

# Restek Technical Articles



## EDITORIAL

### Further Editorials, by Dr. Konrad Grob

< Added September, 2009

Collected from the Restek *Advantage*, thirteen thought-provoking essays offering insight into sample vaporization processes in gas chromatography, important splitless optimization concepts, and food for thought on lab practices, education, and food safety.

[Find out more](#)

### Unraveling Scent Signals to Protect African Wild Dogs

< Added May, 2009

Dr. Peter Apps discusses how gas chromatography is being used to help protect endangered African wild dogs from conflicts with humans in Botswana.

[Find out more](#)

### Analysis of Brominated Flame Retardants by Liquid Chromatography Mass Spectrometry

Dr. Chris Marvin, of Environment Canada, discusses the challenges of analyzing brominated flame retardants, such as polybrominated diphenyl ethers, by LC/MS.

[Find out more](#)

### Achieving Faster GC

Numerous articles have been published on faster methods for gas chromatography (GC), yet uncertainty remains on how best to speed up separations. Here, Dr. Hans-Gerd Janssen clarifies the confusion surrounding fast GC and recommends a strategic approach based on 3 steps: 1) minimizing resolution to a value just sufficient, 2) maximizing the selectivity of the chromatographic system, and 3) implementing a method that reduces analysis time while holding resolution constant.

[Find out more](#)

### Quality Control in Metabolomics

Metabolites are found in different concentrations in complex biological matrices and are very difficult to extract without compromising their structural integrity and relative abundances. Quality control in metabolomics means more than just taking care of chromatographic or mass spectrometry parameters. This article by Oliver Fiehn examines quality control as an attitude towards gaining reliable data, rather than an automatic procedure implemented in instrument software.

[Find out more](#)

### Using Guard Columns and Retention Gaps in GC (Part 2)

Guard columns & retention gaps are used widely in gas chromatography (GC) but the differences between them are not always understood. Part 2 of this two-part editorial by Jaap de Zeeuw discusses guard columns & introduces a new segment coating technology that allows retention gaps & guard columns to be built directly in the same piece of tubing as the analytical column.

[Find out more.](#)

### Using Guard Columns and Retention Gaps in GC (Part 1)

Guard columns & retention gaps are used widely in gas chromatography (GC) but the differences between them are not always understood. Part 1 of this two-part editorial by Jaap de Zeeuw reviews the use of retention gaps & discusses critical factors affecting performance. This sets the background for Part 2, which details guard columns & introduces a new segment coating technology that allows retention gaps & guard columns to be built directly in the same piece of tubing as the analytical column.

[Find out more.](#)

### Retention Cross-over Phenomenon in Gas Chromatography

### *Can the Mystery Be Revealed?*

Dr. Werner Engewald discusses the phenomenon of cross-over, or changes in elution order following modification of the GC temperature program. This effect has been observed for decades but the physio-chemical background still is not well understood. In this article Dr. Engewald explores the theory and potential explanations for the cross-over phenomenon.

[Find out more.](#)

### **Restek: A Company of Owners**

*By Paul Silvis, Restek Founder & former Head Coach*

In this editorial, founder and former CEO Paul Silvis explains some of the reasons for Restek's success as a provider of chromatography columns and supplies. Restek will continue to be successful because, as an employee-owned company, we hold our future in our own hands. Customers will benefit because we can continue to respond to their ideas for the products and services they need to make their work easier.

[Find out more.](#)

### **Sample Preparation Techniques Used for Gas Chromatography**

*Guest Editorial by Robert L. Grob, Ph.D.*

Sample preparation principles and techniques for gas chromatography are reviewed. Techniques include: static headspace, dynamic headspace, solid phase extraction and microextraction, distillation, stir bar sorptive extraction, Soxhlet, accelerated solvent extraction, pressurized liquid extraction, subcritical water extraction, microwave assisted extraction, ultrasonic extraction, and supercritical fluid extraction.

[Find out more.](#)

### **Comprehensive 2D Gas Chromatography — Making GC Separations Work Harder**

Guest editor Dr. Phil Marriott tells us the three primary contributions ascribed to GCxGC are greater separation capacity, greater sensitivity, and a data presentation that permits identification of related compounds based on the molecular properties that control retention. The most significant advantage is separation power: to be able to resolve many more compounds immediately enables a much more complete 'picture' of the composition of a sample.

[Find out more.](#)

### **Preventive Maintenance for GC**

Professor Jennings explains the consequences of ignoring those enclosures included with a new column, and offers simple, proven, preventive maintenance options that help avoid downtime.

[Find out more.](#)

### **The "Replacement" Column, A Recurring Problem in Gas Chromatography**

In his first contribution to the Restek Advantage Professor Walter Jennings discusses why analysts often encounter problems when replacing a capillary GC column, and provides a solution.

