

# Centri

A breakthrough in sample  
automation and concentration  
for GC-MS



Since 1997



# Centri<sup>®</sup>

## Fully automated multi-mode sampling and concentration system for GC-MS.

Built using best-in-class robotic automation and harnessing a versatile, modular design, Centri allows unattended sampling and pre-concentration of VOCs and SVOCs in liquid, solid and gaseous samples, and is compatible with all major brands of GC-MS.

Available options include...

- HiSorb™ high-capacity sorptive extraction
- HS & HS-trap
- Thermal desorption
- SPME & SPME-trap

... all on **ONE INSTRUMENT**

The key enabling innovation at the heart of Centri is a robust cryogen-free focusing device for GC-MS.

Drawing on Markes' 20 years of experience, this powerful technology optimises analytical sensitivity and improves system stability by allowing selective elimination of water and other interferences.

### HiSorb high-capacity sorptive extraction

Convenient probes for immersive or HS sampling of liquids & solids.



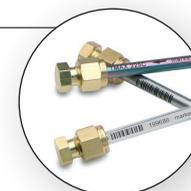
### HS & HS-trap

Versatile sampling from solids and liquids contained in regular headspace vials.



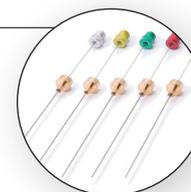
### Thermal desorption

The ideal option for analysis of trace VOCs and SVOCs.



### SPME & SPME-trap

Fast and sensitive sample extraction, with a range of selective fiber types.



# Enhanced productivity and sensitivity

## Centri brings key advantages to every busy GC-MS laboratory

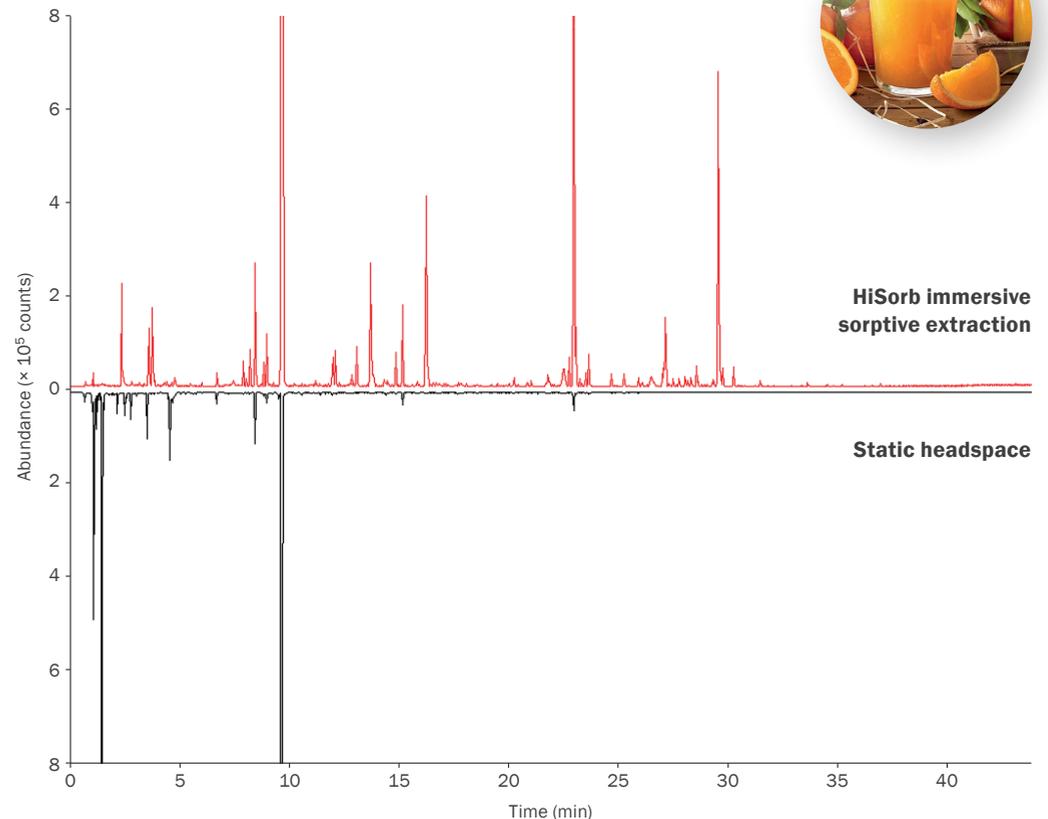
Centri is ideal for the analysis of volatile and semi-volatile organics at ppt to percent-levels. Its amazing flexibility will benefit any GC-MS laboratory looking to improve detection limits, increase throughput, reduce costs or expand their routine or research capabilities.

- **Extended sample characterisation:** Multi-functional Centri allows complementary sampling modes, such as headspace and immersive sorptive extraction, to be run on the same system, allowing the widest possible compound volatility range to be measured in each sample.
- **Sample archiving and repeat analysis:** Centri also offers the unique advantage of quantitative sample re-collection. Extracted sample vapours can be archived in stable sorbent-tube format for validation and/or further tests, with full traceability using RFID and barcode technologies.
- **Prep-ahead:** The extraction of subsequent samples can be started while analysis of previous samples is ongoing, optimising productivity.

