MARKES
international

Centri

A breakthrough in automated sample preparation, extraction and concentration for GC–MS

Centri®

Introducing the Centri portfolio of automated sample preparation, extraction and concentration platforms for GC and GC–MS.

Best-in-class PAL3 robotic automation (CTC Analytics) provides unrivalled flexibility for unattended, rapid and efficient extraction, preconcentration and injection of VOCs and SVOCs from liquid, solid and gaseous samples.

In combination with Markes' advanced cryogen-free focusing trap technology, optimal analytical sensitivity can be achieved, with significant enhancements in the quality and quantity of information obtained from GC–MS analyses.

Compatible with all brands of GC/GC–MS, fully modular Centri systems retain all the capabilities of the world-leading XYZ autosampler and can be configured to expand your application capabilities with:

- 100× sensitivity enhancement compared to conventional headspace and SPME methods
- Versatile water management
- Selective elimination of volatile interferences
- More representative chromatographic profiles covering a broader volatility range
- Robust sorptive probes for immersive and headspace extraction

Liquid handling and injection

Precise, highly reproducible handling of standards and fast GC injection minimises discrimination.

Headspace and headspace–trap

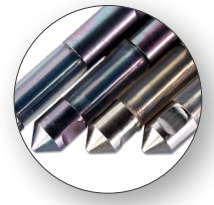
Unique, high-volume sampling of headspace from liquids and solids.

SPME and SPME–trap

Fast and sensitive sample extraction, with a range of selective fibers, including SPME Arrow.

Thermal desorption

The ideal option for analysis of trace VOCs and SVOCs.



High-capacity sorptive extraction

High-sensitivity immersive or headspace sampling of liquids and solids.

Exceptional performance and upgradability for ever-growing business demands

Centri PAL3 sample automation robots:

- Flexible, unattended workflows for liquid injection, HS, and SPME fiber/Arrow.
- Reproducible handling of liquid standards.
- Future in-field upgrade pathway to Centri 90, Centri 180 or Centri 360.

Centri 90 is the ideal upgrade for existing PAL3–GC–MS systems, adding trapping capabilities for high-sensitivity, high-productivity routine analyses. Centri 90 offers:

- Increased sensitivity (by up to 100×) with automated analyte enrichment of routine headspace and SPME.
- Optimised reproducibility and extended system lifetime, thanks to simple selective elimination of water and unwanted volatiles.
- Enhanced lab sustainability thanks to Multi-Gas capability, which ensures compatibility with hydrogen carrier gas as well as helium and nitrogen.
- Easy in-field upgradability: upgradable to Centri 180

Centri 180 offers all the functionality and advantages of Centri 90, plus:

- Thermal desorption of sorbent-packed tubes, including direct thermal extraction, for VOCs and SVOCs in air and materials.
- HiSorb sorptive extraction: Robust, re-usable HiSorb probes can be used for off-line sampling of VOCs and SVOCs in solids and liquids, with fully automated analysis on Centri 180.
- Easy in-field upgradability: Optimise lab productivity and flexibility with HS, SPME, classical GC injection modes, and the option of thermal desorption – all on one system.

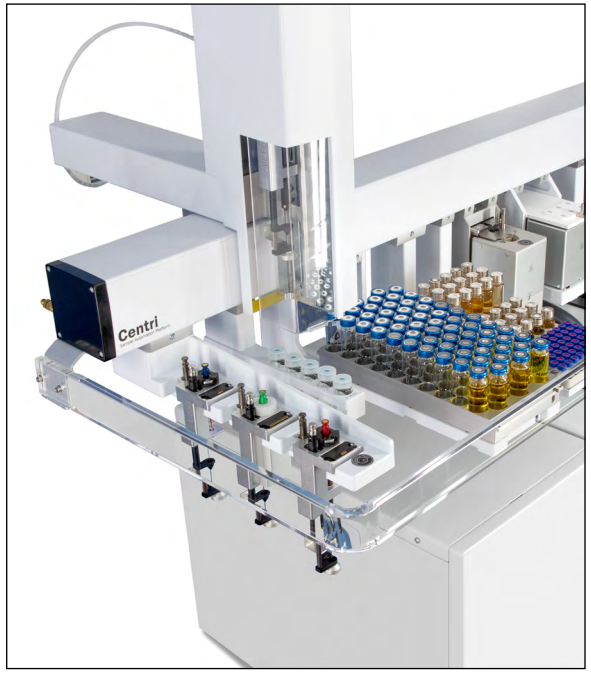
Centri 360

- Highly flexible, modular platform for complete sample characterisation.
- Complementary analyses on a single platform.
- The only system offering fully automated workflows for all methods (including headspace and immersive HiSorb), for further reductions in sample preparation time.

