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An Integrated Microscopy And Spectroscopy Approach For The Characterization Of Air Particulate Matter

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As the main responsible of pollution, particulate matter (PM) in big cities and industrial sites greatly affects the life quality of an ever-growing number of people all over the world. That situation drives the strong effort for continuous PM monitoring by governmental and environmental protection agencies. Despite great attention to such air quality control, the analysis of particulate is often limited to the study of size distribution and elemental composition giving only few information on the pollutant sources of origin (source apportionment). Information about such sources could assist in the development of strategies towards the reduction of pollutant emissions.

In this framework, we report a novel integrated approach for the qualitative and quantitative analysis of air particulate. The developed method leverages on the integration of different analytical techniques on PM samples such as Scanning Electron Microscopy (SEM), Raman Spectroscopy and Fourier Transform Infrared Spectroscopy (FTIR). The proposed protocol aims both at identifying the main constituents of air particulate identifying at the same time its sources (car wheel, combustion, asphalt, car brake, etc...).

The SEM analysis provides information on the size distribution and elemental composition of the particles, whereas the Raman and FTIR spectroscopy allow for the identification of the actual components. By comparing the results of the analysis with a database of spectra obtained from known samples, PM particles can be associated with a probable source.

Finally, a mapping strategy of air sampling filters for the rough quantification of each component of the particulate via Raman and FTIR spectroscopy will be presented.