

# AVEC plots: a new way to visualise EC/OC thermograms

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## Introduction

EC/OC thermal-optical analysis measures the amount of carbon contained in air particulate samples collected on filters. Several operational assumptions are used to then determine organic and elemental carbon (OC and EC). One drawback of this method is the formation of an undesired by-product, the pyrolysed organic carbon (POC). For quality assurance purposes the properties of each sample are normally viewed using thermograms that focus on the instantaneous results from the analyser's detectors over time; e.g. Figure 1. As an alternative to these thermograms, we propose focusing on changes in the bulk properties of the sample; plotting laser attenuation vs. evolved carbon (AVEC).

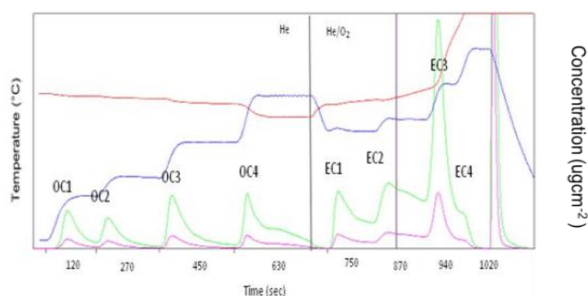


Figure 1. Thermogram from a typical ambient PM<sub>10</sub> sample collected in London. The red line represents the laser transmittance, the blue line the temperature and the green and pink lines FID1 and FID2 signals respectively.

## Method, results and discussion

A Sunset Laboratory Thermal-Optical Carbon Aerosol Analyser was used for the EC/OC analysis. One hundred and eighty samples from the London area were analysed with two protocols, EUSAAR2 (Cavalli et al, 2010) and NIOSH-like Quartz (Birch and Cary, 1996). Source samples were also tested including those from vehicle exhaust tests and solid fuel burning (coal, wood, and peat). The AVEC plot of the analytical data is created from the attenuation of the material on the filter ( $\ln(I_0/I)$ ), where  $I_0$  is the laser transmittance measured at the end of the analysis when all the carbonaceous compounds were desorbed, versus the total carbon

evolved (the integrated FID signal), as the analysis proceeds.

An example AVEC plot (Fig 2) shows an urban background sample analysed with two different protocols. Figure 2 clearly shows the processes the sample undergoes when analysed in different conditions. The formation of the POC is more pronounced in the Quartz sample and the amount of OC is greater than in the EUSAAR analysis.

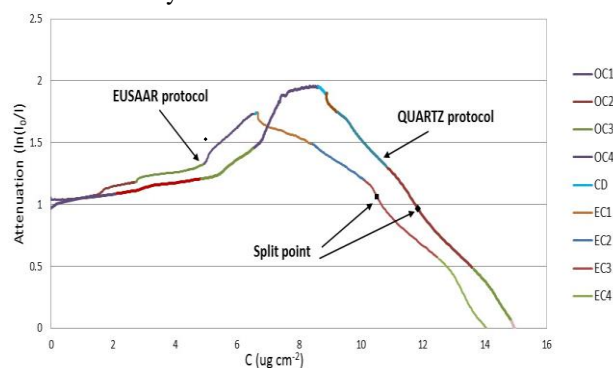


Figure 2. AVEC plot of the same urban background sample analysed with two different protocols

## Conclusion

AVEC plots offer several advantages over the thermograms produced by the Sunset instrument.

- The total carbon and the carbon evolved during each temperature step can be easily read from the x-axis.
- A clear display of any early evolution of EC/POC.
- Information on the formation of POC and evolution of OC.
- Determination of mass absorption coefficients of the combined POC and native EC during the oxygenated phase (Subramanian et al., 2006).
- A clearer split point between OC and EC.

## References

- Birch, M.E. and Cary, R.A. (1996). *AST* **25**(3), 221-241.  
Cavalli, F. et al., (2010) *AMT* **3** 79-89.  
Subramanian, R et al, 2006. *AST* **40**(10), 763-780.