Contribution of water-soluble organic matter to the oxidative and immunomodulatory effects of inhalable fine air particles

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Setting the scene on the health effects of $PM_{2.5}$

Effects of the exposure to inhalable fine air particulate matter ($PM_{2.5}$)

- Cardiovascular diseases, airway damages, lung carcinogenesis, and adverse effects on neurodevelopment.[1,2]
- Impairment of physiological and biochemical processes through oxidative stress, genotoxicity, and inflammation, with these effects occurring primarily in the lung cells. [1]
- These health effects have been mainly linked to $PM_{2.5}$ mass concentration.[3]
- $PM_{2.5}$ constituents and sources were also recognized as having an important role in the induction of toxic responses.[3-5]

$PM_{2.5}$ constituents involved in the biological effects

- Water-soluble metals (e.g., Ni, Cr, Pb) and water-soluble ions (e.g., sulphate, nitrate) from $PM_{2.5}$ have been linked to oxidative and inflammatory responses.[4,5]
- Water-soluble organic matter (WSOM) from $PM_{2.5}$ has been recently recognized as capable of modulating redox and inflammatory states in several cell models.[5-7]
- However, the contribution of WSOM on the inflammatory and redox cellular status of airway tissues remains largely unknown due to its inherent complexity, with different chemical structures and associated physical properties.

What is the relation between fine aerosol WSOM composition and its biological effects?

- The research group has recently shown that the structural features of WSOM from $PM_{2.5}$ are correlated with its ability to induce a moderate inflammatory status in macrophages.[7]
- These preliminary findings highlight the need to develop additional research to firmly establish the association between the WSOM constituents and the biological responses they elicit.
- Studies focusing on aerosol WSOM-induced biological responses should merge emissions and chemical features with possible health effects.

Experimental approach

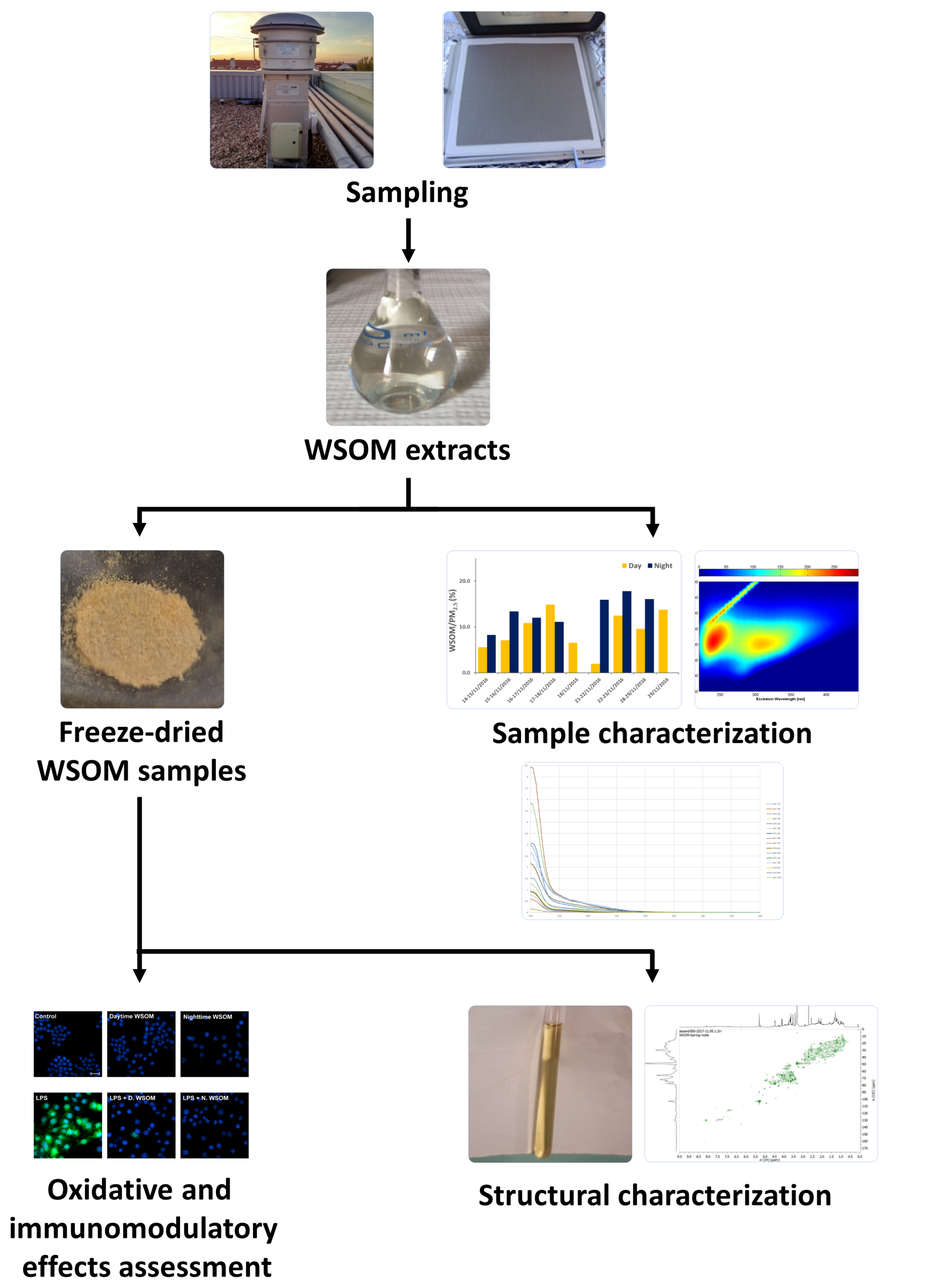

Figure 1 – Experimental approach for the characterization of WSOM from $PM_{2.5}$ and assessment of its oxidative and immunomodulatory effects.

Research questions to be answered in this PhD research project

- How does the day-night cycle, the season, and the location affect the characteristics of WSOM from $PM_{2.5}$ and its consequent oxidative and immunomodulatory effects?
- What are the oxidative and immunomodulatory effects of the exposure of lung cells to WSOM from $PM_{2.5}$?
- How are the structural features of WSOM linked to the biological effects of this $PM_{2.5}$ fraction?

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