MARKES international

Discover more – Deliver more

THE QUEEN'S AWARDS FOR ENTERPRISE: INNOVATION 2019

Centri

A breakthrough in automated sample extraction and enrichment for GC–MS

Centri®

The ultimate automated multi-mode extraction and enrichment platform for GC–MS.

Powered by best-in-class robotic automation, and using a modular design, Centri gives unrivalled flexibility for unattended, rapid and efficient extraction and enrichment of VOCs and SVOCs. With its four sampling modes, Centri offers maximum versatility for liquid, solid and gaseous samples.

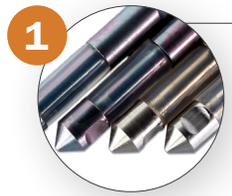
Innovation lies at the heart of Centri. Incorporating Markes' advanced cryogen-free focusing trap technology, Centri optimises analytical sensitivity, and enhances the quality of information obtained from GC–MS.

Whichever major brand of GC–MS you're using, the Centri sample extraction & enrichment platform lets you **Discover more** and **Deliver more**.

Three independent experts in analytical science recognise Centri's sampling versatility:

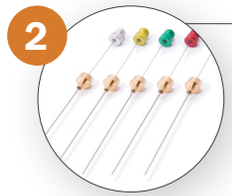
THE INNOVATION AWARDS 2018 Analytical Scientist

> *"It is often not immediately clear upfront which of the different sample preparation techniques for the analysis of volatiles will give the best results –* ***this instrument simply combines them all*** *"*



1 HiSorb™ high-capacity sorptive extraction

Fully automated immersive or headspace sampling of liquids and solids.

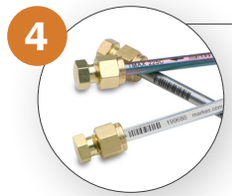


2 SPME–trap

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

3 Headspace–trap

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



4 Thermal desorption and direct thermal extraction

The ideal option for analysis of trace VOCs and SVOCs.

Maximise throughput and productivity

Centri is the only automation platform for GC–MS that supports every stage in the workflow, from sample extraction and enrichment through to GC injection. Harnessing leading robotics technology, Centri allows true unattended operation while delivering clear improvements in data quality.

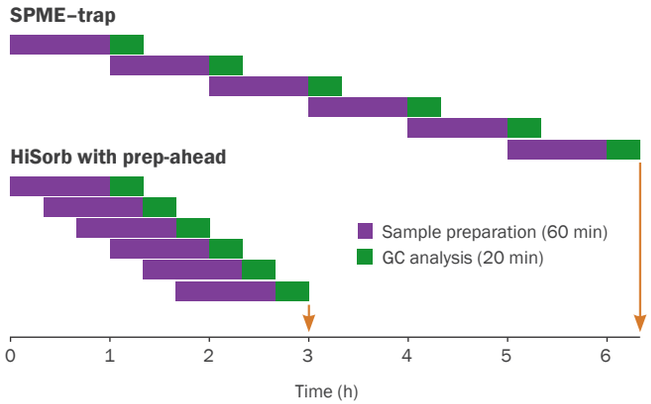
- **Automated tool-change options** allow more than one extraction technique to be run on each sample in a single automated sequence, giving a high degree of flexibility.
- **Moveable rack(s)** accommodates up to 300 × 10 mL or 20 mL vials.
- **Enhanced prep-ahead mode** boosts productivity for HiSorb probe sampling.
- **Agitator** ensures efficient extraction of analytes from liquid and solid samples.
- **Wash/dry station** automatically removes sample matrix from HiSorb probes, enabling robust, automated immersive extraction.
- **Tube module** enables fully automated analysis of up to 50 thermal desorption tubes.
- **Intelligent system monitoring** provides component traceability and information on usage, often important in controlled environments.

Extended productivity for HiSorb sorptive extraction

The patented ‘grab-and-release’ technology used by Centri allows multiple HiSorb sampling probes to be independently transported between storage, sampling, wash and analysis locations.

This capability:

