AutoDesorb™

Automated Short Path Thermal Desorption

A versatile technique for the analysis of volatile and semi-volatile organics in solid, liquid and gas samples.

Scientific Instrument Services, Inc.

NEW - Automated Short Path Thermal Desorption

AutoDesorb™

The PC Controlled Automated Short Path Thermal Desorption System is designed for the continuous and unattended thermal extraction of volatile and semi-volatile organics from solid, liquid and gas samples for analysis by GC and GC/MS.

Features

- **Automated Thermal Desorption Sample Introduction System**
- **Carousel holds 12 samples for unattended operation**
- **Uses the SIS "Short Path Thermal Desorption" technology**
- **Designed to Operate on the Agilent-6890 GC or Agilent-5973 GC/MS**
  also on the Agilent-5890 GC (5971/5972/5973) with the latest software
- **PC Controlled Operation - User-friendly Graphical Interface**
- **Fully integrated with the Agilent ChemStation ™ Software**
- **Permits the analysis of volatile and semi-volatile organics**
- **Uses P&T Thermal Desorption & Direct Thermal Extraction Techniques**
- **No "memory effect" - individual flow path for each sample**
- **Mounts overtop the GC injection port**
- **Not permanently installed to the GC - easily removable**
- **Desorb samples at temperatures from room temperature up to 450°C either isothermal or with multi-step ramp rates up to 100° C/minute**
- **Glass Lined stainless steel desorption sample tubes are inert and strong for sample handling**
- **GC Cryo-Trap Accessory for cryo trapping volatiles during desorption**

Automated Short Path Thermal Desorption

The new AutoDesorb System is the automated version of the patented SIS "Short Path Thermal Desorption System". It is designed for the automatic and unattended pickup, injection and thermal extraction (thermal desorption) of volatile and semi-volatile organics from solid, liquid and gas samples for analysis by GC and GC/MS.

The AutoDesorb System consists of the AutoDesorb Tower (which contains the sample analysis hardware), an Electronics Console (which contains a microprocessor and power supplies) and a PC Windows Software Package (which integrates the AutoDesorb System into the Agilent ChemStation ™ software).

The system is operated and controlled by a PC Windows based software package developed by SIS, which operates within the Agilent (formerly Hewlett-Packard) ChemStation ™ software package on the Agilent 6890 GC or Agilent 5973 GC/MS. It also works with the Agilent 5890 series GC (also Agilent 5971, 5972 & 5973 MSD) operating with the latest version of ChemStation ™ under windows 95 or NT. This provides a seamless integration of the Agilent GC or MSD with the SIS AutoDesorb System.

The AutoDesorb Tower sits over the GC injection port, where it is utilized for the direct desorption of both volatile and semi-volatile samples into the GC injection port and column. Due to its "short path" of sample flow, this system overcomes the limitations of other desorption systems by eliminating transfer lines (which are easily contaminated by samples) and by providing the optimum delivery (and therefore maximum sensitivity) of samples to the GC injector via the shortest path possible, i.e. direct injection into the GC.

The desorption tube with samples for analysis is fitted with a desorption tube needle and attached to a connecting tube. Each connecting tube is sealed at the top with a spring loaded ball seal to prevent sample contamination. A Carousel permits 12 samples to be loaded for the unattended analysis of samples. When signaled by the PC from the ChemStation ™ software, the system automatically locates the sample to analyze, loads the sample, and then using the prescribed desorption method injects and desorbs the sample into the GC. Samples can be run in any sequence using any previously saved method as specified by the ChemStation ™ software.

The AutoDesorb System uses the SIS patented "Short Path Thermal Desorption" technology. This "short path" provides for the highest sensitivity of analysis. The Short Path Thermal Desorption enables the analysis of a wide diversity of samples via several thermal desorption sampling techniques. Both the Purge & Trap technique and Direct Thermal Extraction technique can be used for the analysis of volatile as well as semi-volatile organics.

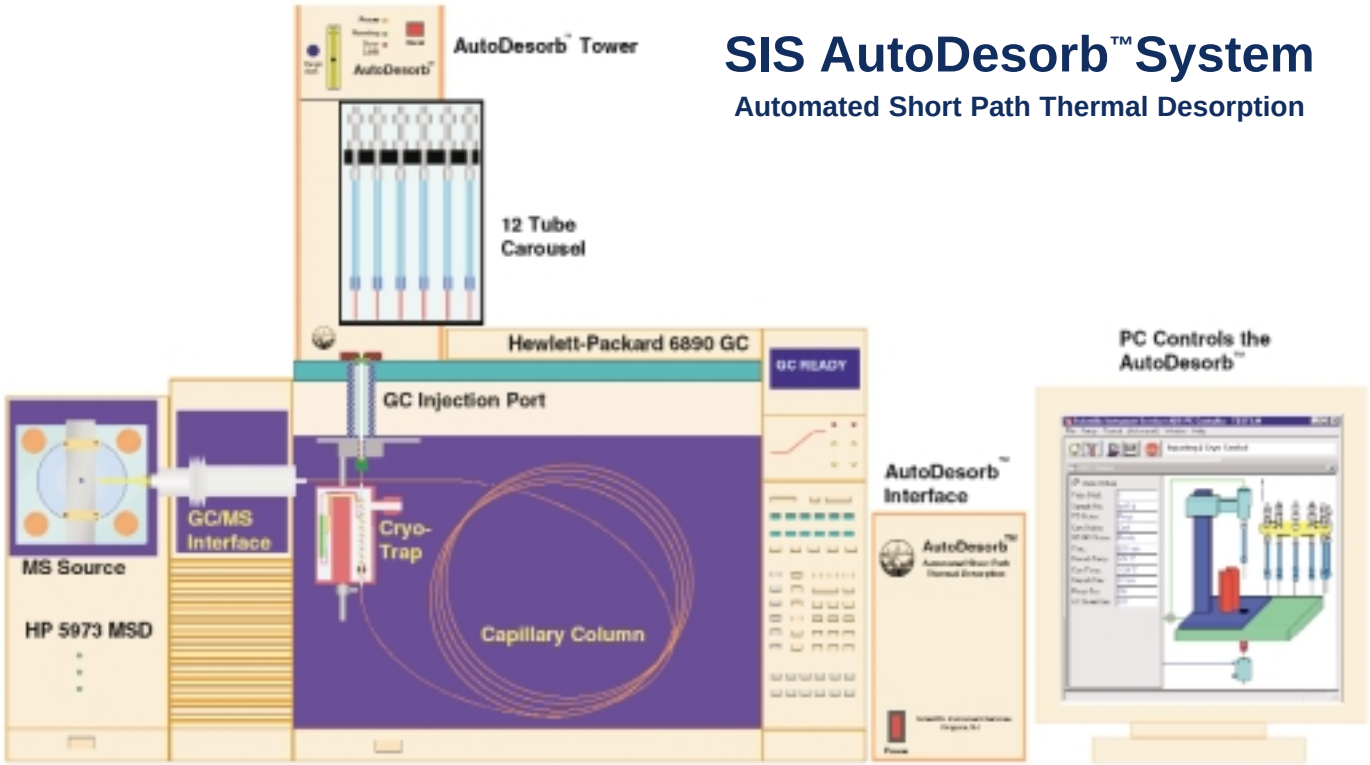
The Short Path Thermal Desorption Technology provides several unique advantages over other desorption systems:

First: It enables the sample, which is trapped on an adsorbent media inside a glass lined stainless steel tube (GLT) desorption tube, to be rapidly (ballistically) heated. The AutoDesorb System can desorb samples at temperatures up to 450°C and at ramp rates for 1° to 100°C/min. Desorption times and other timers can be set from 1 second to 99 minutes. Multi-step desorption heater ramping with hold times can also be programmed.