Centri PAL3 sample automation robots

High-productivity, routine analytical laboratories need true unattended operation by Centri PAL3 sample automation robots to provide reproducible GC–MS results. Whether you're looking for an entry-level or advanced robotics platform, our Centri series has a system suitable for you.

Centri capabilities	LSI	RSI	RTC
Liquid injection and handling for standards (syringe capacity)	Up to 100 µL	Up to 10 mL	Up to 10 mL
Sample capacity	648 x 2 mL	Up to 360 x 20 mL >900 x 2 mL	Up to 360 x 20 mL >900 x 2 mL
Headspace	✘	✓	✓
SPME and SPME Arrow	✘	✓	✓
Multiple headspace extractions	✘	✓	✓
ITEX dynamic headspace	✘	✓	✓
Robotic tool change capability	✘	✘	✓
Advanced sample prep (e.g. on-line derivatisation)	✘	✘	✓



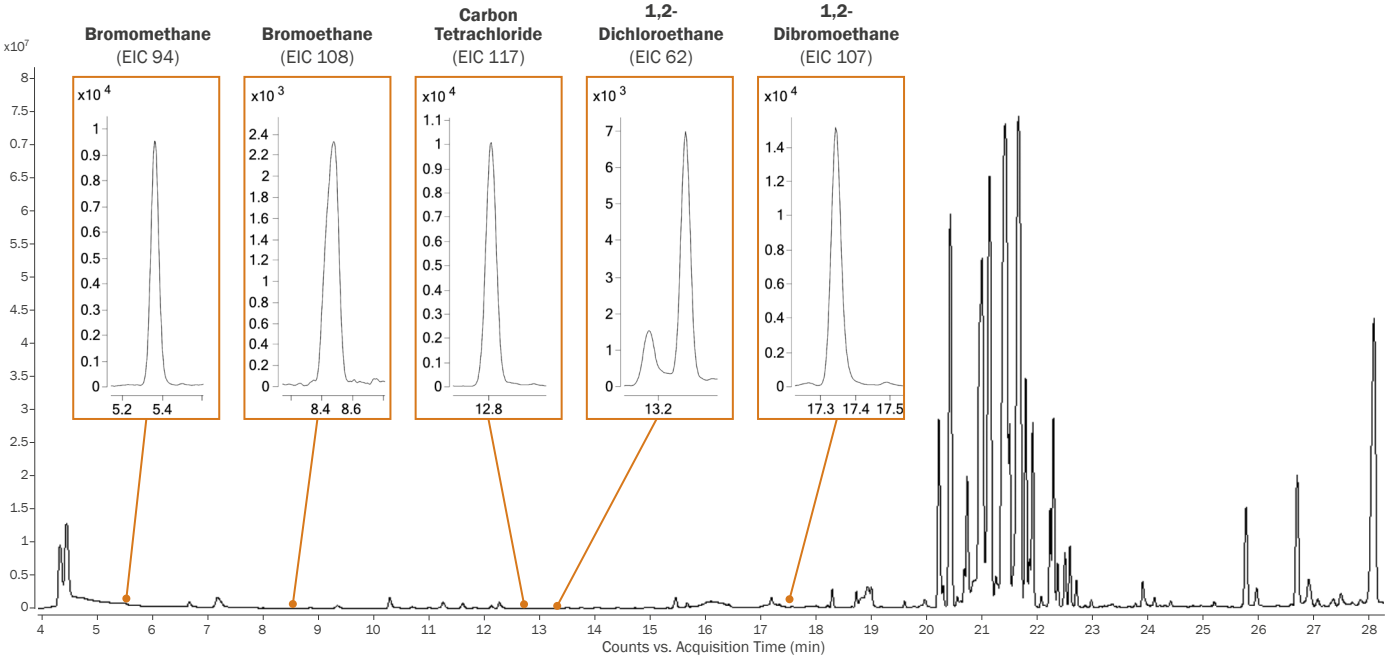
Key features of Centri PAL3

- Automated switching between liquid, headspace and SPME applications.
- 'Smart chips' in consumables provide traceability features, while recording of usage information improves data confidence.
- A range of sample preparation options help to reduce or eliminate manual sample processing.
- Modular design enables additional tools to be added as required.

Centri 90

Enhancing sensitivity in routine VOC analysis

Developed specifically for the selective enrichment of trace volatile and semi-volatile organics in complex real-world samples, Markes' cryogen-free focusing and injection technology leads the world in performance and versatility. Field-proven over 25 years, the backflushed trap of Centri 90 combines exceptional concentration enhancement – increasing detection limits by hundreds of times – with representative profiling of trace analytes over the widest available volatility range. It also facilitates selective purging of water and other volatile interferences, as well as providing a multi-step enrichment functionality for improved sensitivity and for method development.



