Axel Semrau®

LC-LC-GC-MS System PAH

PAH Workstation

Product information

PAH analytics according to the imPAHct method

Polycyclic aromatic hydrocarbons (PAH) are among the most frequently analyzed contaminants in diverse matrices. The reason for this is the partly very high carcinogenicity of the substance group and their broad distribution. PAH are formed during partial combustion and pyrolysis processes. They enter the environment through fumes, bound to dust particles or mineral oil residues. PAH contaminate foodstuff either from the environment (e.g. dust particles on broad-leaf vegetables) or by roasting and smoking processes.

European guidelines set limiting values which vary depending on the foodstuff. For the marker substance benzo[a]pyrene the value lies between 1–6 µg/kg while the total limit value for the PAH4 (this term summarizes benzo[a]pyrene, benzo[a]anthracene, chrysene and benzo[b]fluoranthene) is 1-35 µg/kg.

Due to the required sensitivity and complex matrices, PAH determination is a great challenge for analytics. As an analytical method either HPLC with fluorescence detection or GC-MS are used. Sample preparation is often extensive and time-consuming.

Recent requirements to laboratories include a reduction in sample handling time (Turn-Around-Time) and an increase in the sample throughput. Still, no losses within the analytical parameters, e. g. sensitivity, precision and accuracy are desired. Consequently, highly automated analytical procedures are necessary.

The LC-GC technology by Axel Semrau® is established for the routine analytics of foodstuff and therefore provides an optimal basis for such an application system. Axel Semrau® has developed a method for PAH analytics based on LC-GC technology, the imPAHct method: **i**nnovative **m**ultidimensional **PAH c**lean-up **t**echnology.

To measure PAH, a simple yet fast extraction of the sample is performed. The extract is quickly manually treated and then transferred to the LC-GC system by Axel Semrau®. Here, the extract is purified in a two-step LC separation and subsequently analyzed via GC-MS.

Applying this intelligent matrix management, it is possible to determine the PAH which are prescribed by EFSA fully automated. Depending on the detector, detection limits are reached which are even lower than the required European values for baby food by a factor of 100.

The LC-GC solutions by Axel Semrau® are pre-installed in application laboratories, tested and delivered to the customer ready-to-use. Thus, the quickest possible continuation of the routine measurement is assured.

Specifications

- LOD for all EFSA PAH between 0.01 – 0.02 µg/kg
- LOQ for all EFSA PAH < 0.06 µg/kg
- sensitivity values apply if using a Bruker EVOQ GC-TQ
- reproducibility: relative standard deviation < 15 % for entire method
- duration of analysis: 45 min

Benefits of the imPAHct method

- LOD 1/100 of the limit value for baby formula (example substance benzo[a]pyrene)
- fast results
- high degree of automation
- no consumables necessary (e.g. SPE cartridges)
- excellent reproducibility
- universally applicable to all foodstuff
- investment safety
- expandable to other applications

System components

The application system consists of the following components:

- CHRONECT Robotic consisting of:
  - CTC PAL3 with an 85 cm axis and
  - Software CHRONOS
- Agilent 1260 Infinity II HPLC pump with UV detector and degasser
- Bruker EVOQ GC-TQ
- CHRONECT LC-GC interface for the LC-GC coupling
- data system with control and evaluation software
- accessories and consumables
- Factory Acceptance Test
- instruction and commissioning
- Site Acceptance Test
- training, support

Example chromatograms

The LC-GC coupling supplies two chromatograms at the same time:

- the signal of the UV detector from the HPLC purification
- the signal from the GC-MS

The illustrations on the following pages show examples of these chromatograms.

