

Characterization in the discharge of plants, of atmospheric emission of black carbon

C. Raventos¹, I. Fraboulet¹, O. Favez¹, J. Poulleau¹, A. Fievet¹, P. Dubois¹, N. Karoski¹, J. Ringuet²,
N. Allemand², J. Sciare³, N. Bonnaire³, P. Hease³

¹Institut National de l'Environnement industriel et des RISques (INERIS), Verneuil-en-Halatte, 60550, France

²Centre Interprofessionnel Technique d'Etudes de la Pollution Atmosphérique (CITEPA), Paris, 75010, France

³Laboratoire des Sciences du Climat et de l'Environnement (LSCE) - UMR8212, CNRS-CEA-UVSQ, Gif-sur-Yvette, France

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Presenting author email: cecile.raventos@ineris.fr

Soot, also commonly called Black Carbon (BC) is a component mainly present in fine particles, which has an impact on human health and climate. It results from incomplete combustion of fossil fuels and from biomass. But the knowledge on the emission factors of the main sources requires to be improved, so as to be able to target the suitable reduction actions of emissions from industrial installations and domestic sources of combustion to be implemented.

Today various techniques have been developed for the measurement of soot in ambient air, allowing the characterization of immissions, even if these methods do not show themselves fully equivalent, and if a harmonization of the practices and an improvement of the methods are still necessary.

On the other hand the measurements of soot emissions due to combustions sources remain very limited, as in particular mentioned by the group of expert in charge of the preparation of the amendment of the Protocol of Göteborg, in which the soot was recently included. The gaps in the knowledge on black carbon emissions, and the uncertainties on the available data are mainly due to the absence of comparison between the applied methods, which uses generally remain rather limited to research purpose.

This study proposes to:

- Identify the existing measurement methods for the characterization of soot in emission, or estimating the adaptations to be brought to ambient air methods, to characterize BC emissions from combustion sources
- Evaluate the methods on bench test: performances (robustness, repeatability), implementation (necessary equipments, required quality controls), comparison of the results during measurements on the same source (biomass boiler)
- Perform measurement campaigns on installations corresponding to sources identified, as important contributors of BC emission by CITEPA to: confirm "the applicability" of the methods on real sites, estimate their equivalence on different sources / matrix, calculate sources emission factors, confirm or estimate the distribution in size of the particles of BC

State of progress: implementation and test on bench test, of the measurement methods identified as the most suited and interesting.

Methods chosen by taking into account potential, levels of concentration:

- Adaptation of method using optical analysers, applied in ambient air, with a preliminary dilution of the sample (measurement of equivalent BC: EBC);
- Sampling on filter of total suspended particulates (TSP) and with cascade impactor, associated to a thermal analysis 2-Steps developed by Cachier and al. (measurement of elementary carbon: EC).

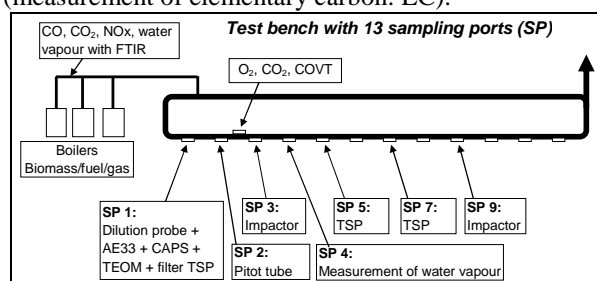


Figure 1. Test of chosen methods on a test bench.

Results so far:

- Good repeatability of each method individually (when 2 equipments were available), and good comparability of both optical equipments tested on one hand, and "thermal" measurements on the other hand
- But important gap between EC and EBC measurements (ratio EBC/EC comprised between 7 and 44; mean: 30)

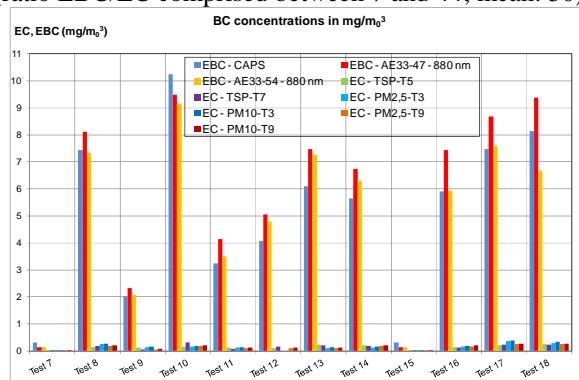


Figure 2. Comparison of EC and EBC measurements

- Identification of key points and weak points for each method: from the point of view of the implementation, performances, equipments, cost;

Additional tests are planned in 2016 before of realizing on-site tries.

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