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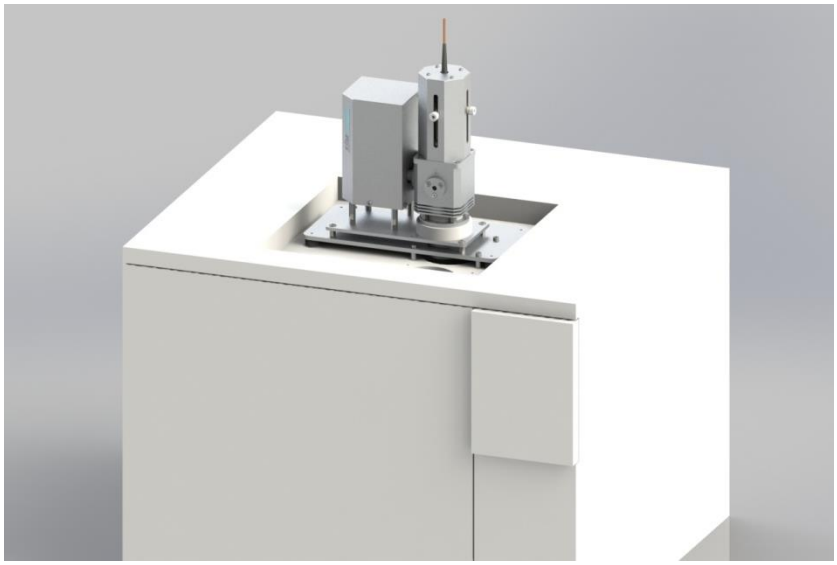
Agilent Technologies
Premier Solution Partner

EPED GC Detector

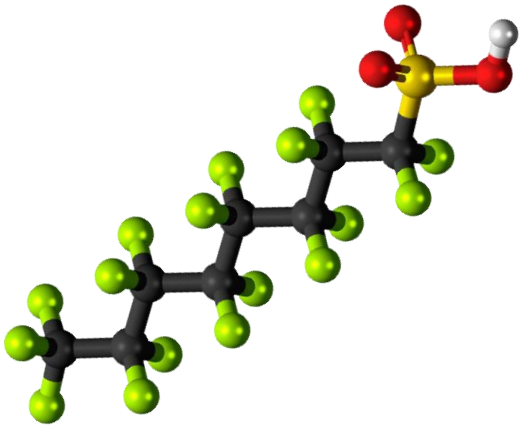
Trace analysis of halogen and sulfur compounds



Analyze sulfur and halogen compounds with the element-specific GC detector EPED:

The Echelle Plasma Emission Detector (EPED) is an element-specific detector developed for the selective analysis of sulfur and halogen compounds. Compared to the also element-specific AED (Atomic Emission Detector), however, it is more robust and the detection limits are lower by a factor of 5 - 10. The advantage of the EPED over a mass spectrometric detector lies in the equimolar response of the Echelle spectrometer, making quantitation of unknowns and samples without specific standards possible as you need just one standard per element for calibration. Fields of application are the currently very up-to-date PFAS-analysis (per- and polyfluorinated alkyl substances), the analysis of chlorinated paraffines and brominated flame retardants as well as sulfur containing pesticides, the sulfur content of gasoline and diesel, and many more.

Analysis of PFAS and chlorinated paraffines



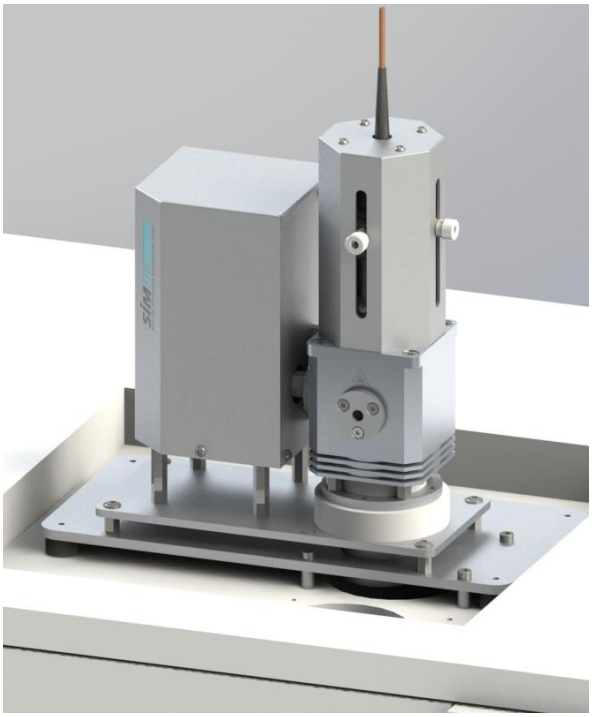
Perfluorooctanesulfonic-acid-3D-balls, Jynto, C0
via Wikimedia Commons

