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Atmospheric Chemistry and Physics Discussions

Interactive comment on "

Condensational uptake of semivolatile organic compounds in gasoline engine exhaust onto pre-existing inorganic particles" *by* S.-M. Li et al.

Anonymous Referee #2

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1/ General Comments The paper describes experiments of interaction between organic gaseous emission of a gasoline (LD-SI) engine with pre-existing particles and the consequent formation of OA. Tests were done with diluted filtered exhaust and inorganic, laboratory-generated seed particles. Author's observations also lead to the conclusion that dissolution is the main reason for the uptake (amount of condensed organic mass is proportional to the seed particle mass).

The authors add new an interesting questions to the, already challenging matter of

SOA formation. By suggesting a new path to the formation of OA, their conclusions are lighting an argument which might open further studies with implications in the emission inventories and vehicle emission regulation as well as in sampling procedures described in the legislative protocols.

This paper shows the importance of opening a discussion on the effects of mobile emissions' sources when the exhaust gets in contact with atmospheric air at the exit of the tail pipe and expands. That concerns spark ignition vehicles, but not only. Dynamic conditions -cooling and dilution of the exhaust gas phase- may also introduce further questions about the influence of the ambient temperature and relative humidity in the exhaust evolution when emitted into the atmosphere.

In any case, regardless the importance of the topic discussed in this paper, before concluding the significance of these findings in the regulation of mobile sources' emissions, further considerations and experiments should be necessary (i.e., use diluted non-filtered exhaust in the experiments, extend the study to other engines and fuels as well as different driving conditions). Revision of the accuracy of the emission databases or questioning the emission control policies need more than some indicators of their incorrectness.

2/ Specific Comments 3463- line 22-24; The fact that the exhaust composition from spark ignition gasoline engines is very different to the diesel exhaust, makes this statement inappropriate. One of the negative aspects of diesel exhaust if compared with gasoline is that more nitrogen oxides (NOx) and soot are released, while gasoline vehicles may have higher emissions of HC and CO. The drastically different composition of the exhaust makes, at least, questionable the similarity in the dilution effect and behavior of different exhaust types once in contact to the air and close to the tailpipe. Aftertreatment devices have made those differences smaller but still the engine described here is not one of the latest generations.

3466- line 7-8; This sentence is very imprecise. Description of the engine test requires

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more details. Time and length of the experiments should appear in the table. Some values for "Exposure time" are missing in Table 2/ pg 3483: days 19, 20 and 24th of April (?) The driving conditions, cold/hot start and settings of the engine greatly determine the exhaust composition. Most of the volatile hydrocarbons are emitted immediately after the engine starts running, until the catalyst is active and fully efficient. So experiments which have been done in very different starting conditions may lead to erroneous interpretation. May be the engine still hot when the repetition starts?

3466- line 9-10; The authors study the formation of COM with known laboratory-generated seed and they used diluted filtered exhaust, meaning exhaust gas phase free of the primary exhaust particulate. In view of the content of sulphur in the fuel used in the experiment, it should be very revealing to do also the experiments with diluted –non filtered- exhaust. HR-ToF-AMS could be used also in these conditions and it should consent to have a more realistic estimation of what happens when the vehicle exhaust (gas phase + particle phase) reaches the open air and meets seeds particles.

3467- line 27-29; Description of the experiments and data analysis are not very detailed. I fully agree with comment of anonymous referee #1 in page C781 that the AMS data should be included in this paper, at least as supplementary material. They are extremely important to support some of the conclusions reached in this paper and, particularly regarding COM.

3469- line 17-21; The effect described here is not the scope of the protocol for sampling vehicle emissions. Filtering the air coming into the dilution tunnel is a requirement for the reproducibility and repeatability of the methodology.

3/ Technical Comments 3469- line 19; Should say "are" instead of "is"

3482- Table 1; Values for total mass (in μg/m3) for 24th of April are very doubtful. In general the intra-day repetitions for this mode are not very good in terms of Total Mass. Same for the values of 01-May and Mode 2. May be due to the fact that the 2nd experiment was done when the engine was still hot (warm) from the previous

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experiment?

3483- Table 2; There are no values for the “Exposure Time” referred to days 19, 20 and 24th of April (?). It should be useful to see in this table again the engine mode (in table 1) as well as the seed particles composition.

3485- Figure 2a; It would be better a bigger type for characters and values inside the graph and axis (smaller than graph 2b). Same for 3 and 4 3489-3492- Figures 5&6; It should useful to specify in the legend the domain covered (eastern North America) and grid space 15km.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 3461, 2011.