ENTECH INSTRUMENTS

See What's Really There™

SORBENT PENS™
FOR NEXT GENERATION
Headspace Analysis

VASE

VACUUM ASSISTED SORBENT EXTRACTION

Headspace Sorbent Pens™ The Ultimate Extraction Power

Introducing Entech's exciting new Sorbent Pen™ technology. The most versatile extraction and sample preconcentration technology available for GC and GCMS. Sorbent Pens™ combine the features of SPME and classical ¼" adsorbent traps in a design with far more flexibility and enhanced performance. Sorbent Pens™ are extremely durable and are designed to perform both active and diffusive sampling. Following sampling, the Sorbent Pen™ is desorbed directly onto the head of a GC column, eliminating losses associated with standard thermal desorption systems that must transport the desorbed sample through rotary valves, secondary traps, and a lengthy transfer line prior to delivery onto the GC column.

The Sorbent Pen uses a new approach for headspace extraction, termed Vacuum Assisted Sorbent Extraction, or VASE. The Sorbent Pen is inserted into the top of the sample vial and brought under reduced pressure. VASE allows the recovery of a far wider range of compounds than what was previously attainable. With Sorbent Pens™, both VOCs and SVOCs can be measured in wastewater, breath condensate, alcoholic beverages, and virtually all other matrices. VASE offers a tremendous advantage over other extraction techniques that perform extractions at atmospheric pressure where diffusion rates are suppressed. Sorbent Pens™ perform sample enrichment offline from a GCMS, allowing all samples to extract simultaneously and for longer periods of time. This approach results in high throughput while yielding a more complete and reproducible extraction for more sensitive and quantitative measurements. The low cost 5800 Sorbent Pen™ Desorption Unit (5800 SPDU) makes this exciting new technique both affordable and practical for virtually any laboratory's budget. Then move up to 120 sample automation with the SPR (Sample Preparation Rail) Autosampler for the ultimate in laboratory productivity. Join the Sorbent Pen™ movement and take advantage of the next generation in GCMS sample preparation.

Improvements over SPME and Dynamic Headspace Trapping

- Highly reproducible.
- Minimal carryover without the need for a secondary bakeout/cleanup step.
- Durable - hundreds of injections.
- Operates at or near equilibrium to improve sensitivity and quantitative accuracy.
- Perform exhaustive vacuum extraction of VOCs through SVOCs.
- Unlike SPME, outer sheath minimizes exposure to aerosols formed during agitation.
- See taints, odors, additives, flavors & fragrances at levels below previously possible.
- Faster injection rates produces better chromatography and less thermal degradation.
- Rapid injections without cryogen or electronic cooling.
- Higher sensitivity and throughput via off-line extraction.
- Sample up to 2 weeks under vacuum for unsurpassed SVOC recovery.
- Sample at elevated or sub-ambient temperatures as needed.

Applications include:

Water Analysis
- VOCs & SVOCs
- Emerging Contaminants
- Odor Agents
- EPA 8270

Flavors/Aromas
- Foods
- Beverages
- Alcoholic Beverages
- Taints/Off-Flavors

Cannabis
- Pesticide Screening
- Terpene Profiling
- Residual Solvents
- Cannabinoid Potency

Food Safety
- Nitrosamines
- Acrylamide
- Pesticides/Herbicides
- Carcinogens
- Preservatives

Clinical Markers/Drugs In
- Blood
- Urine
- Breath

Misc.
- Odors in Consumer Products
- Residue Drugs/Pharma
- PCBs, PBDEs

For a complete list of applications, visit **entechinst.com**

Headspace Sorbent Pens™

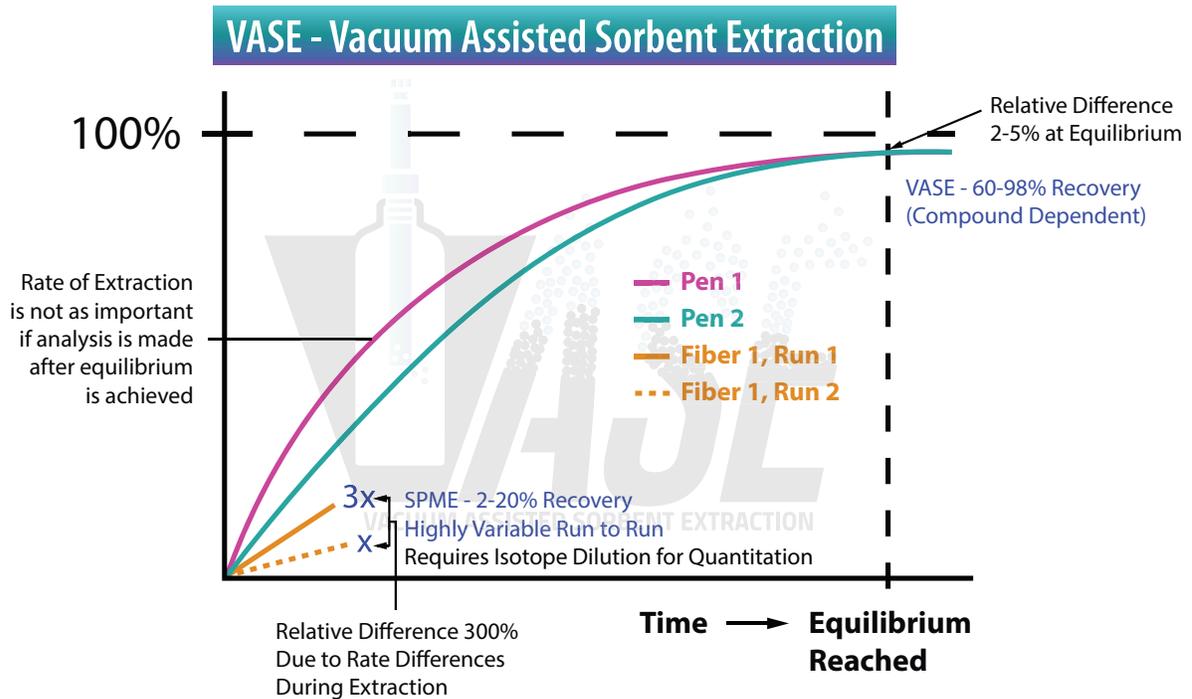| Description	Unit	Part #
Headspace Sorbent Pens™		
Tenax® TA (35/60)	EA	SP-HSP-T3560
Tenax® + Carboxen 1000	EA	SP-HSP-TCBXN
Tenax® + Carbopack™ X	EA	SP-HSP-TCPX
PDMS / Tenax® TA 35/60	EA	SP-HSP-PDMST3560
Empty Headspace Pen	EA	SP-HSP-0
Sorbent Pen Isolation Sleeve	EA	SP-HSP-SLEEVE