**Key applications** that can be run on Centri include:

- Trace VOCs and SVOCs in air, water and soil.
- Environmental odour assessment.
- Fragrance and aroma profiling over an extended volatility range.
- Labour-saving analysis of challenging food samples such as dairy products.

### Flavour compounds in orange juice



**Improved sample characterisation** is possible over a wide volatility range by harnessing the ability of Centri to analyse samples using various injection techniques. In this example of orange juice, static headspace provides information on the most volatile components contributing to product aroma, while immersive sorptive extraction using HiSorb probes adds detail on less volatile flavour components.

# Unrivalled trap technology

## Analyte focusing with powerful re-collection capability

All sampling modes on Centri benefit from selective pre-concentration on the cryogen-free focusing trap, with subsequent ultra-fast desorption/injection into the GC-MS. This offers:

- **Improved detection limits** – Delivering a sharp, concentrated band of vapour to the GC and optimising sensitivity for trace-level analytes.
- **Increased selectivity** – Optimisation of focusing conditions allows interferences such as water and ethanol to be purged to vent before analysis, thus dramatically improving both analytical performance and long-term system stability.
- **Wide dynamic range** – A sophisticated combination of dual, mass-flow-controlled split points and adjustable sampling volumes allows Centri to handle samples ranging in concentration from ppt to percent-level.

A key characteristic of Centri is the use of multi-bed, sorbent-packed focusing traps and re-collection tubes. The type of sorbent materials used and the backflush desorption of tubes and traps allow a wide analyte range – from VOCs to SVOCs – to be analysed in a single run.

## ANALYTE TRAPPING ON CENTRI

### 1 Sample focusing

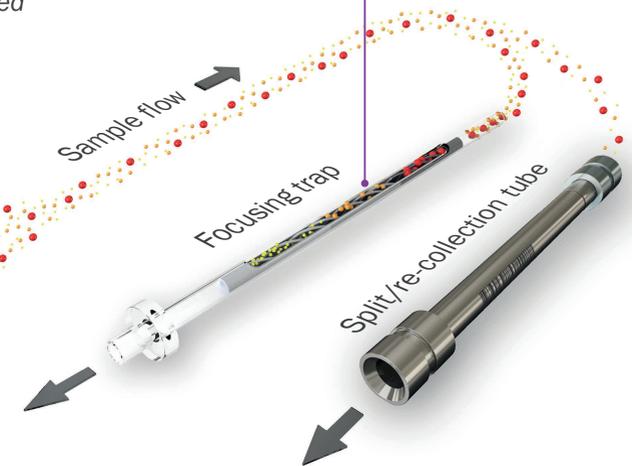
Extracted analytes are swept into Centri's electrically-cooled focusing trap.

HiSorb high-capacity sorptive extraction

Headspace

Thermal desorption

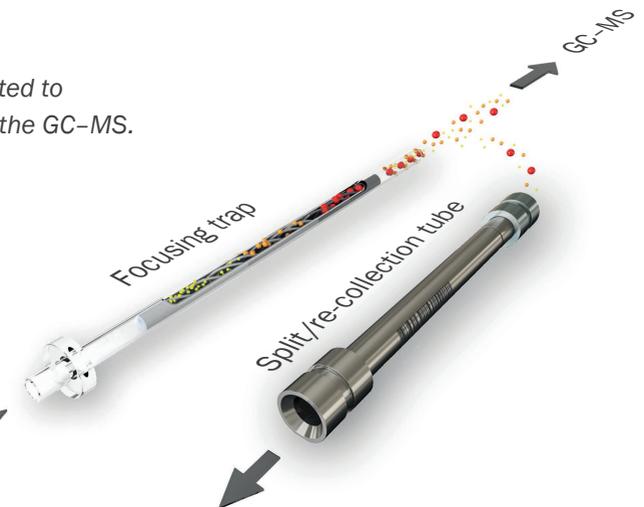
SPME



### 2 Trap desorption

The focusing trap is rapidly heated to transfer (inject) the analytes to the GC-MS.

The carrier gas flow reverses during trap desorption to allow simultaneous analysis of compounds over a wide volatility range (VOCs and SVOCs).



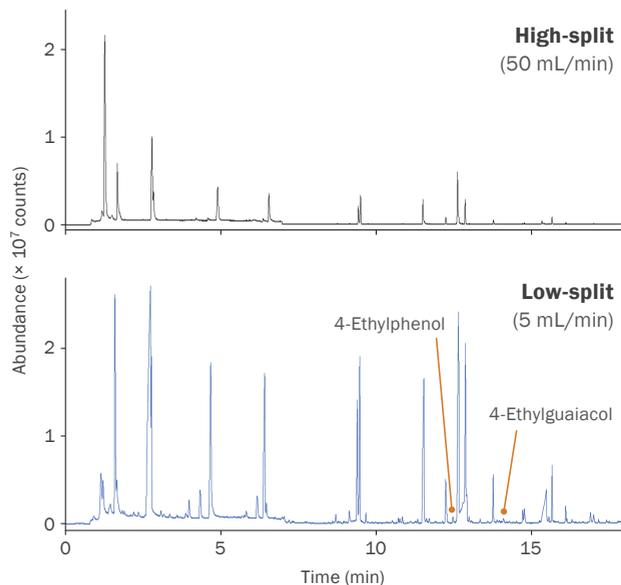
# Re-collection

## Added confidence in any sampling mode

The 50-tube TD module of Centri allows the split portion of any pre-concentrated sample (acquired using TD, HiSorb, HS-trap or SPME-trap) to be archived automatically in stable sorbent-packed tubes for further tests.

