**Trends in Extraction of Chemical Information from N-Dimensional Analytical Strategies Applied to Atmospheric Aerosols**

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The interfacing of multidimensional chromatography (such as two dimensional (2D) comprehensive liquid chromatography, LC×LC) coupled with either online or offline multidimensional analytical instrumentation (such as high resolution mass spectrometry and 2D nuclear magnetic resonance (NMR) spectroscopy) can provide a plethora of large data sets containing chemical information that need to be handled properly in order to become manageable and useful. When such N-dimensional analytical strategies are applied to characterize the natural organic matter (NOM) of complex samples such as atmospheric aerosols, the task of handling and re-arranging such data sets may become an endeavour of utmost importance for decoding the structural features of NOM present in fine atmospheric aerosols. Apart from the intricacies of data acquisition from different instrumental setups available, there are also the difficulties of multivariate analysis of complex data that need to be translated into knowledge about the huge variety and inherent complexity of the molecular structures and formation mechanisms of the Organic Aerosol (OA) fraction.

The application of multivariate and computer based concepts to the interpretation of chemical data obtained from N-dimensional analytical methods can provide insights mainly when dealing with complex samples and “messy data”. This work highlights the specific problems when dealing with N-dimensional experimental designs, and incorporation of quality control strategies at the acquisition stage of N-dimensional analytical data, pre-processing options fit for multivariate analyses, and definitions of sound principles for choosing fit for purpose models in order to avoid misinterpretations of data. Furthermore, this work attempts to follow the application of the above mentioned principles with data from LC×LC and a combination of excitation-emission matrix (EEM) fluorescence spectroscopy and 2D correlation of FTIR and NMR spectroscopies, applied to the characterization of NOM from atmospheric aerosols.

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