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Atmospheric Chemistry and Physics
Discussions

Interactive comment on "Chamber simulation on the formation of secondary organic aerosols (SOA) from diesel vehicle exhaust in China" *by* Wei Deng et al.

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Q: Deng et al. present results showing that diesel exhaust injected into a smog chamber produces SOA when the lights are switched on. This result is far from unexpected, as previous studies have shown the same. Reading through the article gives the impression that the authors followed a recipe. If anything, the main contribution of this work would be to demonstrate that a diesel car without after treatment is the same in China as anywhere else. Thus, considering ACP's scope '[ACP] is focused on studies with general implications for atmospheric science rather than investigations that are primarily of local or technical interest', I feel that this articles falls under the latter category, particularly with regard to local interest. But perhaps the authors can add something. Therefore, aside from criticism of the article's scope,

Reply: As diesel vehicle exhaust is an important source of air pollutants (including BC) with regional impacts, primary emission of diesel exhaust in China and their secondary products formed during atmospheric aging is an issue of wide concern. Quite opposite to the situation in Europe, in China about 80% of motor vehicles are gasoline-driven. If we change more gasoline cars to diesel ones in the future for the control of surface ozone pollutions in the future, we need to know if SOA formation from diesel vehicle exhaust is the same as that in USA or Europe. This kind of study is necessary in China as the engine technology and fuel quality are quite different. We found SOA/POA ratios much lower than previous studies. We estimated that diesel derived OA dominated over gasoline derived OA in China although number of gasoline vehicles are about 4 times that of diesel vehicles. We noticed that our POA had a higher O/C ratio with less volatility. We also tried to investigate more SOA precursors in the gas phase (like glyoxal and methylglyoxal) and in the particulate phase (like the PAHs).

there are other major issues of concern: Q: The grammar needs improvement throughout. While perfection does not need to be the goal, the language should not get in the way of understanding the research.

Reply: The language of the revised manuscript has been edited by a English native speaker.

Q: I also have a concern regarding data represented in Fig. 2C. The authors use the black carbon (BC) time series to quantify organic aerosol (OA) wall losses. Firstly, looking at the first hour after lights on, BC does not decrease. Despite this, wall lost OA is added (since the raw OA trace is decreasing after around 30 minutes). Secondly, variation in the raw trace does not match variation in the wall loss corrected traces. See for example the small perturbation just after t=-1h, not represented in the wall loss corrected trace. Thirdly, variation in the BC trace is not present in the OA trace for the w=1 case.

Reply: As shown in Figure 2C, after the lights were turned on, the measured OA mass increased, demonstrating significant SOA formed. Moreover, as described in manuscript, the newly formed SOA was coated on preexisting particles; this could enhance the BC mass absorption efficiency and artificially increase the estimated BC concentration (Schnaiter et al., 2005; Shiraiwa et al., 2010). Therefore, BC didn't decrease for first hour after lights on. To eliminate this effect, we corrected the wall loss by using exponential fit to the BC data (equation 4, now is equation 5). Therefore, the variation in BC trace is not presented in the OA trace for the ω=1 case. The data of wall loss corrected OA was 10 min averaged to smooth the curve, therefore, the small perturbation not represented in the wall loss corrected trace. That has been corrected in the revised manuscript.

Q: I also note that Equation 2 (w=0 wall loss) does not give the time dependent suspended OA mass, while equation 3 (w=1) does. Can the authors please provide here an equivalent expression for suspended OA mass as a function of time (i.e. the equation used to calculate corrected OA mass), and give assurance that the data, as calculated, is that which is shown?

Reply: Thank you. We have added an equation (Equation 3 in the revised version) to calculate corrected OA mass: ãĂŰOAãĂŮ_(total,t)= ãĂŰOAãĂŮ_sus (t)+ $\int$ _0t k·ãĂŰOAãĂŮ_sus (t)dt (3)ãĂŮ

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/acp-2016-50/acp-2016-50-AC3-supplement.zip

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