Pollution sources affecting oxidative potential of fine aerosols from a Portuguese urban-industrial area

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Associated conference topics: 2.9, 4.5, 4.6
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Oxidative potential (OP) of aerosols is considered as a highly relevant indicator to characterize the toxicity of particulate matter (PM), with recent studies associating OP measurements to adverse health effects.

The dithiothreitol method (OP^{DTT}) has been widely used to assess OP of particles and it has been linked to airway inflammation markers, cellular oxidative stress markers, cellular cytotoxicity and cardiorespiratory health endpoints in epidemiological studies. These findings support OP as a highly health-relevant air quality parameter. However, specific chemical species, aerosol sources and processes that affect the OP of PM are still not well established. No studies are currently available for Portugal.

Fine aerosols ($PM_{2.5}$) were sampled during one year (Dec 2019-Nov 2020, total of 128 sampling days) in an urban-industrial area of the Metropolitan Area of Lisbon (Seixal, Portugal) and their chemical composition was assessed to perform a source apportionment study using Positive Matrix Factorisation. A total of 7 different sources were identified: soil, secondary sulphate, fuel-oil combustion, sea, vehicle non-exhaust, vehicle exhaust and industry (Gamelas et al., 2023).

As a preliminary study, thirty samples were chosen considering the highest load for each source (both massic or %), which could eventually allow to understand the impact of each source regarding its associated OP, assessed by the dithiothreitol method following the methodology fully described elsewhere (Chirizzi et al., 2017). The final DTT activity of samples was normalised in terms of sampled air volume and in terms of collected aerosol mass.

Samples presented mean levels of DTT activity (normalized to the mass) of 11.9 ± 6.8 pmol/min*µg, ranging from 2.6 to 26.1 pmol/min*µg. The DTT activity (normalized to the sampled volume) showed to have an association with the $PM_{2.5}$ levels, as shown by Figure 1.

Considering that the contribution in mass of the different sources was known to the $PM_{2.5}$ levels, Spearman correlations were assessed and it was found significant correlations between DTT_v and two different sources: vehicle exhaust (R^2= 0.651, p-value = 0.001) and fuel-oil combustion (R^2 = 0.510, p-value = 0.016). Main combustion sources (biomass burning and traffic) have also been considered as the main contributors to the majority of DTT_V in fine aerosols in an urban background site in Italy (Giannossa et al., 2022).

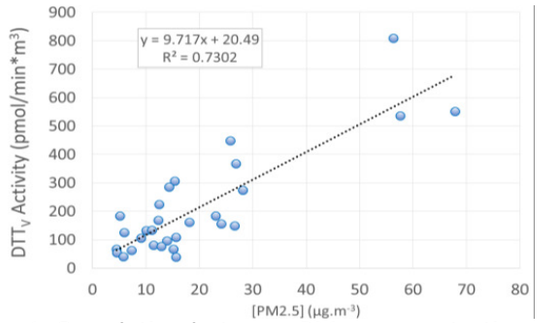

Figure 1. Correlation between $PM_{2.5}$ concentrations and their DTT_v activity.

Current work is assessing the OP of the remaining samples to evaluate the contribution of the different sources for the OP of fine aerosols in the study area. Moreover, additional OC/EC characterisation of all samples was also performed, which will be used to improve the source apportionment results.

The evaluation of the complete dataset (corresponding to one year of sampling) will also allow to assess the OP seasonal variability.

This work was supported by the Portuguese Foundation for Science and Technology (FCT, Portugal) through the HypnosAir project (PTDC/CTA-AMB/3263/2021), the contract 2021.00088.CEECIND (N. Canha) and the financial support to C²TN/IST (UIDB/04349/2020 + UIDP/04349/2020). The COST Action CA17136 – Indoor Air Pollution Network is also acknowledged for supporting the Short-Term Scientific Mission of N. Canha at DISTEBA (Lecce, Italy) in May 2022.

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