Second: The desorbed component can be easily and efficiently transferred into the injection port of the gas chromatograph from a glass lined stainless steel sample tube and its associated injection needle. This provides for a short transfer path for the sample in an inert environment to minimize the degradation of labile sample components which often decompose upon contact with the hot catalytic metal wall surfaces of the transfer path of other systems.

Third: Each sample has its own individual adsorbent trap tube and needle to eliminate the possibility of cross-contamination from sample to sample, thus preventing any "memory effect" due to overloading of the sample in the GLT desorption tube or due to residues from previous samples.

Fourth: The new automated system permits the unattended analysis of multiple samples, thereby increasing the productivity of the laboratory.

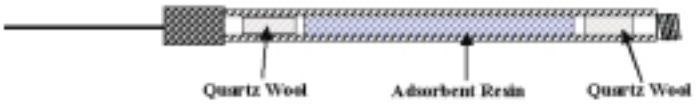


Theory of Operation

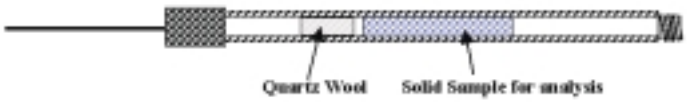
The AutoDesorb System sits on top of the GC injection port of a Agilent (formerly Hewlett Packard) 6890 or 5890 GC, where it is utilized for the direct thermal desorption of samples into the GC injection port and subsequently onto the GC column. It is NOT permanently mounted to the GC. The AutoDesorb tower is held in place by gravity and can be lifted up and removed to restore the GC to its normal operation. The only modification to the GC is the addition of a carrier gas shut-off valve. The GC can be returned to normal GC operation in seconds.

The SIS AutoDesorb system is controlled by a PC Windows software program that is integrated with the ChemStation™ GC or GC/MS program to control the automatic injection, timed desorption, multi-step temperature ramp of heater blocks, control of GC Cryo-Trap accessory, and remote starting of the GC and Mass Spectrometer. The ChemStation™ program is used for sample information input.

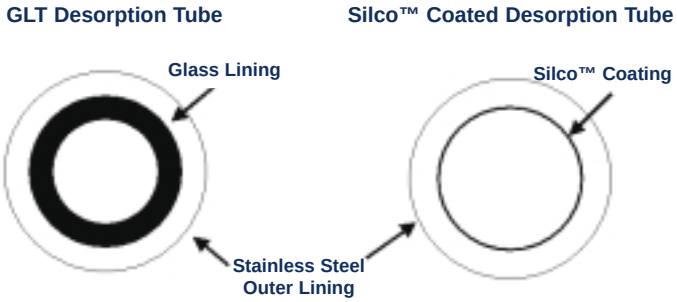
Desorption Tube for Thermal Desorption



Desorption Tube for Direct Thermal Extraction



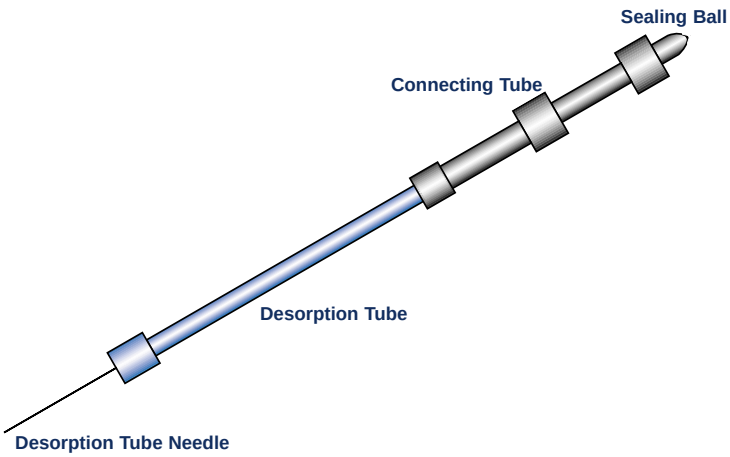
Samples to be analyzed are collected on Glass Lined Stainless Steel (GLT) Desorption Tubes containing an adsorbent resin such as Tenax TA or activated carbon. Alternatively, small samples (1 to 500 mg) can be packed directly into the desorption tube and subjected to direct thermal extraction. The GLT Desorption Tubes have an I.D of 3.0 mm, are 4.0" long by ¼" diameter and are threaded on both ends. The inside of the desorption tube is lined with glass to provide an inert environment for the samples during storage or during the actual thermal desorption process. The thermal desorption tubes can be obtained both empty or packed with a wide variety of thermal desorption resins. These thermal desorption tubes can be reused hundreds of times which brings the cost of sample containers down to pennies per sample. Stainless steel and Silco™ coated stainless steel tubes with an I.D. of 4.0 mm are also available for the analysis of larger samples. After pre-conditioning the desorption tube and then loading the sample



Cross Section of AutoDesorb Thermal Desorption Tube

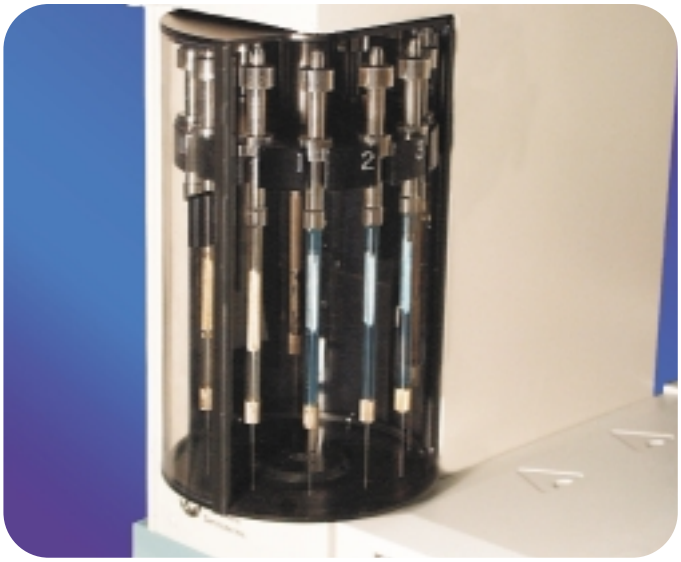
into the desorption tube, the ends of the tubes can be fitted with stainless steel caps with seals to maintain sample integrity during sample storage.

When ready for analysis, the thermal desorption tube is attached to a connecting tube and the desorption needle is attached to the other end of the desorption tube. This connecting tube is the adapter that enables the desorption tube to be inserted into the AutoDesorb carousel. The top of the connecting tube contains a spring loaded sealing ball to seal the desorption tube and sample to maintain sample integrity until the actual thermal desorption process begins.



