Development of supercritical fluid extraction – gas chromatography –mass spectrometry for the investigation of SOA chemical composition formed in smog chamber experiment

Perraudin E.[1], N. Maurin[1], L. Chiappini[1], B. Picquet-Varrault[1],
A. Mellouki[2], J. Wenger[3] and J.F. Doussin[1]

1 LISA, Universités PARIS 12 et 7, CNRS, 61 Avenue du Général De Gaulle, 94010 Créteil, France
2 ICARE UPR CNRS 4211, 1C avenue de la recherche scientifique 45071 Orléans Cedex 2, France
3 Center for Research into Atmospheric Chemistry, Cork University, Ireland

To evaluate the toxicity or the cloud condensation nuclei potential of atmospheric aerosols, it is critical to determine its chemical composition. Furthermore, to model these effects it is also important to link this composition with the chemical processes involved in the aerosol formation and ageing. In this context, atmospheric simulation chambers are essential tools to carry out experiments under controlled and close to real experimental conditions. For these two reasons, an analytical method dedicated to the chemical composition analysis of SOA formed in smog chamber experiment was developped.

This method is based on the coupling of supercritical fluid extraction to gas chromatography and mass spectrometry (SFE/GC/MS). One of the key feature of this method is the in-situ derivatisation (silylation by BSTFA), which allows the measurement of polar and polyfunctional compounds bearing hydroxyl or carboxylic acid groups. This one-step technique avoids sample pre-treatment and hence reduce contamination sources. Moreover, it is time-saving and organic solvent free since the extraction fluid is supercritical CO_2. This method has already been optimised for SOA formed from ozonolysis of biogenic and anthrogenic precursors. After a short description of this analytical technique, the ability (linearity, detection limit and repeatability) to address the previously exposed issue will be illustrated through the identification and quantification of the compounds of SOA from sabinene ozonolysis. SFE/GC/MS appears to be a promising method for SOA chemical composition analysis allowing to perform simulation chamber experiments at low precursor concentrations and to collect aerosol with relatively high frequency. Future developments of the technique, concerning especially oligomers analysis, will finally be discussed.