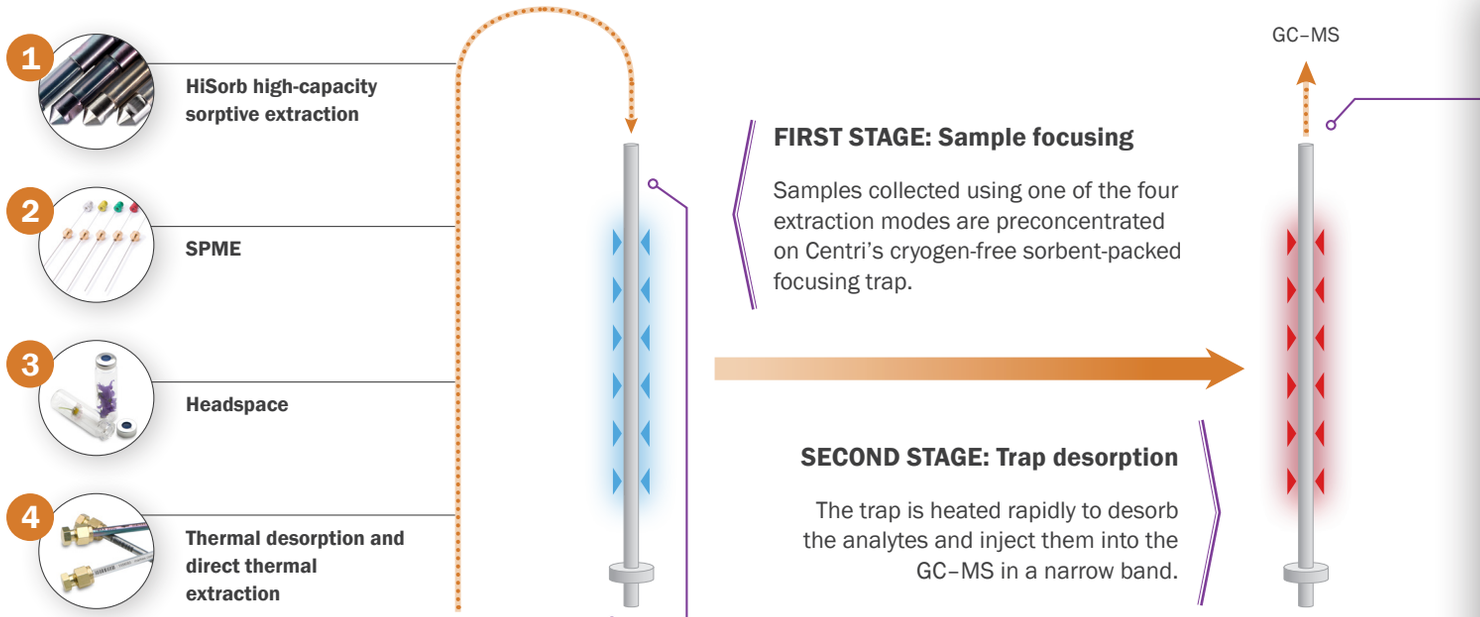
- Boosts everyday productivity by simultaneously extracting multiple sample vials while a previous sample is being analysed (‘prep-ahead’ mode).
- Allows fully automated extraction for headspace and immersive sorptive extraction (including on the same sample if required).



By using a ‘prep-ahead’ workflow, six HiSorb samples can be run in less than half the time of six SPME or SPME–trap analyses.

Innovation in sample extraction...

Centri combines innovation in workflow automation with highly efficient trap-based sample preconcentration prior to injection onto the GC column. Selective purging, multi-step enrichment and sample re-collection contribute to improved selectivity and chromatography, especially for volatiles, as well as supporting data validation and method development.



Selective purging

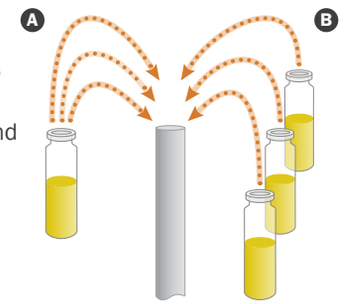
Using Centri, high-loading interferents such as water and ethanol can be selectively removed using an ambient-temperature purge prior to trap desorption.

This reduces background interference without compromising compounds of interest, so improving detection limits and data stability.

Multi-step enrichment

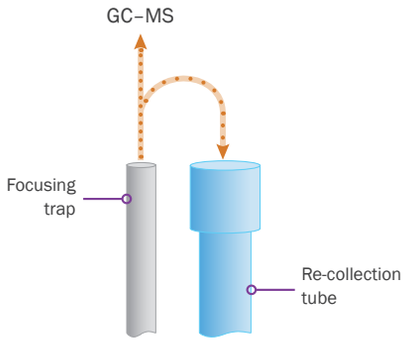
Using Centri, multiple extractions onto the focusing trap prior to desorption increase both the analyte response and the number of compounds identified.

This 'multi-step enrichment' process can be carried out from a single vial (A), or from replicate samples in multiple vials or sorbent tubes (B).



Sample re-collection

Centri's patented re-collection technology allows a proportion of the sample to be split and transferred automatically to a sorbent tube during trap desorption.



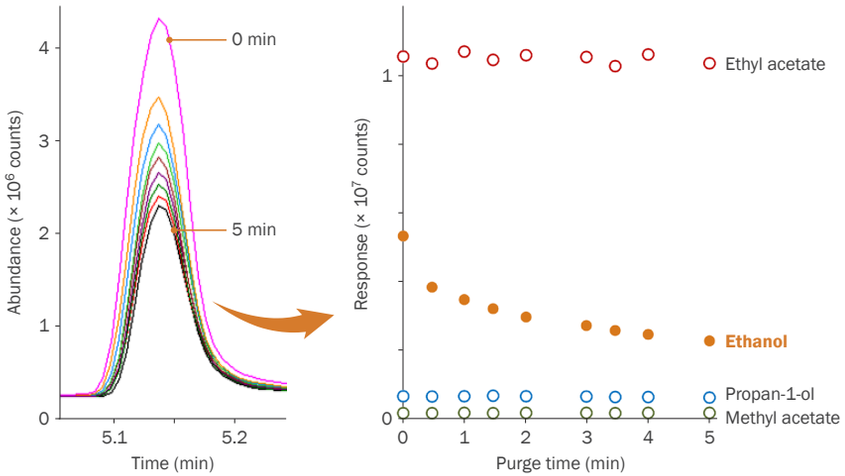
This allows secure archiving of samples in a stable form – an approach that has found widespread acceptance, and is incorporated into various international standards.

It also allows repeat sample analyses, for streamlined method development, reliable data validation, and for obtaining complementary data using different techniques. Such options are particularly valuable when samples are unstable or supplies are limited.