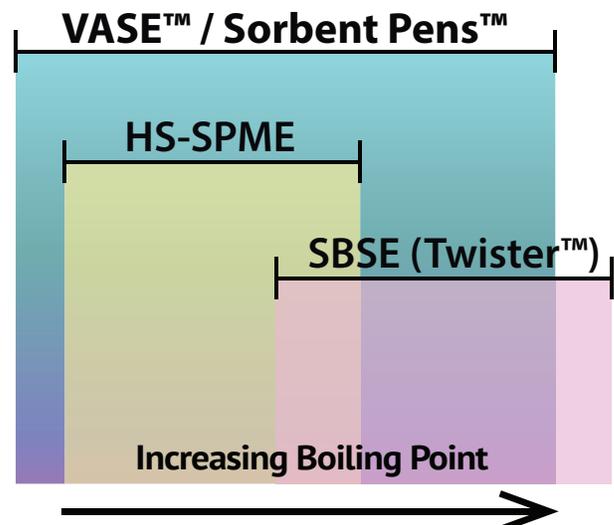*Durable, Reuseable, and Cost Effective!*

VASE, utilizing Sorbent Pens™, Operates at or Near Equilibrium to Improve Sensitivity and Reproducibility.

- Operating at or near equilibrium increases sensitivity and reduces run to run variability.

- Small changes in VASE extraction conditions result in inconsequential differences in the ultimate recovery at equilibrium, resulting in excellent reproducibility..

VASE - Vacuum Assisted Sorbent Extraction

100%

Relative Difference 2-5% at Equilibrium

VASE - 60-98% Recovery (Compound Dependent)

Rate of Extraction is not as important if analysis is made after equilibrium is achieved

— Pen 1
— Pen 2
— Fiber 1, Run 1
--- Fiber 1, Run 2

3x SPME - 2-20% Recovery
x Highly Variable Run to Run
Requires Isotope Dilution for Quantitation

Time → **Equilibrium Reached**

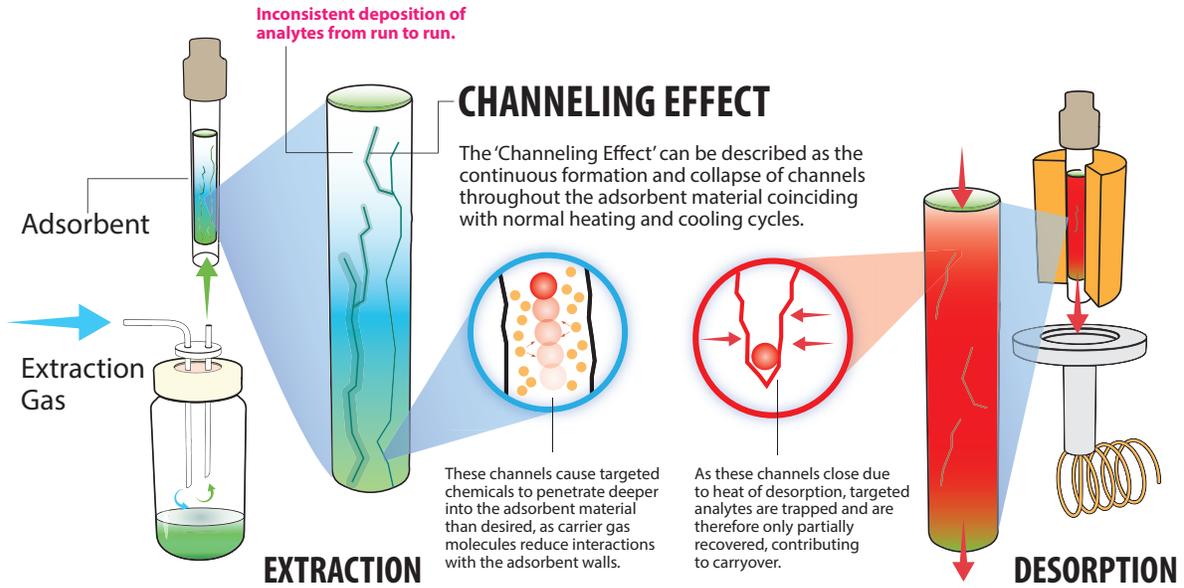Relative Difference 300% Due to Rate Differences During Extraction