The thermal desorption tube is then loaded in the AutoDesorb system carousel. Up to 12 desorption tubes can be loaded into the carousel. Tubes can be continuously loaded and unloaded during the running of the sample sequence. During the thermal desorption process, each desorption tube is checked for leaks. If a problem occurs with the sample such as a pressure leak or system parameter problem, the sample is unloaded and resealed and a report of the error is indicated in the sample log table. The sample integrity is maintained, which enables the error to be corrected and the sample reanalyzed.

After the sample tube and connecting tube have been placed onto the carousel, the ChemStation™ software is set up with the GC or GC/MS method and the desorption method is setup on the AutoDesorb windows. When the sample run is initialized on the ChemStation™ Window, the desorption tube is automatically loaded in the pickup mechanism *(2 & 3)*. The desorption heater blocks are preheated to their initial temperature *(4)* and the cryo-trap cooled to its preset temperature *(5)*. The carrier gas through the desorption tube is turned on and the flow can be



Thermal Desorption Tubes Loaded into the AutoDesorb Carousel

manually adjusted via the flow controller to between 1.0 ml/min and 120 ml/min for an initial purge time *(6)*.The desorption tube is then injected into the GC injection port to position the desorption tube in proper alignment with the open desorption block assembly *(7)*.

When injection is complete, a programmable time delay permits the injection port pressure to equilibrate and the system is checked for pressure leaks *(8)*. If leaks are detected, the sample is unloaded, the error reported and the next sample in the sequence is analyzed.

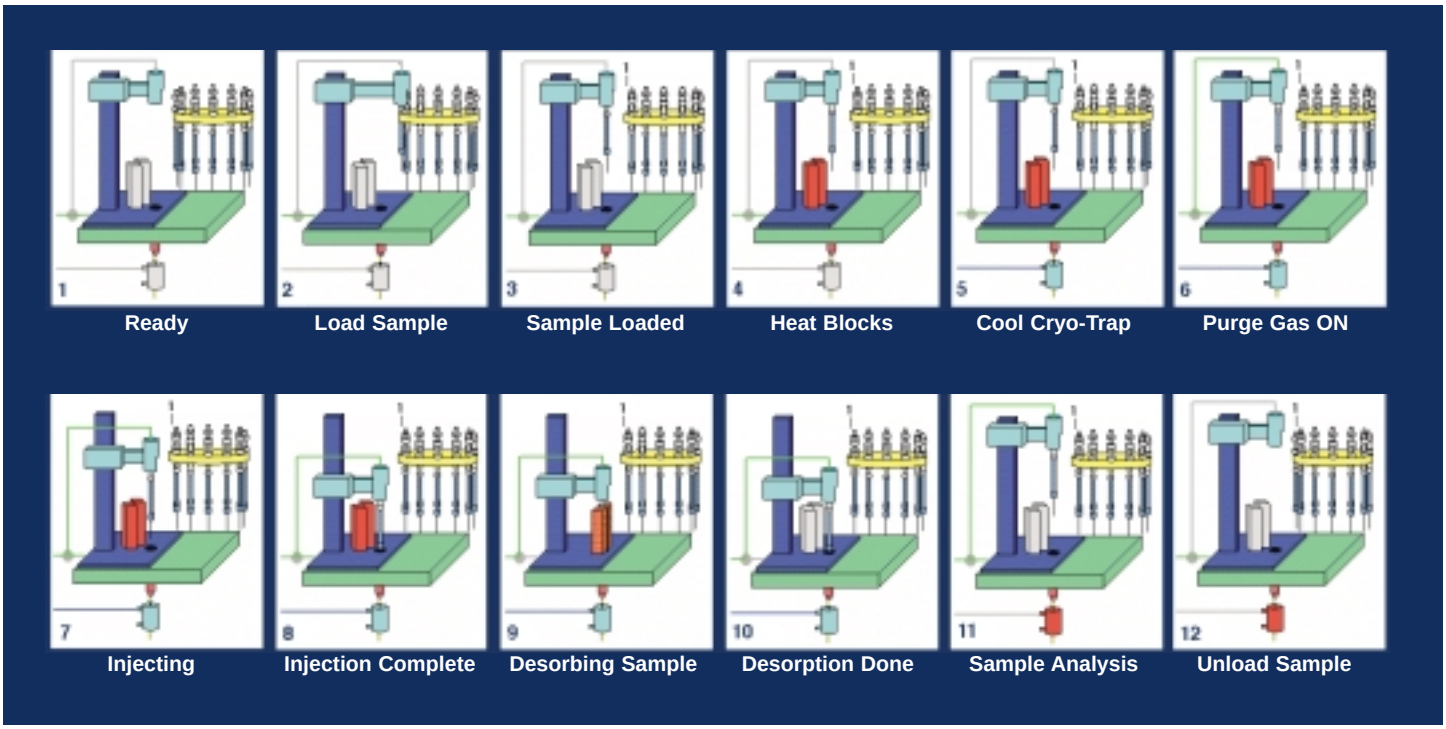
If there are no leaks detected, the desorption blocks close around the desorption tube and will ballistically heat up to the set temperature or the temperature program ramp for the heater blocks will begin *(9)*. The combination of the heat applied and the carrier gas flow through the desorption tube will purge the desired components into the GC injection port and onto the front of the GC column.

Normally desorption temperatures between 70°C and 250°C are suitable for most applications. However, the maximum desorption temperature permissible with the system is 450°C. The heater blocks can be temperature programmed at ramp rates up to 100 degrees/min. Multi-step and hold time desorption heater block programs can be set up via the AutoDesorb software. Normal desorption times vary from 3 minutes to 15 minutes; however, longer desorption times up to 100 minutes are permitted.

Since the column is normally maintained at subambient temperatures, the desorbed compounds of interest are trapped on the front of the GC column in a narrow band utilizing GC oven cooling or the optional GC Cryo-Trap Accessory. Despite the long desorption times, the peaks eluted from the column are extremely sharp and well resolved.

When the sample has been fully desorbed into the GC column, the desorption blocks are opened *(10)*, the sample is uninjected from the GC injection port *(11)*, the Cryo-Trap is heated to release the analytes from the Cryo-Trap and the GC is started by the AutoDesorb system. The GC temperature programming is commenced to elute and separate the analytes into the desired components. The purge gas remains on for 5.0 minutes to cool the desorption tube and then the sample is unloaded back into the AutoDesorb carousel *(12)*.

When the GC analysis is complete, the next sample of the ChemStation™ sequence is loaded, the GC and AutoDesorb system parameters are reset and this next sample is analyzed.



AutoDesorb Sequential Operations

PC Software Control

Integration with Hewlett-Packard ChemStation ™

The AutoDesorb software is fully integrated with ChemStation™ software ***(Figure 1)***. ChemStation™ automatically launches the AutoDesorb software during startup. The entire GC or GC/MS process, as well as the desorption process, is initiated from ChemStation™. The ChemStation™ windows are used for the GC and MS operation and sample information while the AutoDesorb windows are used for thermal desorption method setup and for thermal desorption process monitoring during sample analysis. Thermal desorption methods and operation methods are developed in the AutoDesorb windows and saved into the ChemStation™ method. Methods can be changed between subsequent samples to provide different desorption parameters for different samples, or the same method can be used for all samples. For example, a separate high temperature bakeout or blank method can be setup and run between samples to assure the system is clean for the next sample.