...to achieve more with each sample

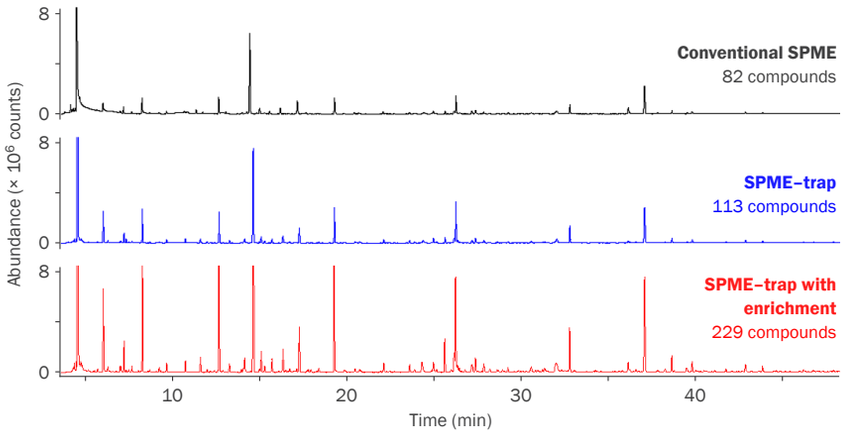
Centri's trap-based enrichment technology makes it easy to solve challenges faced every day in sample analysis, leading to better-informed decision-making.

Eliminating high-abundance interferents



A significant reduction in the response from ethanol in this analysis of red wine is achieved by increasing the purge time to 5 minutes. Other volatiles remain unaffected.

Increasing numbers of identified compounds

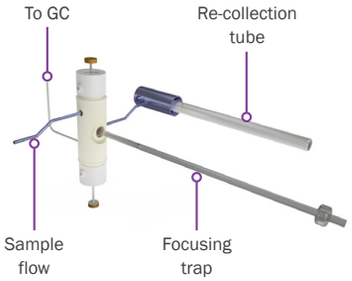


A major boost in the number of compounds identified in this tea sample is achieved using SPME–trap with multi-step enrichment.

Valve technology with no compromises

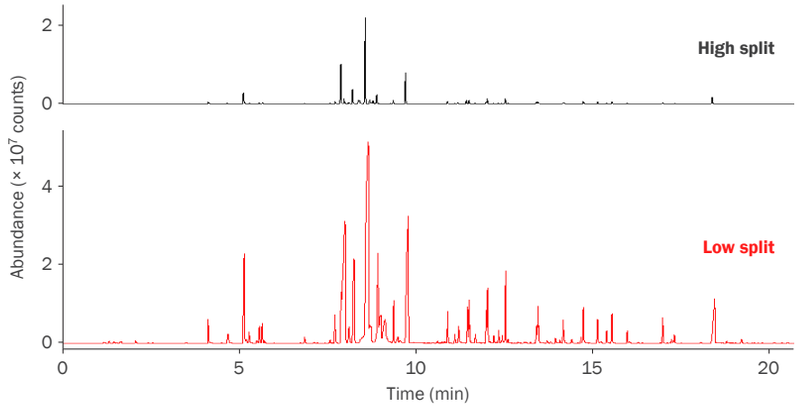
Underpinning many of Centri's key capabilities is a unique combination of a high-performance electrically-cooled focusing trap interfaced directly to a purpose-built valve. Centri's valve was developed specifically for enrichment and desorption in GC. This valve:

- Uses completely inert materials that are compatible with reactive species.
- Has a micro-volume flow-path which ensures efficient transfer of sample.
- Is housed in its own metal block to guarantee uniform heating at precisely controlled temperatures, eliminating the 'cold spots' encountered with other designs.



Field-proven over 20 years, it is this proprietary valve–trap combination that allows Centri to offer selective purging of water to vent and accommodate analytes over a wide volatility range. It also delivers features that are essential for enhanced data confidence, such as stringent pre-analysis leak-checking, and the option of internal standard addition before each run.

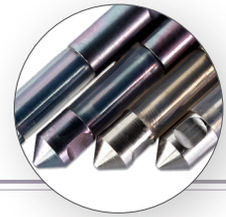
Extending dynamic range



Re-collection allows multiple methods to be applied to the same sample: In this example, an initial high split of a candle wax sample avoids the risk of system overload, while a lower split ratio on the re-collected sample allows trace-level components to be detected.

High-capacity sorptive extraction

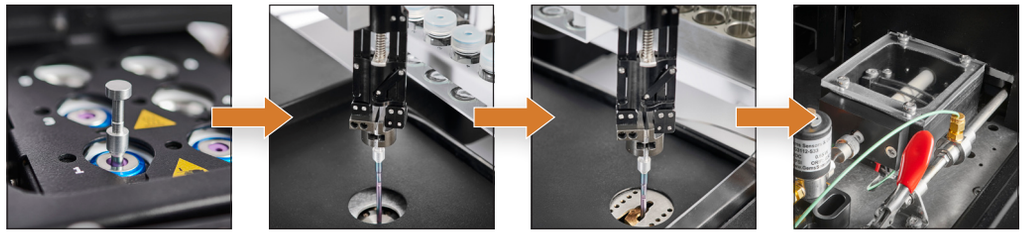
SAMPLING MODE 1



HiSorb probe-based sorptive extraction, automated on Centri, is the only technology that allows reliable, unattended, high-throughput headspace and immersive sampling of liquids and solids.

