



ADSORPTION-THERMAL-DESORPTION GAS-CHROMATOGRAPHY-ION-MOBILITY-SPECTROMETER

ON-SITE SUB-PPB DETECTION OF VOLATILES

PRODUCT HIGHLIGHTS

- Automated analyte adsorption and thermal desorption unit (μ TD)
- Spatial combination of sampling onto adsorption tubes and thermal desorption with subsequent analysis on-site – Sample focussing and analysis at the same place
- Improved sensitivity due analyte enrichment on adsorption trap
- Highly effective 2-dimensional separation technique based on the combination of gas chromatography & ion mobility spectrometry (GC-IMS) – easy detection of coeluting compounds
- No passage of time between adsorption procedure and desorption/analysis avoiding uncontrolled sorption effects
- ppb-to-ppt level sensitivity for VOCs/SVOCs/VSCs
- Cryogen- and solvent-free analyte trapping
- Variety of adsorption tube materials available

FIELDS OF APPLICATION

- Quantification in the sub-ppb range
- High-sensitive on-site measurements of VOCs/SVOCs/VSCs even in complex matrices
- Ambient air monitoring
- Monitoring of outgasings / emissions
- Emission-chamber measurements (vehicle interior / assembly groups)
- Limit value measurements
- Off-smell monitoring
- Employment & environment protection

SET-UP & WORKFLOW

In a first step (*Sampling & Enrichment*) the gaseous sample is sucked into the thermal desorption unit for a defined period of time (s. Figure 1). During this phase the introduced compounds are focussed onto an adsorption tube at relatively low temperatures (s. Figure 2). The volume from which substances are adsorbed is defined by the volume flow and time period, but typically in the range of several liters. Afterwards the temperature of the adsorption tube is increased in order to desorb the afore adsorbed compounds within a small volume (mL). For this reason the factor of the pre-concentration effect typically can be adjusted to 100 up to several thousand. Then the pre-concentrated sample is directly injected into the GC-IMS device (*Separation & Detection*). While the sample is analyzed by the GC-IMS the thermal desorption unit is cleaned/cooled down and afterwards ready for a next cycle.

GC-IMS run and pre-concentration can be overlapped to decrease the overall run time when performing subsequent/continuous measurements (s. Figure 2). After separation by gas chromatography and ion mobility spectrometry the compounds are analyzed. Based on implemented calibration curves and ranges for each substance incoming data are evaluated and the volatiles can be quantified (automated data evaluation). Calculated results can be depicted on the devices display after each measurement. If requested, the results can also be sent to a process control system (PCS) via Modbus protocol. Export of the data to USB-Stick or automated transfer to a PC (via TFTP server, e.g.) is also possible.