Enhanced sensitivity and excellent peak shapes are achieved for the detection of early-eluting, trace-level volatile fumigants (at 0.005 mg/kg), in this ground pepper sample. Sizeable improvements in the signal-to-noise ratios are obtained when combining Centri 90 with GC–MS.

Superior analyte preconcentration for trace volatiles

- Achieve simultaneous analysis of VOCs and SVOCs in a single run with expertly tailored multi-bed sorbent traps combined with backflush operation.
- Eliminate the cost and inconvenience of cryogen, and avoid associated risk of ice blockages with controlled, electrical cooling.
- Optimise sample throughput with short analytical cycle times thanks to fast trap cool-down in combination with robust sample overlap.
- Obtain optimum chromatography with all modes of operation, thanks to the narrow-bore design providing fast and efficient desorption of analytes.

Centri 180

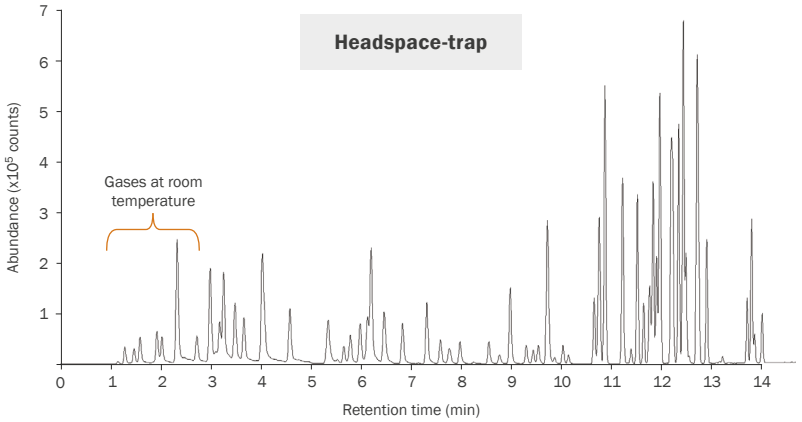
Providing ultimate laboratory productivity

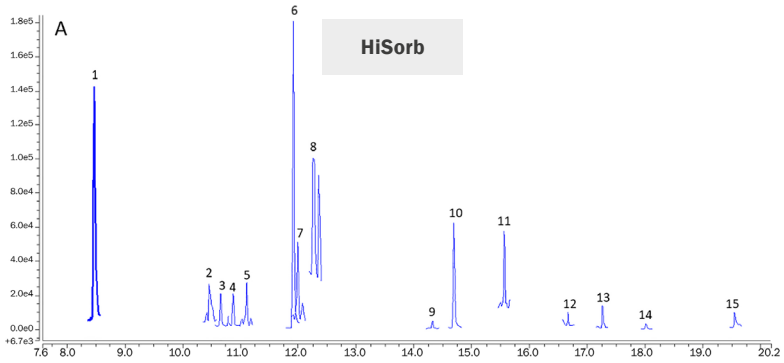
Centri 180 builds on the capabilities of the Centri 90, enabling busy laboratories to adapt to changes in demand for various routine applications. This versatile platform offers highly sensitive analysis of volatile organics sampled *via* headspace, SPME, SPME Arrow, tube-based TD, and HiSorb probes, and is available as an upgrade from the Centri 90. Centri 180 is fully compatibile with industry-standard tubes, ensuring compliance with standard methods such as ISO 16000-6, VDA 278, HJ 644, and US EPA Method TO-17. Efficiency is maintained through the unattended sequencing of all application modes on a single GC–MS system.

	Status	Sample Type	Comment	Method	Sample tray	Sample vial	Tube
Sequence		Repetition: 1 of 1		Continuous	Start Time: --:-- --/--/----		
1	Complete	Sample	HS Sample 1	Centri - Headspace Trap (1) (1)	Tray Holder 1:Rack 1	1	
2	Complete	Sample	HS Sample 2	Centri - Headspace Trap (1) (1)	Tray Holder 1:Rack 1	2	
3	Complete	Sample	HS Sample 3	Centri - Headspace Trap (1) (1)	Tray Holder 1:Rack 1	3	
4	Complete	Sample	HS Sample 4	Centri - Headspace Trap (1) (1)	Tray Holder 1:Rack 1	4	
5	Complete	Sample	HS Sample 5	Centri - Headspace Trap (1) (1)	Tray Holder 1:Rack 1	5	
6	Active	Sample	SPME Arrow MSE Sample 1	Centri - SPME Arrow Trap	Tray Holder 1:Rack 1	6	
7		Sample	SPME Arrow MSE Sample 2	Centri - SPME Arrow Trap	Tray Holder 1:Rack 1	7	
8		Sample	SPME Arrow MSE Sample 3	Centri - SPME Arrow Trap	Tray Holder 1:Rack 1	8	
9		Sample	HiSorb 1	Centri - Tube Desorption			1
10		Sample	HiSorb 2	Centri - Tube Desorption			2
11		Sample	HiSorb 3	Centri - Tube Desorption			3
12		Sample	HiSorb 4	Centri - Tube Desorption			4

Accommodate multiple injection techniques on a single system (and even in a single sequence) with no user intervention and without compromising analytical performance or sample-to-sample cycle time.