PFAS and chlorinated peraffins in particular, which are classified as persistent organic pollutants and are therefore regulated throughout the EU, are very complex mixtures of substances with a large number of congeners and isomers. The EPED with the equimolar response is particularly suitable for screenings, as quantitative determination is possible without the need for a reference standard for each individual substance. The selective quantitative determination of individual F and Cl species, but also of a mixture not completely chromatographically separated, is thus made possible achieved via the fluorine or chlorine content.

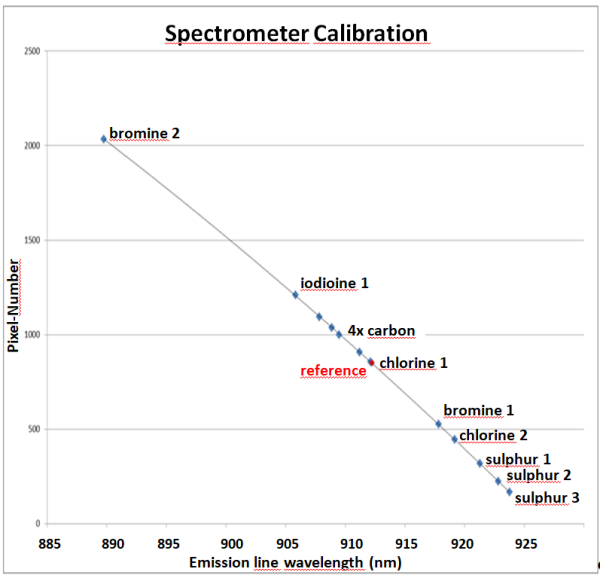
Principle and Detector Design

The functional principle of the detector is based on the atomization of the molecules introduced into a helium plasma:

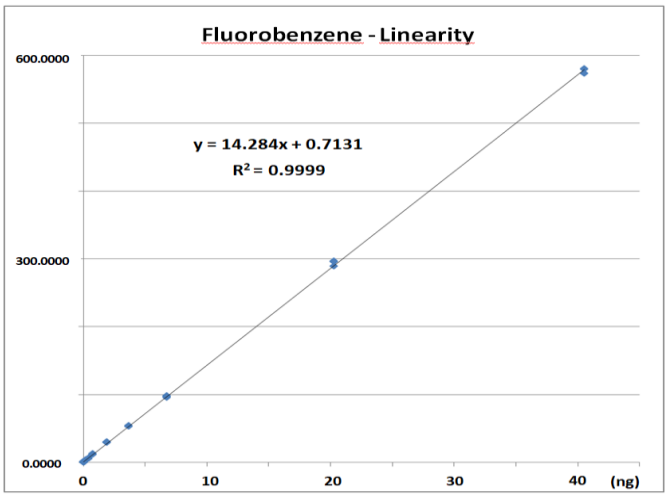
The spectral data are evaluated element-specifically with a high-resolution Echelle spectrometer.
The detector is mounted on the gas chromatograph so that the analytes reach the plasma cell directly when eluted from the GC column; adsorption effects can be mostly excluded.
A pulsed high-frequency microplasma is maintained in the plasma cell by contacting electrodes. Here, the analytes are atomized and induced to emit light. The emitted light is directed into the Echelle spectrometer via an optical fiber. The wavelength of the emitted energy is element-specific and directly proportional to the concentration, so that the peak areas in the chromatogram can be used for quantification. The evaluation is integrated into the Agilent OpenLAB software.