VASE (Sorbent Pens™) vs SPME and SBSE (Twister™) Recovery Relative to Analyte Volatility.
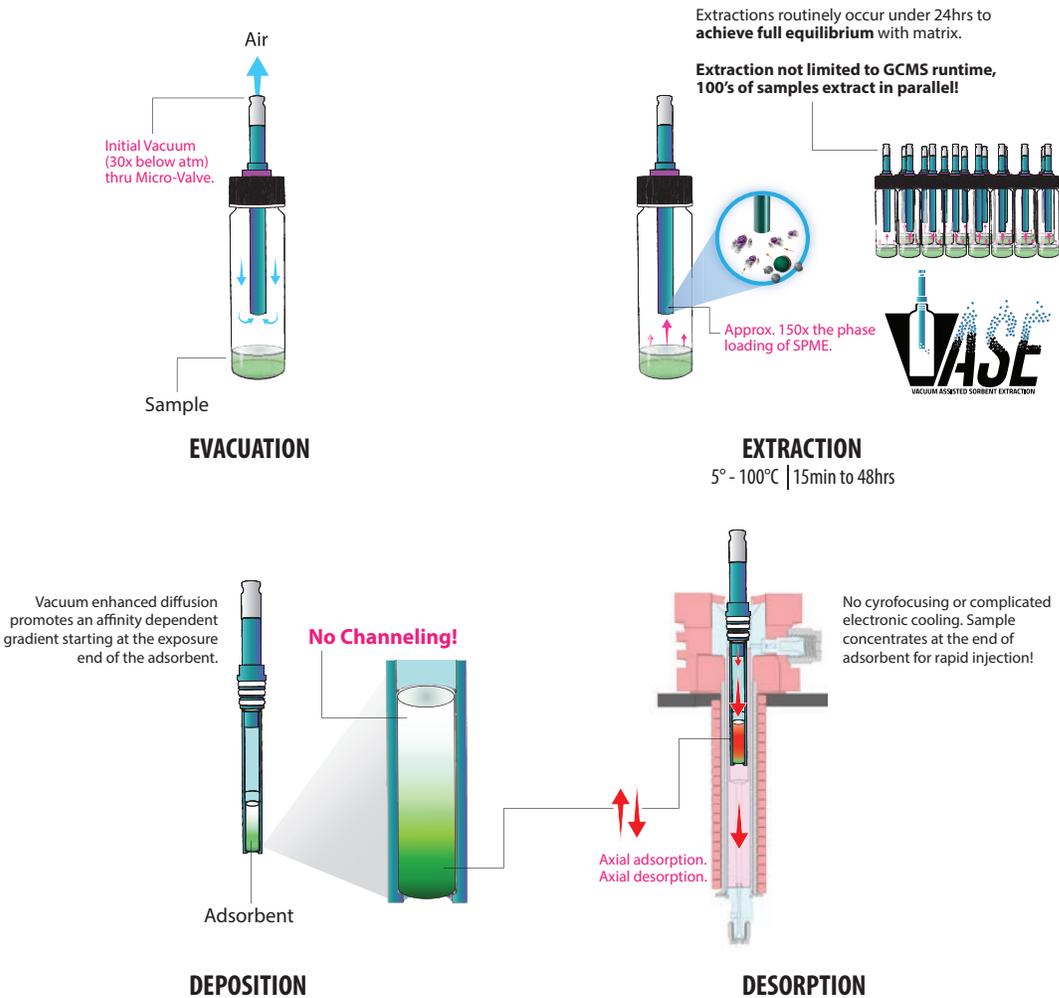
- Using Vacuum Assisted Sorbent Extraction (VASE), Sorbent Pens can be used to recover compounds over a much wider volatility range than both HS-SPME & SBSE.

- Most applications done by either SPME or SBSE can be done more easily and usually with higher sensitivity and accuracy with VASE using   Sorbent Pens™

VASE™ / Sorbent Pens™

HS-SPME

SBSE (Twister™)

Increasing Boiling Point

Inconsistent deposition of analytes from run to run.

Adsorbent

Extraction Gas

CHANNELING EFFECT

The 'Channeling Effect' can be described as the continuous formation and collapse of channels throughout the adsorbent material coinciding with normal heating and cooling cycles.

These channels cause targeted chemicals to penetrate deeper into the adsorbent material than desired, as carrier gas molecules reduce interactions with the adsorbent walls.

As these channels close due to heat of desorption, targeted analytes are trapped and are therefore only partially recovered, contributing to carryover.

EXTRACTION

DESORPTION

VASE PROVIDES EXTRACTION EFFICIENCIES & PROMOTES REPRODUCIBLE ANALYTE DEPOSITION GRADIENTS.

Air

Initial Vacuum (30x below atm) thru Micro-Valve.

Sample

EVACUATION

Extractions routinely occur under 24hrs to **achieve full equilibrium** with matrix.

Extraction not limited to GCMS runtime, 100's of samples extract in parallel!

Approx. 150x the phase loading of SPME.

VASE
VACUUM ASSISTED SORBENT EXTRACTION

EXTRACTION
5° - 100°C │ 15min to 48hrs

Vacuum enhanced diffusion promotes an affinity dependent gradient starting at the exposure end of the adsorbent.

No Channeling!

Adsorbent

DEPOSITION

No cyrofocusing or complicated electronic cooling. Sample concentrates at the end of adsorbent for rapid injection!

Axial adsorption.
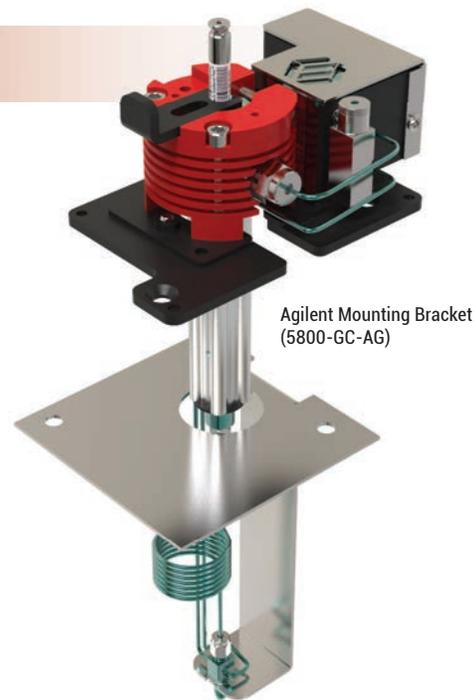Axial desorption.