Multi-technique analysis of water samples on one system





Routine analysis of water samples using different sampling techniques is achieved using the same Centri 180/GC–MS system: (Top) An 83-component mix of volatile organics by HS-trap; (Bottom) A suite of odorous compounds by HiSorb automated analysis. (See Markes' AN285) for details.)

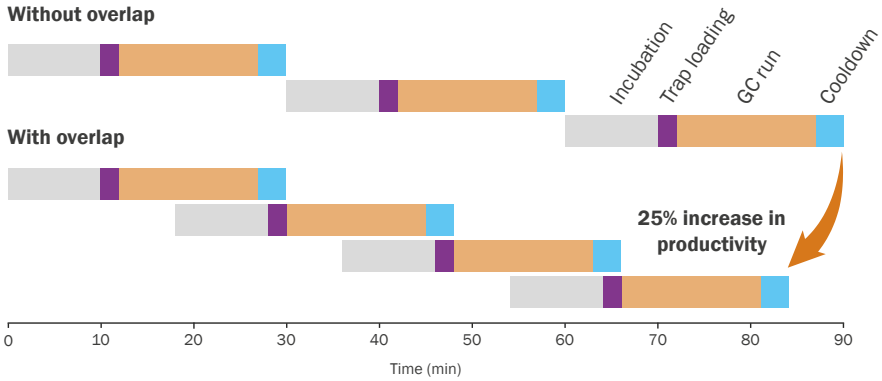
Increase productivity and reduce costs per sample

From solving everyday challenges to providing long-term improvements to data quality in routine analysis, Markes' innovative technologies have been optimised for outstanding GC performance. Using Centri, you can flexibly and rapidly evaluate the advantages of preconcentration using a multi-sorbent, backflushed focusing trap, while retaining direct GC injection capabilities for existing analyses using HS, SPME, SPME Arrow and liquid injection.

In addition, you can benefit from:

- In-built Multi-Gas technology to speed-up your sample analysis and reduce the cost per sample
- Enhanced extraction efficiency with multi-step enrichment on trap
- Versatile water management and selective purging of volatile interferences
- Advanced sample overlap and prep-ahead mode for increased productivity and quicker time-to-results
- Automated pre-analysis leak-checking to ensure sample integrity
- Smart traceability features and recorded usage information to improve data confidence.

Increasing throughput with sample overlap



Fast returns on investment are achieved by the use of overlap and prep-ahead modes to maximise sample throughput.

Future-proof your laboratory with Multi-Gas technology.

- **Independent certification of Centri 90 & Centri 180** for safe use with hydrogen carrier gas, as well as helium and nitrogen.
- **Safeguard against helium shortages,** switch now or in the future.
- **Remove dependency on gas bottles** by using gas generators to provide a consistent gas supply, eliminating any risk of downtime and reducing costs.
- **Speed-up sample analysis** to maximise your return on investment with faster GC separations, enabling higher sample throughput and so increasing earning potential.
- **Remove concerns about potential analyte degradation** in the inlet by always transferring the sample to the trap with an inert carrier (either helium or nitrogen), while still allowing the choice of hydrogen, helium or nitrogen as carrier for GC separation.

MULTI-GAS ENABLED

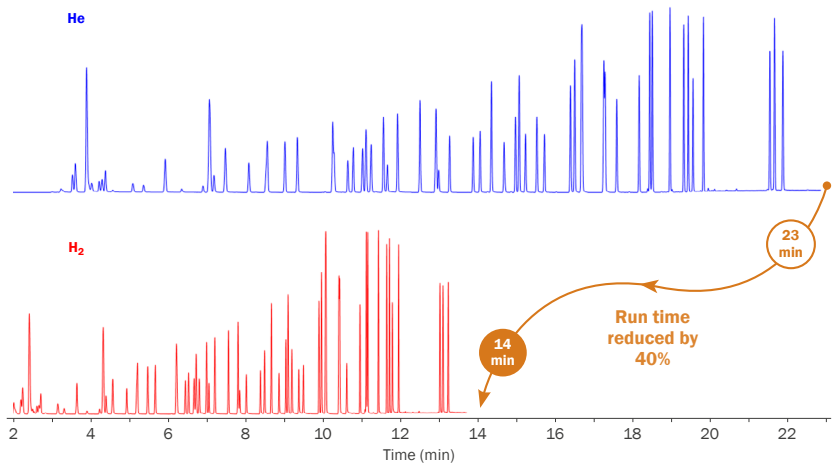
Maximising your return on investment using hydrogen carrier gas

