Comisión Nacional de Energía Atómica

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PM 2.5 chemical composition in Buenos Aires by an ensemble of analytical techniques

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Introduction: The ARCAL-RLA7023 project

The urban environment, where most of population lives and where a significant proportion of the energy is consumed, is the area where people are more exposed to air pollution. However, it also affects the growth of crops and interferes in the global radiative balance by complex mechanisms that change the climate. The ARCAL (Acuerdo Regional de Cooperación para la Promoción de la Ciencia y Tecnología Nucleares en América Latina y el Caribe), financed by IAEA (International Atomic Energy Agency) has recently launched a regional project to monitor atmospheric aerosols in megacities in Latin America and the Caribbean (LAC) region. It aims at providing relevant stakeholders with good quality information, and fomenting the use of nuclear analytical techniques in science and tecnology. Fourteen countries are participating in this endeavour, which is expected to take 4 years.

In all participating cities, the project will launch a year long monitoring, followed by Chemical measurements, data analysis and source apportionment, as well as a specific communication strategy. This project should provide valuable information for (a) analizyng LAC's specific characteristics, which could differ significantly from other regions, and (b) comparing different cities. As in every other megacity, a strategy has been adopted in Buenos Aires Metropolitan Area (BAMA) in Argentina, taking into account its geographical and urban characteristics.

Figure 1: Countries with at least a megacity as part of the ARCAL project

Sampling strategy

BAMA is a flat, coastal city with moderate mean winds. Previous studies have shown that spatial variability is much smaller than temporal variability[1]. Therefore, a single site for sampling has been chosen.

Elements and compounds to be measured

- **Ions Cl^-. K^+, Na^+, NH_4^+, NO_3^-, SO_2^{4-}**
- PM 2.5-10 mass concentration
- Carbonaceous fraction (BC, TC, etc.)
- Organic compounds: PAHs
- Metals and metalloids: Al, As, Ca, Cd, Cr, Cu, Co, Fe, Mg, Mn, Na, Ni, Pb, Sb, Ti, Sc, V, Zn, rare earth elements and others
- Isotopic abundance: $\delta^{13}C$

Importance of water-soluble ions

Among all air pollutants, particles are of great interest to the scientific community and policy makers because of their potential to result in health risks, as well as their influence on air quality and global climate.

Water-soluble ions, such as NH_4^+, SO_4^{2-}, NO_3^- and Cl^-, are significant components of atmospheric particles which varies depending upon the particle source.

PM 2.5 monitoring

- High volume sampler with quartz filters.
- Small volume sampler with Teflon filters

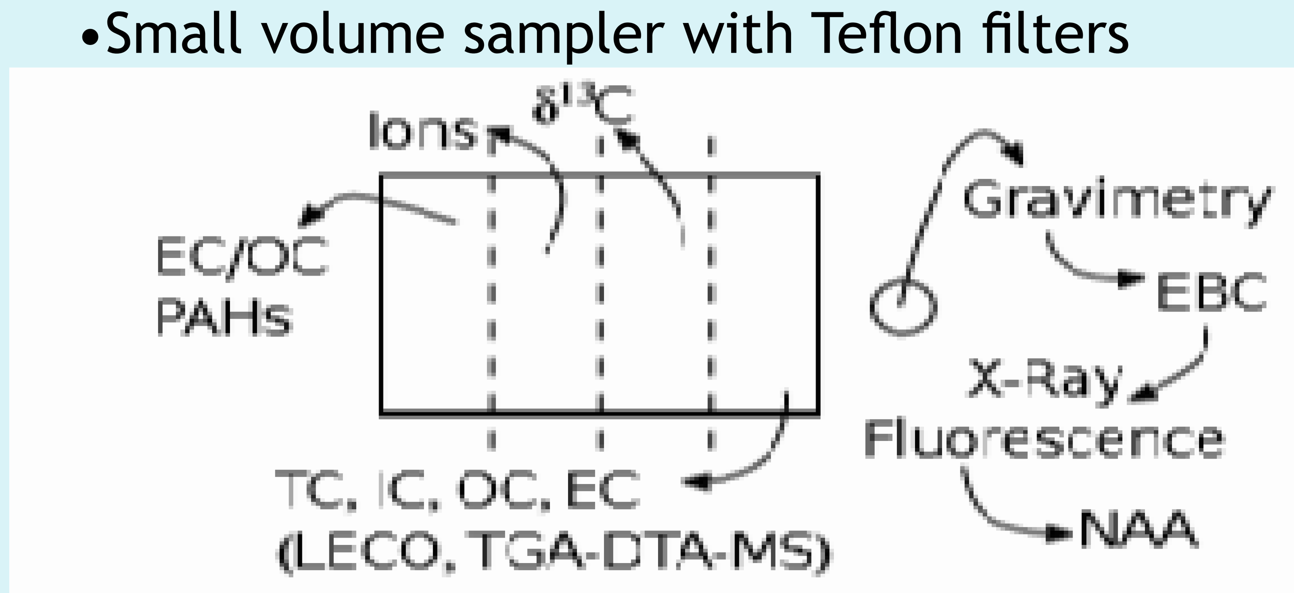

Figure 2: Filter processing. Left: High Volume. Right: Small Volume

- Aethalometer equipped with a PM2.5 cut-off inlet.

Particle mass concentration will be determined by gravimetry, with a microbalance and a ultra-microbalance

Partial Results

Until now, 28 filter have been analyzed. The following results are for microgram (µg) per cube meter (µg/m^3)

	Cl (µg/m^3)	NO_3^- (µg/m^3)	SO_4^{2-}(µg/m^3)	Na^+ (µg/m^3)	NH_4^+(µg/m^3)
MIN	0.07	0.11	0.21	1.09	< LD
MEAN	0.24	0.46	0.43	1.36	0.13
MEDIAN	0.12	0.30	0.38	1.31	0.06
MAX	2.11	2.41	1.15	2.45	0.7

Table 1 Descriptive statistics of measured concentrations of ions for PM2.5 samples collected in Buenos Aires.

The general objective of this work is to characterize in an integrated and systematic way, chemical, microphysical and dynamic properties of the atmospheric aerosol system of the city of Buenos Aires. Based on all this information, spatial and temporal patterns will be build of aerosol distribution in the study area, to identify not only the incidence of anthropogenic sources, but also the natural origins such as dust storms from arid and semi-arid areas, and eventually volcanic eruptions.

Taking all this into account, the proper use of the ***Hysplit*** is essential to calculate the trajectories of the air parcels and the dispersion of the aerosols to identify the sources of contamination.

[1]M. Arkouli et al. Distribution and temporal behavior of particulate matter over the urban area of buenos aires. Atmospheric Pollution Research, 1(1):1-8, 2010.

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