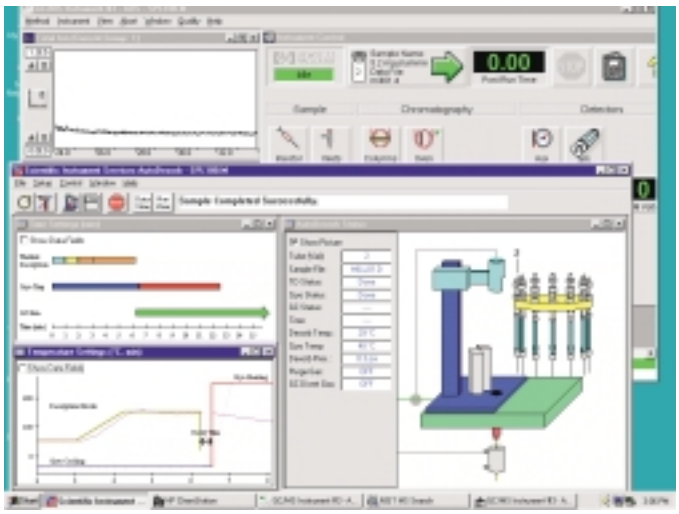


Figure 1 - AutoDesorb and ChemStation™ Software Integration

The AutoDesorb software is designed to be graphical and easy to use. Sample information need only be entered once. All data such as sample name and vial number are entered into the ChemStation™ sample run window or the sequence run window for the analysis of samples. This data is automatically transferred to the AutoDesorb software and is included in the AutoDesorb logs.

AutoDesorb Software

The AutoDesorb software system provides visualization and control of all the thermal desorption operations, including sample purging and injecting times, desorption temperatures and times, GC start times, and Cryo-Trap heating and cooling parameters. A user-friendly graphical interface displays the pictorial, as well as digital status, of the thermal desorption system and GC Cryo-Trap operation. Changes made to the thermal desorption methods can be saved to the ChemStation™ method. All the AutoDesorb setup and operational parameters are displayed on four graphical windows. Other windows are available for system setup and for setting system limits such as maximum temperatures and times.

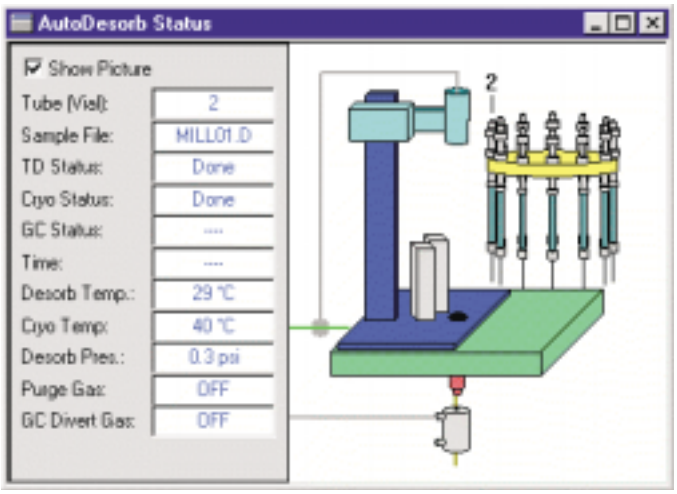


Figure 2 - AutoDesorb Status Window

The first of these window is the AutoDesorb Status Window ***(Figure 2)***. This window displays the current status of the AutoDesorb system. The graphic display visually illustrates the mechanical operation of the AutoDesorb system as it occurs. The carousel moves as the next sample is loaded and the number above the carousel indicates the next sample to be analyzed. The information panel lists the current thermal desorption system conditions, including sample name and vial number, desorption and cryo-trap temperatures, GC inlet pressure, and the status of the valving systems.

The second window is the Temperature Settings Window ***(Figure 3)***. Method setup is done here, as well as monitoring the current status of the thermal desorption block heaters and cryo-trap temperatures. Operational parameters for the thermal desorption and Cryo-Trap are entered on the lower panel of this window. Up to three temperature ramps and hold times for the desorption block heaters are permitted in the method. Both the heating and cooling temperatures for the cryo-trap are also entered here. The system automatically detects if the Cryo-Trap is present and the type of cryo-trap (liquid nitrogen or CO2), and then automatically limits the minimum temperature that the user can enter for cooling the cryo-trap (-70° for CO2 and -180° for LN2). The method can then be saved to the ChemStation ™ method file and used for the analysis of subsequent samples. When the desorption run is started, the actual temperatures of the desorption blocks and Cryo-Trap are plotted on top of this window.

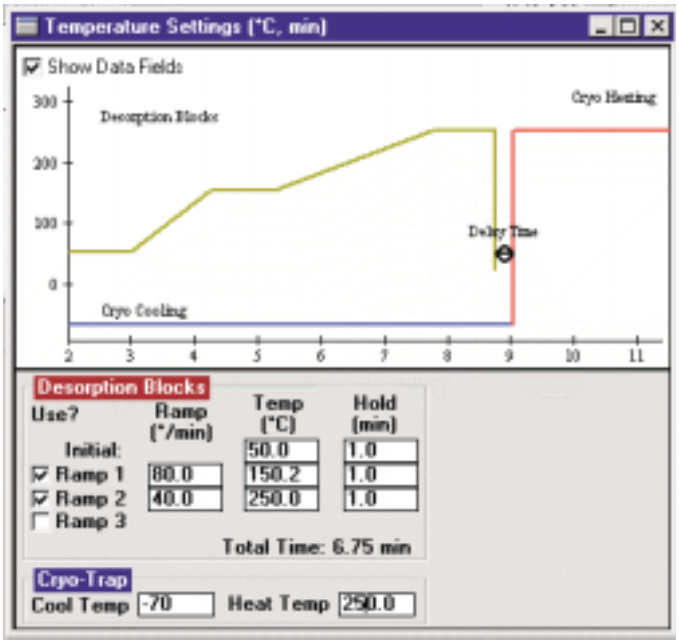


Figure 3 - Temperature Settings Window

The third window is the Time Settings Window ***(Figure 4)***. Method setup is done here, as well monitoring the current status of purge gas time, injection time, desorption time, Cryo-Trap cool and heat times, and the GC Start run time. The times for the various thermal desorption and cryo-trap processes are entered in the lower panel of this window. The GC start time can be be set anytime, from the time of injection until after the desorption process is complete. The graphic display shows the relative times of each of these events. During the actual desorption process, a time bar shows the actual time position of the thermal desorption process.