Helium carrier: 48 samples per system per day

Hydrogen carrier: ~50% (25) more samples per day ⇒ 73 samples per system per day

At $100/sample, this means **additional earnings of $2500 per system, per day**

Increasing productivity using hydrogen carrier gas



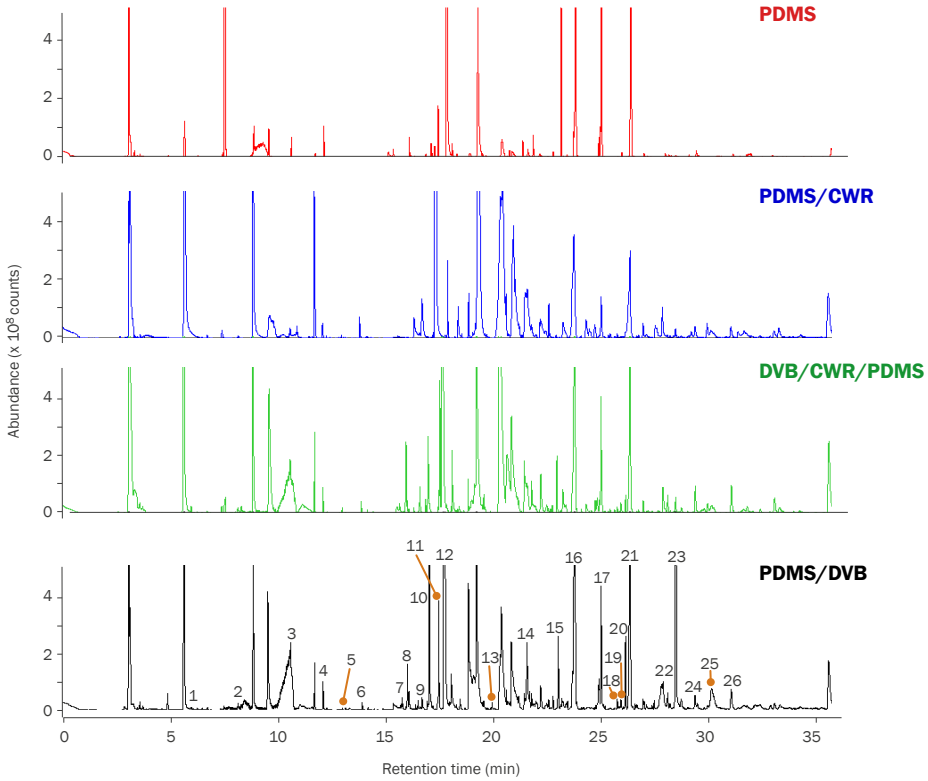
Analysis of 'air toxics' at ppt to ppm levels: Using hydrogen as a carrier gas it is possible to significantly reduce the run time while still maintaining excellent separation.

HiSorb™, high-capacity sorptive extraction

Extract maximum information with full automation and no sample prep

HiSorb is an innovative, labour-saving sampling system for the analysis of volatile and semi-volatile organic compounds (VOCs and SVOCs) in liquids and solids by GC–MS. HiSorb probes and accessories are ideal for trace-level component characterisation, aroma profiling, quality control and advanced research across a wide range of applications.

HiSorb probes are designed to allow compatibility with manual, off-line sampling with analysis by thermal desorption on Centri 180, or full automation of the entire workflow (from sampling through to GC injection) on Centri 360, including automatic re-sealing of vials using special plugs to avoid contamination of laboratory air.

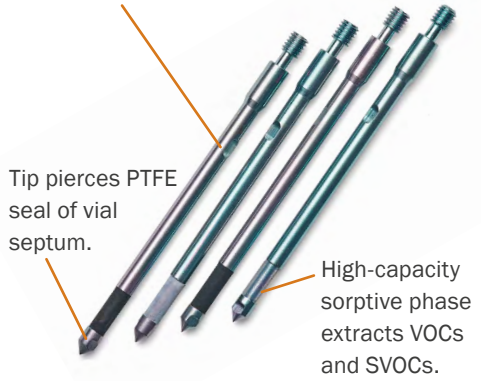


1 3-Methylbutanal
2 Benzene
3 Hexanal
4 2-Methyl-2-pentenal
5 2-Hexenal
6 Allyl hexanoate
7 1-Ethenyl-3-ethylbenzene
8 3-Hexen-1-ol
9 Decanal
10 Furfural
11 Acetic acid
12 Benzaldehyde
13 4-Ethylbenzaldehyde
14 1-Dodecanol
15 3-Mmethylbutanoic acid
16 4-Methoxybenzaldehyde
17 γ-Decalactone
18 Piperonal
19 Decanoic acid
20 2,3-Dihydro-3,5-dihydroxy-6-methyl-4H-pyran-4-one
21 p-Anisylacetone
22 Dodecanoic acid
23 5-Hydroxymethylfurfural
24 1-Octadecanol
25 Octadecanoic acid
26 Tetradecanoic acid

