GERSTEL

Thermal Desorption Unit

TDU

Analysis of Gases, Liquids and Solids

Most Advanced, Flexible System Available

Universal Sample Introduction System

Highest Productivity and Throughput

GERSTEL TDU

Thermal Desorption

A system for all techniques that involve Thermal Desorption and Thermal Extraction

Thermal Desorption Unit **TDU**

The GERSTEL Ther-mal Desorp-tion Unit (TDU) is the most flexible automated solution available for thermal desorption and thermal extraction. The TDU fits on top of any modern GC without the need for additional bench space and it is perfectly suited for the analysis of gaseous, liquid and solid samples.

Conventional thermal desorption systems usually consist of a desorption unit, a cooled trap, one or two long transfer lines, as well as some type of valve. In such systems, void volumes and active sites on metal and polymer materials can cause peak broadening, loss of analytes and memory effects. The TDU incorporates the latest advances in thermal desorption technology. Intelligently designed and based on a "Liner-in-Liner" concept it has no valves or transfer lines. The TDU is connected directly to the GERSTEL Cooled Injection System (CIS), which serves both as a cryo-focusing trap and as a temperature programmable GC inlet. Active sites are eliminated, reducing the risk of analyte loss, discrimination and memory effects to an absolute minimum. The TDU can be operated in split or true splitless mode enabling it to cover the widest range of concentrations, to protect the column from water and contamination and to achieve the lowest possible detection limits. For extreme sensitivity, the multi-desorption mode can be selected in MAESTRO.

Thermal desorption and thermal extraction techniques can be performed manually using the TDU. However, the TDU can be automated and upgraded to exceptional productivity by adding the GERSTEL MultiPurpose Sampler (MPS). The MPS enables automated analysis of up to 490 samples such as GERSTEL Twisters®, adsorbent packed tubes, solids, and liquids contained in micro-vial inserts for matrix elimination.

TDU Liner

with frit for thermal extraction of solid samples

adsorbent packed

for Twister® desorption

for thermal extraction in micro-vials (ATEX)

TDU

CIS
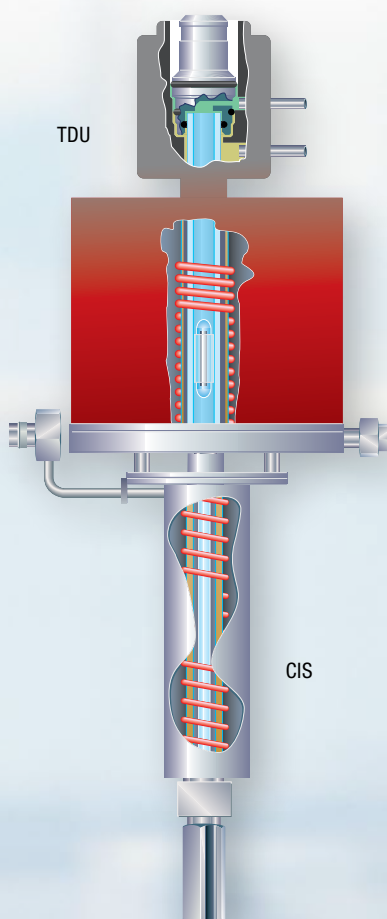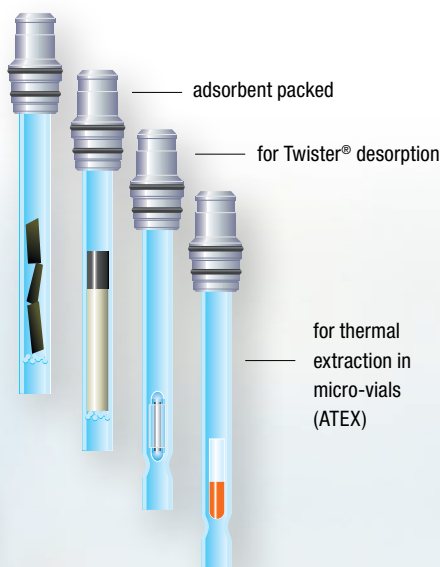
The TDU is coupled directly to the Cooled Injection System (CIS): The "Liner-in-Liner" design ensures best possible analyte transfer to the GC column without discrimination or cross contamination.

