



Characterisation of the organic composition of size segregated atmospheric particulate matter at traffic exposed and background sites in Madrid

F. Mirante (1), R. Perez (2), C. Alves (1), M. Revuelta (2), C. Pio (1), B. Artiñano (2), and T. Nunes (1)

(1) CESAM, Department of Environment and Planning, Aveiro University, Portugal (fmirante@ua.pt), (2) CIEMAT, Madrid, Spain

The growing awareness of the impact of atmospheric particulate matter (PM) on climate, and the incompletely recognised but serious effects of anthropogenic aerosols on air quality and human health, have led to diverse studies involving almost exclusively the coarse or the fine PM fractions. However, these environmental effects, the PM formation processes and the source assignment depend greatly on the particle size distribution. The innovative character of this study consists in obtaining time series with a size-segregated detailed chemical composition of PM for differently polluted sites. In this perspective, a summer sampling campaign was carried out from 1 of June to 1 of July 2009. One of the sampling sites was located at a representative urban monitoring station (Escuelas Aguirre) belonging to the municipal network, located at a heavy traffic street intersection in downtown Madrid. Other sampling point was positioned within the CIEMAT area, located in the NW corner of the city, which can be considered an urban background or suburban site. Particulate matter was sampled with high volume cascade impactors at 4 size stages: 10-2.5, 2.5-0.95, 0.95-0.45 and $< 0.45 \mu\text{m}$. Daily sampling was carried out on quartz fibre filters.

Based on meteorological conditions and PM mass concentrations, each one of the 7 groups of filters collected during the first week were combined with the corresponding filters of the third week. The same procedure was undertaken with samples of the second and fourth weeks. Filters of 0.95-0.45 and $< 0.45 \mu\text{m}$ were pooled to obtain the PM_{0.95} organic composition.

The PM size-segregated samples were subjected to organic analysis by gas chromatography-mass spectrometry (GC-MS), after solvent extraction of filters and an appropriate derivatisation technique. Besides the homologous compound series of organic classes (e.g. n-alkanes, n-alkanols and n-alkanoic acids), special attention was given to the determination of specific molecular markers for different sources (e.g. vehicular). Carbon preference indices (CPI) close to the unity and the presence of PAHs point out vehicle exhaust as the main emission source of the aliphatic and polycyclic aromatic fractions, especially for the roadside aerosols. Concentration ratios between PAHs were also used to assign emission sources. The abundance and the sources of these carcinogenic pollutants are discussed and compared taking into account the local/regional characteristics.

Water-soluble ions in PM were also analysed by ionic chromatography. A portion of the same filters was subjected to metal speciation by Inductively Coupled Plasma Mass Spectrometry (ICP-MS) or Instrumental Neutron Activation Analysis (INAA).

Receptor-oriented modelling for source apportionment was applied to the size-segregated PM chemical composition data. Results of this work are expected to cover a lack of reliable information for the knowledge of the particle size-dependent constitution, sources and atmospheric formation processes in this area of the central Iberian Peninsula.

Acknowledgements: F. Mirante thanks the Portuguese Science Foundation for financial support of the training period at CIEMAT, as well for the PhD grant SFRH/BD/45473/2008. M.A. Revuelta acknowledges the Ministry

of Science and Innovation for their economical support through the FPI predoctoral grant BES-2008-007079.