Immersive, multi-phase HiSorb analysis of a 'cherry/berry'-flavoured hard seltzer drink, resulting in a wide range of organoleptic compounds discovered that were not present when using PDMS only.

Versatile probes for diverse applications

Metal shaft of probe provides intrinsic robustness and allows manual and automated operation on Centri.



- Patented technology allows automated, unattended high-capacity sorptive extraction for the first time.
- Four phase combinations available for selective preconcentration of a wide range of polar and non-polar analytes encountered in major applications, including aroma discovery in foods, beverages and fragrances.
- Short-length probes allow headspace sampling from 20 mL vials, or immersive sampling from 10 mL vials.
- Standard-length probes allow immersive sampling from 20 mL vials.

Centri 360

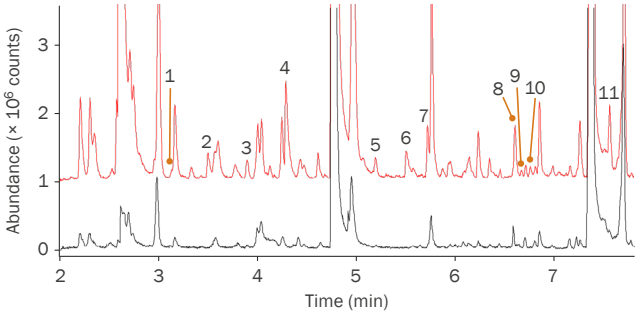
Unrivalled flexibility for full sample characterisation

Centri 360 is highly flexible and modular, enabling complete sample characterisation through complementary analyses on a single platform. It supports full automation of high-capacity sorptive extraction workflows for the first time, extracting maximum sample detail with minimum sample preparation.

Harnessing the power of Markes' backflushed trap, in combination with automated tool changes and more configuration options, Centri 360 allows you to tackle the most challenging of applications with a high degree of flexibility for sample discovery.

Trace-level compounds in 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



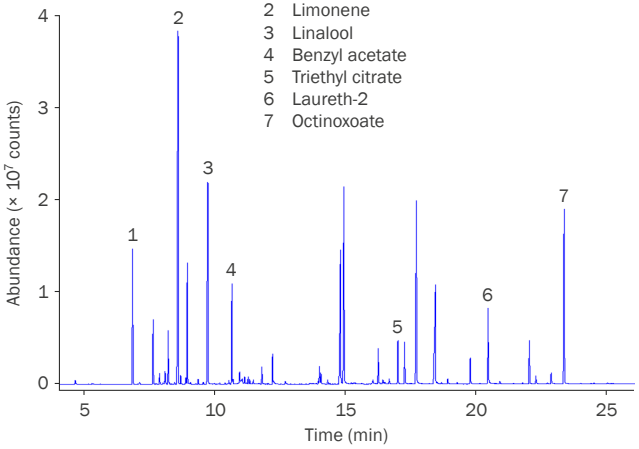
Multi-step enrichment (red trace, 3 × 5 mL) greatly increases the number of important trace-level aroma compounds identified in this headspace–trap analysis of orange juice.

THE INNOVATION AWARDS 2018 Analytical Scientist

Wiley Analytical Science Award Winner

Semi-volatiles in fragranced goods

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



Information about the semi-volatile components in this fragranced shower gel is obtained using immersive high-capacity sorptive extraction. The large phase volume provides greater sampling capacity than SPME fibers, making it ideal for trace-level analysis.

