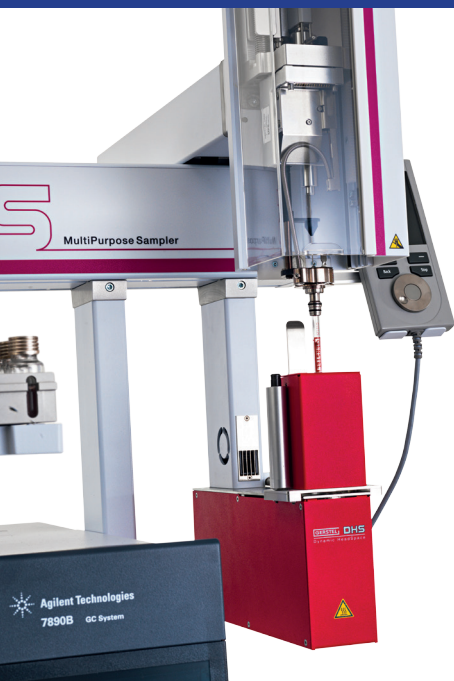# GERSTEL

Automated
Dynamic Headspace

DHS

Enhanced Detection Limits
Carryover Eliminated
Highest Productivity and Throughput
Most Flexible Automated Solution Available

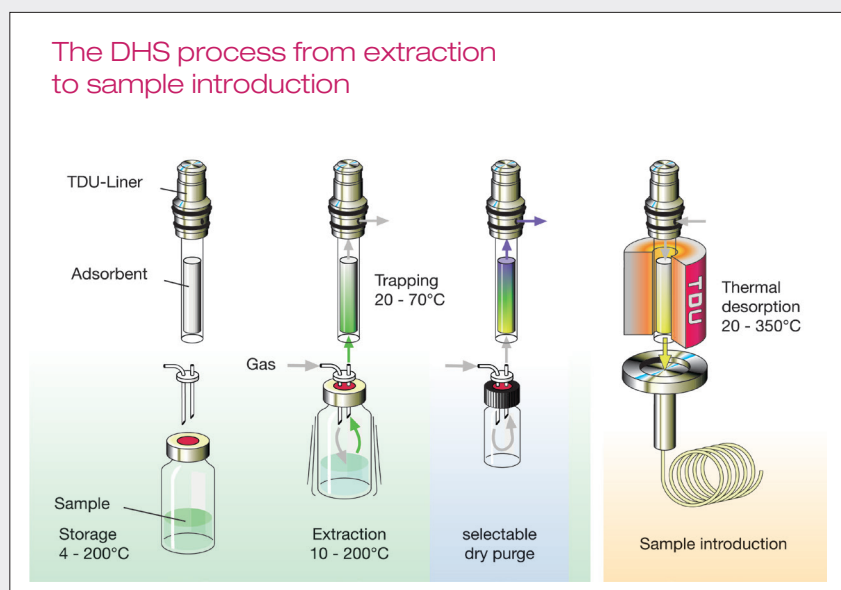# Automated Dynamic Headspace **DHS**

The Dynamic Headspace technique combines the sensitivity and low detection limits of Purge and Trap with the ease of handling, high productivity and ruggedness of Headspace analysis.

The Dynamic Headspace (DHS) option for the GERSTEL MPS autosampler, an industry standard, offers complete automation of the dynamic headspace technique. The DHS station is used to extract and concentrate VOCs from liquid or solid samples placed in standard headspace vials. The headspace above the sample is purged and analytes are concentrated on a user selectable adsorbent-filled trap. Analytes are subsequently introduced into a gas chromatographic system by thermal desorption of the trap in a GERSTEL Thermal Desorption Unit (TDU) resulting in maximum recovery, and lowest possible detection limits. DHS offers improved performance for a wide variety of sample types, such as food, beverages, polymers, personal care products and pharmaceuticals.

GERSTEL exclusive MAESTRO software enables fully integrated control of the complete process from extraction and analyte collection to GC/MS analysis. Just one method and one sequence table is required, minimizing the risk of errors and enabling fastest possible set-up. Intelligent software control ensures that the DHS process is performed during the GC run of the preceding sample, thereby optimizing productivity and system utilization, an exclusive GERSTEL feature.

The DHS process from extraction to sample introduction

TDU-Liner

Adsorbent

Trapping 20 - 70°C

Gas

Thermal desorption 20 - 350°C

Sample

Storage 4 - 200°C

Extraction 10 - 200°C

selectable dry purge

Sample introduction

Adsorbents

For most applications, Tenax TA adsorbent can be used in the trap. If your application requires another adsorbent, you can choose from a selection of pre-packed and conditioned tubes or you can pack the tubes yourself with the adsorbent(s) of your choice. Since the trap is back-flushed during desorption, multi-bed adsorbent tubes can be used in order to cover a wide range of analyte boiling points and polarities in one analysis for improved flexibility and productivity.

