Quantifying the Levoglucosan in atmospheric aerosols by High Pressure Liquid Chromatography-Electrospray Ionization Ion Trap Mass Spectrometry

Laure MARET

Introduction

Atmospheric aerosols (i.e., suspended particles), in general, present a particular interest due to their ability to affect the climate on a local and global scale. Indeed, biomass burning, which is a significant source of aerosol particles in the atmosphere, produces an impact on the global climate.

Levoglucosan (1,6-anhydro-β-D-glucopyranose) is a product of cellulose combustion, which has been recognized as a biomass burning tracer in atmospheric aerosol particles. Part of the levoglucosan is consumed in different reactions during combustion but it is emitted in large quantities in the final aerosol smoke. Therefore it can be utilized as a specific tracer for the presence of emissions from a given biomass burning source in an atmospheric particulate matter. Consequently, a lot of effort has recently been put into developing methods to quantify levels of levoglucosan

Experimental Conditions

The different samples came from an air collector, which inhaled the atmospheric air through DA-80 filters. Then, filters of 3.8cm of diameter were taken from those filters and extracted in 15mL of water.

The chemical analysis was performed by high-performance liquid chromatography with quadrupole tandem mass spectrometric detection, in the following conditions:

- Instruments : Dionex 2010i and ThermoFisher scientific LCQ Fleet
- Column : Dionex carbopac PA1 (4x250mm)
- Carrier gas type : helium
- Flow-rate : 1.2mL/min, with a flow of leak at 0.4mL/min, fixed at the end of the column
- Injection volume : 449µL
- Method of sample ionisation : ESI
- Separation of sample Ions : Simple quadrupole

Levoglucosan was identified by negative ion electrospray mass spectrometry using m/z 161/113, 161/101, 161/ 85, and 161/71 as monitoring ion transitions. Contamination problems were carefully taken into account by adopting ultraclean procedures during sampling and sample extraction.

Results and discussion

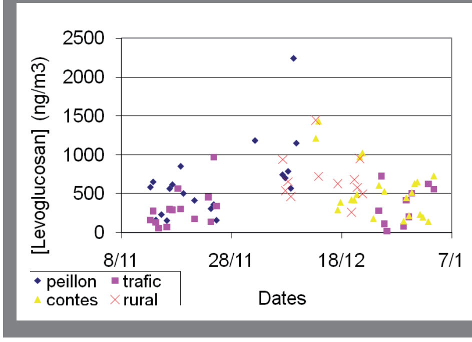
The detection and quantification of levoglucosan was easily performed by cleaning the column between each sample. Thanks to two injections, stability and reproducibility of the results were observed.

The daily evolution of levoglucosan concentration (Figure 1) was realised at four different sites, which presented different environments (Road traffic, cement works, countryside...).

The activity of the cement works influences the air quality. Indeed after the cement works closed on December 21st at the site of Contes there was a dramatic fall in the levoglucosan concentration.

Furthermore, there was a strong episode of burning on December 9th on the Peillon site.

Figure 1. Daily evolution of levoglucosan concentration



Conclusion

The levoglucosan analysis allowed to identify a kind of pollutant.

Indeed, in the valley where the study took place, the cement works influenced the air quality. The European regulation, which fixed the PM10 maximum value (pollutant particles with diameters lower than 10µm), is not respected in this valley. When PM10 concentration went over 50µg/m3 it was partially due to the cement works.

The ions study, particularly the dosage of the nitrates and sulfates, also showed the influence of this activity.

A second project is planned in June and July, to look at the difference between winter and summer, and the real contribution of wood burning in the air quality and the real impact of cement works.

Laboratoire de Glaciologie et Géophysique de l'Environnement
CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE

Laboratoire de Glaciologie et Géophysique
de l'Environnement
54 rue Molière
38402 St Martin d'Hères Cedex