- **'Prep-ahead' mode** allows simultaneous extraction of multiple samples as part of an automated sequence, streamlining high-throughput analysis.
- **The large volume of sorptive phase** gives HiSorb probes much greater sampling capacity than SPME fibers. This makes them ideal for trace-level analysis of VOCs and SVOCs – for example, small volumes of biological fluids such as saliva and urine, and fragrance products.

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.

Versatile probe-based sampling

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

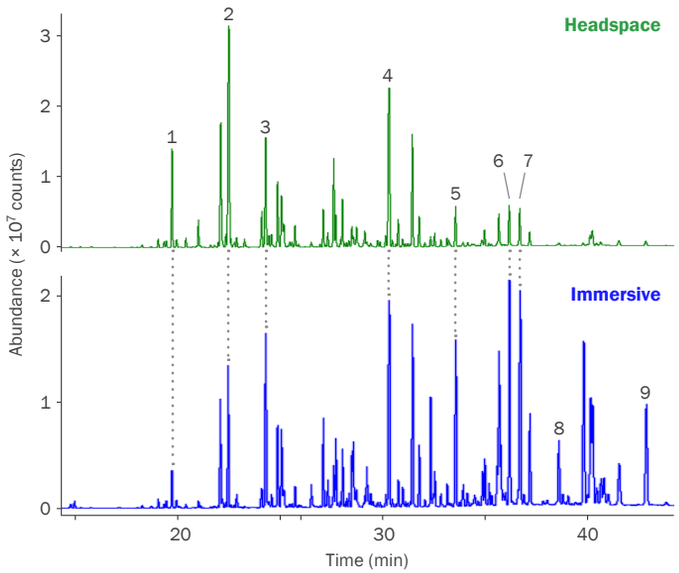
Standard-length probes allow immersive sampling from 20 mL vials.

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

The positioning of the probes in the middle of the vial avoids damage to the sorptive phase caused by contact with the vial sides.

Once sampled, vials are automatically re-sealed with special plugs to avoid contamination of laboratory air.

Comprehensive profiling using headspace and immersive sorptive extraction



1 Ethyl 2-methylpentanoate
2 Limonene
3 Dihydromyrcenol
4 Isobornyl acetate
5 Indan-1,3-diol monoacetate
6 Lilial
7 Rosacetol
8 n-Heptyl-γ-butyrolactone
9 n-Hexyl cinnamaldehyde

Complementary sampling approaches provide comprehensive information about sample constituents across the volatility range, as illustrated by these analyses of a fabric conditioner using HiSorb. In particular, the immersive sampling gives better responses for later-eluting, less-volatile compounds.

SPME–trap

SAMPLING MODE 2

Centri's compatibility with commercially available SPME fibers allows users to benefit from the versatility of the system by adapting existing manual methods into a fully automated workflow. Combining SPME with automated trap-based enrichment offers further benefits:

- **Peak shape** and **signal-to-noise ratios** for the most volatile, early-eluting species are significantly improved.
- **Sample stacking** further improves sensitivity.
- **Overlap mode** allows a new sample to be extracted and enriched while the previous sample is running on the GC.
- **The focusing trap** allows fiber desorption to be separated from GC column flow, allowing high desorption flows to be used without sample splitting. This improves recovery, resolution and sensitivity.

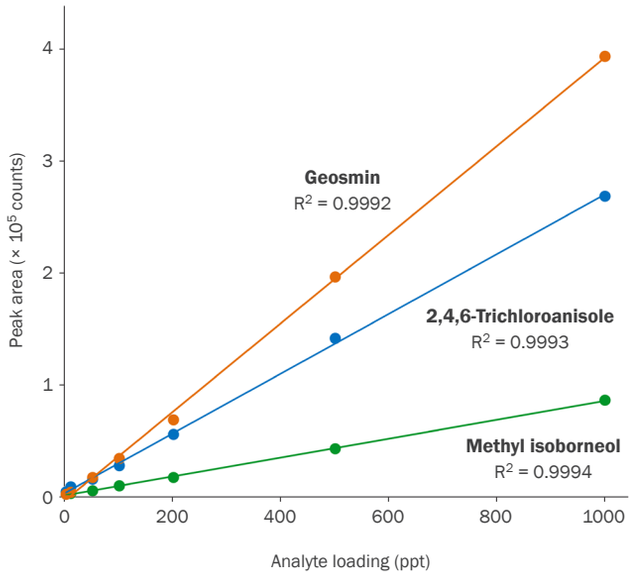
Automated SPME–trap on Centri

The SPME fiber is 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).

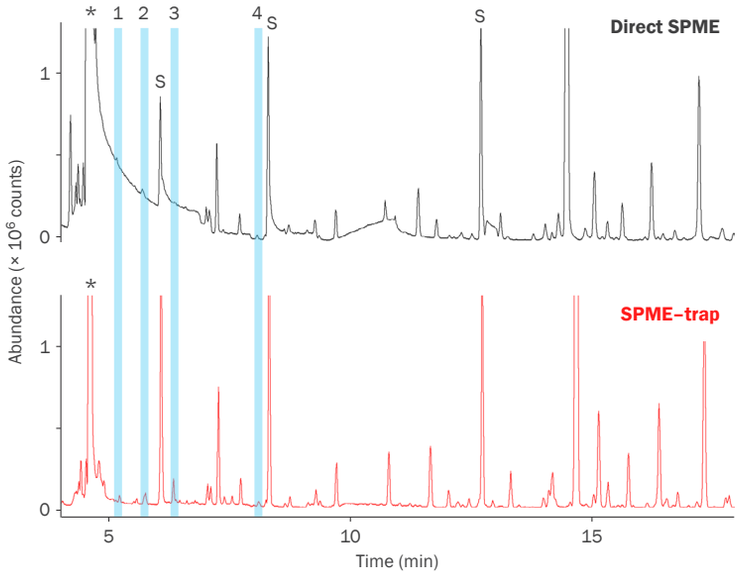
The trap is thermally desorbed at up to 100 °C/s to inject the sample into the GC–MS as a narrow band.