Repeat analysis of re-collected samples provides enhanced data confidence, without having to repeat lengthy sample preparation steps. Re-analysing a previously acquired sample under different split conditions can also be used to greatly extend the dynamic range, allowing automated, quantitative analysis of both trace and high-level components in the same sample.

## Using re-collection to extend concentration range



**A wide concentration range** is achieved for this analysis of off-odours in wine, using immersive sampling with HiSorb probes. Any risk of detector overload is avoided by first using a high split, and the re-collected sample is then run at a lower split to detect two trace-level 'Brett' compounds.

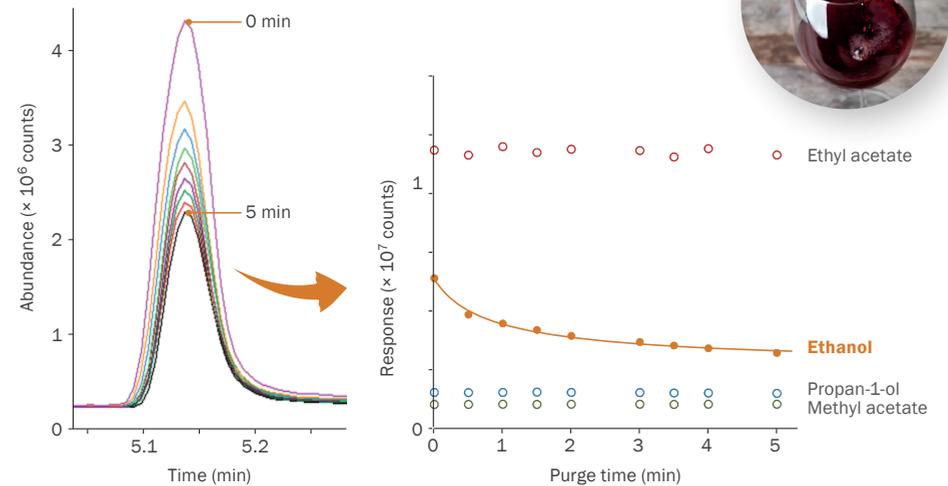
# Analyte selectivity

## Selective elimination of interferents

Detecting minor compounds in foods and drinks can be difficult due to the presence of high-abundance interferents such as ethanol or other solvents. Centri tackles this through the ability to selectively purge such components from the focusing trap prior to injection into the GC-MS, without affecting other analytes of interest.

Elimination of water vapour from environmental samples can be performed in a similar way, resulting in higher sensitivity and repeatability, improved peak shape, and extended column and detector lifetime.

## Purging of ethanol from wine



**Selective purging of interferents** is a key benefit of trap-based focusing on Centri, as illustrated here for red wine analysed in headspace-trap mode. Increasing the purge time from 0 to 5 minutes results in a steady decrease in the amount of ethanol reaching the GC-MS, without affecting target compounds eluting nearby.

# Reliable automation

## Productivity in GC-MS

From sample preparation to GC injection, Centri uses leading robotics technology to automate every aspect of sample preparation, extraction and pre-concentration.

Automated tool-change options allow more than one extraction technique to be run on each sample in a single automated sequence.

Agitator ensures efficient extraction of analytes from liquid and solid samples.

Wash/dry station removes sample matrix from HiSorb probes before desorption, enabling robust, automated immersive extraction.

Storage capacity for multiple HiSorb probes allows the overlap of sample extractions, increasing productivity.

Inlet to focusing trap or GC column.

Moveable rack(s) accept 10 mL or 20 mL headspace vials.

Tube module enables analysis of up to 50 thermal desorption tubes.



# Sample handling and traceability

## Dependable robotics and electronic sample tracking options for complete chain of custody

Automated, unattended sample preparation is vital to increase laboratory throughput and to achieve precise and accurate results.

Centri uses the latest generation of market-leading robotic technology, for maximum productivity and future-proof operation. Instrument configurations are available that allow tools to be changed either automatically or with user intervention, and on all systems HS, SPME or HiSorb sampling can be sequenced with automated TD analysis and sample re-collection.

For laboratories working under strict data-quality procedures, Centri also offers two options to keep track of your samples at every point in the analytical process:

- **Compatibility with Markes' TubeTAG™ technology** for error-free tracking of sorbent tubes .

