Point of View

Analytical Chemistry: Atmospheric Particulate Matter and Environment

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I would like to thank the Brazilian Journal of Analytical Chemistry (BrJAC) for the invitation to contribute my point of view on atmospheric pollution, an important topic in environmental analytical chemistry.

Atmospheric pollution has been an area of interest and concern throughout the years due to its harmful effects on agriculture, forests, buildings, works of art, and human health. Atmospheric pollution can occur directly (inhalation or ingestion) or indirectly (contamination of hydric resources, food, or soil), and is composed of atmospheric aerosol that is related to the emission source (anthropogenic or not). Atmospheric particulate matter (APM) can be present in the atmosphere in addition to gases. In urban environments, APM is mostly found as inhalable particles with aerodynamic diameters smaller than 10 micrometers (PM_{10}) and as respirable particles ($PM_{2.5}$ or smaller).

The chemical characterization of APM and the investigation of its effects on the environment and human health requires, in my opinion, a multidisciplinary approach involving various areas of science, such as geosciences, health sciences, engineering, architecture and urbanism, physics, and chemistry. In this context, Analytical Chemistry has a fundamental role, including the development of sample preparation methods and the identification, quantification, and chemical speciation of trace elements (adverse effects on human health) and black carbon analysis (climate change and mortality due to respiratory diseases). Analytical Chemistry also involves the analysis of organic compounds such as polycyclic aromatic hydrocarbons (PAHs), the investigation of the bioaccessibility of essential and toxic species (risk assessment), the evaluation of meteorological influences compared to concentration/dispersion of particulate matter, and the application of receptor models (identifying and quantifying emission sources of particulates). In addition, Analytical Chemistry contributes to studies involving climate change (the particulate matter influences the radioactive balance and cloud formation; therefore, acting as an agent in climate change). Finally, Analytical Chemistry includes the investigation of internal atmospheres (indoor), such as classrooms, recreation areas, offices, automobiles, tunnels, parking lots, and bus stations (where concentrations of pollutants are often high). Analytical Chemistry can also help with the correlation of atmospheric pollution with the deleterious effects of cigarettes (cancer), the interactions between species in the soil, atmosphere, and water bodies, and the study of atmospheric pollution at regions affected by mining-metallurgical activities. Furthermore, the geosciences area is of fundamental importance for the comprehension of the obtained results and their interactions with the environment. In the specific case of Juiz de Fora (MG), the partnership between the Chemistry and Geosciences Departments of the Federal University of Juiz de Fora (DEGEO-UFJF) allowed for a better and critical interpretation of the meteorological data extracted from the meteorological station of UFJF.

In conclusion, it is not an overstatement to say that Analytical Chemistry is of great importance to studies related to atmospheric pollution. The diverse origins of this type of matrix (its composition depends on emission sources, such as biomass burning, vehicular emissions, and industrial emissions, etc.) and the complex nature of its interactions indicates an imperative demand for the development of new analytical strategies to overcome the challenges of atmospheric analyses, as discussed by Prof. Dr. Daniel Borges (DQ-UFSC) [1] in the special number of BrJAC dedicated to 17th Brazilian Meeting on Analytical Chemistry (ENQA).

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1.Borges, D. L. G. Analytical Chemistry in Brazil: Working at the frontier. *Br. J. Anal. Chem.*, **2014**, 3 (12), p. X.