DHS Background and System Overview

The DHS station provides sample thermostating and agitation combined with purging of the sample headspace with a controlled flow of inert gas. The result is fast, efficient and reproducible extraction of analytes from liquid or solid samples. Extracted compounds are trapped and concentrated on a replaceable adsorbent-filled trap, which is subsequently thermally desorbed in the integrated GERSTEL Thermal Desorption Unit (TDU) followed by determination of the analytes using GC/MS.

While in the GERSTEL MPS autosampler, samples are stored in standard headspace vials at ambient temperature. Optionally, samples can be stored at controlled temperatures between 4 °C to 200 °C. Lower sample temperatures can help reduce decomposition of heat sensitive samples such as food and biological materials. Higher temperatures can be used to simulate sample behavior under "stressed" conditions. During extraction, samples can be agitated to enhance and speed up the extraction process. The temperature of the adsorbent tube during the DHS process can be independently controlled from 20 °C to 70 °C for optimal trapping of the analytes of interest. The adsorbent tube can be dry purged for water removal to ensure the best possible chromatography and MS stability. A new adsorbent tube can be used for every sample, eliminating the risk of cross contamination or the same tube can be used for multiple samples as in standard Purge and Trap instruments.

GERSTEL

DHS Benefits

1 Low detection limits

- Exhaustive purge of sample headspace
- Efficient trapping on selectable adsorbent tube
- Direct and quantitative, split or splitless transfer from trap to GC/MS system
- Lower detection limits than static headspace, SPME, and other widely used techniques

2 Reliable and reproducible

- Inert, unique valve free sample path: No analyte discrimination, no cross contamination
- A new trap can be selected for every sample to eliminate any risk of cross-contamination
- Headspace purge technique, limits the risk of system contamination from sample foaming
- Automated standard addition provides improved Quality Control
- Integrated GERSTEL MAESTRO control of complete system minimizes risk of errors

3 High productivity through high throughput design

- Complete automation from sample extraction to sample introduction
- Fast, simple analysis setup, just one integrated method and one sequence table
- Agitation and gas purge provides fast extraction and short analysis cycles
- Optimized system utilization with exclusive GERSTEL PrepAhead functionality
- High throughput, up to 120 samples in one sequence (custom systems with higher sample capacity available)

4 Highly Flexible

- User defined extraction time, flow and temperature
- Samples can be heated, cooled and agitated
- Large capacity adsorbent trap can cover a wide analyte concentration range
- Any adsorbent can be used for analyte trapping
- A new trap can be used for every sample
- Adsorbent trap can be heated or cooled for better efficiency
- Multi-method sequences for method development and flexible analysis

5 Solvent free extraction

- Saves on costly solvents and expensive disposal fees
- Improves the laboratory environment and occupational safety
- Improves detection limits by eliminating solvent dilution factor

6 Multiple water management options

- Subambient extraction temperature can be selected to limit evaporation of water
- Trap temperature and adsorbent type can be varied to reduce trapping of water
- Automated dry purge

7 Convenient, user friendly operation

- GERSTEL "Sample Prep by Mouse-Click"
- Control of complete system including GC/MS through one method and one sequence table
- Simple sample handling using standard headspace vials
- No solvents required
- Modular system, easy upgrade of existing MPS
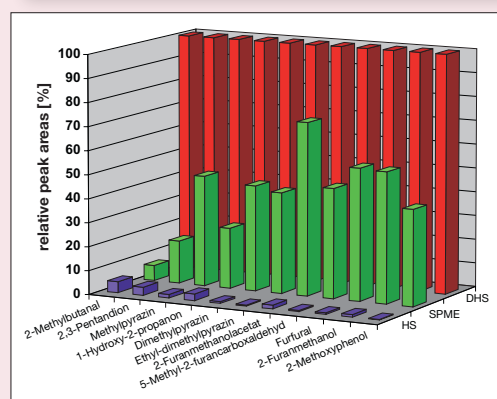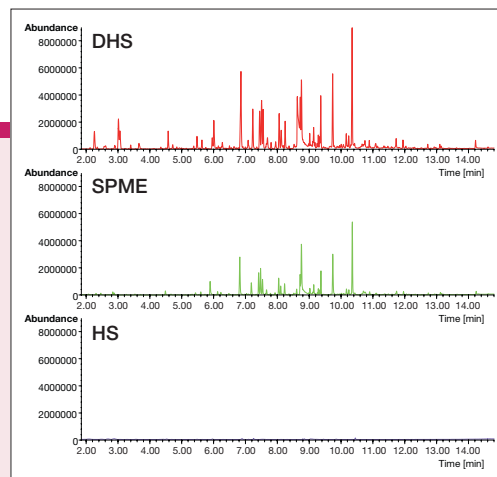
Analysis of coffee powder using DHS, HS-SPME and Static Headspace