DESORPTION

5800 SORBENT PEN™ DESORPTION UNIT

Sorbent Pens™ are analyzed using the 5800 SPDU. After sample enrichment, simply insert the Sorbent Pen™ into the 5800 SPDU, and press START on the 5800 SPDU Controller. The complete desorption process is performed automatically to transfer both volatile and semi-volatile compounds onto the GC-column for extremely sensitive and accurate headspace analysis. Control the extraction and desorption conditions to either limit or optimize the molecular weight range transferred onto the column. A unique desorber design utilizes a Silonite™ coated flow path, allowing simple liner replacement to maintain maximum inertness for optimum long-term performance. Methods are created and stored on the same PC operating the GCMS. Develop methods using this entry level solution and then add the SPR Autosampler when you are ready to fully automate the analysis of up to 120 Sorbent Pens™.

Agilent Mounting Bracket
(5800-GC-AG)

5800 SPDU - *Easily transfers volatile and semi-volatile compounds to a GCMS for extremely sensitive and accurate headspace analysis.*

5800 SPDU Ordering Information

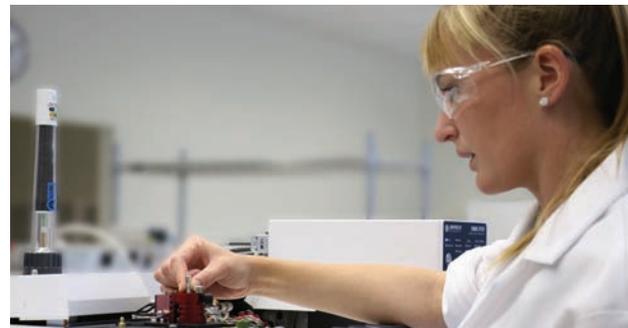| DESCRIPTION	UNIT	PART #
Sorbent Pen™ Desorption Unit (120VAC)	EA	5800-SPDU
Sorbent Pen™ Desorption Unit High Voltage (230VAC)	EA	5800-SPDU-HV
Consumables & Replacement Parts		
5800 Insert for HSP, DSP, ASP Pens (Silonite coated)	EA	5800-INSERT
HSP/DSP/GSP Glass Liner for 0.53mm ID Column 1	EA	5800-LNR-HD-1mm
HSP/DSP/GSP Glass Liner for 0.53mm ID Column 1 w/ Glass Wool	EA	5800-LNR-HD-1mm-GW
HSP/DSP/GSP Glass Liner for 1/16" OD Column 1	EA	5800-LNR-HD-2mm
HSP/DSP/GSP Glass Liner for 1/16" OD Column 1 w/ Glass Wool	EA	5800-LNR-HD-2mm-GW
GC Model Mounting Kits* (Must select one)		
Agilent 6890 / 7890(B)	EA	5800-GC-AG
Thermo 1300 / 1310 GC	EA	5800-GC-TH
Shimadzu 2010 GC	EA	5800-GC-SH

* Required component

Shimadzu Mounting Bracket
(5800-GC-SH)

Thermo Mounting Bracket
(5800-GC-TH)

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HEADSPACE SORBENT PEN STARTER BUNDLE

Experience the power of Entech Sorbent Pens with a ready to order bundle that takes the guesswork out of getting started. The Starter Bundle comes equipped with everything you need to launch a successful research platform and perform method development. When success demands automation, the SPR (Sample Preparation Rail) will take your productivity to a whole new level.
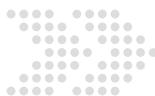
START HERE.
The Headspace Sorbent Pen Starter Bundle is available in low or high voltage.

DESCRIPTION	QTY	UNIT	PART #
Headspace Sorbent Pen Starter Bundle (120VAC)	1	EA	SP-HSP-B01
Headspace Sorbent Pen Starter Bundle (230VAC)	1	EA	SP-HSP-B01-HV

NOT INCLUDED IN BUNDLE.
You must also select a GC Mounting Kit with the bundle.

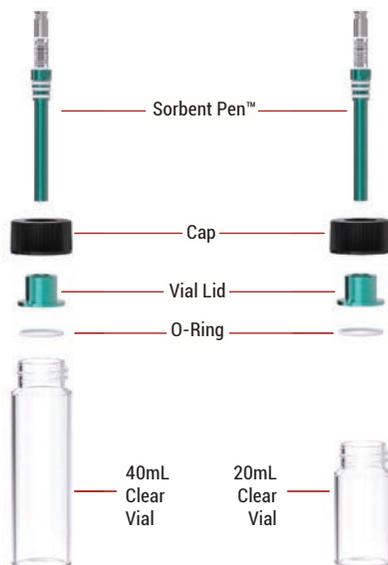| DESCRIPTION	QTY	UNIT	PART #
Agilent 6890/7890	1	EA	5800-GC-AG
Thermo 1300/1310	1	EA	5800-GC-TH
Shimadzu QP2010	1	EA	5800-GC-SH

PRODUCTS INCLUDED IN HEADSPACE SORBENT PEN STARTER BUNDLE

5800 SPDU Injector Unit

5800 SPDU Controller

Silonite Coated Pre-Column

Sorbent Pen™

Cap

Vial Lid

O-Ring

40mL Clear Vial

20mL Clear Vial

DESORPTION SYSTEM & GC COMPONENTS

DESCRIPTION	UNIT	PART #
5800 Sorbent Pen Desorption Unit (120VAC)	EA	5800-SPDU
* 5800 Sorbent Pen Desorption Unit High-Voltage (230VAC)	EA	5800-SPDU-HV

* Included only with order of High Voltage version.

