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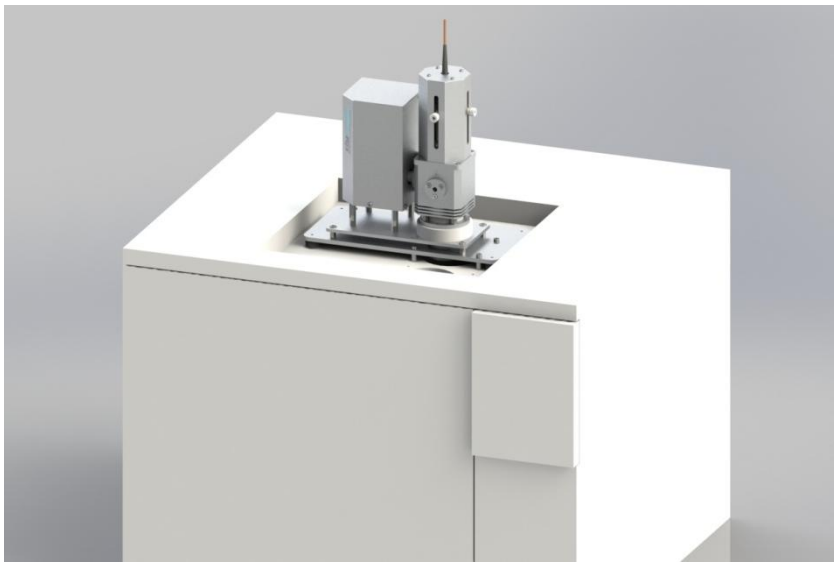
Agilent Technologies
Premier Solution Partner

EPED GC Detector

Trace analysis of halogen and sulfur compounds



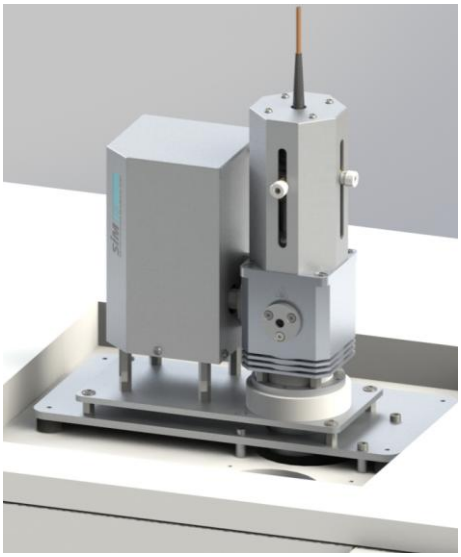
Analyze sulfur and halogen compounds with the element-specific GC detector EPED:

With coupling of high-frequency plasma and the high-resolution Echelle spectrometer you achieve detection limits of less than 5 pg/s.

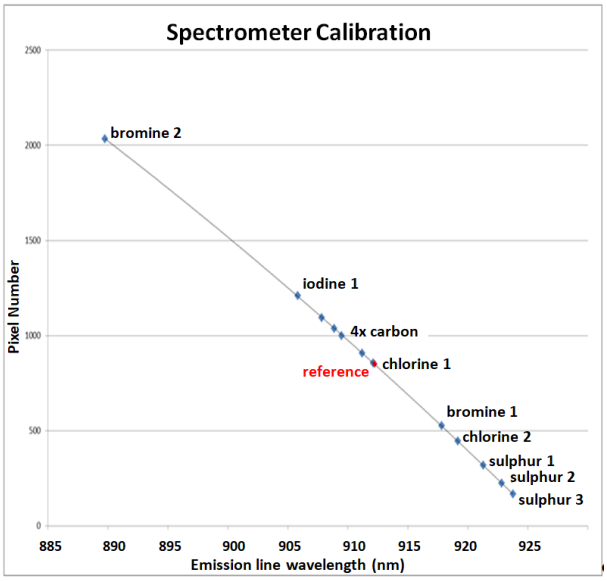
The Echelle Plasma Emission Detector (EPED) is an element-specific detector developed for the selective analysis of sulfur and halogen compounds. Compared to the also element-specific AED (Atomic Emission Detector), however, it is more robust and the detection limits are lower by a factor of 5 - 10. 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 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 brominated flame retardants as well as sulfur containing pesticides, the sulfur content of gasoline and diesel, and many more.