Comparison of gas phase extraction techniques

In order to compare different gas phase extraction techniques, 100 mg samples of a ground coffee were analyzed using static headspace, headspace-SPME and DHS. Comparable extraction conditions were chosen: Extraction temperature: 40 °C; Extraction time: 30 min (HS, SPME), 5 min (DHS); DHS gas flow: 20 mL/min; Adsorbent: DVB/Carboxen/PDMS (SPME), Tenax (DHS)

It can be seen from the sample chromatograms and the bar graph showing relative peak areas (DHS response normalized to 100%), that DHS provided the highest response for the analytes that were determined. For most analytes, DHS provided relative standard deviations well below 5%, which is equal to or better than the other techniques

GERSTEL DHS^{large}

The DHS can be extended with the DHS*large* module to perform analysis of large or inhomogeneous bulk samples. For example, consumer products, packaging or flooring material can be placed directly in sample containers up to 1L in volume. Sample holders are available for flooring material, eliminating interfering emissions from the edges of the cut sample. Purge periods can be introduced to simulate air exchange conditions in environmental chambers. A series of analyses can be performed on a sample to determine emission behavior over time. DHS operation or DHS*large* operation is selected by mouse-click.

DHS*large* sample containers with pressure release valves. Sizes: 250, 500 mL and 1 L

GERSTEL DHS^{large} Autosampler

The DHS*large* Autosampler enables unattended analysis of up to 11 samples in containers up to 1L in volume. Series of samples can be analyzed using the PrepAhead function: Sample conditioning and analyte extraction are performed in parallel with GC/MS analysis for best possible productivity and system utilization. Automated screening with the DHS L can eliminate tedious, time consuming, and expensive chamber work. Other application areas are determination of volatiles in bulky consumer products or packaging, from which small representative samples cannot easily be taken.

GERSTEL MAESTRO Software

MAESTRO provides a comprehensive and efficient solution for the modern laboratory. All GERSTEL modules and systems are operated in a simple, productive and transparent manner in stand-alone mode or integrated with the GC/MS or LC/MS software. Just one sequence table and, depending on the system, one integrated method run the complete system from sample preparation and sample introduction to GC/MS or LC/MS analysis.

MAESTRO is designed for simple and productive laboratory operation – day in and day out.

### Software for all GERSTEL Modules and Systems

➜ Unified and reliable control of all GERSTEL modules for GC/MS and LC/MS
➜ Simple and reliable method generation and set up with intuitive user interface and interactive on-screen help
➜ Fully integrated operation with Agilent Technologies chromatography data systems (CDS), using one method and one sequence table to operate the entire system
➜ Integrated sequence table with other leading CDSs
➜ Independently controlled stand-alone operation

Unique flexibility

➜ Priority samples can be added at any time without stopping the on-going sequence
➜ Real-time display of instrument parameters provides at-a-glance reassurance that the ongoing analysis is progressing as planned. The display can be configured to the needs of the analyst

Simple and intuitive operation

➜ Context sensitive on-line help and parameter range information enable fast, error free method generation ensuring a short learning curve
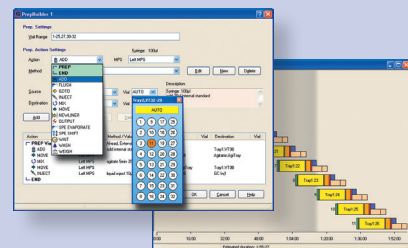
➜ Time saving sample preparation by mouse-click for highest productivity. Prep steps are selected from a drop-down menu in the PrepBuilder and are easily edited. **No need for macro programming**

Highest productivity

➜ Optimized system utilization through intelligent PrepAhead sample processing. Chromatography and sample preparation are perfectly synchronized and performed in parallel
➜ The Scheduler clearly shows you the timing of every step as well as the total run time for the batch enabling easier laboratory work-flow planning

Reliable operation and results you can rely on

➜ For highest reliability and confidence in the results, MAESTRO monitors maintenance intervals and reminds the analyst to replace consumable items in a timely manner
➜ The log file and service log file register all system parameters for full traceability of all steps in the process

www.gerstel.com

GERSTEL   G L O B A L   A N A L Y T I C A L   S O L U T I O N S

ISO 9001
CERTIFIED QM-SYSTEM
ISO 9001:2008
CERTIFICATE NO. 0089 D

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