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Advanced receptor modelling for the apportionment of road dust resuspension to atmospheric PM

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Fugitive emissions from traffic resuspension can often represent an important source of atmospheric particulate matter in urban environments, especially when the scarce precipitations favour the accumulation of road dust. Resuspension of road dust can lead to high exposures to heavy metals, metalloids and mineral matter. Knowing the amount of its contribution to atmospheric PM is a key task for establishing eventual mitigation or preventive measures. Factor analysis techniques are widely used tools for atmospheric aerosol source apportionment, based on the mass conservation principle. Paatero and Tapper (1993) suggested the use of a Weighted Least Squares scheme with the aim of obtaining a minimum variance solution. Additionally they proposed to incorporate the basic physical constraint of non negativity, calling their approach Positive Matrix Factorization (PMF), which can be performed by the program PMF2 released by Paatero (1997).
Nevertheless, Positive Matrix Factorization can be either solved with the Multilinear Engine (ME-2), a more flexible program, also developed by Paatero (1999), which can solve any model consisting in sum of products of unknowns. The main difference with PMF2 is that ME-2 does not solve only well-defined tasks, but its actions are defined in a "script file" written in a special-purpose programming language, allowing incorporating additional tasks such as data processing etc. Thus in ME-2 a priori information, e.g. chemical fingerprints can be included as auxiliary terms of the object function to be minimized. This feature of ME-2 make it especially suitable for source apportionment studies where some knowledge (chemical ratios, profiles, mass conservation etc) of involved sources is available.
The aim of this study was to quantify the contribution of road dust resuspension in PM10, PM2.5 and PM1 data set from Barcelona (Spain). Given that recently the emission profile of local road dust was characterized (Amato et al., in press), authors show how to apply in ME-2 this knowledge to obtain a quantitative assessment of this source. The achievement of this objective permitted to show how is possible to improve a basic solution of PMF2 basing on an extended model.
Results show that road dust resuspension accounted for 6.7 μg/m3 (16%) in PM10, 2.2 μg/m3 (8%) of PM2.5 and 0.3 μg/m3 (1%) of PM1, revealing that fugitive emissions were responsible of the 36%, 18% and 2% of total traffic emissions respectively in PM10, PM2.5 and PM1.

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