SORBENT PENS & VIALS

DESCRIPTION	QTY	UNIT	PART #
Sorbent Pens™			
HS Sorbent Pen - Tenax TA	3	EA	SP-HSP-T3560
HS Sorbent Pen Tenax® + Carboxen 1000	3	EA	SP-HSP-TCBXN
HS Sorbent Pen Tenax® + Carbopack™ X	3	EA	SP-HSP-TCPX
HS Sorbent Pen - Blank	1	EA	SP-HSP-0
HS Sorbent Pen - PDMS Coated Glass Beads + Tenax TA	1	EA	SP-HSP-PDMST3560
HS Sorbent Pen O-Rings (upper) (10 pack)	4	Pack	SP-OR-SP1-2
HS Sorbent Pen O-Rings (lower) (10 pack)	2	Pack	SP-OR-SP3
Glassware, Caps, & Lids			
20mL Clear Vials (72 ct.)	1	Box	39-75020
40mL Clear Vials (72 ct.)	1	Box	39-75040
Caps for 20mL/40mL/60mL Vials (144 ct)	1	Pack	39-76044B
Vial Lid (Silonite Coated) for 20/40/60mL Vials	9	EA	SP-L024S
White Viton O-Rings for 20/40/60mL vials (10 ct) Low Bleed	1	Pack	SP-OR-L024
Sorbent Pen Ejection Kit	1	EA	SP-PEN-EJECT-TOOL

30 Position Sorbent Pen™
Isolation Tray

Vial Evacuation
Unit

Double-Ended
Micro-QT Valve

30-0"Hg Vacuum
Test Gauge

2-Stage Oilless
Diaphragm Pump

SAMPLE PREPARATION & EXTRACTION

DESCRIPTION	QTY	UNIT	PART #
Essential Preparation			
30 Position Sorbent Pen Isolation Tray	1	EA	SP-HSP-TRAY30
Vial Evacuation Unit	1	EA	SP-VIAL-EVAC
30-0"Hg Vacuum Test Gauge (w/ Female Micro-QT)	1	EA	29-70010QT
Double-Ended Micro-QT Valve	1	EA	MQT-2S
2-Stage Oilless Diaphragm Pump	1	EA	10-20030
*2-Stage Oilless Diaphragm Pump (230VAC)	1	EA	10-20034

* Included only with order of High Voltage version.

30 pos tray for 20/40/60mL vials

5600 Sorbent Pen™
Extraction System

30-Position Cold Tray

The Sorbent Pen™ Extraction System provides a convenient way to perform in-vial extractions using 30-position trays. Load the sample to be extracted into the vial, insert the Sorbent Pen™, create a vacuum through the Micro-QT™ seal at the top of the Pen, and then load the tray into the 5600 to start the vacuum extraction. The Sorbent Pen™ Extraction System agitates the samples at 30-300 RPM to speed up transfer of volatiles to the headspace, while optionally heating the sample from ambient +4˚C to 70˚C. Extractions are generally complete in 1–48 hours depending on the application.

DESCRIPTION	QTY	UNIT	PART #
Agitation, Extraction, Water Management			
5600 Sorbent Pen Extraction System	1	EA	5600-SPES
*5600 Sorbent Pen Extraction System (230VAC)	1	EA	5600-SPES-HV
30 Position Tray for 20mL/40mL/60mL Vials	1	EA	5600-040TRAY30
30-Position Cold Tray for 20/40/ 60 mL Vials	1	EA	SP-HSCOLDTRAY30

* Included only with order of High Voltage version.

Sorbent Pen™
Thermal Conditioner

DESCRIPTION	QTY	UNIT	PART #
Sorbent Pen Conditioning			
3801 Sorbent Pen Thermal Conditioner	1	EA	3801-SPTC
*3801 Sorbent Pen Thermal Conditioner (230VAC)	1	EA	3801-SPTC-HV

* Included only with order of High Voltage version.

GLASSWARE, CAPS, LIDS, & MISC PARTS

Description	Unit	Qty. Incl.	Part #
Headspace Vials (vial caps and lids sold separately)			
20mL Clear Vials	Pack	72	39-75020
20mL Amber Vials	Pack	72	39-75020A
40mL Clear Vials	Pack	72	39-75040
40mL Amber Vials	Pack	72	39-75040A
60mL Clear Vials	Pack	72	39-75060
60mL Amber Vials	Pack	72	39-75060A
125mL LVSH Vials	Pack	12	39-75125BW
250mL LVSH Vials	Pack	24	39-75250BW
500mL LVSH Vials	Pack	12	39-75500W
1L LVSH Vials	Pack	12	39-75L1W
Headspace Bottles			
125mL Amber Bottles, deactivated*	Pack	24	39-75125AD
250mL Amber Bottles, deactivated*	Pack	12	39-75250AD
500mL Amber Bottles, deactivated*	Pack	12	39-75500AD
Sorbent Pen Bushing for 125/250/500/1L Vials			
Bushing	EA	1	SP-L100S
Vial Caps			
Plastic Vial Caps for 20/40/60mL Vials	Pack	144	39-76044B
High Temp Vial Cap for 125mL Vials	EA	1	39-76812HS
High Temp Vial Cap for 250mL Vials	EA	1	39-76825HS
High Temp Vial Cap for 500mL Vials	EA	1	39-76850HS
High Temp Vial Cap for 1L Vials	EA	1	39-76894HS
Vial Lids			
Silonite Coated Sorbent Pen Receiver Lid for 20/40/60mL Vials + All Bottle-Vac Sizes	EA	1	SP-L024S
125mL Silonite™ Lid for Micro-QT Valve	EA	1	HS-760125
250mL Silonite™ Lid for Micro-QT Valve	EA	1	HS-760250
500mL Silonite™ Lid for Micro-QT Valve	EA	1	HS-760500
1L Silonite™ Lid for Micro-QT Valve	EA	1	HS-761000
Individual O-Rings			
White Viton O-Rings for 20/40/60mL Vials (10 ct)	Pack	1	SP-OR-L024
Viton O-Rings for 125mL Vials	EA	1	39-20629
Viton O-Rings for 250mL Vials	EA	1	39-26M02-48
Viton O-Rings for 500mL Vials	EA	1	39-76508V
Viton O-Rings for 1L Vials	EA	1	39-26151
Viton O-Rings for Sorbent Pen Bushing	EA	1	39-26012

