

Novel Photoacoustic Aerosol Monitor for Optical Absorption Coefficient Determination. Laboratory and Field Test.

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There is an increasing concern for novel methods to determine the optical absorption coefficients of atmospheric aerosol. The available on-line instruments like MAAP (Multi Angle Absorption Photometer) and PS2 (Single Particle Soot Photometer) has weakness of spectral resolution or the sampling artifact of filter matrix. These methods neither suitable for direct determination of light absorption by aerosol nor dispose the capability of the source apportionment. Photoacoustic measurement technique is one of the highly promising method for analysis of aerosols, as it can determine directly the amount of light absorption by aerosols while being largely insensitive to uncharacteristic light scattering.

The Multi Wavelength Photoacoustic System (WaSul-MuWaPaS) operating at four different wavelength in wide wavelength range (266nm, 355nm, 532nm, 1064nm) for optical characterisation of artificially generated and atmospheric aerosol was developed.

The system characteristic performances are shown at table 1. (MDOA: Minimum Detectable Optical Absorption Coefficient)

Table 1. Wasul-MuWaPaS system performance

Wavelength (nm)	Power (mW)	MDOA (Mm-1)
1064	360	0,6
532	90	1,2
355	12	9,6
266	6	9,5

The spectral PA response of different type of artificially generated soot and dusts were measured. As a reference the extinction spectrometer and TSI; 3653 Nephelometer was used. From the extinction and scattering measurement the absorption coefficient can be calculated. Good agreement was found between the PA and the reference response. Figure 1.

The WaSul-MuWaPaS was deployed at the EMEP-GAW regional station of JRC Ispra and operated parallel with the instrumentation used at the site

including Nephelometer, Aethalometer, MAAP, DMPS.

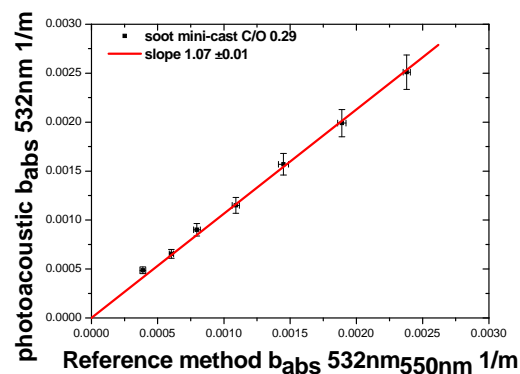


Figure 1: Correlation between the PA and the reference spectral response of CAST soot at 532nm wavelength.

Despite the low EBC mass concentration (below 1µg/m³) occurred at the field station during the experiments excellent agreement was found between the PA and the corrected aethalometer response.

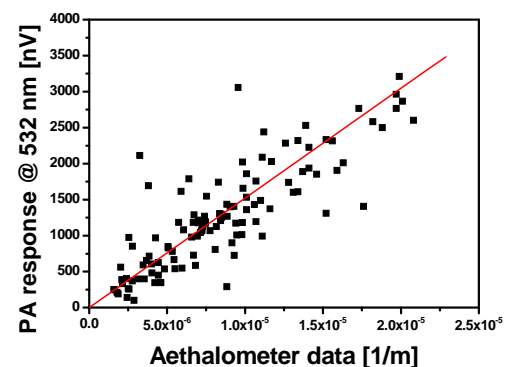


Figure 2. Correlation between the PA response and the corrigated aethalometer data at 532nm wavelength during the one week measurement period.

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