

Emission factors and mitigating measure for Vehicle-Induced Resuspension of PM₁₀ and brake-related elements

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Compliance with air quality standards requires control of source emissions: fine exhaust particles are already subject to regulation but vehicle fleets increase whilst the non-exhaust emissions are totally uncontrolled. Emission inventories are scarce despite their suitability for researchers and regulating agencies for managing air quality and PM reduction measures. Only few countries in Europe proposed street cleaning as a possible control measure, but its effectiveness is still far to be determined.

This study, pioneering in the Mediterranean region, offers estimates of both Real-world Emission Factors for PM₁₀ and brake-wear elements and the effect on PM₁₀ concentrations induced by intense street cleaning trials.

A straightforward campaign was carried out in the city centre of Barcelona with the innovative use of hourly elemental composition of fine and coarse PM to detect any short-term effect of street cleaning on specific tracers of non-exhaust emissions. Samples were analyzed by Particle Induced X-Ray Emission at an external beam facility based on a 3MV Tandatron accelerator (Chiari et al., 2005; Calzolari et al., 2006; Formenti et al., 1996).

Real-world Emission Factors for PM₁₀ averaged for the local fleet resulted to be 0.097 g veh⁻¹ km⁻¹, confirming the air quality burden of non-exhaust emissions in the Mediterranean cities. For brake related elements, total EFs were estimated, accounting for the sum of direct and resuspension emissions, in 7400, 486, 106 and 86 μg veh⁻¹ km⁻¹, respectively for Fe, Cu, Sn and Sb. In PM_{2.5} Fe and Cu emission factors were respectively 4884 and 306 μg veh⁻¹ km⁻¹.

Intense Street cleaning trials evidenced a PM₁₀ reduction of 3 μg/m³, with respect to reference stations. Due to adverse meteorological influence, such benefit was only detected during afternoon hours, and not on a daily basis. Hourly PM elemental monitoring allowed the identification of mineral and brake-related metallic particles as those responsible of the PM₁₀ reduction.

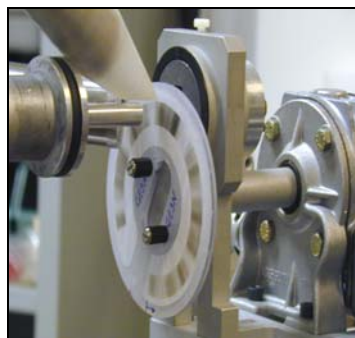


Figure 1: PIXE analysis of hourly PM elemental composition, performed at the external beam facility of the 3MV Tandatron accelerator in Florence (INFN)

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