PM Oxidative Potential:

response of acellular assays to predict PM-induced oxidative stress activity

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The importance of extracting solutions for a more relevant evaluation of the oxidative potential of particulate matter using DTT and AA assays.

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The dithiothreitol (DTT) and Ascorbic Acid (AA) methods are two of the widely used acellular assays to quantify PM oxidative potential. In such assays, it is essential that the filter extraction conditions mostly represent the physiological fluids encountered by PM in lung.

For this purpose, in this work the Gamble's solution was used to extract real $PM_{2.5}$ filters, as it is a mixture of salts (pH: 7.4) miming the interstitial lung fluids. Also phosphate buffer (pH 7.4) and methanol were used, as the most widely applied extraction solvents, even if they are unrepresentative of physiological conditions.

The field study concerns 24 $PM_{2.5}$ samples collected at an urban (Bologna) and rural (san Pietro Capofiume) site in March-April 2018. The $PM_{2.5}$ samples were analyzed for their mass concentration, metals and Elemental and Organic Carbon.

A comparison was performed among the OP responses measured after extraction with three different solutions, in order to look at the impact of extracting media on OP responses. The obtained results are summarized in Figure 1, where the average values (±standard deviation) were separately computed for urban and rural samples.

Our finding for AA assay is a significant decrease of the OP^{AA}_V responses, mainly for urban samples, when methanol was used for extraction, in comparison with the other media (t statistical test, p-value < 0.05). On the contrary, a different pattern was shown by the other solutions depending on $PM_{2.5}$ composition, with higher OP^{AA}_V response for urban samples extracted with buffer and for rural ones extracted with Gamble's solution. Overall, all the obtained OP^{AA}_V were poorly correlated with the concentrations of $PM_{2.5}$ mass and aerosol components.

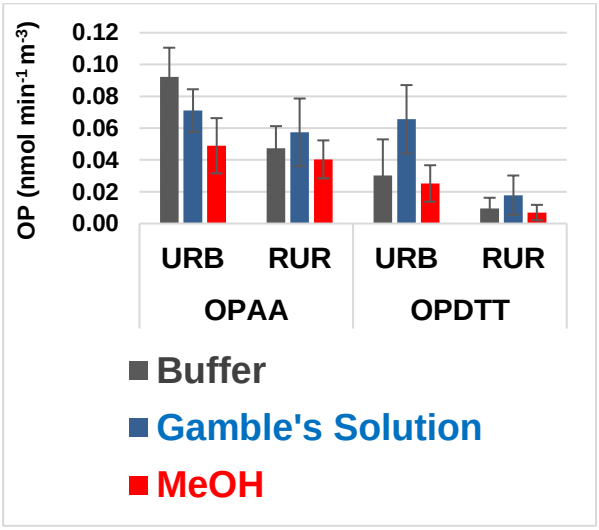

Figure 1: mean OP^{DTT}_V and OP^{AA}_V of PM from different locations extracted with the different media (bars correspond to standard deviation).

Concerning the DTT assay, the Gamble's solution extraction yielded the highest OP^{DTT} responses for all samples. This may be due the complexation of some PM components from ligand compounds present in such a solution. The obtained values were correlated with the concentrations of $PM_{2.5}$ mass and aerosol components, including OC, EC, and various water-soluble metals. In particular, MeOH extracted samples were highly ($R^2 \geq 0.9$) correlated with OC and EC. This finding may be explained by the increased extraction power of such an organic solvent towards the carbonaceous components, which are particularly active to DTT assay.

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