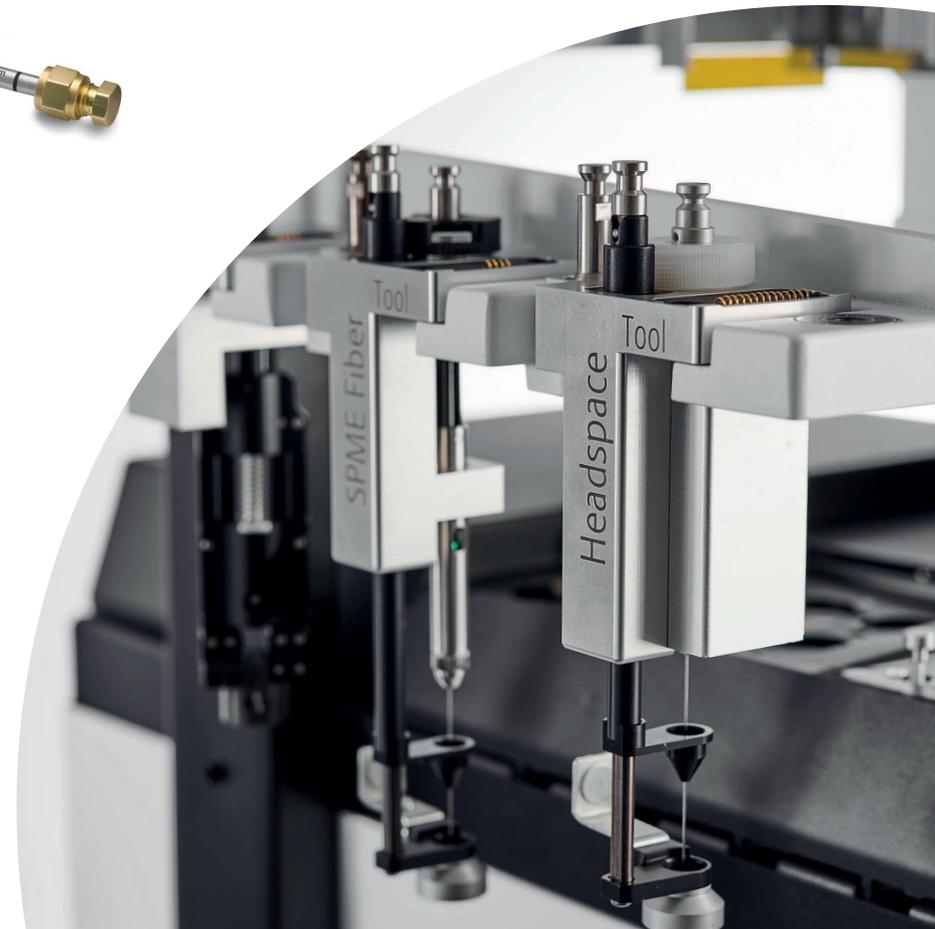
A key advantage of TubeTAG is that it allows samples re-collected from HiSorb, HS-trap, SPME-trap or TD to be fully traced in subsequent repeat runs, without the need to scan each tube.



- **Barcode readers** for headspace vials and tubes allow all samples to be tracked through the system.



Centri's software retains full control of all these operations, and guarantees full traceability for sample preparation, injection, reporting, and sample storage for subsequent re-analysis.



# HiSorb™ high-capacity sorptive extraction

## Fully automated probe-based sampling

HiSorb probes use high-capacity sorbent polymer to extract and concentrate a wide range of organic compounds from liquid and solid samples.

Centri represents a real breakthrough in the automation of high-capacity sorptive extraction. Reliable, high-throughput operation is delivered using a combination of innovative functions:

- Simultaneous preparation/extraction of multiple samples (prep-ahead). Centri accommodates multiple HiSorb probes.
- Efficient post-immersion removal of sample matrix residue before probe desorption.
- Selective elimination of water and other volatile interferences before GC-MS analysis.
- Optional quantitative re-collection of extracted vapours for sample security and/or further tests.

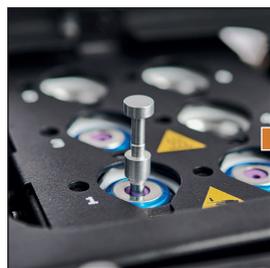


As well as being compatible with Centri automation, probes can be used to sample manually prior to automated TD-GC-MS analysis.

Standard-length probes allow immersive sampling from 20 mL vials.

Short-length probes allow headspace sampling from 20 mL vials (or immersive sampling from 10 mL vials).

## Automated high-capacity sorptive extraction on Centri



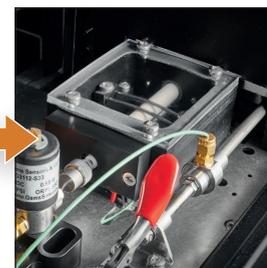
The robot inserts the probe into the vial, and the assembly is incubated/agitated to ensure analyte equilibration.



The probe is removed from the vial, and a wash/dry station removes residual sample matrix.



The probe is thermally desorbed and vapours transferred to the focusing trap.



The trap is thermally desorbed at up to 100°C/s to inject the sample into the GC-MS as a narrow band.