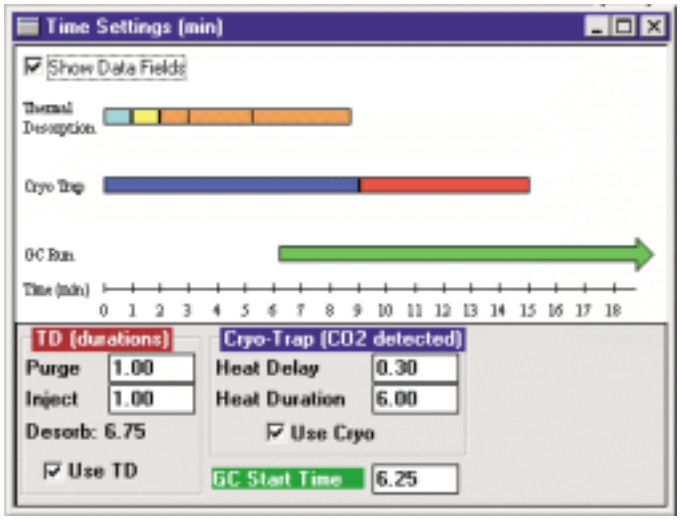


Figure 4 - Time Settings Window

The fourth window is the Sample Log Window, which maintains a log of all samples run ***(Figure 5)***. A log is maintained of each sample run, including the vial number, analysis start time, as well as any error messages for problems that may have occurred during the sample run. This report may be printed out.

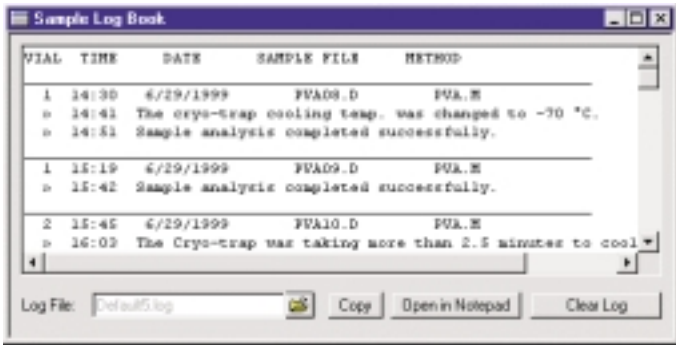


Figure 5 - Sample Log Window

An additional window, the System Limits Window, enables the user to establish parameters that should not be exceed by the system operator ***(Figure 6)***. These limits include maximum temperature limits for the desorption blocks and Cryo-Trap, maximum sample gas pressure, and maximum times for purging, injecting, and desorbing samples. This minimizes the possibility of a user inadvertently entering erroneous data when setting up a method. If bad data - such as a desorption temperature of 800°C or a desorption time of 600 minutes - is entered, the data will not be accepted and the operator will be prompted to correct the method parameters.

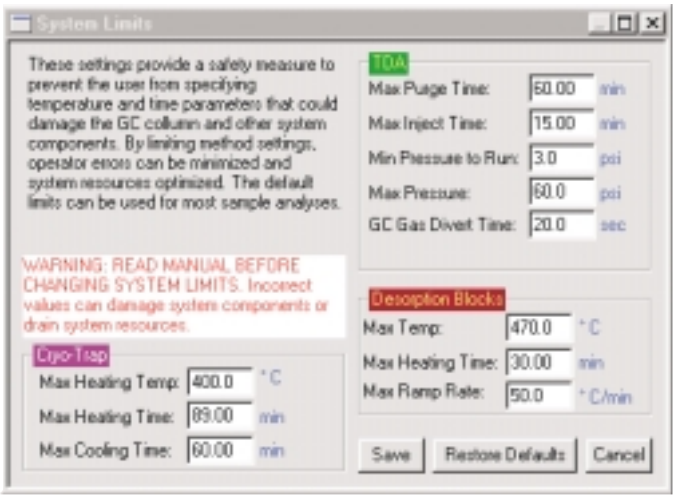


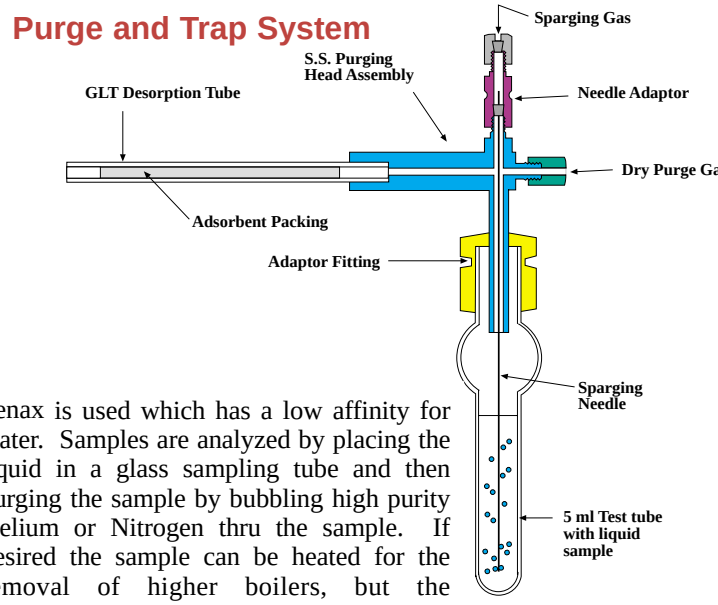
Figure 6 - System Limits Window

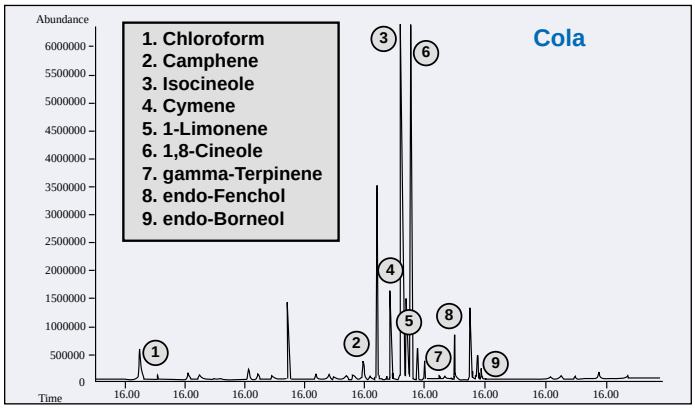
Charts and data tables are included for the breakthrough volumes for 200 organic analytes for 6 adsorbent resins including Tenax TA, Tenax GR, Carbotrap, Carboxen 569, and Glass beads as a function of temperature. This data, which can be accessed with a web browser, is useful for designing methods for collecting and desorbing samples using thermal desorption systems.

Applications

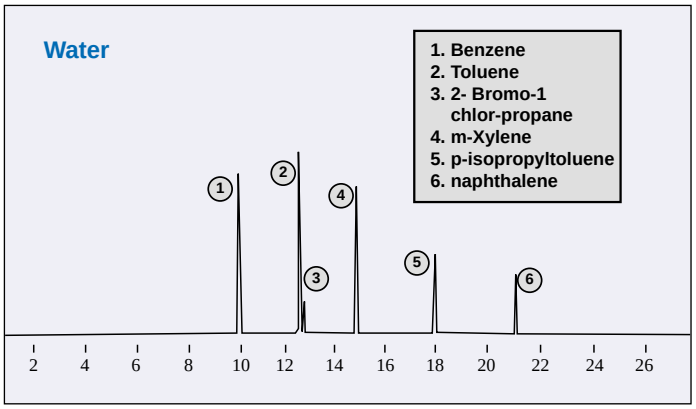
Purge and Trap of Liquids

The Automated Short Path Thermal Desorption System can be used for the analysis of volatile organics (VOC's) in commercial water based products including liquid formulations, colloidal suspensions, and liquid pastes. Using the S.I.S. Purge and Trap System for the purging of the volatiles from the liquid based samples followed by trapping on GLT desorption traps packed with Tenax or other suitable resins, the samples thus collected can be analyzed using the Short Path Thermal Desorption System. Using this technique it is possible to detect and identify various flavors, fragrances, off-odors, and manufacturing by-products in a wide diversity of liquid matrix samples. Water does not present any problem, since a dry gas purge is added just before the desorption tube to aid in the removal of water from the adsorbent resin, and an adsorbent resin such as Tenax is used which has a low affinity for water. Samples are analyzed by placing the liquid in a glass sampling tube and then purging the sample by bubbling high purity Helium or Nitrogen thru the sample. If desired the sample can be heated for the removal of higher boilers, but the temperature should be kept well below the boiling point of the liquid. The volatiles thus purged from the sample are trapped on the adsorbent trap. They are subsequently placed on the Short Path Thermal Desorption System to complete the analysis.

