Seasonal variations in the size distribution of elements and ions in the Po Valley

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Keywords: cascade impactors, seasonal sources, dimensional distribution
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The study of the size distribution of the PM and its components constitutes an extremely valuable support for the characterization of the emission sources and for the study of aging phenomena of the dusts.
This paper discusses the results obtained during winter or summer monitoring campaigns carried out over the period 2008-2014 in the industrial area of Ferrara. Samples, collected by a 10 stage impactor, were analysed by an analytical procedure that [allows the determination of inorganic ions (NO_3^-, $SO_4^=$, Na^+, NH_4^+, K^+, Mg^{++}, Ca^{++}) and of two solubility fractions of the elements (As, Ba, Be, Cd, Co, Cu, Fe, Li, Mn, Ni, Pb, Rb, Sb, Se, Sn, Sr, Ti, Tl, V, Zn) [1]. This procedure allows an increase of the selectivity of elements as source tracers [2].

The comparison between summer and winter size distributions of the individual tracers allowed to identify and characterize the contributions from different types of source. The contributions related to local sources of industrial type and to the emissions from vehicular traffic (traced by the soluble fraction of Se, Tl, V, Ni, Cd, As and Sb), were constantly confined in fine-stage of the impactor and showed a seasonal variability mainly due to changes in atmospheric mixing conditions, with a modest concentration increase during the winter, accompanied by a dimensional growth due to dust aging phenomena.

Other industrial contributions, not locals and traced by the soluble fraction of Pb, Fe, Ti and Zn, were instead characterized by fine dusts of larger size and provided a greater contribution during the winter period, probably due to the higher incidence of diffusion phenomena in periods of prolonged atmospheric stability.

Dusts released from domestic heating are characterized by a fairly wide dimensional mode in the range 0.18÷1.8 µm, present only during the winter months; this mode is clearly present, not only for elements already known as possible tracer of biomass burning (K, Rb; soluble fraction), but also for several other elements (Cd, As, Li; soluble fraction, Mn, Sb, Pb, Sn; insoluble fraction).

The contribution of soils erosion (traced by the insoluble fraction of Li, Ti, Se and Rb) was more consistent during the dry summer period and it was characterized by a coarse mode that undergoes a shift to lower dimensions during the winter season, due to the increase of the residence time in the atmosphere. The same dimensional behaviour is also characteristic of the dusts produced from abrasion of brakes and mechanical parts of vehicles (insoluble fraction of Sb, Cu, Fe and Ba), which however did not show significantly different concentrations in the two seasons.

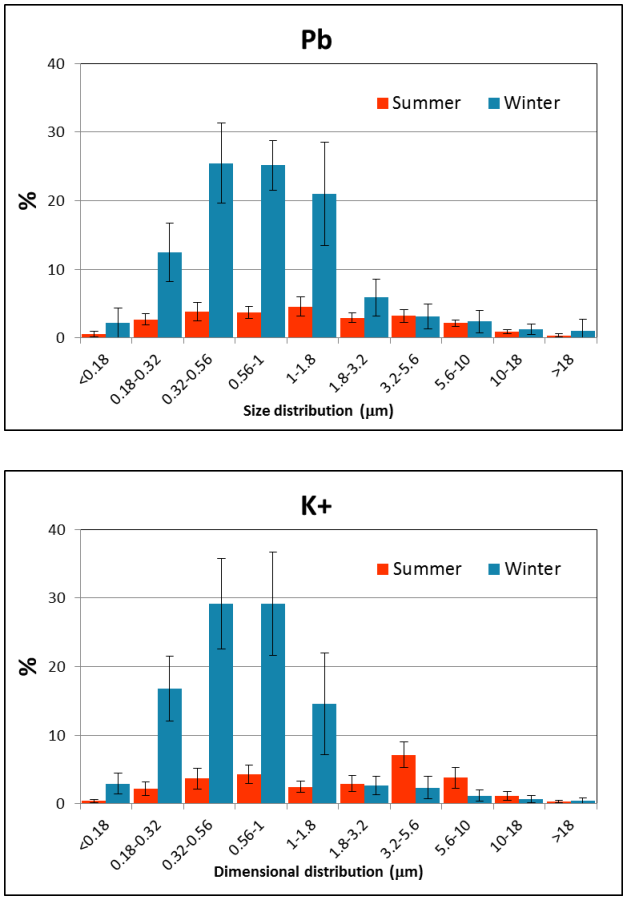

Fig.1 Size distribution of Pb (insoluble fraction) and K+ (soluble fraction), during summer and winter.

[1] Canepari, S. et al., (2009). *Talanta*, **77**, 1821-1829.

[2] Canepari, S. et al., (2009). *Atmos. Environ.*, **43**, 4754-4765.