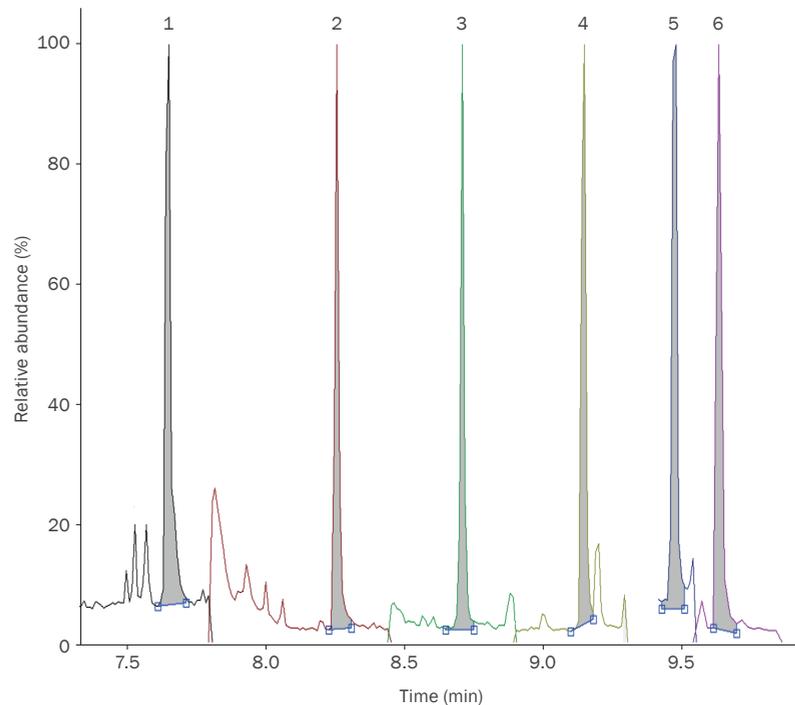
The headspace vials are re-sealed with special caps to avoid contamination of laboratory air.

# HiSorb™ high-capacity sorptive extraction

## Applications

Applications of HiSorb range from detecting trace-level water contaminants to profiling the aroma of complex natural foodstuffs such as dairy products, and the analysis of VOC markers in biological fluids.

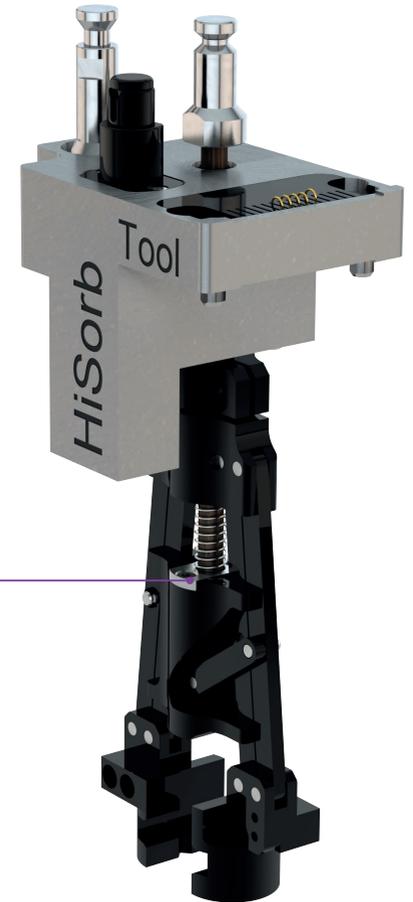
## Odorants in water



- 1 2,4,6-Trichloroanisole
  - 2 2,4,6-Trichlorophenol\*
  - 3 2,3,4,6-Tetrachloroanisole
  - 4 2,3,4,5-Tetrachlorophenol\*
  - 5 2,4,6-Tribromoanisole
  - 6 2,4,6-Tribromophenol\*
- \* As acetate derivative



**The challenging low-ppt detection** of odorous halogenated phenols and anisoles is achievable using automated HiSorb sampling on Centri, as illustrated by SIM chromatograms of six compounds spiked in water at 5 ppt.



The HiSorb tool fully automates all probe operations, allowing multiple samples to be run simultaneously. This 'overlap mode' is particularly valuable for applications requiring longer extraction times.

## High-capacity sampling

The large volume of poly(dimethylsiloxane) (PDMS) sorptive phase on each HiSorb probe results in greater robustness and sampling capacity compared to SPME fibers, making them ideal for trace-level analysis of VOCs and SVOCs.



# HS & HS-trap

## Increasing sensitivity for headspace analysis

Headspace techniques are widely used for analysing VOCs in water, soil, blood, pharmaceuticals and cosmetics. Although headspace overcomes the foaming issues associated with purge-and-trap methods, a drawback is that sensitivity is limited in conventional static (or equilibrium) headspace mode.

The cryogen-free focusing trap on Centri enables enhanced sensitivity for headspace, by allowing:

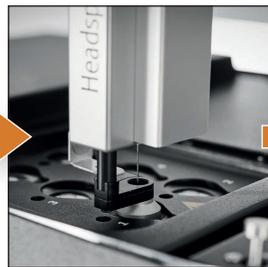
- Larger (up to 5 mL) volumes of vapour to be injected onto the trap under splitless conditions.
- Selective elimination of water and other volatile interferences that would otherwise quench or mask detector response.
- Pre-concentration of multiple headspace extracts from the same sample vial if required, to further extend analytical sensitivity.



