



## **UV-Visible light absorption and size distribution of particulate matter collected in “El Arenosillo” (Spain)**

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Within the context of current aerosol measurements in El Arenosillo station a more detailed summer campaign was carried through July 15th to October 15th, 2004. During this campaign, size mass distribution of particulate matter was measured by a DEKATI impactor at four fractions. The numerical size particle distribution was also measured, the fine particles by a SMPS (Scanning Mobility Particle Sizer) and accumulation and coarse fractions by the APS (Aerodynamic Particle Sizer), both commercial spectrometers of TSI company. Measurements by the Cimel photometer provide the data and aerosol products given by AERONET. Analysis of the geo-chemical composition of aerosol material was also carried out by different chemical techniques applied to TSP sample filters given by a High-Volume Sampler system. The Atmospheric Sounding Station “Esat-El Arenosillo”, is located in the coastal southwest of Spain (37.10° N, 6.70° W), belonging to the National Institute of Aerosol Technology (INTA) ≈30 km from Huelva town, Spain.

Although the location of the station is near a protected area, the National Park of Doñana, the relative proximity to the town of Huelva and its strong industrial area is the first source of contamination. Huelva, which is a medium size town with ≈160 000 inhabitants located in the southwest of the Iberian Peninsula (maritime climate), is a heavy industrialized area where industrial emissions are mixed with urban emissions and frequent natural emissions of Saharan dust episodes.

In this work we focus on the mass concentration analysis of Dekati samples where

the fine fraction (particles less than  $1\ \mu\text{m}$ ) was used to determine the light absorption coefficient.

The DEKATI PM10 impactor collected the particles over Millipore polycarbonate membrane filters with  $0,2\ \mu\text{m}$  pores. The impactor had a constant flow rate of  $16,5\ \text{l/min}$  and the sampling time was between 24 h and 72 h. The impactor aerodynamic cut-off diameters are  $1\ \mu\text{m}$ ,  $2,5\ \mu\text{m}$  and  $10\ \mu\text{m}$ .

It were collected five samples per week, four of 24 h and one of 72 h (the weekend one). This makes a total of 64 days of measurement and 256 filters with aerosol collected.

Every filter was measured with a precision balance, prior and after collection. Care was taken in order to eliminate electrostatic charges from the filters before weight.

For determination of absorption coefficients we developed an integrating sphere photometer, based on the largely known integrating sphere technique (Fischer,1973, Horvath,1993). The light source was provided by a 450 W xenon lamp. A double monochromator was laid between the light source and the integrated sphere; this allows the integrating sphere to be illuminated by monochromatic light with a wavelength dependent of the diffraction gratings of the monochromator. The detection system was a simple photosensor. With this approach a continuous spectrum with 10 nm of resolution, from 320 to 800 nm, was measured for the absorption aerosol coefficient.

The exposed filters were dissolved in chloroform inside a quartz cell which was inserted in the center of the integrating sphere. A stable suspension of the aerosols was obtained using ultrasound. Chloroform completely dissolves the polycarbonate filter and lets the aerosol particles in suspension. The technique is destructive but has the advantage that aerosols are measured in a more realistic situation when in suspension than when collected on the filter. Furthermore chloroform real part of refractive index is nearly the same as that of suspended particles so that the light scattering is highly reduced.

Absorption coefficients were evaluated by performing measurements of the light transmission through the cell with the filter dissolved after the aerosol collection and with a blank filter dissolved. In practice, light transmission through the blank filter was determined as the average of 20 blank filters to account for the differences in filters.

It were observed several Saharan dust episodes during the campaign period, one of each particularly high (July 26th). So, we present the data set values of PM10, PM2,5 and PM1 for the measurement period and analyze in particular this strong dust event.

The highest value of PM10 was  $119,69 \mu\text{g}/\text{m}^3$  and the lowest value was  $7,37 \mu\text{g}/\text{m}^3$ . For PM2,5, the concentration ranged between  $6,29 \mu\text{g}/\text{m}^3$  and  $92,41 \mu\text{g}/\text{m}^3$ . Less variability was observed for the temporal average of PM1, which ranged between  $3,83 \mu\text{g}/\text{m}^3$  and  $43,59 \mu\text{g}/\text{m}^3$ .

The temporal average PM10/PM2,5 ratio is also presented and analyzed.

For the absorption coefficients determination, we present daily values for all the campaign.

For 320 nm the absorption coefficients ranged between  $3,58 \times 10^{-7} \text{ m}^{-1}$  and  $2,95 \times 10^{-6} \text{ m}^{-1}$ . For 800 nm we observed values between  $3,86 \times 10^{-8} \text{ m}^{-1}$  and  $1,97 \times 10^{-6} \text{ m}^{-1}$ . It was observed that the absorption coefficient value decreases with the wavelength, the smaller the wavelength the highest the absorption coefficient. However, this decrease is not very pronounced.

## References

- [Fischer(1973)] K. Fischer. Mass absorption coefficients of natural aerosol particles in the 0,4 to 2,4  $\mu\text{m}$  wavelength interval. *Contr. Atmos. Phys.*, 89:46, 1973.
- [Horvath(1993)] H. Horvath. Atmospheric light absorption - a review. *Atmos. Environ.*, 27A:293–317, 1993.