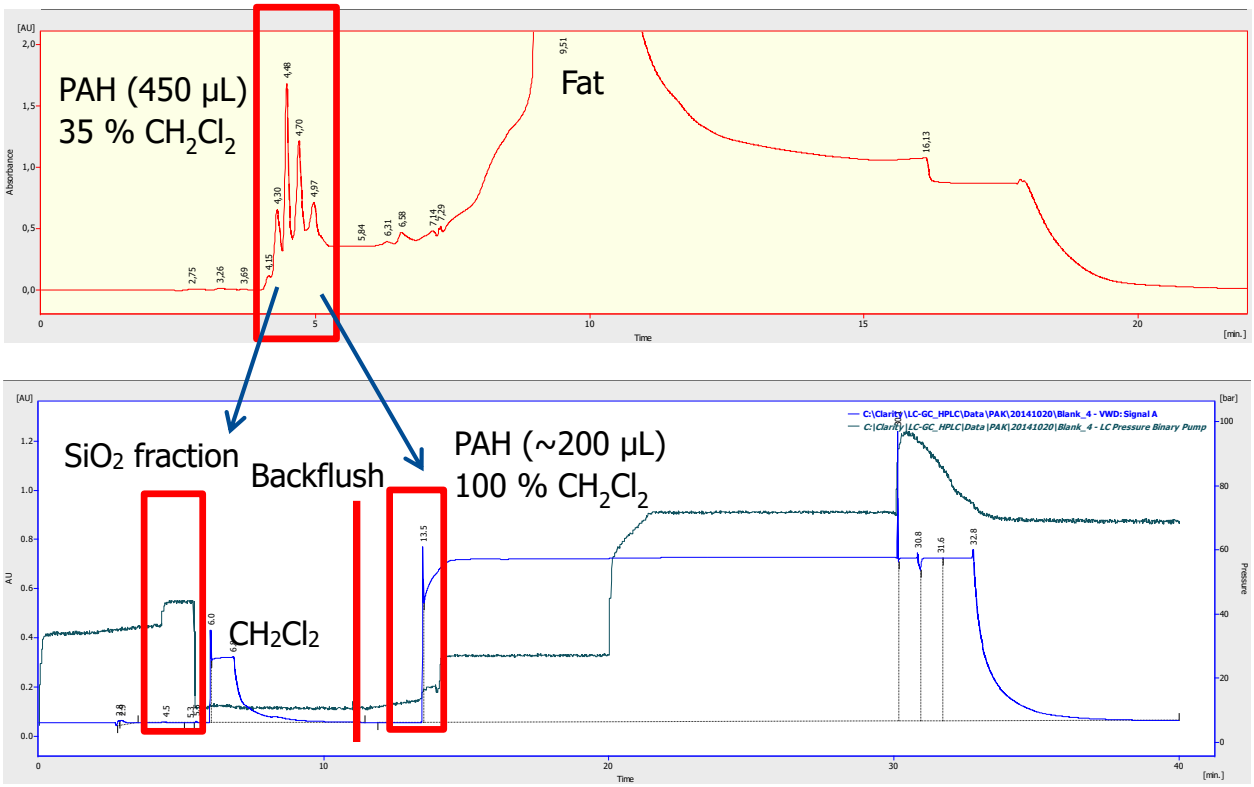

Figure 1: HPLC chromatogram of the first purification (upper chromatogram) and HPLC chromatogram of the two step HPLC purification (bottom chromatogram)