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:

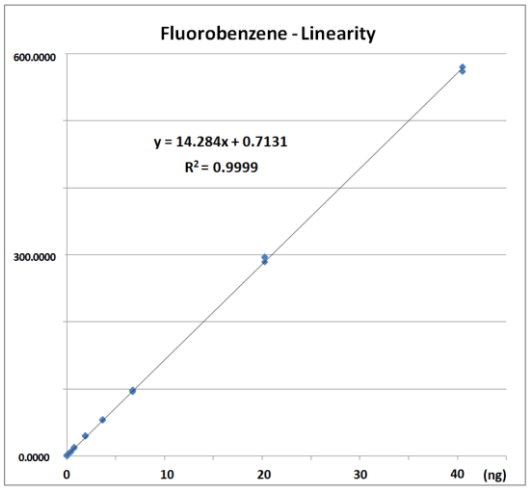


The detector is mounted on the gas chromatograph so that the analytes from the GC column reach the plasma cell directly. A pulsed high-frequency microplasma is maintained in the plasma cell by adjacent electrodes. Here the analytes are atomized and excited to emit light. The emitted light is guided into 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.



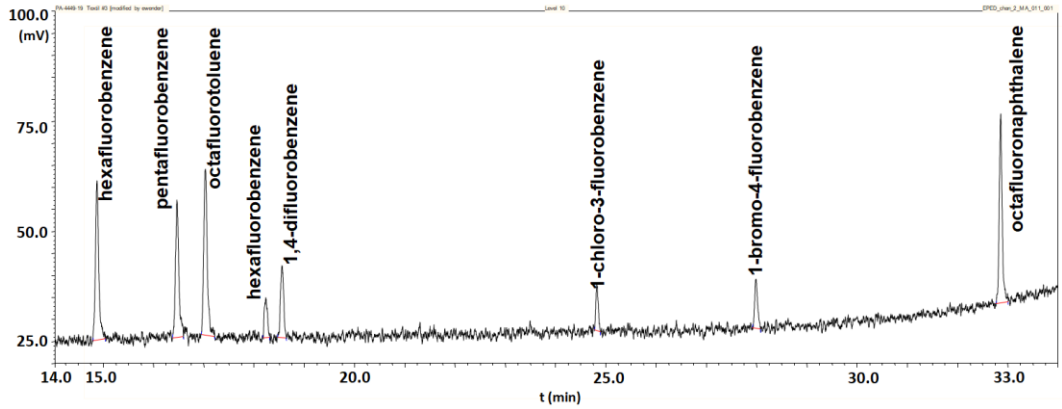
The Echelle grating enables the high spectral resolution of the emitted light. With the high resolution CCD camera, the element-specific wavelengths for halogens and sulfur are recorded. The element-specific lines of halogens and sulfur in the wavelength range from 889.5 nm to 926.5 nm are used for detection. After installing and "adjusting" the Echelle grating these wavelengths have to be checked and corrected if necessary.

Calibration and Sensitivity



Calibration of fluorobenzene (15 pg – 40 ng)

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 fluorine containing analytes. You can see the very good linearity over a wide concentration range (generally over 3 - 4 decades).



The chromatogram shows the separation of 8 fluorine compounds with concentrations of 0.04 to 0.214 ng.

Comparison of the detection limits of EPED (data rate 10 Hz) and AED

element	EPED LOD (pg/s)*	at (nm)	AED LOD (pg/s)	at (nm)
sulfur	0.33	921+922+924	2	181
fluorine	3	740	20 (t)	690
chlorine	0.9	838+895+912	30	479
bromine	< 4	827+883+890	20	827
iodine	< 1	906	10	181

* after smoothing

Features of EPED

- element-specific GC detector for halogens and sulfur
- detection limits < 5 pg/s at a data rate of 10 Hz
- linear range over 3-4 decades
- 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)
  brominated flame retardants
  sulfur containing pesticides
  sulfur content in fuels and much more

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