Atmospheric Aerosol Characterization and Source Apportionment: The Key Role of X-ray Based Techniques

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The efforts to improve air quality and to understand the climate changes must rely on a knowledge of the processes (the "sources") responsible of the emission of pollutants into the atmosphere. This kind of exercise if usually named as "source apportionment" and it's particularly complex in the case of atmospheric aerosol or particulate matter (PM). All over the world, PM samples are collected and sent to several laboratory analyses to determine their composition. As a matter of fact, most of the emitting sources can be identified and apportioned looking for their footprint in the PM composition. In particular metals, despite usually accounting for a minor fraction of the PM, are quite stable and their atmospheric concentration can be linked to the peculiar emission pattern of different sources. In this contest, X-ray based techniques (i.e. XRF, PIXE and others) are among the most effective tools to measure the PM composition in large quantities of samples. In fact, the thickness of the PM deposited on filtering membranes during PM sampling campaigns, is generally small enough to make negligible self-attenuation an energy loss effects with a consequent simplification of the data reduction process. On the other hand, very abundant PM components cannot be detected (at least with a complete information on their chemical form) by X ray fluorescence (eg: carbonaceous compounds, nitrates, sulphate, etc.). Other techniques must therefore be coupled with X ray fluorescence to gain the complete PM characterization and to run the source apportionment codes.
Several examples on the role of X ray analysis on time and size resolved PM characterization and in source apportionment studies will be given.