Linearity over a wide concentration range



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.

Improved detection of minor components



1 Dimethyl sulfide
2 Acetone
3 Butanal
4 2-Ethylfuran
S Siloxane

Improved responses for trace-level species (1–4) in this tea-leaf suspension are obtained using SPME–trap, thanks to the improved peak shape and a reduced response from diethyl ether (*), which was previously masking some early-eluting components.

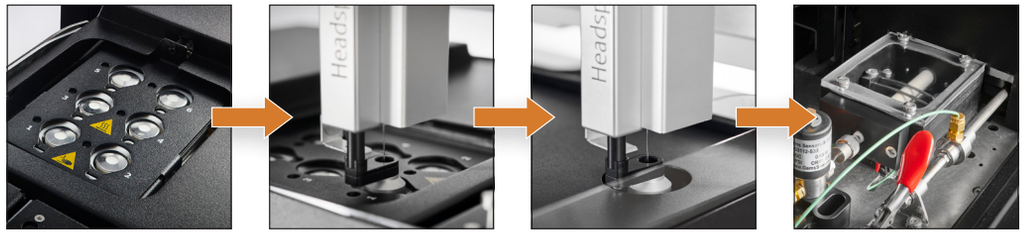
Headspace–trap

SAMPLING MODE 3

Centri provides all the versatility of regular headspace techniques, with the additional benefits of full automation and trap-based focusing:

- **Enrichment of large headspace volumes** (up to 5 mL in a single injection) on the trap prior to split or splitless GC analysis significantly improves peak shape and sensitivity, particularly for early-eluting compounds.
- **Sample stacking of multiple vials** further improves sensitivity. Up to 15 extractions from a single vial (or higher for multiple vials) can be focused on the same trap.
- **Overlap mode** allows a new sample to be extracted and enriched while the previous sample is running on the GC.

Automated headspace–trap on Centri



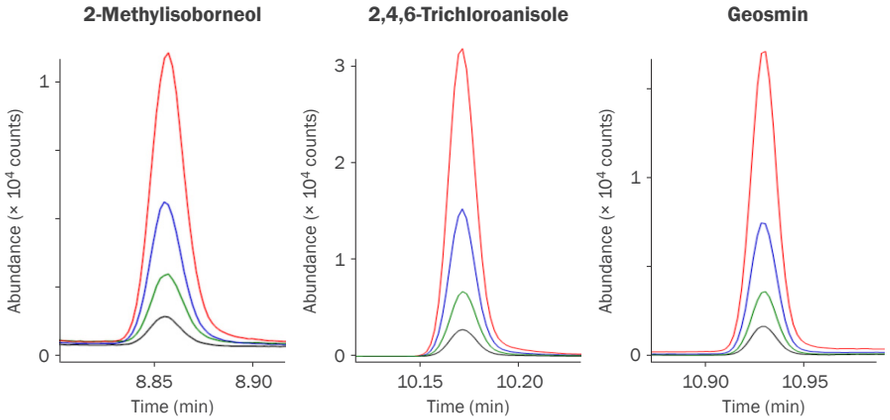
The sample vial is incubated/agitated to speed up analyte equilibration.

Headspace vapour is withdrawn using regular 1, 2 or 5 mL syringes.

The sample is sent to the focusing trap (or sent directly to the GC–MS).

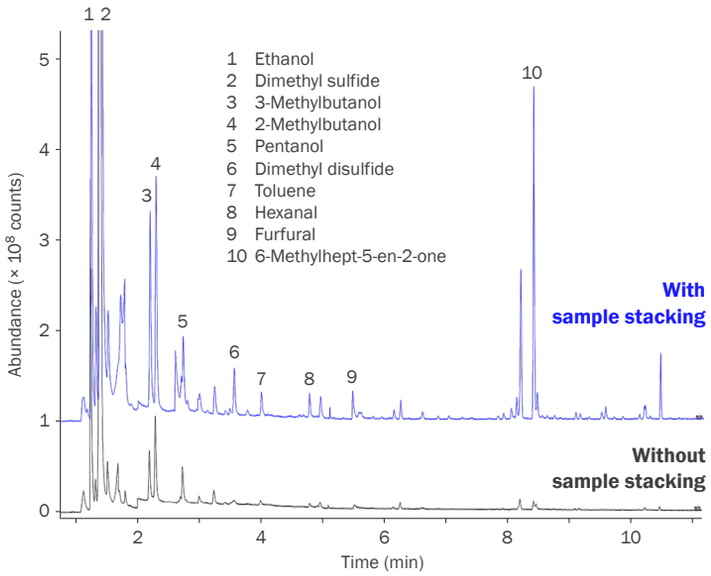
The trap is thermally desorbed at up to 100 °C/s to inject the sample into the GC–MS as a narrow band.

Combining large volumes and splitless analysis



Excellent chromatography is achieved in this series of splitless headspace–trap analyses of odorants in water, with trapping ensuring excellent chromatography even with 5 mL headspace volumes.