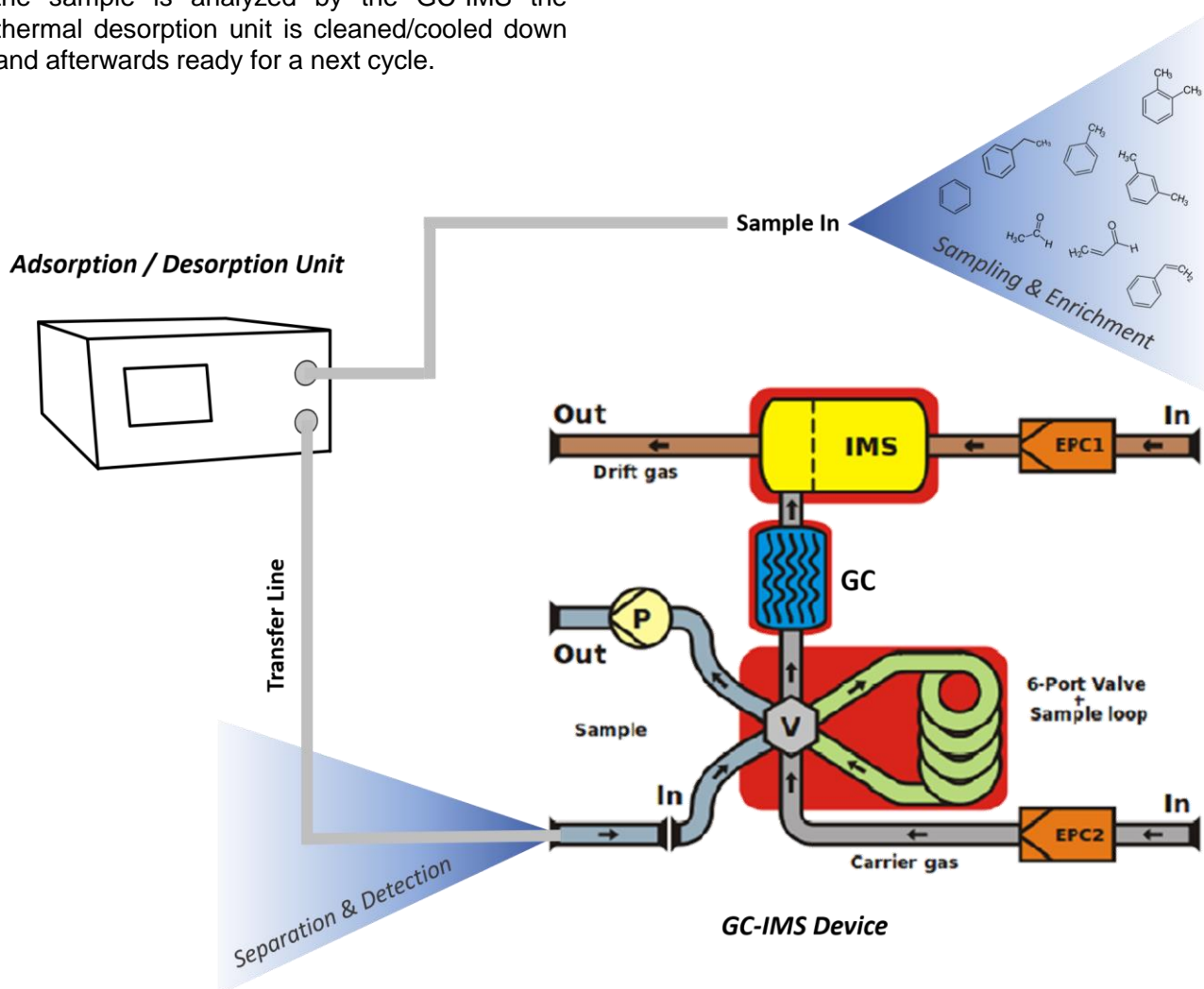


Figure 1: Schematic drawing of the combination of the adsorption-thermal-desorption unit and the GC-IMS by G.A.S.

