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Source apportionment of the redox activity of urban fine particulate matter in Athens, Greece

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In this study, we performed chemical characterization and source apportionment of the oxidative potential of airborne particulate matter <2.5 μm in diameter particulate matter ($PM_{2.5}$) at a residential, urban background (UB) site in the outlying neighborhood of Demokritos (Greece). To this end, weekly time-integrated $PM_{2.5}$ samples were collected during summer (July-September), and winter (February-March). PM samples were then analyzed for chemical composition, and the *in vitro* alveolar macrophage assays were performed to determine PM oxidative potential. Chemical analysis was done for metals, water-soluble organic carbon (WSOC), elemental and organic carbon (EC/OC), and markers of biomass burning (e.g. levoglucosan). The Spearman rank-order correlation analysis was then used along with the principal component analysis (PCA), and multiple linear regression (MLR) to apportion the redox activity of $PM_{2.5}$ into its contributing sources. Results of this study indicated that the intrinsic (mass-based) and extrinsic (volumetric) oxidative potentials of ambient $PM_{2.5}$ in urban background region of Athens was noticeably higher than PM redox activity in many metropolitan areas of the world. In addition based on MLR results, traffic emissions (characterized by EC), secondary organic aerosols (SOA) (characterized by WSOC), and biomass burning (identified by levoglucosan) were the major sources contributing to 44%, 16%, and 9% of the PM oxidative potential respectively. Higher oxidative potential levels were also observed in warm phase than cold period, due mainly to higher concentrations of EC, and WSOC during warm season. Results of this study reveal the most significant $PM_{2.5}$ sources which are responsible for PM-induced toxicity and thus can be used by policy makers and public health authorities to adopt appropriate policies regarding detrimental health impacts of $PM_{2.5}$.

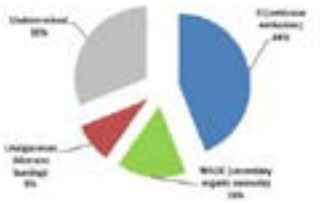

Figure 1: Source apportionment of the redox activity of urban fine particulate matter.

Recent Publications:

1. Diapouli E et al. (2017) Evolution of air pollution source contributions over one decade, derived by PM 10 and PM 2.5 source apportionment in two metropolitan urban areas in Greece. Atmos. Environ. 164:416-430.
2. Shirmohammadi F et al. (2018) Chemical composition and redox activity of PM 0.25 near Los Angeles International Airport and comparisons to an urban traffic site. Sci. Total Environ. 610-611:1336–1346.
3. Landreman A P et al. (2008) A macrophage-based method for the assessment of the reactive oxygen species (ROS) activity of atmospheric particulate matter (PM) and application to routine (Daily-24 h) aerosol monitoring studies. Aerosol Sci. Technol. 42:946-957.

Biography

Constantinos Sioutas is the Fred Champion Professor of Civil and Environmental Engineering Department at University of Southern California (USA). He has completed ScD in Environmental Engineering from Harvard University. His area of expertise includes development of several particle sampling technologies that have enabled the assessment of the relative toxicity of particulate matters using realistic atmospheres in *in-vivo* and *in-vitro* exposure studies funded by US Environment Protection Agency, National Institute of Health and California Air Resources Board in Southern California. Findings from his work have also been extensively used in the revision of US EPA national air quality standards on particulate matters.

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