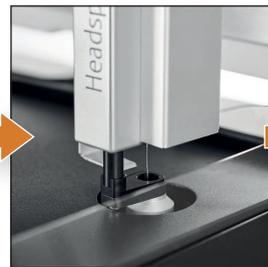
## Automated HS and HS-trap on Centri



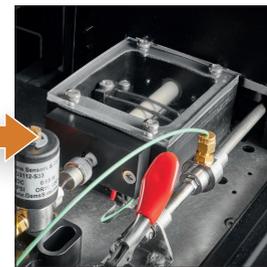
The sample vial is incubated/agitated to speed up analyte equilibration.



Headspace vapour is withdrawn. Overlap mode optimises productivity for the incubation & sampling of multiple HS vials.



The sample is sent to the focusing trap, and this can be repeated to improve sensitivity. Alternatively, the trap can be by-passed.



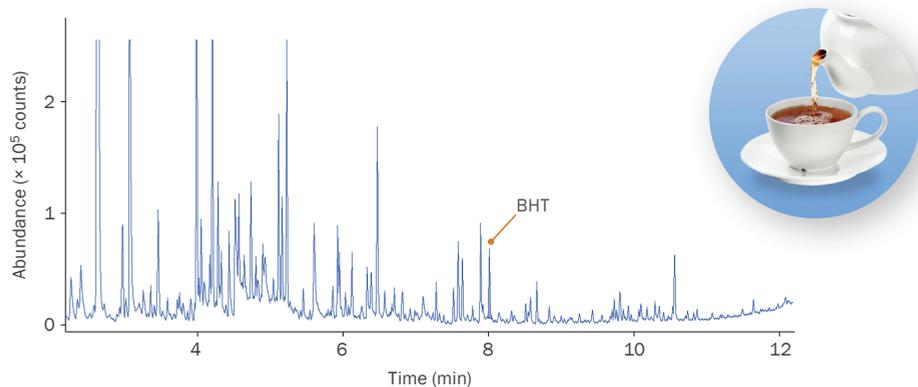
If applicable, the trap is thermally desorbed at up to 100°C/s to inject the sample into the GC-MS as a narrow band.

# HS & HS-trap

## Applications

Applications for robust fully-automated HS-trap range from the analysis of aromatics and halogenated solvents at sub-ppb levels in water, to the determination of trace food contaminants and residual monomers in polymers.

### Nanogram sensitivity for food & beverage additives

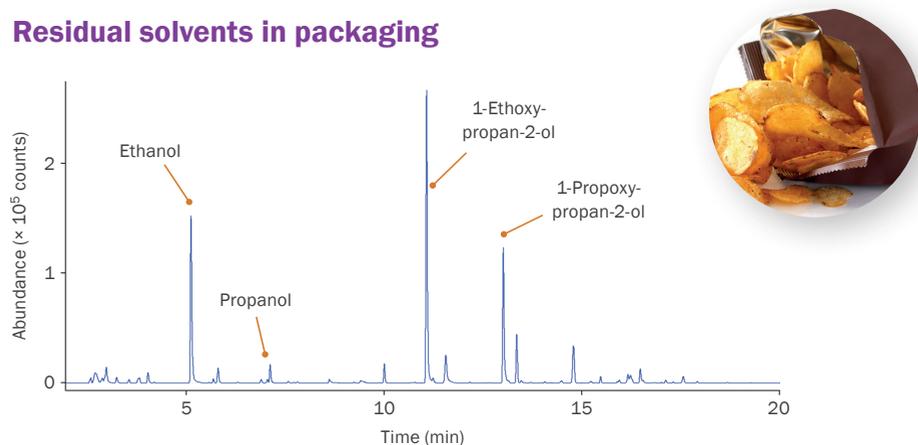


Tool changeover can be carried out manually, or using an automated tool-change option.

The Centri robot uses standard headspace syringes to inject up to 5 mL of headspace.

**Using the focusing trap of Centri to boost sensitivity,** traces of the preservative butylated hydroxy-toluene (BHT) were detected in the headspace of a black tea infusion.

### Residual solvents in packaging



**Solvents and other contaminants** at loadings in the low mg/m<sup>2</sup> range are prominent in the profile of packaging used to contain a savoury snack, analysed here by headspace-trap on Centri.



# Thermal desorption

## Method-compliant analysis of vapour-phase organics in air, gas and materials

Inert, metal or glass sorbent tubes are used to collect organic vapours from many litres of air or gas in accordance with standard methods. The organics retained by each sample tube are subsequently re-released and injected into the GC-MS allowing quantitation to ppt levels and below.

Typical applications include: characterising airborne odours and aromas, monitoring changing fragrance profiles, taint and off-odour diagnostics and air or gas purity assessment.