Comprehensive sample profiling

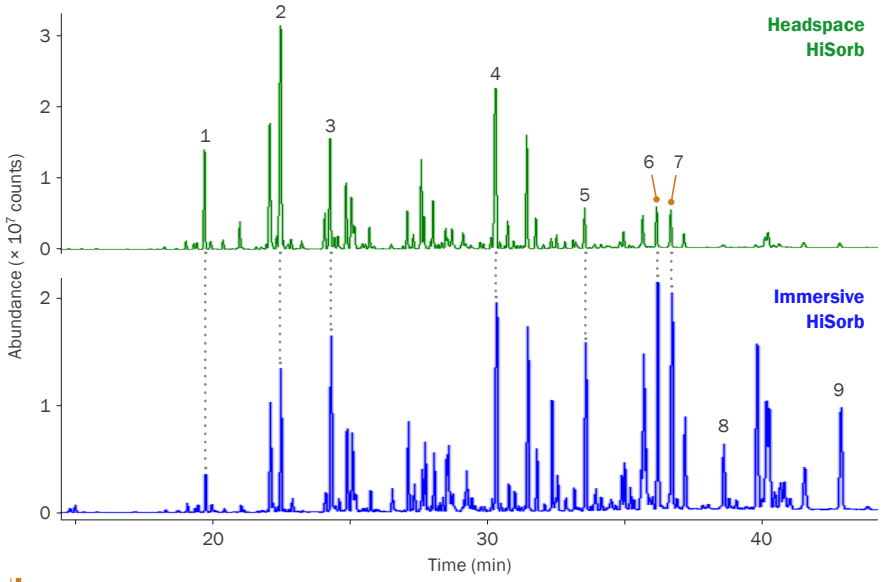
Discover more with Centri 360

Complementary sampling approaches provide comprehensive information about sample constituents over a wide concentration and volatility range. The flexibility of Centri 360 allows you to easily change between techniques on a single platform, making it ideal for non-target research applications such as aroma and flavour profiling.

Enhanced sample profiling and sample security is enabled by Centri's proprietary re-collection feature. This allows re-analysis without re-sampling, and enables the dynamic range of the same sample to be extended, to quantify both major and minor components.

Improve decision making with complementary analyses

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



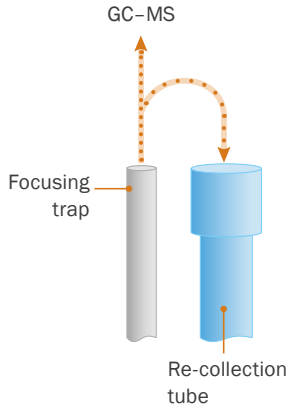
Analysis of a fabric conditioner using different techniques generated a more comprehensive fragrance profile. This example shows improved responses for later-eluting, less-volatile aroma-active compounds when using immersive HiSorb sampling.

Unique re-collection for all sampling modes

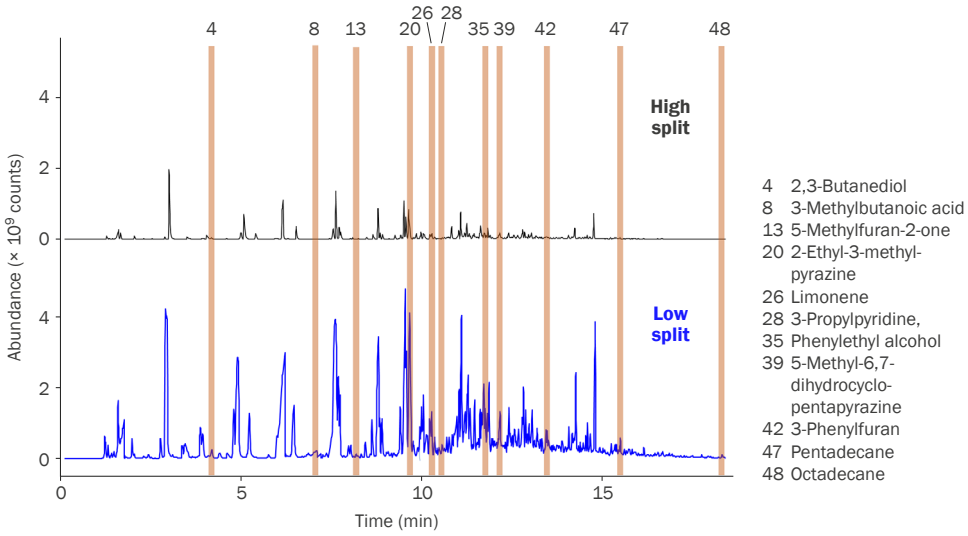
On all Centri systems, patented re-collection technology allows the split portion of sample to be transferred automatically to a clean sorbent tube during GC injection.

Providing **enhanced security** for critical, perishable or limited-size samples, re-collection allows **quantitative repeat analysis** without the need to re-sample.

This also allows simpler and faster **method development,** provides a means of reliable **data validation**, and even permits **complementary analysis** using different systems or analytical detectors.



