Carbonaceous aerosols and variations in their light absorbing properties

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In urban environments carbonaceous aerosols have serious impact on air quality and therfore on human health. Moreover due to their strong absorption properties in the visible spectral region they directly contribute to radiative forcing on regional and global scales.

In spite of various analytical and/or optical methods the accurate determination of atmospheric burdens by carbonaceous aerosol is still challenging (Cavalli et al., 2010, Lack et al., 2008).

In a combined laboratory and field study we characterised the spectral light absorption properties of soot with a single cavity multi wavelength photoacoustic spectrometer. During laboratory experiments we studied artificially generated combustion soot (mini-CAST) of increasing organic content. Therefore the burning conditions were stepwise changed towards more and more incomplete combustion (Schnaiter et al., 2006). From these experiments we can show that different burning conditions correlate to different wavelength dependencies of the measured absorption coefficients. Moreover, absorption cross sections were independently calculated from off-line filter measurements analysed by Sunset EC/OC.

Table 1. Absorption cross sections (ACS) of CAST soot for different burning conditions and for a wavelength of 532nm

CAST soot C/O ratio	ACS from PAS and EC (m2/g)	ACS from PAS and TC (m2/g)
0.29 (35%EC,65%OC)	14.5 ±1.6	5.4 ±0.4
0.4 (10%EC,90%OC)	18.6 ±4.2	1.6 ±0.1

For the first time we operated the multi-wavelength photoacoustic spectrometer during an urban field campaign (AIDA mobil urban) in autumn 2012 at Durlacher Tor in Karlsruhe, Germany. At that time, the measurement site was characterised by intense road works (construction of subway tube) and high traffic volume. In combination with concurrently determined refractory black carbon mass concentrations from a single particle soot photometer (SP-2), we derived absorption cross sections for the three photoacoustic wavelengths.

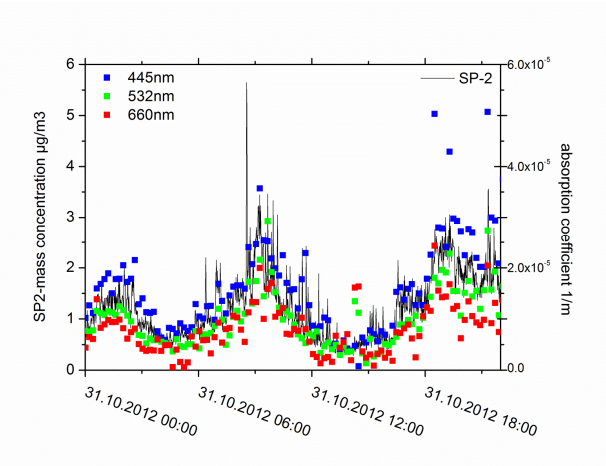

Figure 1. Diurnal variations of incandescence derived refractory BC mass concentration (SP-2) and photoacoustic absorption coefficients in the blue, green and red wavelength range during the field campaign at Durlacher Tor, Karlsruhe, Germany, in autumn 2012

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