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Sources of inhalable road dust particles in different European cities

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As a result of the demographic growth of large European cities, urban air pollution has become increasingly affected by traffic-related emissions in recent years. Emissions of inhalable particulate matter (PM) from road traffic are responsible for most of the exceedances of the Air Quality Limit Values (2008/50/EC). A large part of the road traffic emissions comes from the so-called non-exhaust sector. This comprises several mechanical processes that emit PM while vehicles are travelling, including wear of brakes, tyres and road pavement but mainly involving the resuspension of deposited particles due to wheel-generated turbulence (Schauer et al., 2006; Thorpe and Harrison, 2008). Several studies have shown that the importance of these non-exhaust emissions is comparable (or even higher) to that of emissions from vehicle exhaust systems (Querol et al., 2001 and 2004; Harrison et al., 2008; Amato et al., 2009). The concern over this PM component is increasing because while a downward trend for the exhaust emissions is being achieved through the EUROx standards applied over the last decade (2007/715/EC, 2002/80/EC among others), no abatement strategies are currently underway to combat non-exhaust emissions.

The present study aims to investigate the source origin of road sediments below 10 μm in three contrasting European urban environments: a densely populated major coastal Mediterranean city (Barcelona, Spain; 1.6 million inhab.), a much smaller Southern European city situated away from the coast (Girona, Spain: 95,000 inhab.), and a moderate sized Central European city (Zurich, Switzerland: 380,000 inhab.). The same sampling method, protocol and laboratory analysis was applied by the same operators for the three campaigns, in order to minimize technical and experimental uncertainties.

The principal sources responsible for road dust build-up and their contributions to road dust levels were investigated by means of a standard multivariate receptor model (PMF) commonly used for the source apportionment of ambient air PM.

The results presented have important implications for scientific and policy perspective: firstly, the chemical analysis of the collected samples provides valid emission profiles useful for airborne PM source apportionment studies. The Chemical Mass Balance approach and recent applications of Target Factor Analysis techniques have shown the importance of characterizing local source profile of PM for a reliable estimate of the source contributions to atmospheric PM (Amato et al., 2009; Escrig et al., 2009). Secondly, the field observations reported are of interest for dispersion modelling, since they explore the spatial variation of the strength of different PM10 sources (resuspension and brake wear) by means of the loadings (μg m-2) of sediments below 10μm and specific tracers such as Cu and Sb.