Analysis of GERSTEL Twisters®

The GERSTEL Twister® is a unique, patented extraction tool used for Stir Bar Sorptive Extraction (SBSE). The Twister enables ultra-trace determination of organic compounds in aqueous and gaseous matrices. When submerged into aqueous samples, the PDMS phase that surrounds the Twister efficiently extracts organic compounds, while the stir bar actively stirs the sample. SBSE is performed without additional sample preparation and it is up to 1000 times more sensitive than Solid Phase Micro-Extraction (SPME). The Twister can also be used as a passive sampler for air monitoring, for example to determine the level of SVOCs in air.

The TDU has been carefully optimized for thermal desorption of Twisters: The Twister is placed in a glass liner that is fitted with a transport adaptor, which also serves to seal the liner and eliminate contamination or loss of analytes. The MPS automatically transfers the TDU liner from its tray to the TDU. Up to 490 Twisters can be desorbed automatically in one sequence. TDU liners can also be transferred manually if automation is not required. The TDU seals itself using the transport adaptor and the Twister is desorbed using a temperature program to transfer analytes to the CIS where they are cryo-focused and concentrated. Analyte transfer can be performed in split or splitless mode, or even in multi-desorption mode, ensuring that a wide range of concentrations can be covered.

Important Features of the TDU System:

1 Universal Sample Introduction System for a Wide Range of Applications

- Analysis of solids, liquids and gases
- Temperature programmed desorption ensures optimal conditions for all analytes
- Split and true splitless analyte transfer covers a wide concentration range
- Extremely low detection limits
- Flexible refocusing options; cryogen-free with adsorbent bed or cryogenic to -180 °C *
- Small footprint, mounts on top of GC

  * Temperature settings below -150 °C require Controller C506 and firmware activation.

2 Liner-in-Liner Design

- No transfer line, excellent recovery of all analytes
- No active sites, no memory effects
- Chromatography performed using advanced EPC of GC inlet
- Improved reliability and easy maintenance

3 Highest Productivity and Throughput

- Automated desorption of up to 490 samples
- Performs multiple techniques without reconfiguration
- Adsorbent tubes, Twisters, solids and liquids can be analyzed in one automated sequence
- Simultaneous desorption of multiple Twisters from sequential SBSE
- Automated addition of internal standard for improved quality and productivity

4 Sealed Sample Storage

- Sample integrity ensured through individual, leak-tight storage
- Reliable results achieved by eliminating analyte loss, contamination from laboratory air and cross contamination

5 Easy Control through MAESTRO Software

- Efficient and convenient operation by mouse-click
- Independent operation with any chromatography software
- One integrated method and sequence table for complete system including GC/MS when using Agilent Technologies ChemStation or MassHunter software
- Complete documentation and log
- E-mail notification if sequence stops

Thermal Extraction in Micro-Vials (ATEX)

Until now, anyone determining volatiles in "dirty matrix" liquids ran the risk of contaminating their GC/MS system. GERSTEL's Automated TDU Liner EXchange (ATEX) eliminates such problems. The MultiPurpose Sampler (MPS) transfers liquids automatically to a disposable micro-vial inside a TDU tube. When the tube is heated in the TDU, volatile analytes are extracted from the sample and transferred to the Cooled Injection System (CIS) where they are concentrated for transfer to the GC/MS. The non-volatile matrix residue is left behind in the disposable micro-vial. The result: Contamination of the GC Inlet and the GC/MS system is eliminated, while productivity, throughput and quality of results are significantly improved.

Further possibilities with the ATEX Option:

- Solvent venting; targeted analyte concentration and determination of semi-volatile compounds
- Thermal extraction of solid or viscous samples
- Addition of liquid standards to adsorbent tubes inside the TDU
- Using the TDU/CIS combination as a Dual-PTV system for extended solvent venting

Automated Pyrolysis (PYRO)