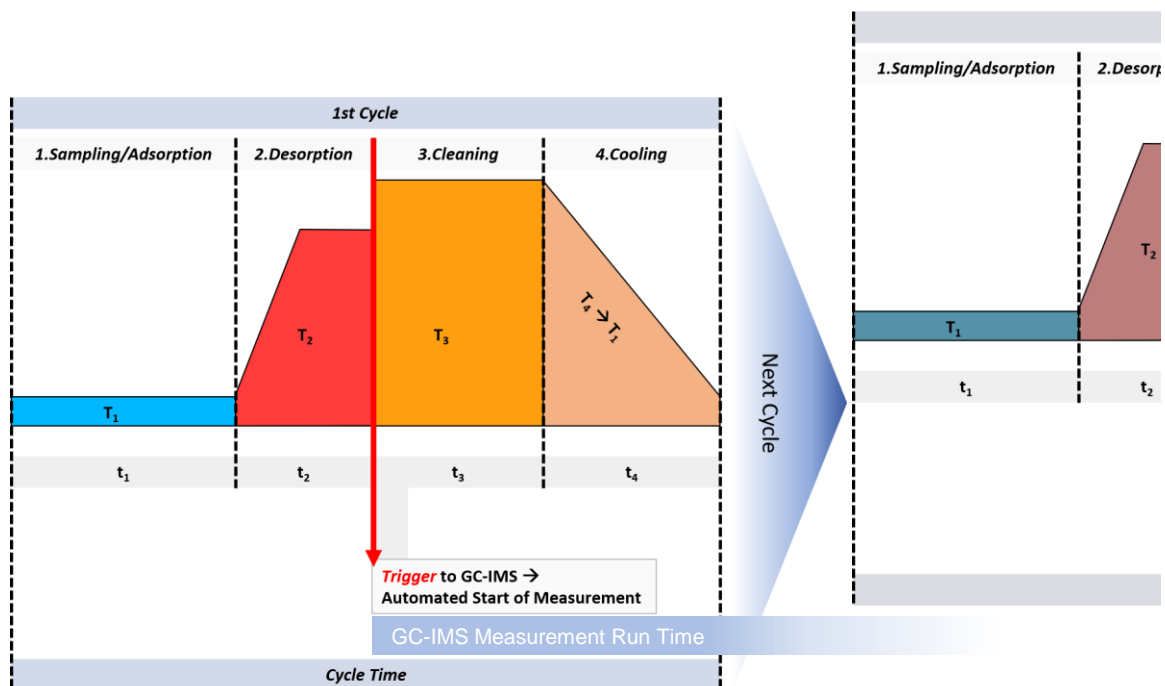


Figure 2: Different working phases of the pre-concentration step with T_n = Temperature n and t_n = time period n. Overlap of pre-concentration steps and GC-IMS measurement run of subsequent measurements is shown.

EXEMPLARY RESULTS

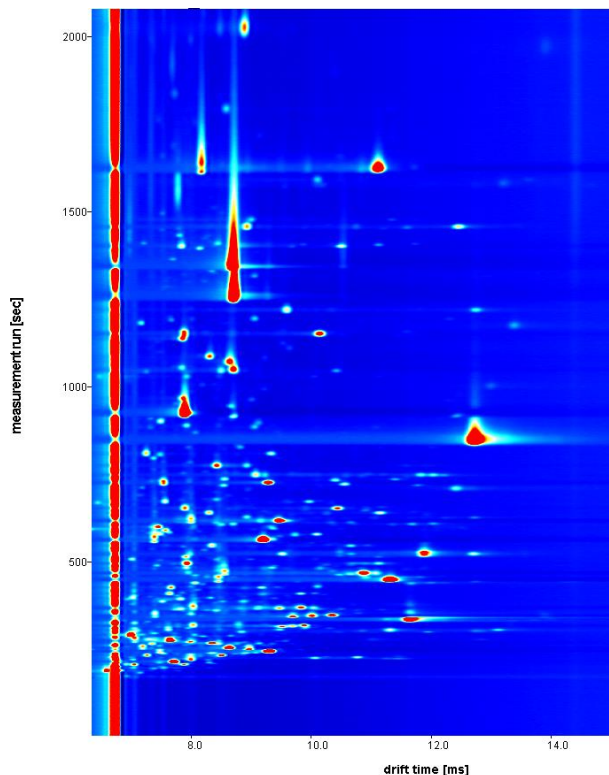


Figure 3: μTD-GC-IMS data of a car's interior - chamber measurement.

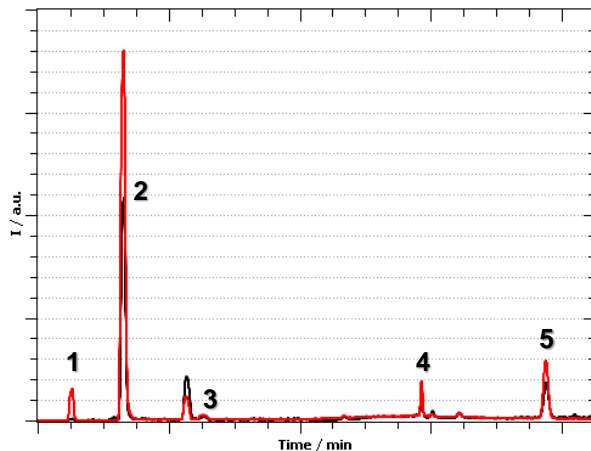


Figure 4: Exemplary chromatograms of a test gas mixture pre-concentrated and measured using the μTD-GC-IMS system. **Black line = 5 ppb, red line = 10 ppb**. Signal assignment: 1 = Acetaldehyde, 2 = Acrolein, 3 = Benzene, 4 = m-Xylene, 5 = Styrene.