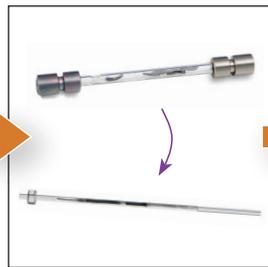
The Centri TD module features world-leading, method-compliant thermal desorption technology compatible with reactive odorous species and compounds ranging in volatility from propene to n-C<sub>44</sub>. Up to 50 sealed sample tubes can be analysed automatically and reliably, with optional sample re-collection. Thermal desorption can also be combined with other injection modes in one fully automated Centri sequence.

In addition, the Centri TD module can be used to analyse any re-collected and archived samples from previous HiSorb, HS-trap and SPME-trap analyses.

### Automated thermal desorption on Centri



Capped tubes are placed in trays and leak-tested to confirm sample integrity, as required by standard methods.



Analytes are released from the tubes in a flow of heated gas, and the vapours collected on the focusing trap.



The trap is thermally desorbed at up to 100°C/s to inject the sample into the GC-MS as a narrow band.

Sample integrity for tubes used in the autosampler is assured by the use of DiffLoK™ caps.

The Centri autosampler accepts up to 50 industry-standard 3½" × ¼" thermal desorption tubes.



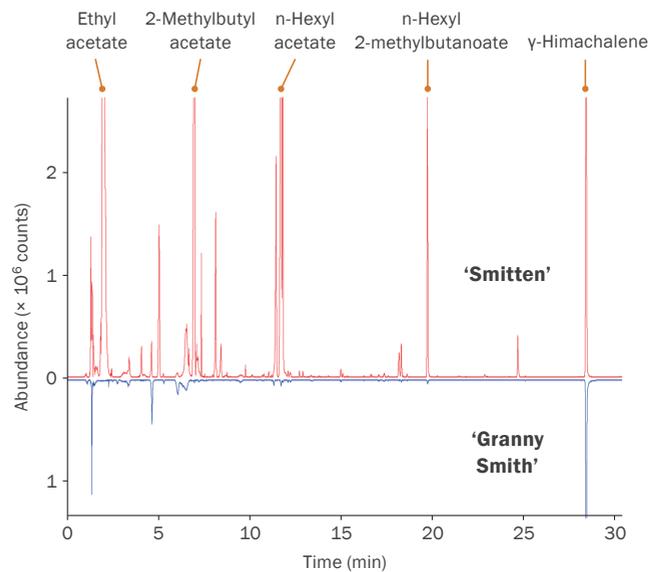
# Thermal desorption

## Applications

Thermal desorption tubes are compatible with a range of sampling modes, greatly extending Centri's application range. Key methods include:

- **Pumped sampling** of vapours onto sorbent tubes – accommodates the widest analyte range, and is popular for air and odour monitoring.
- **Passive sampling** is a well-established approach to monitoring marker compounds in multiple indoor and outdoor locations.
- **Dynamic headspace sampling** to screen vapours emissions from products and materials using Markes' Micro-Chamber/Thermal Extractor ( $\mu$ -CTE™).
- **Direct desorption** is ideal for quick analysis of residual (S)VOCs in small solid or liquid samples placed in empty TD tubes..

## Food aroma profiles

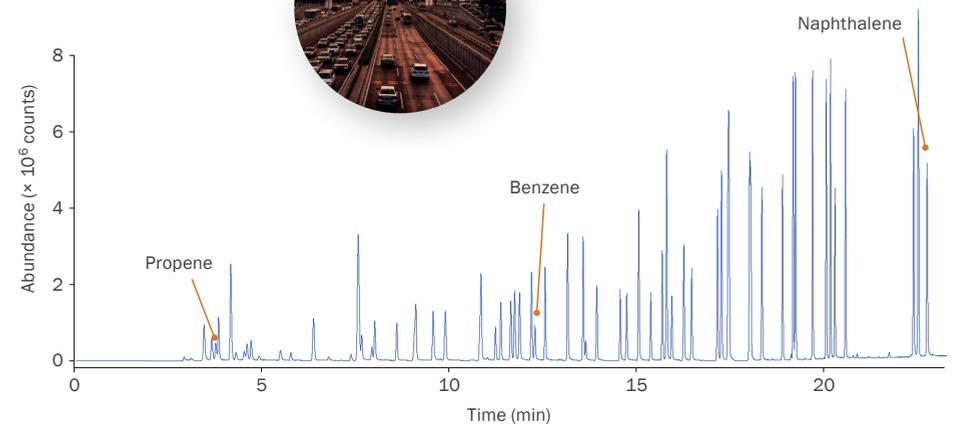


**Comparison of the aroma profiles of two apple cultivars** is easily achieved by sampling onto sorbent tubes using Markes'  $\mu$ -CTE, followed by automated analysis on Centri.

Markes' versatile  $\mu$ -CTE units allow fast screening of product-emission profiles. Released vapours are collected on sorbent tubes for subsequent analysis.



## TO-17-compliant air analysis



**This analysis of a 5 ppb 65-component VOC standard** demonstrates the ability of Centri to monitor a wide range of 'air toxics' in accordance with US EPA Method TO-17.