The PYRO module performs pyrolysis of solids and liquids at temperatures up to 1000 °C. PYRO is easily mounted onto the TDU in just a few minutes. PYRO performs Standard, Sequential and Fractionated pyrolysis. Using an initial thermal desorption step, volatile compounds in the sample can be determined in a separate initial GC/MS run as needed, or simply purged and removed from the sample resulting in a clean, easy-to-interpret pyrogram without interfering volatile compounds. Pyrolysis breakdown products are transferred directly to the GC/MS system for best possible results without analyte discrimination. Up to 196 samples can be pyrolyzed automatically using the GERSTEL MPS under MAESTRO control or integrated with the GC/MS software.
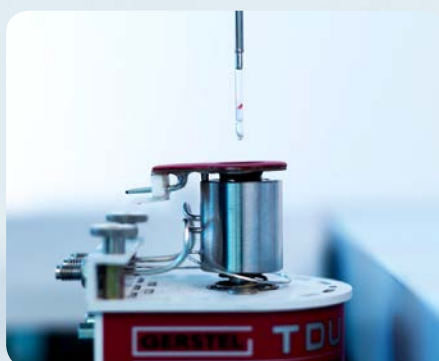
Automated Dynamic Headspace (DHS)

The industry standard GERSTEL MPS autosampler combined with the Dynamic Headspace (DHS) option and the TDU enable complete automation of the DHS technique. In the DHS station, VOCs are extracted 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 (TDU tube) at user defined sample and trap temperatures and flow. A dry purge step can be selected to purge humidity from the adsorbent bed. Analytes are subsequently introduced into a gas chromatographic system by thermal desorption of the trap in the TDU, resulting in maximum recovery, and lowest possible detection limits.

The DHS option offers improved performance for a wide variety of sample types, such as food, beverages, polymers, personal care products and pharmaceuticals. The analyst can freely select the temperature, flow and adsorbent type. The DHS is uniquely qualified as a general thermal extraction tool for GC/MS analysis.

Tube Spiking System TSS

The GERSTEL Tube Spiking System (TSS) enables automated generation of standard tubes for Thermal Desorption analysis. Using the GERSTEL MPS, adsorbent tubes are spiked with a user defined volume of liquid standard and the solvent purged with a defined flow of carrier gas as required for method calibration and validation according to international standard methods. Multiple TSS units can be mounted on the MPS for higher throughput.

HIT-Headspace sensitivity gain

The Hot Injection and Trapping (HIT) technique combines analytes from several Headspace injections for each GC/MS run. HIT is performed using the GERSTEL MPS with Thermal Desorption Unit (TDU) and a Cooled Injection System (CIS), PTV-type inlet. The system is easily switched between standard and HIT operation. The number of injections is simply specified in the MAESTRO software under integrated control with the GC/MS system or under standalone control. Application examples are VOCs including flavor and off-flavor compounds in water and beverages resulting in improved recovery and very low LODs.

Sample Prep by Mouse-Click MAESTRO

The MultiPurpose Sampler (MPS) is an autosampler and sample preparation robot for GC/MS and LC/MS. Sample preparation steps are performed during the analysis of the preceding sample for best possible system utilization and highest sample throughput. Sample preparation steps are performed in a controlled, highly accurate and reproducible manner for best possible results. Every step is selected by mouse-click from a pull-down menu in the MAESTRO software and added to the overall GC/MS or LC/MS method. In addition to the TDU functions, the following sample preparation techniques are available:

- Automated Liner EXchange (ALEX)
- SPME and SPME MultiFiber Exchange (MFX)
- Multi-dimensional GC (MCS)
- Solid Phase Extraction (SPE) and dispersive SPE (DPX)
- Derivatization and addition of standards
- Extraction, dilution and filtration
- Weighing, sonication, centrifugation and evaporation (^{m}VAP)
- Heating, conditioning, mixing and vortexing (^{m}VORX)

GERSTEL MAESTRO Software

Next generation software for automated sample preparation and sample introduction. MAESTRO optimizes performance and throughput of GERSTEL modules and systems.

- Stand-Alone operation, fully integrated in the Agilent ChemStation or MassHunter Software, or integrated with the Thermo Scientific® Xcalibur™ sequence table
- Sample Prep by Mouse-Click using PrepBuilder functions
- Scheduler for easy planning of sequences and of laboratory work-flow
- PrepAhead / Multiple Sample Overlap: Automated overlapping of sample preparation and analysis for maximum throughput
- Priority samples can be added to the system at any point in the analysis sequence
- LOG file and Service LOG file functions ensure traceability
- Automated E-mail notification if the sequence is stopped
- Control of up to 4 systems from one PC
- Real-time monitoring of all modules and parameters
- Interactive on-line help function

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