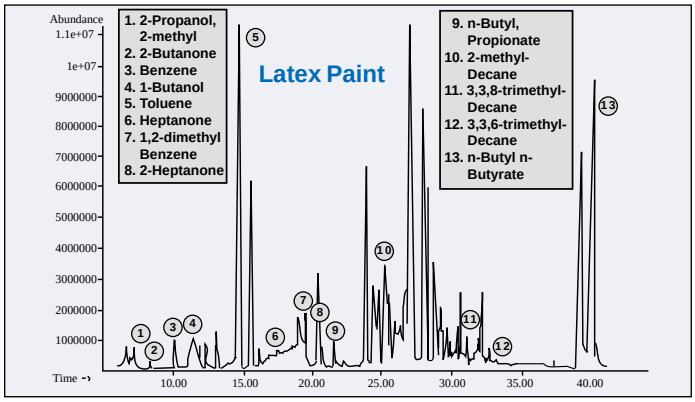




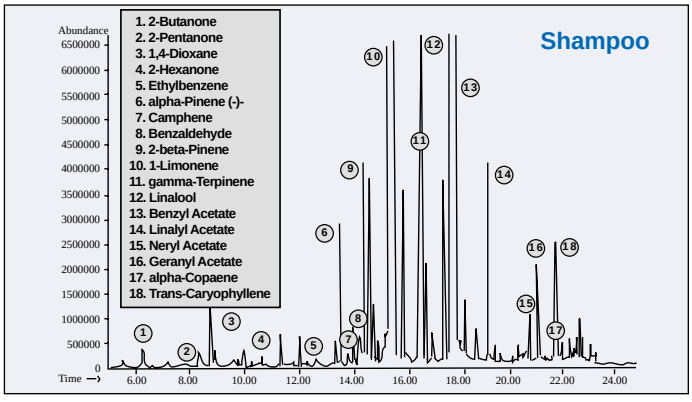
Technique: Purge and Trap of Volatiles in Liquid Samples
Sample: 25 ml of a Carbonated Cola was purged with 150 ml of high purity He at 15 ml/min and a dry purge of 15 ml/min. The volatiles were trapped on Tenax traps.
Thermal Desorption: Block temperature: 150°C, Purge flow:2.0 ml/min He, Desorption time: 10.0 min. Initial column trap temperature: -40°C
Column: DB-5, 25 meter x 0.25 mm I.D., 0.25 u film, -40° to 280°C at 10°/min.



Technique: Purge and Trap of Volatiles in Liquid Samples
Sample: 50 ml of water spiked with several aromatics at 20 ppm was purged with 300 ml of high purity He at 20 ml/min and a dry purge of 20 ml/min. The volatiles were trapped on Tenax traps.
Thermal Desorption: Block temperature: 150°C, Purge flow:2.0 ml/min He, Desorption time: 10.0 min. Initial column trap temperature: -40°C
Column: DB-5, 25 meter x 0.25 mm I.D., 0.25 u film, -40° to 280°C at 10°/min.



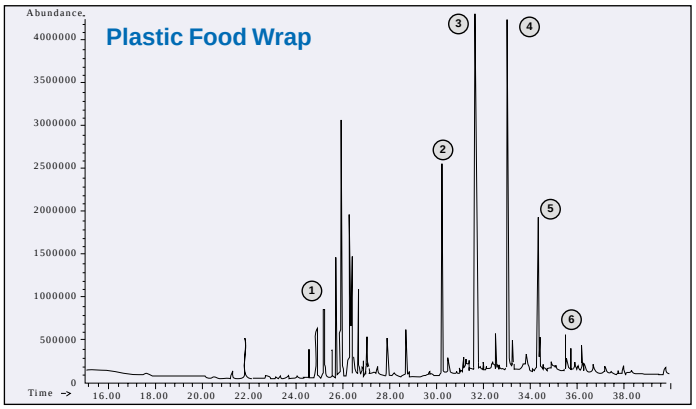
Technique: Purge and Trap of Volatiles in Liquid Samples
Sample: 1.0 ml latex Enamel paint was purged with 150 ml of high purity He at 15 ml/min and dry purge of 15 ml/min.
Thermal Desorption: Block temperature: 150°C, Purge flow:2.0 ml/min He, Desorption time: 10.0 min. Initial column trap temperature: -40°C
Column: DB-5, 25 meter x 0.25 mm I.D., 0.25 u film, -40° to 280°C at 10°/min.



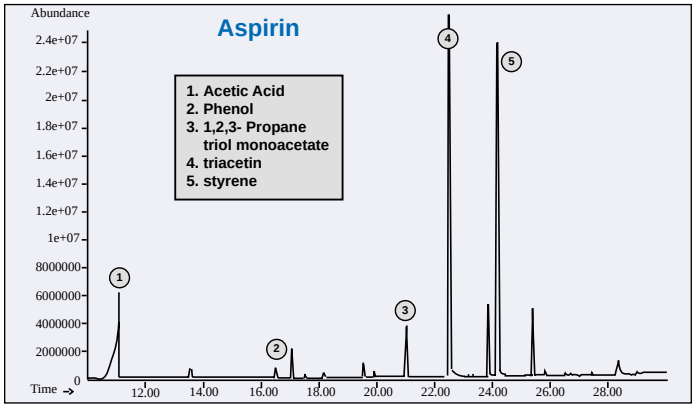
Technique: Purge and Trap of Volatiles in Liquid Samples
Sample: 5.0 ml of Liquid Shampoo was purged by passing 200ml of high purity He over the surface of the liquid shampoo at the rate of 20 ml/min. and a dry purge of 20 ml/min (Dynamic Headspace Purge). The volatiles were trapped on Tenax traps.
Thermal Desorption: Block temperature: 150°C, Purge flow: 2.0 ml/min He, Desorption time: 10.0 min. Initial column trap temperature: -40°C
Column: DB-5, 25 meter x 0.25 mm I.D., 0.25 u film, -40° to 280°C at 10°/min.

