



GERSTEL

MAKING LABS WORK

GERSTEL

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THE ORIGINAL



GERSTEL Twister®



The GERSTEL Twister® enables efficient extraction of organic compounds from aqueous matrices based on Stir Bar Sorptive Extraction (SBSE). SBSE is a solvent-free extraction technique, which is significantly faster than most conventional extraction techniques. SBSE is up to 1000 x more sensitive than SPME since the stir bar has significantly more sorbent volume and since it can extract, and concentrate analytes from, a much larger sample volume due to the efficient stirring. The Twister may look like a conventional magnetic stirring rod, but while it stirs samples, such as water, body fluids or beverages it absorbs and concentrates organic compounds into its sorbent coating. A large number of samples can be extracted simultaneously using multi-position stir plates resulting in high productivity and throughput. Labor- and resource-intensive sample preparation steps are eliminated. Analytes are typically desorbed from the Twister using thermal desorption. Liquid desorption using a solvent can be performed whenever the analytes are very high-boiling, thermally labile, or when they must be determined by HPLC.

The GERSTEL Twicester® offers a simple possibility to position one or more Twisters magnetically on the inner wall of a sample vial

for more efficient sample extraction. The Twicester approach enables the extraction of a sample using more Twisters simultaneously, for example using Twisters with different types of phases for a more complete combined extraction and improved analyte recovery.

Twister/SBSE Benefits:

- Up to 1000 times more sensitive than SPME
- Quantitative, with large linear range
- A large number of samples can be extracted simultaneously for highest productivity
- Requires minimal time and labor
- Thermal desorption and GC/MS analysis are performed in one automated system





Twister Application Fields

The Twister has proven itself in a wide range of application areas, such as food and beverages, flavor and fragrance, extractables and leachables from packaging as well as environmental analysis. Thanks to its mechanical stability, the Twister can be reused up to 200 times, depending on the sample matrix and desorption conditions, and can also be used for field sampling; it is easy and convenient to use, requires little or no solvent and it is inexpensive to ship to the laboratory for analysis.

Applications:

- Food and beverages
- Flavor and Fragrance
- Environmental analysis of water (EU-WFD) or waste water
- Extractables and leachables from pharmaceutical packaging

	PDMS Twister*	EG/Silicone Twister
Phase	 Polydimethylsiloxane (PDMS)	 Polydimethylsiloxane (PDMS) / Ethylene glycol (EG) - copolymer on an inert metal grid for mechanical stabilization
Enrichment	Unspecific sorption of apolar compounds $\log(Kow) > 4$ The polarity range can be extended by adding salt to the sample (salting out).	Unspecific sorption of apolar compounds, additionally specific binding of polar hydrogen bond donors, such as phenols
Application examples	Pesticides in water PAH in marine tissue 2,4,6-TCA in wine Flavor compounds in food	Flavor compounds in beverages

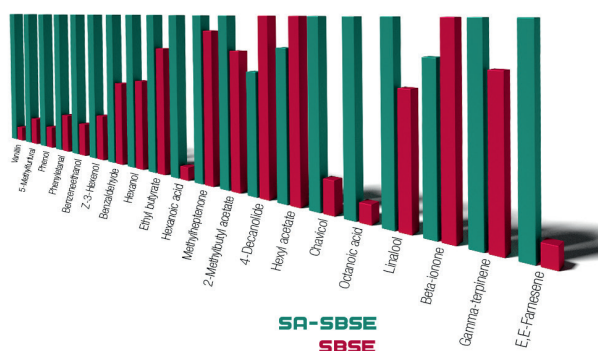
* Available in 10 mm or 20 mm length with phase thickness 0.5 or 1.0 mm. Phase volume: 24, 47, 63, and 126 µL respectively.

GERSTEL Flex-Twister

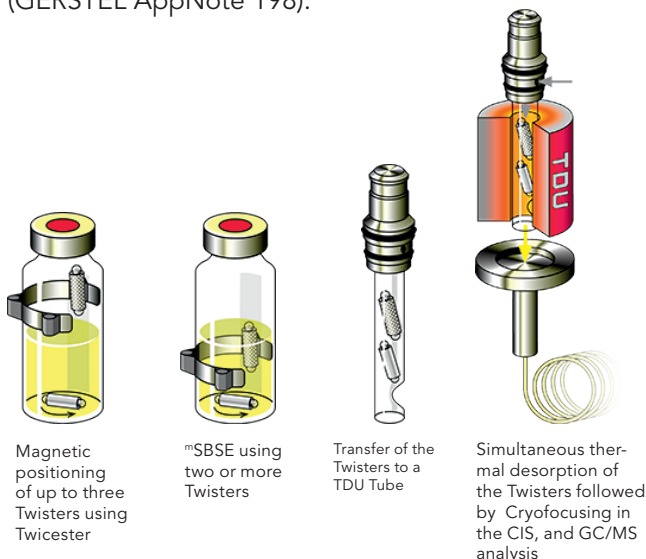
The Flex Twister was developed specifically for Solvent Assisted Stir Bar Sorptive Extraction (SA-SBSE), a novel extraction technique that relies on Flex Twisters that have been swollen with a user defined solvent.

The solvent is added to the Flex Twisters before the extraction step leading to a modification of the sorbent phase properties and thereby, depending on the solvent used, to significantly improved extraction recovery for polar compounds with log Kow values between 1.0 and 2.0. Compared with standard SBSE, the SA-SBSE phase volume is increased significantly leading to improved recovery even of non-polar compounds as an added bonus.

