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Atmospheric Measurement Techniques Discussions

Interactive comment on "Chemical discrimination of the particulate and gas phases of miniCAST exhausts using a two-filter collection method" *by* Linh Dan Ngo et al.

Anonymous Referee #2

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The present paper examines the separation and the speciation of organic compounds in the particle and gaseous phases emitted during combustion processes. The laboratory experiments were conducted using a CAST burner. The authors proposed a two-filter sampling method to collect particulate matter on quartz fiber filters while the gas phase passed through the first filter and was then trapped on a second filter covered by black carbon. The samples are then analyzed using several techniques as two-step laser mass spectrometry (L2MS), secondary ion mass spectrometry (SIMS), and micro-Raman spectroscopy.

The experimental section and data analysis have been carefully carried out and fully

described. The manuscript is suitable to publication in AMT after revision.

General comments:

Collection system and experimental set-up. The collection system poses some serious problems. Positive artefacts are well known on quartz filters. Some of the filters were highly charged (PF1, PF2, PF3). We could expect that a kind of "soot cake" is formed on the front filters increasing the filtration efficiency and causing more adsorption of the gaseous compounds onto the deposited particles (see Fig. 1 images front filters).

In fig. 2 front and back filters mass spectra (L2MS) are presented. The m/z 202 ion partition on both the gas and particle phases (for SP1, SP2, SP4 but not for SP3) even though the signal is very high in the mass spectrum of the particle phase it almost not visible in the gas phase. How is it possible if for the other SPi it did partition? So why the partitioning of m/z 202 is so different for SP3 with respect to the other?

Another issue is the dilution system and the temperature in the sampling line. Low dilution at room temperature will enhance adsorption of relatively light PAHs onto the particles, while once in the atmosphere high dilution will alter this partitioning. This aspect has not been addressed.

It is relatively common, when working on filter samples, to remove the gaseous phase using denuders. This test has not be done apparently, and it would have been a easy test to verify the presence of organic volatile of the front filter.

Environmental relevance. The authors claim that their approach allows to identify distinct surface chemical compositions of aerosols discriminating semi-volatile and non-volatile polycyclic aromatic hydrocarbon (PAH) contents as a function of the combustion process. However modern engines are equipped with after-treatment devices that highly alter the exhaust emissions (oxidation of hydrocarbons and particle bound compounds). So in which way these results can be extrapolated to nowadays diesel engine emissions?

Quantification issues: since the author states that using three different ionization wavelengths, it is possible to target various classes of compounds and to reach sub-fmol limit of detection, e.g. for PAHs (Faccinetto et al., 2008, 2015). So why the results are not present in a quantitative way?

Preparation of the filters. Prior to sampling the authors prepared the filters by heating them at 150°C for 16 hours. It seems to be a relatively low temperature with respect to the common procedure found in the literature for quartz filters (often up to 400°C).

Poor English and paper structure. The paper is far too long and should be reduced in length and simplified. We need to understand what is important and not and to get few strong messages expressed in a clear and synthetic way. This paper is written as a scientific report or a student PhD thesis. I strongly suggest to revise completely the paper and possibly make nicer figures and plots.

PAC analysis. The added value was "to highlight variation and patterns in a data set, and in this case was used to reveal the differences in 210 chemical composition of the samples, and in particular between (i) Front and Back Filters and (ii) miniCAST set points." I can only partly agree to the added value of PCA analysis nevertheless the discussion is far too long. Please revise it.

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