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Spatial variation of levels and composition of PM_{10} in deposited road dust in an urban environment

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Atmospheric pollution by particulate matter (PM) in big urban environments originates from multiple emission sources. Specific chemical markers characterize each source: metals, metalloids and organic compounds, among others. Recent studies reveal that the concentrations of several trace elements such as Cu, Zn, Sb, Mo and Ba in urban areas are comparable or even higher than in industrial environments (steel and stainless steel industries, copper and zinc metallurgies, ceramic and petrochemical estates). This is mostly due to the increase in the vehicle fleet in the last decades, the rapid advance and implementation of abatement policies for the industrial emissions, and the technical progress in materials for vehicle manufacture. Therefore, nowadays the traffic sector represents a major source of diffuse metal and metalloid emissions, which in the near past were markers exclusive for industrial emissions. These results are especially relevant taking into account that the population density is much higher in urban than industrial environments, and therefore the exposure to these pollutants has greatly increased in recent decades. Recent research interest focuses on road dust re-suspension as one of the major sources of atmospheric PM in urban environments, mostly in countries with scarce precipitations. Road dust represents a hazardous carrier of pollutants which can easily be re-suspended by passing cars, lorries and wind, being a significant source of air pollution. Studies investigating the variability of the PM_{10} fraction (particles with aerodynamic diameter $<10\mu$m) of road deposited sediments are still few to completely understand the main factors influencing chemistry and mass concentration of such deposited PM_{10}. In the present study, a new sam-

pling methodology was devised and applied in order to collect the PM_{10} deposited sediments directly from road surface, minimizing also particle-losses of customary sampling procedures. The goals of the study were to understand the variability of road dust load and chemistry among different urban environments, including city centre, ring roads, and locations affected by demolition/construction activities. With this aim, a collaboration with the local Urban Police allowed to perform measurements (1 m^2 sampled) on active traffic lanes at 23 sampling sites during an intensive campaign performed in Barcelona (3.1 millions of inhabitants in the metropolitan area), Spain, in June 2007. The application of the same sampling procedure for each sampling site assured the inter comparability in levels of deposited PM_{10} and chemical profiles. Results showed that levels of PM_{10} road dust (3-23 mg/m^2 in the city centre) are basically controlled by traffic of uncovered heavy lorries (24-80 mg/m^2). Demolition and construction activities within the urban area showed to have a high impact (up to one order of magnitude). Chemical abundances (in %) are determined by the emission sources. Therefore, city centre locations showed enrichments in OC, EC, Fe, S, Cu, Zn, Mn, Cr, Sb, Sn, Mo and Zr, among others being Cu, Zn, Sb, Mo and Ba highest at sampling sites characterized by traffic deceleration (traffic-lights and crossroads).