Ultrafine particles, ^{13}C, trace elements and ionic water soluble species in PM_{10} in a suburban area of Galicia, NW Spain

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Particulate matter is associated with harmful effects on human health and climate change (Moreno *et al.*, 2015). However, chemical composition and particle size play an important role in these effects.

The aim of this work is to determine the concentrations of trace elements and soluble ionic species in PM_{10} and particle size distribution during March-June 2014.

The sampling was carried out in a suburban area located in Oleiros, close to A Coruña, in the northwest of Spain. This site is characterized by an Atlantic climate, and the sea breeze is presented during all year. 24h PM_{10} samples were collected using a high-volume sampler (DIGITEL DHA 80) from 23 March 2014 to 1 June 2014, operating at 30 m^3/h. Also, Scanning Mobility Particle Sizer (SMPS, 3936 Model, TSI) was used to carry out the measurements of ultrafine particles with aerodynamic diameters between 13 and 289 nm.

PM_{10} concentrations were determined by gravimetric procedure and then trace elements were determined by ICP-MS (Thermo Finnigan X Series) and soluble ionic species by Capillary Electrophoresis with conductivity detection (Agilent HP3DCE and C4D-TraceDec). Moreover, ^{13}C stable isotopes and total carbon (TC) in samples were also determined using a stable Isotope Ratio Mass Spectrometer (IRMS).

Particle concentrations were in the range 4-16 $\mu g/m^3$ for PM_{10} and the mean value was 9 $\mu g/m^3$. Ultrafine particles were classified into 3 modes: nucleation ($N_{13\text{-}30nm}$), Aitken ($N_{30\text{-}100nm}$) and accumulation mode ($N_{100\text{-}289nm}$), and their main values were 1507 cm^{-3}, 2019 cm^{-3} and 547 cm^{-3}, respectively.

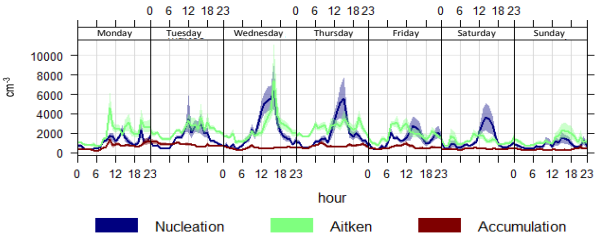

Figure 1. Hour and weekday averages of ultrafine particles during sampling period.

Figure 1 shows mean values of the 3 studied modes, and it is remarkable that nucleation mode reached maximum values at midday, Aitken at traffic rush hours and few hours later than nucleation mode maximum, and accumulation mode at traffic rush hours like Aitken particles.

According to carbon-isotope characterization of mobile and point-source emissions, when plotted on a $\delta^{13}C$ vs. total carbon concentration (%C) diagram (Figure 2), the results confirm that the PM_{10} input is dominated by diesel (Prada-Rodríguez *et al.*, 2014) and this result can be due to road traffic influence and domestic heating.

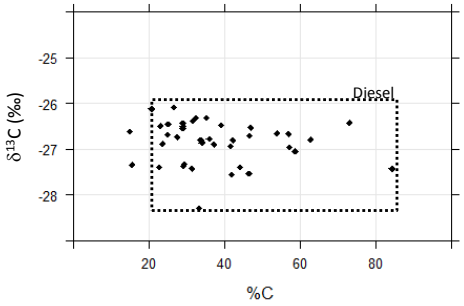

Figure 2. Aerosol source by stable carbon isotopes.

TC in PM_{10} ranged between 2.34-4.59 $\mu g/m^3$ (mean value=3.01 $\mu g/m^3$). The mean value of carbon contribution to PM_{10} was 38% so, carbonaceous compounds are an important fraction in PM_{10}. On the other hand, total determined elements ranged from 1.42 to 5.23 $\mu g/m^3$, being the mean value 3.07 $\mu g/m^3$. Al, Ca, Fe, K, Mg, Na and Zn and ionic water soluble species reached the highest concentrations, therefore mineral dust and sea salt are other important fractions at the sampling point. Trace elements like As, Cd, Co, Cs and Hg had low concentrations compared to the other ones (< 0.30 ng/m^3).

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