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A comparison of indoor and outdoor size distribution and chemical composition of fine particles in residential and traffic sites

Air Pollution from traffic is a major public health concern and improving the characterization of population exposure to traffic pollutants occurring both indoor and outdoor is a key element both from epidemiological and health prevention point of view. In this work we present the results of a study undertaken in the urban area of Bologna (Italy).

Both indoor and outdoor monitoring was simultaneously carried out at a residential setting as well as at a high traffic site. Indoor environments were uninhabited, very similar in terms of volumes and building materials, and air exchange rates were maintained at the fixed value of 0.5 h-1, a typical level for residential environments. In fact one of the main goal of the study was to assess the differences of population exposure to particles in relation to traffic without considering the specific indoor characteristics and personal behaviours.

Both sites were monitored during three15-days periods, suitably distributed to cover the different seasons. We collected data of PM2.5 mass and chemical composition (ions, organic and elemental carbon, metals). Two FMPSs (TSI) provided size distribution of particles in the 5.6-560 nm interval and Ultra-Fine Particle (UFP) concentration with 1-min time resolution. Two switching units, one for each site, alternatively activated indoor and outdoor inflow with a switch time of 10 min.

While we found very similar PM2.5 mass concentrations in the two monitoring sites, chemical composition and UFP concentrations showed large differences. UFP outdoor concentrations in the traffic site were almost twice as much as the residential site. Indoor UFP concentrations were much lower than outdoor with a ratio between the two sites similar to outdoor concentration ratio. Indoor/outdoor ratio showed an inverse relation with outdoor concentrations. Size distribution showed a strong multi-modality with relevant differences between the two sites.

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