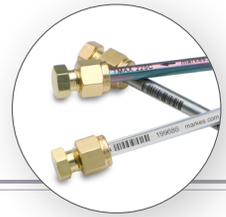
Sample stacking to boost sensitivity



Trace-level aroma compounds and contaminants such as toluene were identified in this sample of tomato paste using Centri's focusing trap to boost sensitivity. Stacking multiple 5 mL headspace extractions from the same vial (or different vials) onto the trap further enriches the sample prior to GC injection.

Thermal desorption and direct thermal extraction

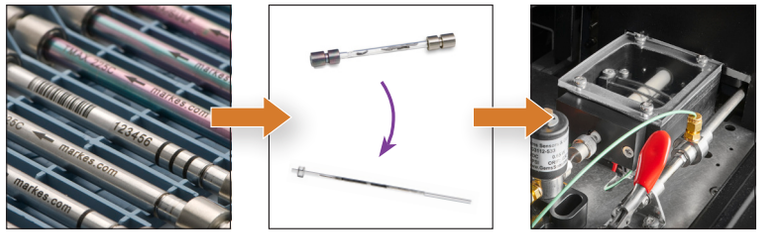
SAMPLING MODE 4



Centri's thermal desorption module fully automates analysis of up to 50 industry-standard 3½″ × ¼″ sample tubes, using two modes. **Tubes packed with sorbent** can be used for collecting vapour samples off-line – for example, from air or breath. **Direct thermal extraction** can be carried out by weighing materials directly into empty tubes and purging the VOCs onto the focusing trap. This is a versatile, simple dynamic headspace approach that generates repeatable, sensitive and broad-ranging GC profiles for materials as diverse as foods, textiles, biological samples, and the plastic components of medical devices. Centri also offers:

- **A wide analyte range** – propene to n-C_{44}, including reactive and thermally-labile species.
- **Full compliance** with national and international standard methods.
- **Guaranteed sample integrity**, through the use of DiffLok™ caps while tubes are on the autosampler.

Automated thermal desorption on Centri

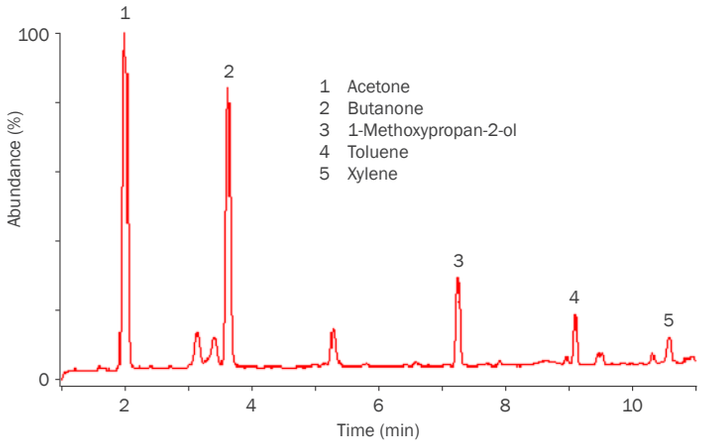


Capped tubes are placed in trays and leak-tested to confirm sample integrity, as required by standard methods.

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

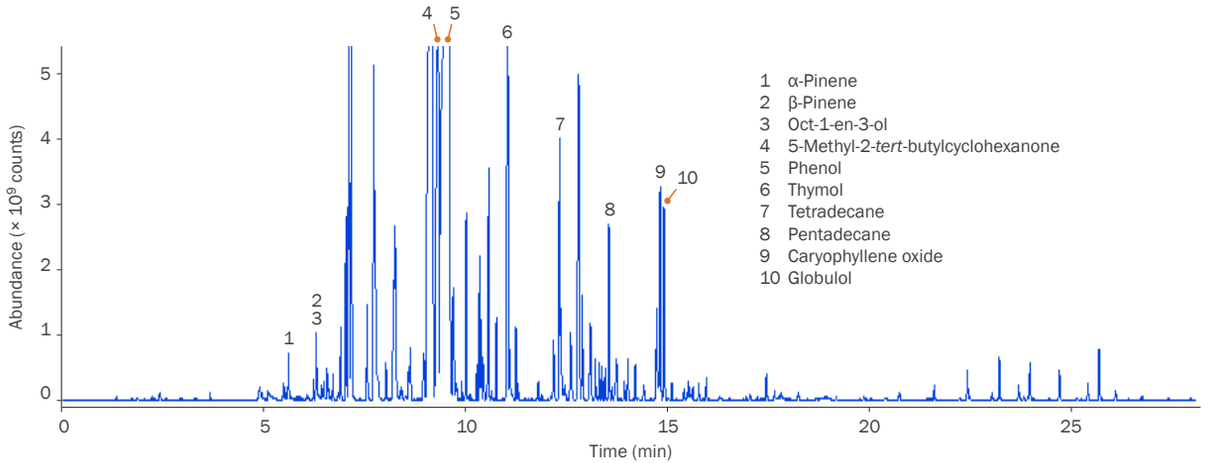
The trap is thermally desorbed at up to 100 °C/s to inject the sample into the GC–MS as a narrow band.

Breath sampling for occupational health monitoring



Off-line sampling of breath from shoe industry workers, followed by thermal desorption, enables detection of skin-absorbed solvents.

