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Organic and inorganic sampling artefacts assessment in Milan (Italy)

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Evaluation of sampling artefacts is essential to correctly estimate PM levels and to obtain an accurate speciation of collected aerosol. Several studies (e.g. Turpin *et al.*, 2000; Viana *et al.*, 2006; Schaap *et al.*, 2004), show that during collection on filter-based aerosol samplers, organic and inorganic aerosol compounds both contribute to positive and negative artefacts, affecting chemical analyses results for single species up to 70%, and PM mass concentrations up to 30%. If not accounted for, these artefacts influence the comprehension of pollution origin and effects, as well as statistical analyses and models outputs (Novakov *et al.*, 2005).

As the artefacts relative weight is sampling site dependent, it should be assessed at each investigated site. The semi-volatile nature of major aerosol compounds (i.e. organic compounds and ammonium nitrate), heterogeneous reactions in air or on filters, sampler differences, sampling filters, face-velocities, and meteorological conditions are among the most important parameters to be considered for the comprehension of the phenomenon. The complexity of these studies is overall recognised and research groups developed different methodologies to evaluate sampling artefacts of organic or, alternatively, inorganic nature.

As far as we know, this work is the first attempt to simultaneously assess sampling artefacts due to both fractions, in different sampling conditions. A field campaign was carried out during winter 2006-2007 and summer 2007, in Milan, which is located in the heavily populated, industrialised and polluted Po valley. 24-hours samplings were performed starting at 12 p.m. and both EPA- or CEN-equivalent samplers were tested in different conditions.

The inorganic artefacts quantification was carried out using 2 PM10 samplers (denuded and un-denuded) with filter packs (Teflon + Nylon or Quartz + Nylon) operating in parallel. Two URG annular denuders, mounted in series before the filter pack, were properly coated to remove ammonia and nitrous/nitric acids.

Two additional PM10 un-denuded samplers were devoted to organic artefacts evaluation: the first one always sampled on a quartz fibre filter and the second one had a Teflon + Quartz filter pack configuration.

Forty runs were performed during the field campaign obtaining information on about 350 samples (filters + denuders).

Meteorological parameters were also monitored at the sampling site, which is placed at about 10 m above ground level.

After filters gravimetric weighing, the samples and the denuders extracts were analysed for water-soluble components by Ion Chromatography. Elemental and organic carbon quantification was carried out on Quartz fibre filters using Thermal Optical Transmission method (NIOSH 5040 protocol).

Seasonal differences were observed in PM mass concentration and chemical composition, as well as in organic/inorganic artefacts importance. Inorganic artefacts were negligible during winter-time in all sampling conditions, while during summer-time losses in the 10-60% range were measured. Positive artefacts on Quartz fibre filters due to adsorption of volatile organic compounds accounted for about 20%-30% of total carbon concentration in both seasons.

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