Application of Curie-point-Pyrolysis-GC-MS for Characterisation of organic Compounds in airborne Particulate Matter

A contribution to subproject AEROSOL

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Curie-point-pyrolysis-gas chromatography/mass spectrometry (Cp-Py-GC-MS) was applied to the study of the chemical composition of size-segregated atmospheric aerosol samples of 0.05 to 3.5 µm diameter collected by a Berner-type cascade impactor.Moreover, aerosol samples were collected by a high-volume sampler (diameter < 10 µm) on quartz fibre filter. In the present study a modified commercial Cp-pyrolyzer was mounted directly onto a GC-MS system. As ferromagnetic carrier Fe/Ni foils with a Curie point of 590°C were used, which can be placed directly in the Berner-impactor. In the case of quartz fibre filter a small piece of coated filter was wrapped in the Pyrofoil.

In Curie point pyrolysis the carrier is heated rapidly (0.2 s) to the pyrolysis temperature by eddy currents induced in the presence of an RF frequency magnetic field. When the alloy reaches its Curie point temperature the carrier becomes non-magnetic and the heating effect ceases. The self-limiting temperatur of an inductively heated carrier and the rapidity of temperature increase are major advatages of the Curie point system.

The Cp-Py-GC-MS can be utilized for identification and quantification of polycyclic aromatic hydrocarbons, n-alkanes and other semivolatile components in atmospheric aerosol particles. At the given temperature of 590 °C under helium atmosphere the main part of relevant PAHs evaporated without degradation. The quantification can be carried out by addition of deuterated internal standards. The Cp-pyrolysis as well is a powerful method for component and structural analysis of non-volatile compounds like polymers which are represented one of known uncertainties in the chemical analysis of the organics in atmospheric particles. The fact that a minute amount of sample (sub mg range) can be analyzed without any additional sample preparation makes the Cp-Py-GC-MS superior to other techniques.