex phenomenon influenced by many factors. Therefore the terminology 'SOA emissions factor' will be replaced in the revised manuscript with 'potential SOA formation factor' to reflect the temporal nature of SOA formation and the fact that the SOA observed here is but one of many possible outcomes upon aging of emissions.

References

Nordin, E. Z., Eriksson, A. C., Roldin, P., Nilsson, P. T., Carlsson, J. E., Kajos, M. K., H., H., Wittbom, C., Rissler, J., J., L., and others: Secondary organic aerosol formation

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 28343, 2012.

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