Sorbent Pen™

Bushing

Cap

Vial Lid

Vial O-Ring

SPR
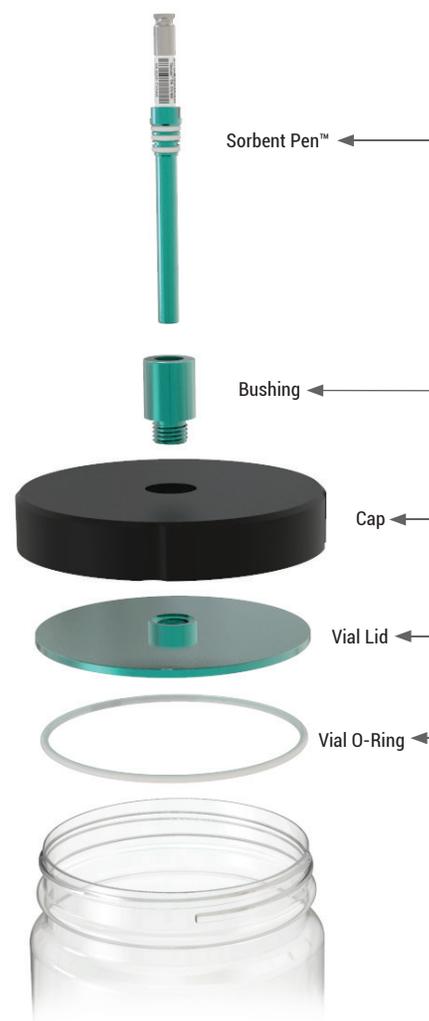
Sample Preparation Rail

VASE™ & SORBENT PEN AUTOMATION

Take productivity to a whole new level by combining the award winning VASE & Sorbent Pen™ extraction solution with Entech's new Sample Preparation Rail (SPR). The SPR delivers unattended sample prep options and unattended desorption of up to 120 pre-extracted Sorbent Pens.

START HERE.
Sample Preparation Rail Bundle

DESCRIPTION	QTY	UNIT	PART #
Sample Preparation Rail Bundle (100-250VAC, 50-60Hz)	1	EA	SPR40-H01
- Sample Preparation Rail System	1	EA	SPR40
- 5800 Controller Platform with Rail Clamp	1	EA	SPR-PF-CTRL1
- 30 Position Sorbent Pen Isolation Tray	2	EA	SP-HSP-TRAY30
- SPRINT Control Software	1	EA	45-SPRINT
Rail Mounted Components			
Dual Sorbent Pen Isolation Tray Platform w/Legs & Magnetic Sensing Rail Clamps	1	EA	SPR-PF-TR2

NOT INCLUDED IN BUNDLE.
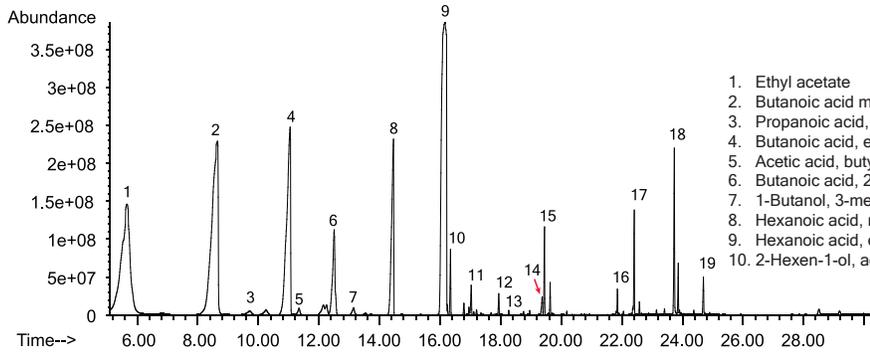**You must also select a GC Rail Mounting Kit with the bundle.**

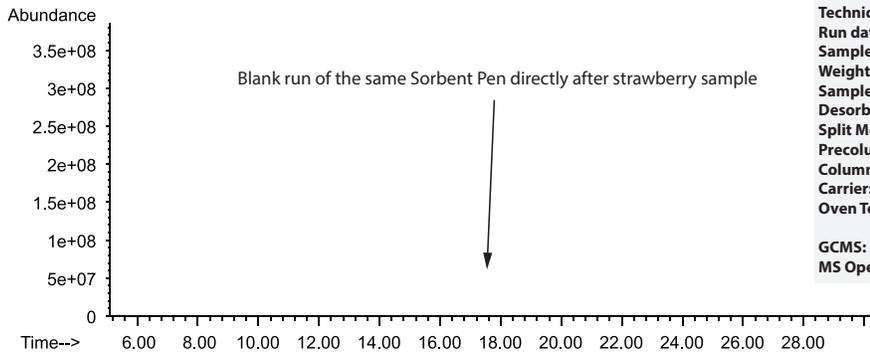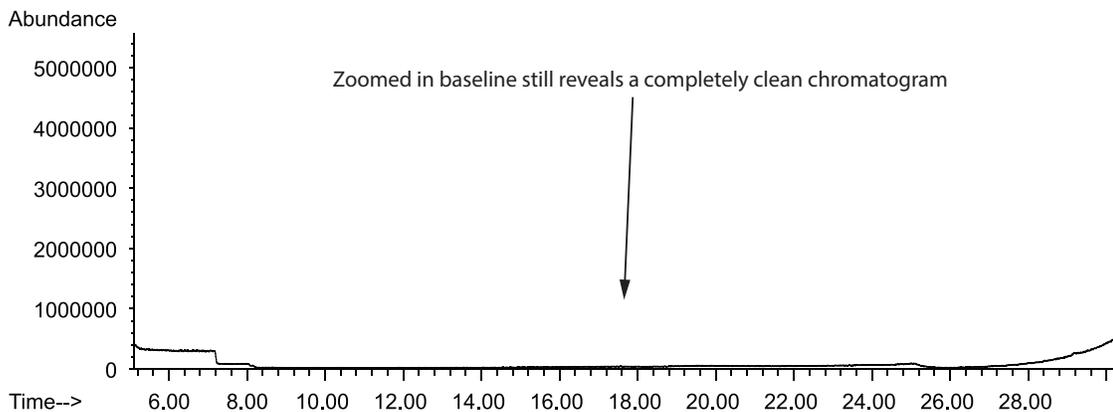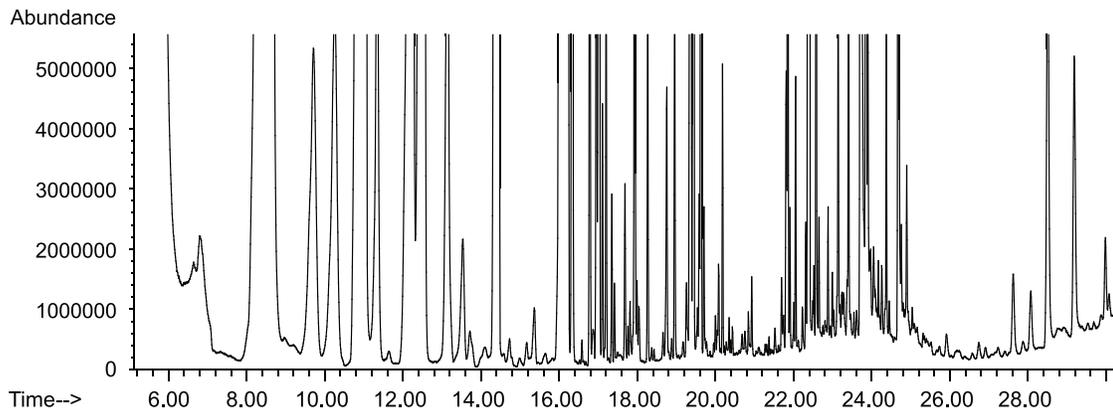| SPR GC Mounting Kits		
Rail Mounting Kit for Agilent® GC	EA	SPR-MNT-AG
Rail Mounting Kit for Thermo® GC	EA	SPR-MNT-TH
Rail Mounting Kit for Shimadzu® GC	EA	SPR-MNT-SH