Calibration and Sensitivity

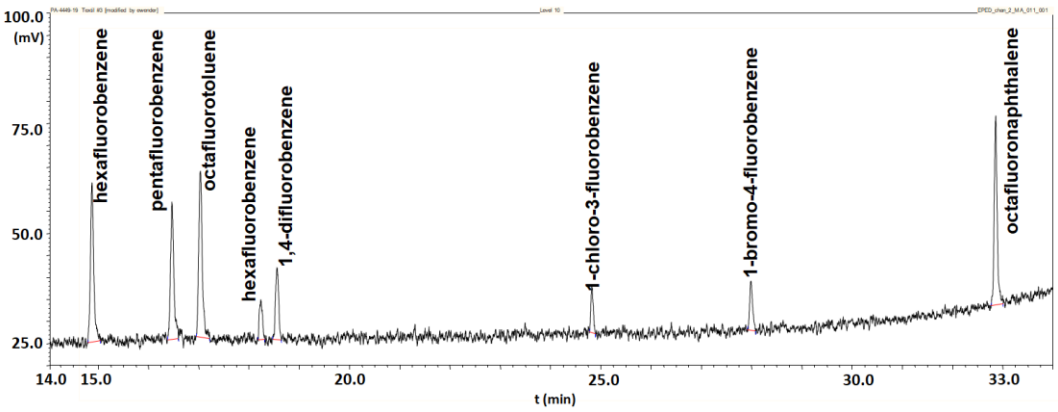


The Echelle grating enables the high spectral resolution of the emitted light. With the high resolution CCD camera, the element-specific wavelengths for halogens and sulfur are recorded.
Up to three wavelengths of an element can be added for evaluation in order to increase sensitivity.



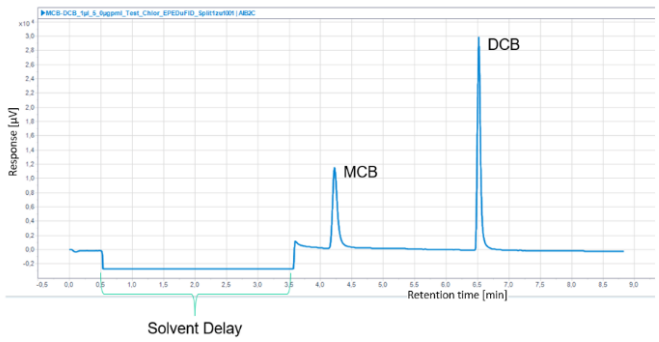
Due to the detection principle, the EPED does not require a separate standard (primary standard) for each analyte, but can be calibrated with one substance per element. The calibration for fluorobenzene is shown on the left. It can be used for all analytes containing fluorine. You can see the very good linearity over a wide concentration range (generally over 3 - 4 decades).

Calibration of fluorobenzene (15 pg – 40 ng)



separation of 8 fluorine compounds with concentrations of 0.04 to 0.214 ng

Long Term Stability



separation of monochlorobenzene (MCB) and 1,2.dichloro-benzene with solvent peak suppression (solvent delay)

To ensure a stable measurement, hydrogen and oxygen are used as reaction gases in very small quantities.

Moreover, the He plasma is switched off during the solvent peak (solvent delay) to avoid soot formation. This has further improved the long-term stability and sensitivity of the detector.

Features of EPED

- element-specific GC detector for halogens and sulfur
- linear range over 3-4 decades
- high sensitivity due to solvent suppression
- evaluation integrated in Agilent OpenLAB software
- trouble-free plasma operation at atmospheric pressure with air cooling:
  fuel gas: helium (100 ml/min), reaction gases: O_2 and H_2
  purge gas: N_2 (50 ml/min)
- long service life of the quartz plasma cell
- robust and low-maintenance detector for routine analysis and research
- fields of application:
  PFAS analysis (per- and polyfluorinated alkyl substances)
  chlorinated paraffines
  brominated flame retardants
  sulphur containing pesticides
  sulfur content in fuels and much more

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