# SPME & SPME-trap

## Enhanced sampling options for solid-phase microextraction

SPME is a convenient and readily-automated approach, typically used for sampling VOC and SVOC levels in the headspace of food, environmental and clinical samples. The availability of a variety of extraction phases for SPME fibers allows different volatility and polarity ranges to be targeted.

Combining SPME with secondary re-focusing on Centri enhances sensitivity by allowing multiple extraction cycles from a single sample to be 'concentrated' in one GC-MS run. It also significantly improves peak shape and signal-to-noise ratios for the most volatile, early-eluting species.



Using the SPME tool in 'overlap mode' allows a fiber to be desorbed while other samples are being incubated.

Centri uses commercially available SPME fibers, enabling users to apply standard operating procedures when required.



## Automated SPME and SPME-trap on Centri



The SPME fiber is normally positioned in the sample headspace and incubated/agitated to facilitate extraction.

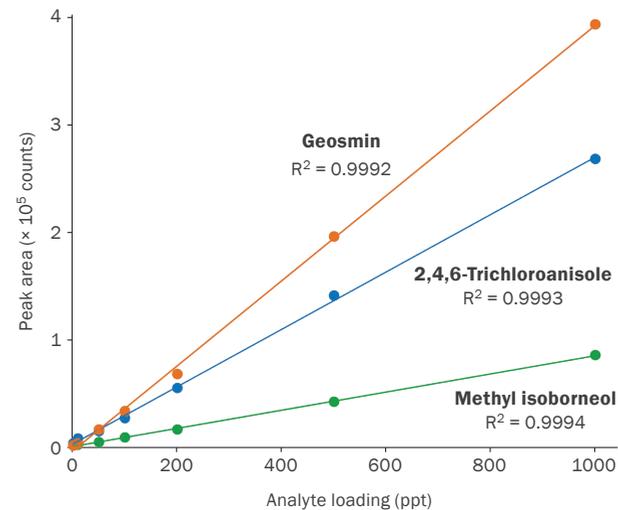


The fiber is inserted into the injection port and the vapours transferred to the focusing trap (or sent directly to the GC-MS).



If applicable, the trap is thermally desorbed at up to 100°C/s to inject the sample into the GC-MS as a narrow band.

## Drinking water odorants



**Excellent linearity from 1 ppt to 1 ppb** is achieved by combining SPME with trap-based focusing for the detection of odorants in drinking water.

# Centri – one platform, many applications

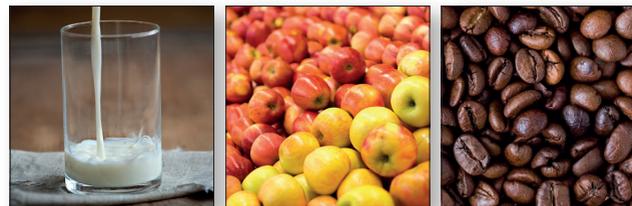
## Total versatility for GC-MS

Centri is a multi-technique GC automation platform offering numerous practical innovations to boost productivity and extending the application capability of every busy GC-MS laboratory.



### Key applications for Centri

#### Foods & Beverages



- Dairy products
- Fruit
- Vegetables
- Wine
- Spirits
- Fruit juices
- Tea
- Coffee
- Dried goods

#### Environmental



- Potable water
- Waste water
- Ambient air
- Soil
- Workplace air
- Industrial emissions

#### Fragrance & Odour



- Personal care products
- Fragranced consumer goods
- Flavour & fragrance research

#### Clinical & Forensic



- Clinical research
- Extractables & leachables
- Markers in biological fluids
- Medical devices

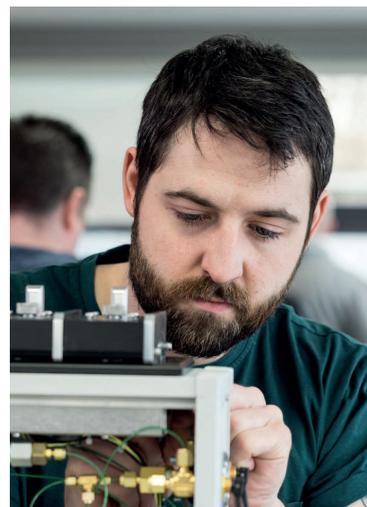
# Markes International

## World-leading technologies and unmatched expertise in VOC and SVOC monitoring

Founded in 1997, Markes International is the world leader in thermal desorption and associated technologies. We manufacture a comprehensive range of instrumentation, accessories and consumables for enhancing GC-MS analysis of trace organic chemicals, and have a well-deserved reputation for innovation and expertise.

We're headquartered in Llantrisant, UK, where we manufacture our products in accordance with the ISO 9001 quality standard. Our customers (in over 60 countries) are supported through our technical centres in Frankfurt, Sacramento and Shanghai, and through a global network of world-leading distribution partners.

Our products are used for a wide variety of applications, including environmental monitoring, testing of consumer goods, military and civil defence and food/fragrance profiling, and we support customers from major industry, government agencies, academia and service laboratories.



Since 1997



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