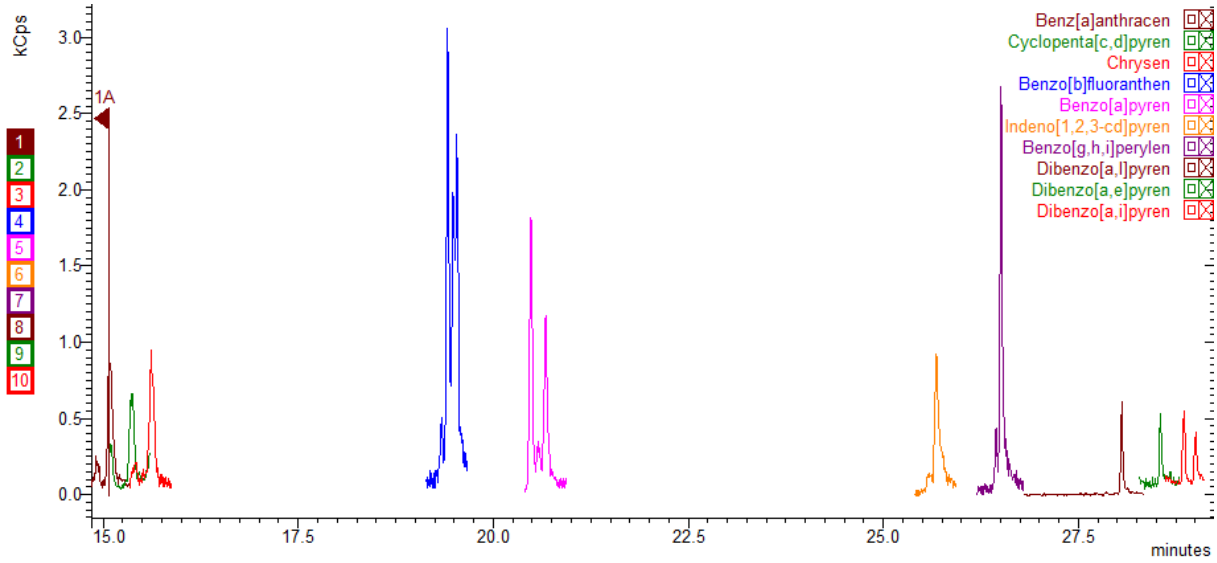

Figure 2: LC-LC-GC-MS/MS measurement of cocoa butter which was doted to 0.04 µg/kg with PAH

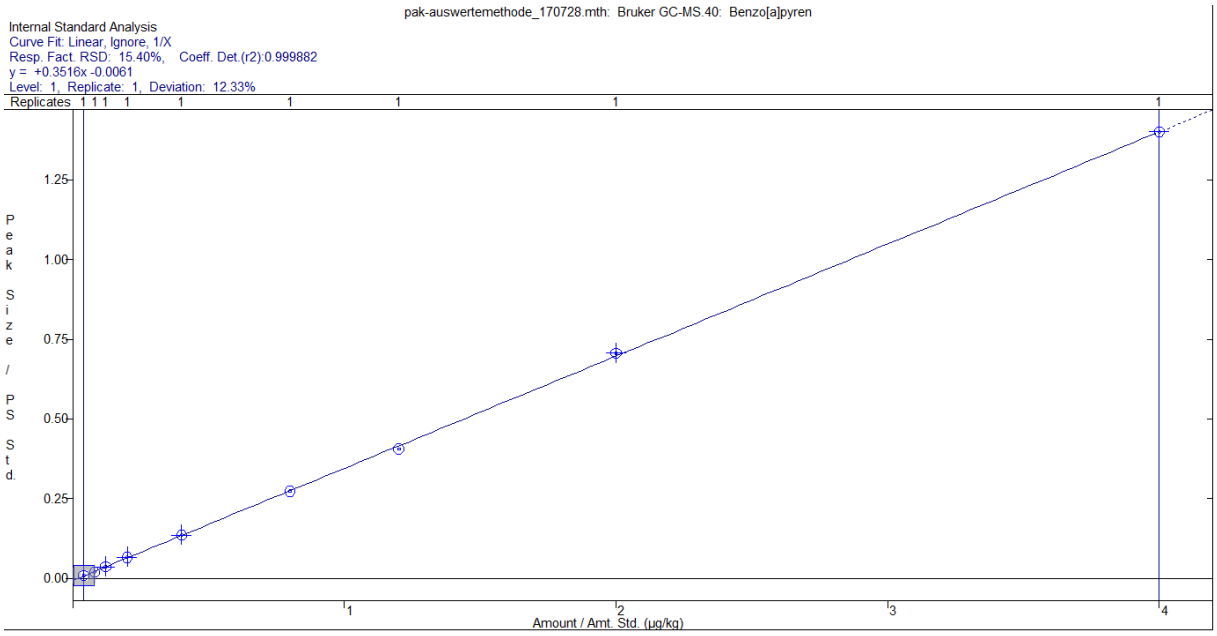

Figure 3: Calibration curve for benzo[a]pyrene between 0.04 - 4 µg/kg

Subject to technical changes

The imPAHct method and the PAH Workstation are developments by Axel Semrau®.

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