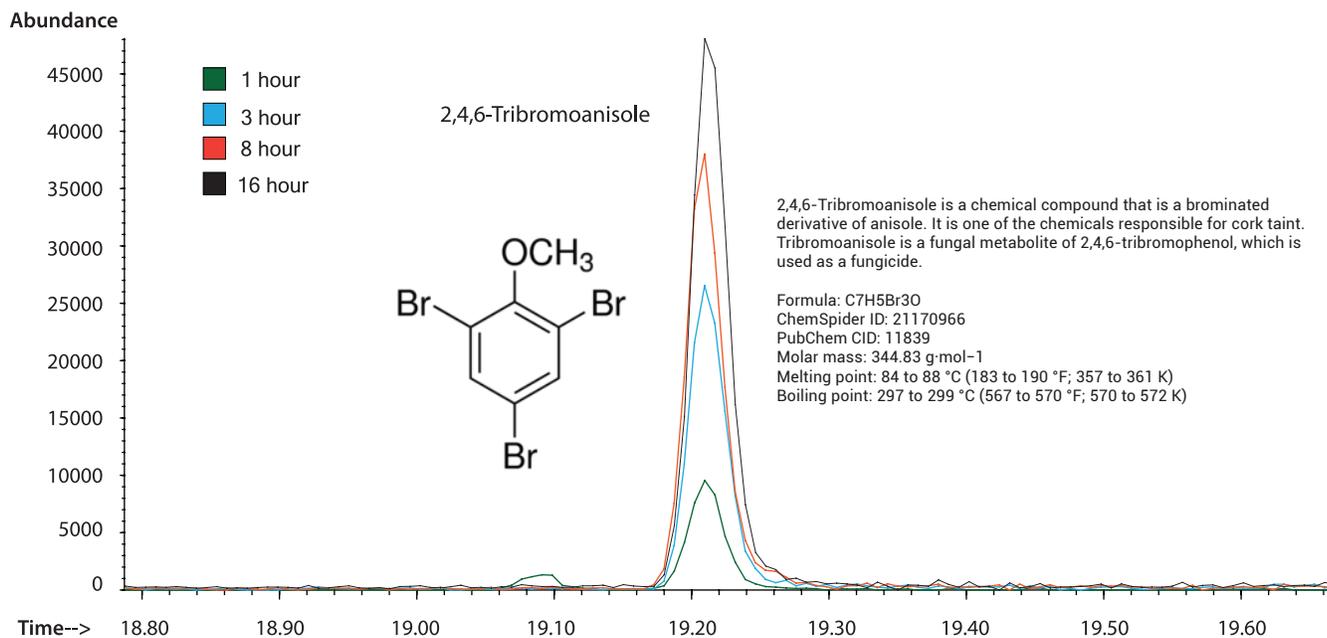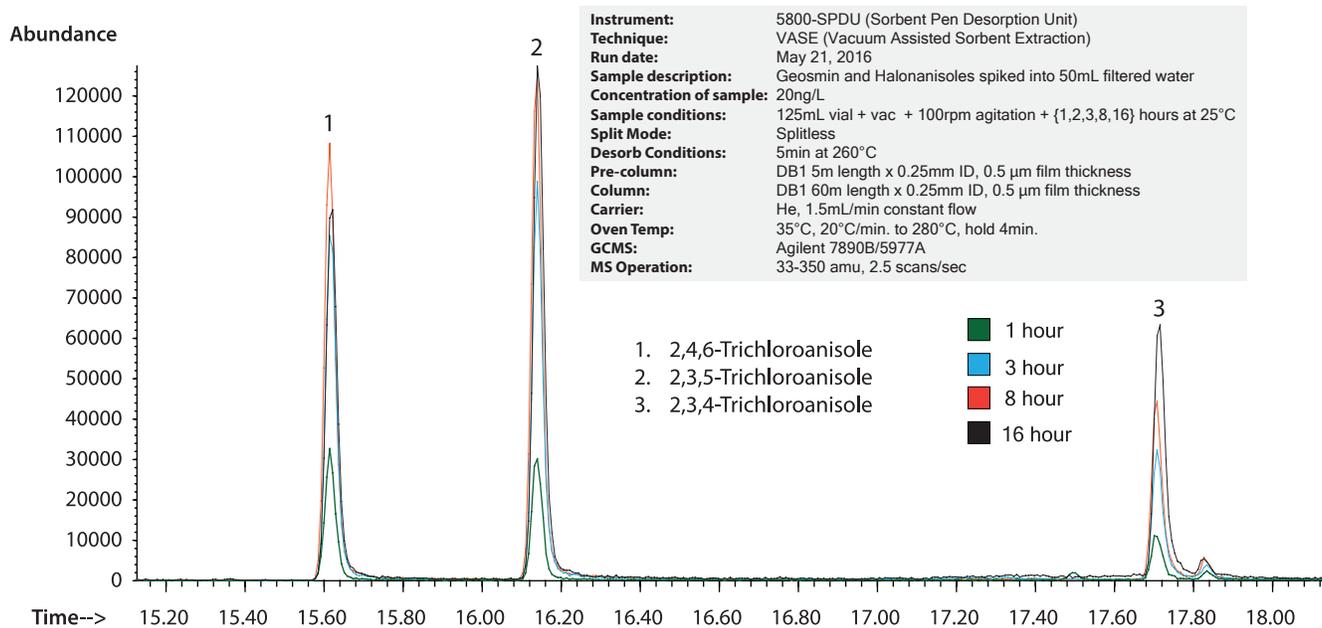# Extremely Clean Blank After Strawberry Analysis