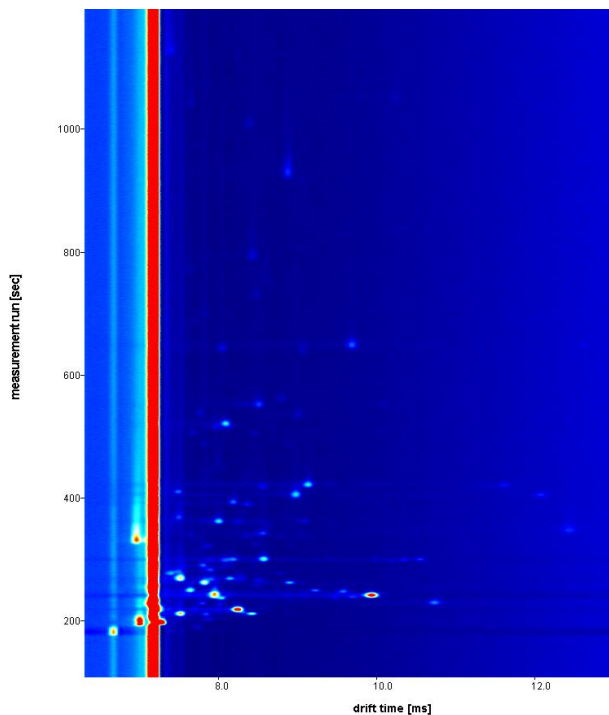


Figure 5: μTD-GC-IMS data of ambient air.

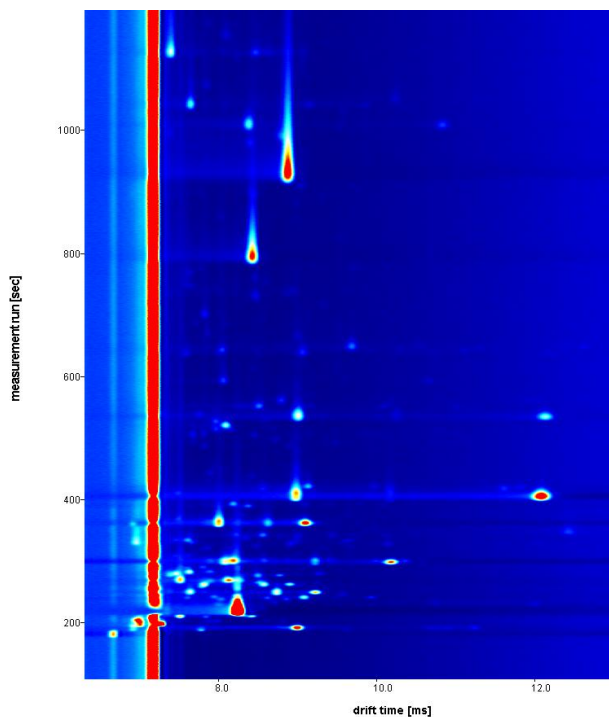


Figure 6: μTD-GC-IMS data of human breath (compare to Figure 5).

SPECIFICATIONS

Separation/detection technique	2-dimensional separation by gas chromatography – ion mobility Spectrometry
Ionisation source	³ H, <300 MBq, below EUROATOM exempt limit acc. to 2013/59 EURATOM DIRECTIVE
Detection limit	Typically sub-ppb level
Flow control	Electronic pressure controller
Sampling	6-port valve (Cheminert®), integrated sample pump
Display	6.4" TFT
Data transfer	Modbus TCP, current loop, USB, Ethernet
Automated result output	Modbus TCP, current loop
Safety features	Hardware watchdog, self-check of system parameters
Dimensions (W x D x H)	449 x 435 x 287 mm
Power consumption maximum (GC-IMS / μTD)	221 W / 100 W

FURTHER INFORMATION

The μTD-GC-IMS device can be optimized to address several applications whenever a very high sensitivity and selectivity is needed. For more information visit gas-dortmund.de.