Direct thermal extraction for comprehensive aroma profiling



A range of flavour compounds are identified in peppermint tea, using direct thermal extraction and TD–GC–MS analysis to generate a comprehensive and representative aroma profile, with no need for sample preparation.

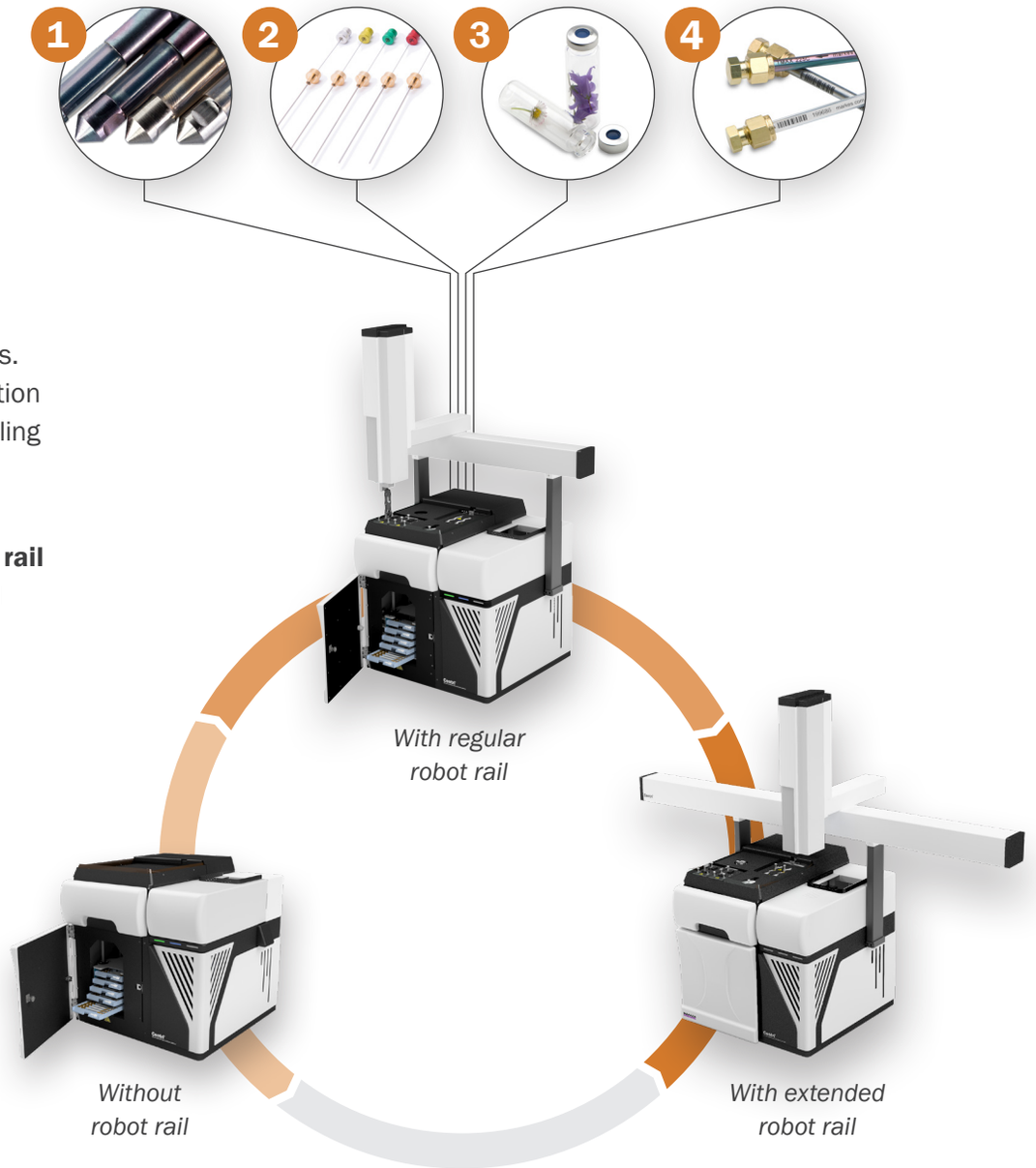
Flexibility to future-proof your laboratory

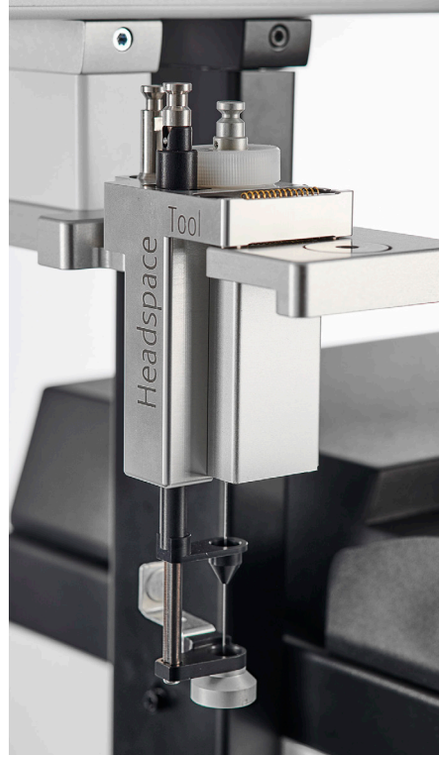
The modularity of the Centri platform makes it easy to configure the system in the way that's right for you.

