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A TGA/FT-IR study for measuring OC and EC in aerosol samples

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Abstract. Carbon analysis consists in the evaluation of the carbonaceous content of the aerosol (TC) but, more importantly, of its distribution between the two components EC (Elemental Carbon) and OC (Organic Carbon) that are characterized by different physical-chemical properties. In spite of the numerous studies focused on this topic, nowadays a universal methodology for the determination of the two components EC and OC is not available. In fact OC and EC (also known as black carbon or soot) are operationally defined by the method of analysis and, as a consequence, different methods can produce different results.
In this paper we present results on the application of TGA/FT-IR (Thermo-gravimetric Analysis/Fourier Transformed Infrared Spectroscopy) to the characterization of carbonaceous aerosols. The analytical methodology was applied to PM10 (particulate matter with aerodynamic diameter smaller than 10 μm) four-hour time resolution samples collected in Milan urban area. The method is a two-steps thermal one and it is based on the different thermal behaviour of OC and EC. It has been set up analyzing suitable standards containing both organic and elemental carbon. Carbon quantification is achieved by on-line, continuous monitoring of CO_2 infrared absorption at 2361 cm^{-1}. A good separation between OC and EC on particulate matter (PM) samples has been obtained. Ranges and average values were 12–70 $\mu g/m^3$ and 20 $\mu g/m^3$ for OC and 0.2–6 $\mu g/m^3$ and 2 $\mu g/m^3$ for EC. On average OC and EC made up 29 (±13)% and 2.5 (±1.8)% of the PM10 fraction, respectively. The method reliability has been verified by a preliminary comparison with TOT (Thermal Optical Transmission) technique. OC and EC values determined for ambient samples of PM10 were correlated with meteorological parameters as well as with Radon concentrations.

Final Revised Paper (PDF, 1331 KB) Discussion Paper (ACPD)

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