Source Apportionment of Children Exposure to Particulate Matter in Lisbon

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Keywords: Particles, homes, schools, receptor models
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Introduction

According to the LIFE Index-Air survey, children living in Lisbon spend 87% of their time in indoor micro-environments (ME), such as homes (55%) and classrooms (27%). This indicates that risk assessment should focus on these ME where air particulate matter (PM) levels may differ from those outdoors due to specific indoor sources. Therefore, investigating the sources of PM in homes and schools and understanding to what degree indoor particles are affected by indoor activities or by outdoor pollution is a very relevant challenge. This work was developed in the framework of the LIFE Index-Air project (www.lifeindexair.net) and aims to identify the sources that affect the children exposure to PM in Lisbon.

Methods

This study was performed in the city of Lisbon at 40 houses, 5 schools and respective outdoor sites during the years 2017-2018 (Fig. 1). Leckel MVS6 samplers were used to collect PM2.5 and PM2.5-10 on Teflon filters, which were analysed by X-Ray Fluorescence for the measurement of major and trace elements, and on quartz filters, which were analysed by the Thermo-Optical Transmittance method for the determination of the organic and elemental carbon. A source apportionment analysis of the PM data was carried out by means of Positive Matrix Factorization to identify the main sources and their contribution.

Figure 1. Equipment installed in a classroom and outside the school (upper graphs) and in a living room and in the balcony (lower graphs).

Conclusions

The PMF identified six source factors that contributed to PM: vehicles exhaust, secondary sulfates, mineral dust, a Pb source, sea salt and road dust.

The mineral factor was identified by crustal species such as Al, Si, Ca, Ti, Fe, Cr. In schools, the contribution of this source was significantly higher than in homes and outdoors, showing the important contribution of the high activity of primary schools students in the resuspension of deposited particles in classrooms.

Vehicles exhaust and road dust profiles comprise organic and elemental carbon from motor exhaust, metals form brake wear and mineral elements from the soil resuspension. Results showed a good correlation between the vehicles contribution to indoor (both in homes and schools) and the correspondent outdoor sites indicating significant children exposure to PM originating from outdoor urban sources, due to high aerosol infiltration rates.

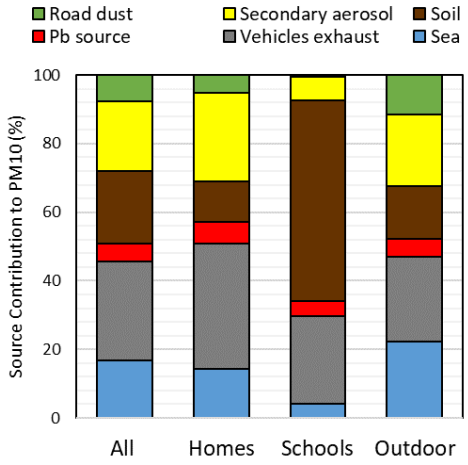

Figure 2. Source contribution to PM10 sampled in all ME, homes, schools and outdoors.

This work was supported by LIFE Index-Air project (LIFE15 ENV/PT/000674). Authors gratefully acknowledge the FCT support through the UID/Multi/04349/2013 project and the PhD grant SFRH/BD/129149/2017. This work reflects only the authors' view and EASME is not responsible for any use that may be made of the information it contains.