Direct Thermal Extraction

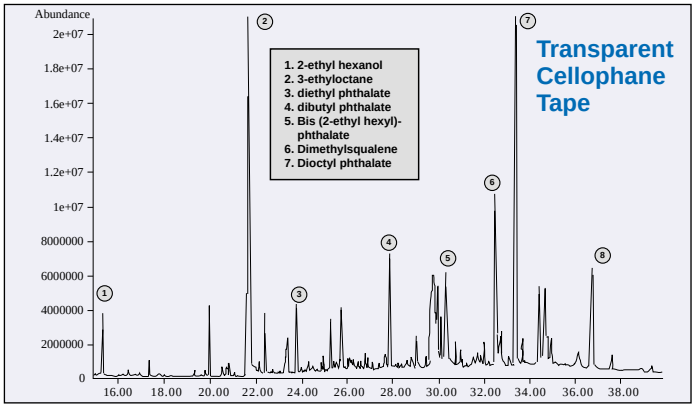
The technique of Direct Thermal Extraction permits the analysis of solid samples without any prior solvent extraction or other sample preparation. Solid samples between 1 and 500 milligrams are placed directly inside the GLT desorption tube between two glass wool plugs. The desorption tube needle is attached to one end of the sample tube. The desorption tube with sample enclosed is then attached to the Short Path Thermal Desorption System, purged with carrier gas to remove all traces of oxygen and injected into the GC injection port. The preheated heater blocks are closed around the desorption tube thereby permitting the thermal extraction of the volatiles and semi-volatiles present into the GC injection port. After the desorption is complete, these components, which have been trapped on the front of the GC column, are eluted and separated via a temperature program of the GC oven. This technique is useful for the analysis of a wide variety of low moisture content solid samples including vegetation, food products, pharmaceuticals, building materials, forensic samples and packaging products. By the proper selection of the desorption block temperature, the number and molecular weight distributions of components in the samples can be selected.



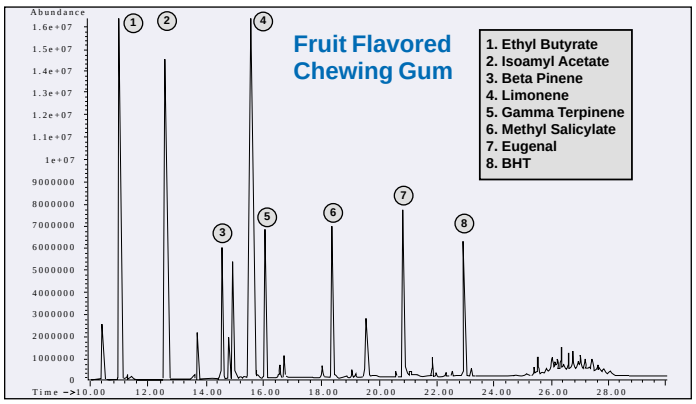
Technique: Direct Thermal Extraction of Solid Samples
Sample: 2.0 sq. in. piece of a clear plastic food wrap was placed inside the GLT desorption tube
Thermal Desorption: Block temperature: 100°C, Purge flow: 2.0 ml/min He, Desorption time: 10.0 min. Initial column trap temperature: -40°C
Column: DB-5, 25 meter x 0.25 mm I.D., 0.25 u film, -40° to 280°C at 10° / min.



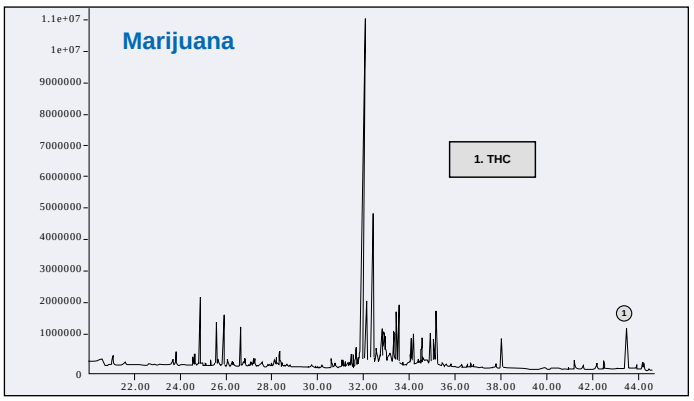
Technique: Direct Thermal Extraction of Solid Samples
Sample: 2.0 mg. crushed aspirin was placed inside the GLT desorption tube
Thermal Desorption: Block temperature: 100°C, Purge flow: 2.0 ml/min He, Desorption time: 10.0 min. Initial column trap temperature: -40°C
Column: DB-5, 25 meter x 0.25 mm I.D., 0.25 u film, -40° to 280°C at 10° / min.



Technique: Direct Thermal Extraction of Solid Samples
Sample: 2.0 sq. mm. of a transparent tape was placed inside the GLT desorption tube
Thermal Desorption: Block temperature: 150°C, Purge flow: 2.0 ml/min He, Desorption time: 10.0 min. Initial column trap temperature: -40°C
Column: DB-5, 25 meter x 0.25 mm I.D., 0.25 u film, -40° to 280°C at 10° / min.



Technique: Direct Thermal Extraction of Solid Samples
Sample: 8.3 mg. of thinly sliced gum was placed inside the GLT desorption tube
Thermal Desorption: Block temperature: 100°C, Purge flow: 2.0 ml/min He, Desorption time: 10.0 min. Initial column trap temperature: -40°C
Column: DB-5, 25 meter x 0.25 mm I.D., 0.25 u film, -40° to 280°C at 10° /min.



Technique: Direct Thermal Extraction of Solid Samples
Sample: 3.0 mg. of marijuana was placed inside the GLT desorption tube. Data courtesy NJSP
Thermal Desorption: Block temperature: 200°C, Purge flow: 2.0 ml/min He, Desorption time: 10.0 min. Initial column trap temperature: -40°C
Column: DB-5, 25 meter x 0.25 mm I.D., 0.25 u film, -40° to 280°C at 10° / min.

Application Notes

The following Application Notes and Technical bulletins are available on the SIS Web Site. The application notes are available in full text with color graphics and cover a wide range of applications including environmental, forensic, food science and industrial.

TECHNICAL BULLETINS:

1. Design & Operation of the Short Path Thermal Desorption System. (781201)
3. Elimination of "Memory Peaks" from Thermal Desorption. (781203)

APPLICATION NOTES:

1. Determination of Off-Odors and Other Volatile Organics in Food Packaging Films by Direct Thermal Analysis-GC-MS. (781301)
2. Detection of Arson Accelerants Using Dynamic Headspace with Tenax Cartridges Thermal Desorption and Cryofocusing (781302)
3. Indoor Air Pollution (781303)
4. Direct Analysis of Spices and Coffee (781304)
5. Direct Analysis Using the Short Path Thermal Desorption System: A new technique to permit the analysis of volatiles and semi-volatiles in solid samples without solvent extraction. (781305)
6. Direct Thermal Analysis of Plastic Food Wraps Using the Short Path Thermal Desorption System. (781306)
7. Chemical Residue Analysis of Pharmaceuticals Using The Short Path Thermal Desorption System. (781307)
8. Detection of Volatile Organic Compounds in Liquids Using the Short Path Thermal Desorption System. (781308)
9. Methodologies for the Quantification of Purge and Trap Thermal Desorption and Direct Thermal Analyses. (781309)
10. Quantification of Naphthalene in a Contaminated Pharmaceutical Product by Short Path Thermal Desorption (781310)
11. Flavor/Fragrance Profiles of Instant and Ground Coffees by Short Path Thermal Desorption. (781311)
12. Identification of the Volatile and Semi-Volatile Organics in Chewing Gums by Direct Thermal Desorption. (781312)
13. Detection and Quantification of PNA's and PCB's in Soil by Direct Thermal Desorption (781313)
14. Analysis of Carbonated Beverages by P&T Thermal Desorption Quantification of Limonene and Cymene (781314)
16. Analysis of Indoor Air and Sources of Indoor Air Contamination by Thermal Desorption. (781316)
17. Identification of Volatile Organics in Wine over Time (781317)
18. Determination of Volatile Organic Compounds in Mushrooms (781318)
19. Design and Application of the SIS GC Cryo-Trap (781319)
20. Using Direct Thermal Desorption to Assess the Potential Pool of Styrene and 4-Phenylcyclohexane in Latex-Backed Carpets. (781320)
21. Detection and Identification of Volatile and Semi-Volatile Organics in Synthetic Polymers Used in Food and Pharmaceutical Packaging. (781321)
22. Comparison of Volatile Compounds in Latex Paints (781322)
23. Fragrance Qualities in Colognes (781323)
24. Selection of GC Guard Columns for Use with the GC Cryo-Trap (781324)
25. Flavor and Aroma in Natural Bee Honey (781325)
26. Volatile Organics Present in Recycled Air Aboard a Commercial Airliner (781326)
27. Analysis of Volatile Organics in Soils by Automated Headspace GC (781327)
28. Analysis of Volatile Organics in Latex Paints by Automated Headspace Sampling and GC-Cryo-Focusing (781328)
29. Analysis of Volatile Organics in Oil Base Paints by Automated Headspace Sampling and GC Cryo-Focusing (781329)
30. Comparison of Cooking Oils by "Direct Thermal Extraction" and Purge and Trap GC/MS (781330)
31. Volatile Organic Composition in Several Cultivars of Peach (781331)
32. Selection and Use of Adsorbent Resins for Purge and Trap Thermal Desorption Applications (781332)
33. Changes in Volatiles in Milk Over Time (781333)
34. Selection of Thermal Desorption and Cryo-Trap Parameters in the Analysis of Teas
35. Volatile Organic Composition of Cranberries
36. Identification of Volatile Organic Compounds in a New Automobile
37. Volatile Organic Emissions from Automobile Tires
38. A New Micro Cryo-Trap for Trapping of Volatiles at the front of a GC Capillary Column
39. Comparison of Sensitivity of Headspace GC, Purge and Trap Thermal Desorption and Direct Thermal Extraction Techniques for Volatile Organics
40. Composition of Septa by Direct Thermal Extraction
41. Hydrocarbon Production in Pine by Direct Thermal Extraction
42. The Influence of Pump Oil Purity on Roughing Pumps
43. Volatile Organic Composition in Blueberry
54. Identification of Volatile Organic Compounds in Office Products
55. Seasonal Variation in Flower Volatiles
57. Aroma Profiles of Various Lavandula Species
58. Direct Probe Analysis and Identification of Multi-component Pharmaceutical Samples via Electron Impact MS
60. Programmable Temperature Ramping of Samples Analyzed via Direct Thermal Extraction GC/MS
63. Organics in Printer Toners using Thermal Desorption
64. Comparison of Various GC/MS Techniques for the Analysis of Black Pepper
65. Determination of Ethylene by Adsorbent Trapping and Thermal Desorption GC
71. Flavor Profile Determination of Rice Samples Using Thermal Desorption
73. The Analysis of Perfumes and Their Effect on Indoor Air Pollution
75. An Apparatus for Sampling Volatile Organics from Live Plant Material Using Short Path Thermal Desorption
77. The Determination of Volatile Organics in Vacuum System Components
79. Volatile Organic Compounds From Electron Beam Cured and Partially Electron Beam Cured Packaging Using Automated Short Path Thermal Desorption
80. Design, Development and Testing of a Microprocessor Controlled Automated Short Path Thermal Desorption Apparatus

On the WEB at: http://www.sisweb.com

System Accessories

Cryo Trap

The Cryo Trap is used for the cryo focusing or trapping of volatile and semi volatile organics at the head of the GC column after thermal desorption and is a recommended accessory for the AutoDesorb system. The 2” long Cryo-Trap was designed to mount inside the GC oven just under the GC injection port. Liquid Nitrogen or Liquid CO2 can be used for cooling the Cryo-Trap and a built in heater permits the rapid heating of the trap to release the analytes for subsequent chromatography.

24 Tube Conditioning Oven

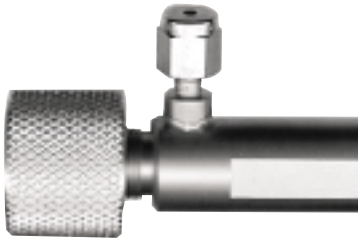
The 24 tube conditioning oven is used for the flow conditioning of thermal desorption tubes as well as desorption tube needles and connecting tubes. A high purity gas such as helium or nitrogen is used to purge the tubes and needles while they are baked out at elevated temperatures. By proper conditioning of the desorption tubes with adsorbent resins and needles, no foreign contaminants will interfere with or contribute to the composition of the samples which are to be analyzed.

Purge and Trap System

The SIS Purge and Trap System is used to purge volatile and semi-volatiles from liquid and solid samples and trap the purged analytes on a thermal desorption tube with an adsorbent resin. The system consists of two single ball rotameters with adjustable needle valves and a stainless steel purging head. The sampler can be placed into a heated water bath or heater blanket to analyze samples at elevated temperatures.

Desorption Tube Injection Head

The Desorption Tube Injection Head is used for loading internal standards or liquid samples onto packed thermal desorption tubes. Samples are injected through a septum and a stream of carrier gas purges 100% of the volatiles onto the adsorbent resin.



Sample Collection System

The Sample Collection System permits the purging of volatiles and semi-volatiles from larger solid samples and trapping of the analytes on a thermal desorption tube packed with an adsorbent resin. Sample sizes up to 20 grams can be extracted with this system.

Air Sampling Pump

The Low Flow Air Sampling Pump is used for pumping air through packed desorption tubes at constant air flows that can be set between 5 and 200 ml/min at variable back pressures up to 25" of water. This system is used for air sampling to trap analytes present in the air on the adsorbent resin traps for thermal desorption analysis.

Thermal Desorption Sampling Chamber

The Heated Thermal Desorption Sampling Chambers are used to contain large solid matrix samples to purge off the volatile and semi-volatile organics at elevated temperatures and then trap these analytes on thermal desorption tubes packed with a variety of adsorbent resins. These systems are custom made on order and other chamber designs can be constructed according to your requirements.

For additional information call Scientific Instrument Services, Inc. at 908-788-5550

Applications-Thermal Desorption

Environmental Air Analysis
Indoor Air Pollution
Flavor and Fragrance Analysis
Off-odor/Off-flavor Analysis
Forensic Arson Analysis

Residual Gas, Solvents and Chemicals in:

Pharmaceuticals
Packaging Materials
Building Products
Food Products
Natural Products

Direct Thermal Extraction of:

Plastics
Synthetic Fibers and Other Materials
Spices
Natural Products
Pharmaceuticals
Finished Products for Solvent Residues

Visit Our WEB site for information on

- **System Components**
- **System Description and Theory of Operation**
- **Ordering Information**
- **Accessory Equipment and Supplies**
- **Installation Directions**
- **Application Notes**

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