TIC: 16080301.D\data.ms

1. Ethyl acetate
2. Butanoic acid methyl ester
3. Propanoic acid, 2-methyl-, ethyl ester
4. Butanoic acid, ethyl ester
5. Acetic acid, butyl ester
6. Butanoic acid, 2-methyl-, ethyl ester
7. 1-Butanol, 3-methyl-, acetate
8. Hexanoic acid, methyl ester
9. Hexanoic acid, ethyl ester
10. 2-Hexen-1-ol, acetate, (Z)-

11. 3(2H)-Furanone, 4-methoxy-2,5-dimethyl-
12. 1,6-Octadien-3-ol, 3,7-dimethyl-
13. Octanoic acid, methyl ester
14. Methyl salicylate
15. Octanoic acid, ethyl ester
16. Butanoic acid, octyl ester
17. Pentanoic acid, octyl ester
18. 1,6,10-Dodecatrien-3-ol, 3,7,11-trimethyl-
19. .gamma.-Dodecalactone

Blank run of the same Sorbent Pen directly after strawberry sample

Instrument:	5800-SPDU (Sorbent Pen Desorption Unit)
Technique:	VASE (Vacuum Assisted Sorbent Extraction)
Run date:	August 3, 2016
Sample description:	Fresh strawberries
Weight of sample (g):	7.7425
Sample conditions:	vac(30sec) + 15hr equilibration
Desorb conditions:	260°C for 5 min.
Split Mode:	Splitless
Precolumn:	DB1 5m length x 0.25mm ID, 0.25µm film
Column:	DB1 30m length x 0.25mm ID, 0.5µm film
Carrier:	He, 1.5cc/min. constant flow
Oven Temp:	40°C hold 5min., 6°C/min. to 95°C, 10°C/min. to 140°C, 15°C/min. to 325 hold 5min.
GCMS:	Agilent 7890B/5977A
MS Operation:	34-450 amu, 1.8 scans/sec

Zoomed in baseline still reveals a completely clean chromatogram

Sorbent Pen™ Kinetic Study

Abundance

Instrument:	5800-SPDU (Sorbent Pen Desorption Unit)
Technique:	VASE (Vacuum Assisted Sorbent Extraction)
Run date:	May 21, 2016
Sample description:	Geosmin and Halonanisoles spiked into 50mL filtered water
Concentration of sample:	20ng/L
Sample conditions:	125mL vial + vac + 100rpm agitation + {1,2,3,8,16} hours at 25°C
Split Mode:	Splitless
Desorb Conditions:	5min at 260°C
Pre-column:	DB1 5m length x 0.25mm ID, 0.5 µm film thickness
Column:	DB1 60m length x 0.25mm ID, 0.5 µm film thickness
Carrier:	He, 1.5mL/min constant flow
Oven Temp:	35°C, 20°C/min. to 280°C, hold 4min.
GCMS:	Agilent 7890B/5977A
MS Operation:	33-350 amu, 2.5 scans/sec

1. 2,4,6-Trichloroanisole
2. 2,3,5-Trichloroanisole
3. 2,3,4-Trichloroanisole

1 hour
3 hour
8 hour
16 hour

Abundance

1 hour
3 hour
8 hour
16 hour

2,4,6-Tribromoanisole

2,4,6-Tribromoanisole is a chemical compound that is a brominated derivative of anisole. It is one of the chemicals responsible for cork taint. Tribromoanisole is a fungal metabolite of 2,4,6-tribromophenol, which is used as a fungicide.

Formula: C7H5Br3O
ChemSpider ID: 21170966
PubChem CID: 11839
Molar mass: 344.83 g·mol−1
Melting point: 84 to 88 °C (183 to 190 °F; 357 to 361 K)
Boiling point: 297 to 299 °C (567 to 570 °F; 570 to 572 K)

Figures 2, 3 (above) – Relative responses for target compounds extracted from 20ng/L standards in 50cc filtered water at 25˚C, no salt added, 100 rpm agitation, 1/30th atm vacuum, for 1,3,8, and 16 hours.

ENTECH
INSTRUMENTS

Sorbent Pens™ - A Revolutionary Extraction Technology That Is Quantitative By Design.

Learn more about us:

🌐 entechinst.com

📘 facebook.com/entechinst

🐦 twitter.com/entechinst

in linkedin.com/company/entech-instruments-inc

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Phone: 805-527-5939
Sorbent Pens™ –190226 -14.0