Extending dynamic range to detect trace-level analytes with re-collection



4 2,3-Butanediol
8 3-Methylbutanoic acid
13 5-Methylfuran-2-one
20 2-Ethyl-3-methyl-pyrazine
26 Limonene
28 3-Propylpyridine,
35 Phenylethyl alcohol
39 5-Methyl-6,7-dihydrocyclo-pentapyrazine
42 3-Phenylfuran
47 Pentadecane
48 Octadecane

Quantifying major and minor components from the same sample: An initial high split of freshly ground coffee, sampled using headspace HiSorb, avoids the risk of system overload for higher-abundance components, while a lower split ratio applied to the re-collected sample (automatically retained on a clean sorbent-packed tube during the original HiSorb analysis) improves responses and allows trace-level analytes to be detected (labelled).

Uncovering detailed sample information

Seamless workflow integration.

Centri 360 increases sample information obtained for discovery applications, thanks to flexible sampling options and preconcentration. As a result, more comprehensive approaches can be used to separate, detect and identify the compounds present, and provide additional dimensions of information about every sample.

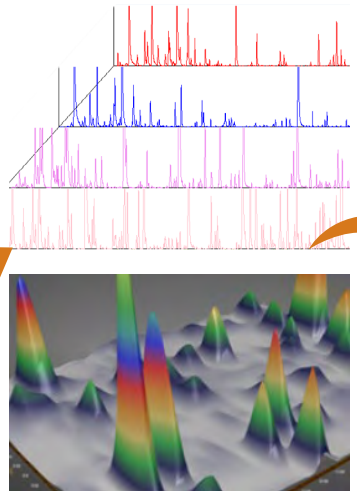
Seamless integration of Centri 360 with advanced techniques such as GC×GC provides improved separation to uncover hidden or co-eluting peaks. When coupled with a mass spectrometer like the BenchTOF2 (SepSolve Analytical Ltd), this provides clearer spectra, and so improves confidence when performing library matches in non-target screening.

Automated data analysis and intelligent chemometrics software can then be used independently or as part of a complete 'discovery' workflow, to quickly find the maximum number of compounds and meaningful trends within complex datasets.

SAMPLE INTRODUCTION

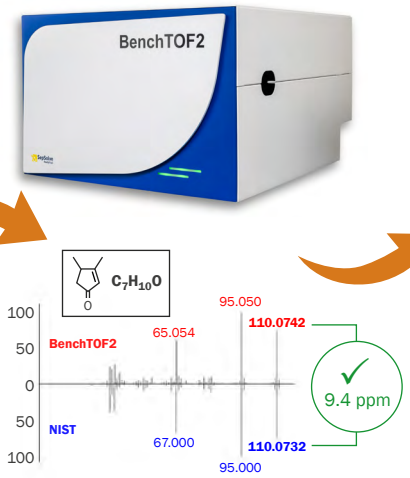
Extract maximum detail. Superior sample extraction and enrichment using advanced techniques combined with electrically-cooled trap technology enhances sensitivity and data quality.

SEPARATION



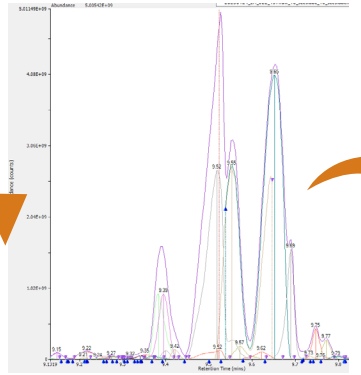
Uncover more compounds. In addition to 1D GC, comprehensive 2D GC can provide further analyte separation, uncovering hidden or co-eluting peaks, to reveal even more information in every sample.

DETECTION



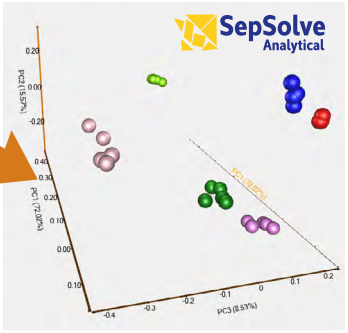
Remove the guesswork. The BenchTOF2 delivers exceptional sensitivity, reference-quality spectra and powerful mass accuracy, giving the confidence to distinguish between candidate structures with very similar masses.

DATA ANALYSIS



Single software platform. ChromSpace software (SepSolve) integrates full instrument control with both qualitative and quantitative data processing in a single, easy-to-use platform.

CHEMOMETRICS



Find the differences. The ChromCompare+ (SepSolve) module provides powerful, automated alignment and chemometrics tools, to quickly find key differences between complex chromatograms and generate meaningful results.

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.

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

The company is headquartered in Bridgend, UK, and support customers in over 60 countries through a network of offices and distribution partners.

Markes International, and its sister company, SepSolve Analytical, are companies of Schauenburg Analytics Ltd.

> “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

Work with our experienced application chemists to find out how Centri can help you discover more and deliver more.

Access the training and support you need, to ensure you get the best from your investment.

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