

# ***Interactive comment on* “Technical note: Emission factors, chemical composition and morphology of particles emitted from Euro 5 diesel and gasoline light duty vehicles during transient cycles” by Evangelia Kostenidou et al.**

## **Anonymous Referee #1**

Received and published: 11 October 2020

See Attached document. Review of Kostenidou et al. “Technical Note: Emission factors, chemical composition and morphology of particles emitted from Euro 5 diesel and gasoline light duty vehicles during transient cycles”

The manuscript details gas- and particle-phase emissions from 3 diesel vehicles and 4 gasoline light duty vehicles (1 PFI and 3 GDIs) certified to the Euro 5 emission standards. All vehicles were tested on a chassis dynamometer on 2 different driving cycles. Main conclusion from this study is that GDI engines emit more PM and gas-phase PAHs compared to a single PFI engine. The suite of instrument used measurements is com-

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prehensive. The manuscript is well written and the measurements from this study are largely in-line with existing studies. However, given the small vehicle fleet size (and just a single PFI vehicle tested), I expect to see a more detailed discussion of the literature, especially for PFI gas and particle phase emissions. The authors often carefully report measurements of highly resolved instrumentations (e.g., PAHs, TEM XPS measurements) but fail to convey to the reader the main point (and the importance) of conducting these time consuming and expensive analyses. I recommend publication after the authors address these comments (and the below).

Minor comments: Line 24: Odd transition, both PAH and NPAH concentrations were higher in GDIs compared to the PFI engine.

Line 26: lower detection limit

Line 27: Emissions of Aitken-mode particles (particle with diameter < 30 nm)

Line 73. Citation needed when citing mentioning that NH<sub>3</sub> might enhance NPF.

Lines 72-73: “Despite all the previous studies for the characterization of the vehicles’ emissions, an integrated and comprehensive analysis for the understanding of these emissions is missing.” Not sure what this means. Either be specific or remove.

Table1: Why is the numbering for PFI, GDI, and D vehicles not continuous. This is confusing, I suggest you adjust. There is a single PFI vehicle presented in the manuscript, yet it is numbered PFI4, leaving the reader the impression that the data from at least 4 PFIs were reported. Also, the use of the blue and red colors makes the table harder to read, I suggest keeping all text in black.

Line 94: add reference for the WLTC cycle. I also think that a brief description of each driving cycle is needed in section 2.1.

Line 98: “The line was heated at 80-120 C..” was this to reduce semi volatile losses?

Line 104: (Table 1)

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Section 2.2.1: The authors do not discuss the CE of the AMS. Is it 1? 0.5? the choice of CE should be explicit in the manuscript. Also, have the authors compared the AMS non-refractory OM mass to filter OC mass? If OC filters were collected and analyzed the comparison between OC and OM should be provided in the MS or the SI.

Section 2.2.3: This section discusses TEM sampling and not “exhaust gas sampling”. Please adjust.

Section 2.3 is named “instrumentation” so is section 2.2. Adjust

Line 140: “CO<sub>2</sub> (the signal at m/z 44). . .”

Line 162: “the distance-based EF”

Line 164: are the concentrations C(t) background corrected?

Line 165: What is DR? dilution ratio?

Line 170: BC is not measured by AMS. Adjust

Line 173: I was surprised to see that the BC fraction of PM emissions for GDI5 was so high for GDIs (>96%). The authors should provide how often this is seen in the literature.

Line 174: 120 mg/m<sup>3</sup> should be for BC and not organics.

Line 185: Refer to panels b and c in Fig 2 as Figure 2b and 2c. Right now, “(a) . . . (b and c)” is confusing. Adjust also in other instances in the text.

Lines 190 and 196: The authors claim that the sulfate measured is in ammonium bisulfate form yet offer no justification to why that is. Either justify your assumption or remove.

Line 207: “Figure 3 shows the HR-AMS mass spectra for the GDI5 and the D4 vehicle during the first (cold start?) and last 2 minutes (hot running exhaust?) of each cycle.”

Line 228: “Sulfur containing ion fragments were mostly emitted from hot engines (end

of urban cycle and motorway cycle) and are tentatively explained by the release of some lubricant oil.” Why would this be the case for the GDI5 vehicle and not for the D4 vehicle as well? It is clear from Figure 3 that only the GDI5 showed trace amounts of sulfur containing organic fragments

Figure 3: It is worth mentioning in the text that there are no significant differences in the non-refractory organic composition of exhaust particle emissions for cold start vs hot start.

Line 261: The author mention that MPAH are carcinogenic compounds. Looking at Table S3 in the SI, it seems that MPAH emissions during hot start (the large fraction of a trip) are usually larger than during cold starts which can have important implication on public health near emission sources.

Line 276: replace “the car” with “vehicle tailpipe”

Line 293: “(below 20 nm)”. Give exact statistics (mean, std). This data is helpful for studies looking at the optical properties of fresh combustion soot particles.

Line 306: The authors assume that inclusions in soot particles are metals. The authors should provide a reference for this claim.

Lines 331-346: it is not clear to me what are the main points the authors are trying to make from that large paragraph.

Line 412: replace “should be taken into account”

Figure 1: Change OA in caption to organics

Figure 3: make font in panel a same as panel b.

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2020-842>, 2020.

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