Following SA-SBSE, the analyst can desorb the Flex Twister using either a solvent for subsequent GC/MS or LC/MS analysis or thermal desorption with moderate temperature programming allowing the solvent to be evaporated before analytes are transferred to the GC/MS for determination.



SA-SBSE is a rugged analysis technique that is well suited for analysis of samples with a heavy matrix load, such as, flavor compounds in smoothies (GERSTEL AppNote 198).



Schematic diagram of the Multi-Stir Bar Sorptive Extraction (mSBSE) process

GERSTEL Twicester®

The GERSTEL Twicester® offers a simple possibility to position one or more Twisters magnetically on the inner wall of a sample vial for more efficient sample extraction. The Twicester approach enables the extraction of a sample using more Twisters simultaneously, for example using Twisters with different types of phases for a more complete combined extraction and improved analyte recovery. The method, referred to as Multi-Stir Bar Sorptive Extraction (mSBSE), was developed in a cooperation between GERSTEL K.K., Tokyo, Japan, and the Research Institute for Chromatography (RIC) of Professor Pat Sandra in Kortrijk, Belgium. Twicester is well suited for the simple and efficient determination of a wide range of flavor compounds in aqueous matrices and it has been used successfully for the analysis of beverages.

A key element of the method is the use of both PDMS- and EG-Silicone Twisters in one vial and the simultaneous desorption of both Twisters combined into a single GC/MS run. While the PDMS Twister stirs the sample extracting non-polar to medium polarity compounds, the EG-Silicone Twister is held in position on the inside wall of the vial by the Twicester clip.

The EG-Silicone Twister very efficiently extracts more polar compounds that form hydrogen bonds as hydrogen donors, for example phenols. Twicester can be used to place Twisters in the liquid phase or in the headspace as required.

GERSTEL Twicester® benefits

Magnetic mounting of the Twister on the inside wall of the vial

- The sorbent surface is stationary avoiding mechanical stress.
- No sample to sample carry-over, only the Twister is in contact with the sample.

Multi-Stir Bar Sorptive Extraction (mSBSE)

- Simple solution for simultaneous extraction of a sample with multiple Twisters based on the GERSTEL Twicester®
- A wide polarity range can be covered by using different Twisters simultaneously.
- Improved recovery and lower limits of determination through use of multiple Twisters

Simultaneous thermal desorption of multiple Twisters

- All extracted compounds are determined in one comprehensive GC/MS run
- Improved limits of determination through simultaneous desorption and analysis of multiple Twisters



Twister Desorption in the TDU

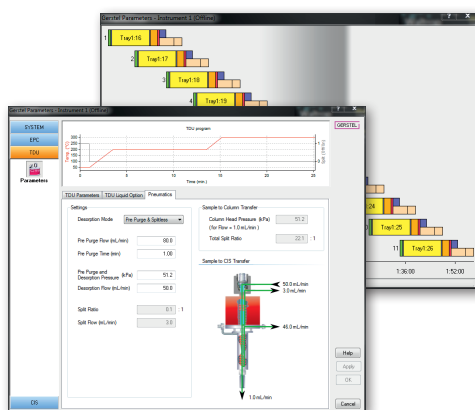
The Thermal Desorption Unit (TDU 2) is perfectly suited for desorption of the GERSTEL Twister and sorbent-packed tubes – as well as for thermal extraction of liquids and solids. The TDU fits on top of any modern GC-MS without need for additional bench space. The TDU 2 incorporates the latest advances in thermal desorption technology based on a "Liner-in-Liner" concept without valves or transfer lines. The TDU 2 is connected directly to the GERSTEL Cooled Injection System (CIS), PTV type inlet that serves as cryo-focusing trap. Active sites are eliminated, reducing the risk of analyte loss, discrimination, and memory effects to an absolute minimum. The TDU 2 can be operated in split or true splitless mode. It covers a wide range of concentrations while protecting both GC column and MS from water and contamination and achieving extremely low detection limits. For extreme sensitivity, multi-desorption mode can be selected by mouse-click in MAESTRO.

TwisterBackExtraction TBE

Twister® Back Extraction as MPS option The combination of Twister technology (SBSE; Stir Bar Sorptive Extraction) with solvent elution and subsequent chromatographic determination is a powerful and reproducible process for the determination of high boiling and thermally labile organic analytes from aqueous samples; e.g. PAH, pesticides, herbicides or phenols. The process was developed by UFZ Leipzig-Halle GmbH in close cooperation with GERSTEL.

Twister Back Extraction TBE offers:

- Extraction, enrichment and analysis of high boiling or thermally labile compounds
- Combination of Stir Bar Sorptive Extraction (SBSE) and LC or LC/MS analysis



Tube Conditioner TC

To fully benefit from the high sensitivity offered by thermal desorption and for best possible quality of analysis, clean and well-conditioned TD tubes and Twisters are needed. The Tube Conditioner (TC 2) is separate from the GC-MS system, eliminating the risk of contamination during conditioning and freeing the GC-MS for analytical tasks with maximum productivity. TD tubes are held at a user-specified fixed temperature or undergo a specified temperature program cycle while being purged with inert gas to remove contaminants. Up to 10 tubes with 50 Twisters are conditioned in one batch, with independent gas flow regulation, enabling the conditioning of one to ten tubes without adjusting flows.