Not only can you select whichever of the four extraction modes you need, but you can choose the level of automation:

- **The extended rail** offers greater capacity and more configuration options. It also allows automated classical injection modes *via* the GC inlet, and liquid handling functions such as internal standard addition and derivatisation.
- **Centri configurations without a robot rail** also offer high-performance automated thermal desorption, semi-automated HiSorb and manual headspace/ SPME–trap, with the flexibility for integration with existing or third-party robot rails to enhance existing workflows.

Extraction modes and automation capability can be added to Centri at any time.



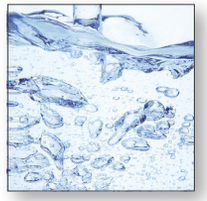


Centri – One platform, many applications

Key applications for Centri – Discover more at markes.com

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

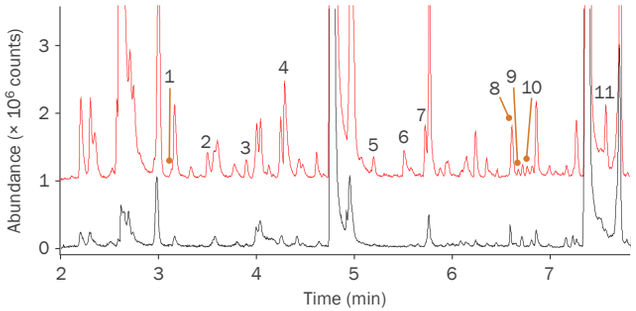
- Personal care products
- Fragranced consumer goods
- Fragrance research

Clinical & Forensic

- Clinical research
- Markers in biological fluids
- Extractables and leachables in medical devices

Trace-level compounds in foods & beverages

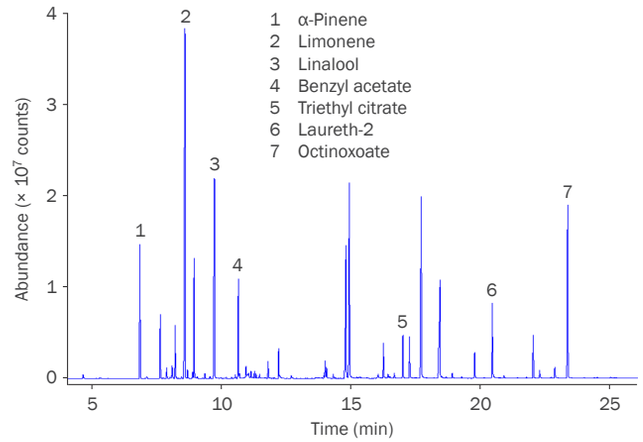
1 Phenol
2 3-Methylbutanol
3 Ethyl 2-methylpropanoate
4 3-Methylbut-2-en-1-ol
5 3-Methylbut-2-enyl hexanoate
6 Furfural
7 Ethyl methacrylate
8 Heptan-2-one
9 Bromoform
10 Propyl butanoate
11 Ethyl isoamyl ketone



Sample stacking (red trace) greatly increases the number of important trace-level aroma compounds identified in this headspace–trap analysis of orange juice.

Semi-volatiles in fragranced consumer products

1 α-Pinene
2 Limonene
3 Linalool
4 Benzyl acetate
5 Triethyl citrate
6 Laureth-2
7 Octinoxoate



Valuable information about the semi-volatile components (5–7) in this fragranced shower gel is obtained by using immersive high-capacity sorptive extraction. Headspace would have given much lower responses for these compounds.

Wide range of sampling accessories

Markes International offers all the sampling accessories and consumables you'll need to keep your Centri system running at maximum capacity.

- HiSorb probes (long-form and short-form)
- SPME fibers with a range of sorbent phases
- Headspace syringes (1, 2.5, 5 mL)
- TD tubes (sorbent-packed or empty)
- Caps for TD tubes
- Focusing traps
- Sample vials (2, 10, 20 mL)
- Caps, septa and injector liners
- Tools for efficient sample handling
- Accessories for calibration and maintenance.

Many of the above products are also available as cost-effective starter kits.

A full listing of these products can be found in Markes' *Sample Extraction Consumables and Accessories* catalogue.

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.

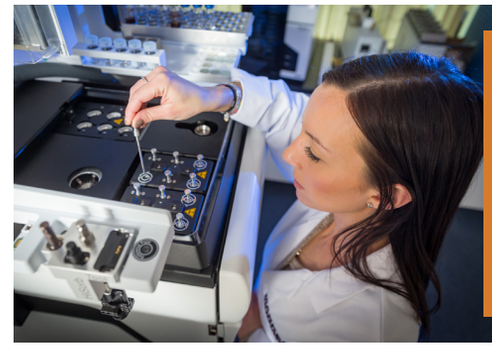
We manufacture a comprehensive range of instrumentation, accessories and consumables for enhancing GC–MS analysis of trace organic chemicals, and have a well-deserved reputation for innovation and expertise.

We're headquartered in Llantrisant, UK, and support customers in over 60 countries through a network of offices and distribution partners.

Discover more – Deliver more

> "Working with Centri opens the door, in a completely automated way, to **new possibilities** in analysis of volatiles. The use of multiple-cumulative extractions exploiting the trapping technique significantly improves the level of information that can be acquired in untargeted studies of volatile metabolites. Centri provides **unique capabilities**, in a user-friendly interface."

Giorgia Purcaro, Analytical Chemistry Professor
University of Liège, Belgium



Book your Centri demo

Contact your distributor, or one of our regional offices, to find out how Centri could help you **Discover more** and **Deliver more**.

Markes International

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