[Find out more.](#)

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**PETROCHEMICAL**

### **Accurately Quantify Methanol and Ethanol in E85 Biofuel by D5501 with New Rtx®-DHA-150 Column**

*Content previously published in Petro Industry News*

< Added November 2009

Improve D5501 analysis of ethanol biofuel with Rtx®-DHA-150 columns. Reliably separate methanol and isobutane in just 20 minutes, with excellent symmetry for both target alcohols.

[Find out more.](#)

### **New PLOT Column Technology Stabilizes Flow and Improves Analysis of Light Hydrocarbons, Solvents, and Permanent Gases**

*Content previously published in Petro Industry News*

< Added November 2009

New PLOT columns offer significantly reduced particle release, extending column lifetime and assuring highly reproducible retention times column-to-column. Improved applications for porous polymer, molecular sieve, and alumina columns.

[Find out more.](#)

### **Tighten Control of Distillation Processes with the New MXT®-1HT Sim Dist Column**

*Content previously published in Petro Industry News*

< Added November 2009

New MXT®-1HT SimDist GC columns outperform competitors, allowing more productive D6352 analyses. Here we demonstrate lower bleed levels and higher efficiency, improving resolution and assuring more samples can be run within method specifications.

[Find out more.](#)

### **Advances in Porous Layer Open Tubular Columns**

*Content previously published in International Laboratory*

< Added October 2009

Jaap de Zeeuw discusses recent advances in PLOT column technology in an *International Laboratory* article. New stabilization technology minimizes particle release, assuring more consistent flow and better performance for a number of applications.

[Find out more](#) (4.4mb pdf)

### **Higher DHA Sample Throughput for PONA Analysis: Options for Helium and Hydrogen**

*Content previously published in Petro Industry News*

< Added August 2009

Rtx®-1 PONA columns are highly stable and can be run with helium or hydrogen under accelerated conditions. Restek has developed a new DHA method using Rtx®-1 PONA columns with hydrogen that can double refinery sample throughput.

[Find out more](#)

### **New D3606 Column Set Outperforms TCEP Columns for Benzene Analysis**

*Content previously published in Petro Industry News*

< Added August 2009

Restek's new D3606 column set outperforms TCEP columns for gasoline testing. The D3606 set has higher thermal stability and reliably resolves benzene from ethanol, resulting in more accurate quantitation.

[Find out more](#)

### **Stable Sulfur & Mercury Sampling in Refineries**

*Using Siltek® and Sulfinert® Surface Treated Components*

Refinery and natural gas samples often contain trace amounts of sulfur- and mercury-containing compounds, which can interfere with reactions, poison catalysts in petrochemical processes, and damage equipment. Because these compounds quickly react with stainless steel surfaces, accurate determination of these compounds is impossible when samples are collected and stored in untreated sample cylinders. Restek's Siltek® and Sulfinert® passivation techniques bond an inert layer into the surface of stainless steel, preventing active compounds from reacting with or adsorbing to the steel.

[Find out more.](#)

### **Eliminate Column Breakage in High Temperature Biodiesel Analysis**

Using metal columns to analyze glycerin in biodiesel offer significant performance advantages compared to fused silica columns, as shown in this evaluation.

[Find out more.](#)

### **How Good is Your PONA Column?**

*Data-Based Decisions Help Simplify the Choice*

We evaluated our 100 meter x 0.25mm ID x 0.5df PONA column and equivalent columns from four other vendors, following ASTM D-6730 methodology (hydrogen carrier gas). Data and chromatograms presented here show that only the Restek PONA column performed to method specifications admirably. Column efficiency exceeded specification.

[Find out more.](#)

### **Parker ChromGas® Hydrogen Generators**

Relative to helium as the GC carrier gas, hydrogen from a gas generator reduces gas costs, cuts analysis time by 50%, and reduces temperatures needed for eluting analytes — which increases column lifetime.

Parker ChromGas® hydrogen generators are safe, convenient, reliable, and easy to use.

[Find out more.](#)

### **High Temp. Stability Problem Solved with New Metal Columns**

*Analysis of Total Glycerides in Biodiesel Oils by ASTM D-6584 Using the New MXT®-Biodiesel TG Capillary Column*

The high temperatures required for biodiesel analysis by gas chromatography present a considerable challenge to analytical columns. Fused silica columns, even those rated for high-temperature tolerance, breakdown relatively quickly. Restek's new MXT®-Biodiesel columns are more stable up to 430°C and offer excellent chromatography for glycerides. These columns are available in two configurations: factory-coupled to a 0.53mm retention gap, or with a built-in, leak-proof Integra-Gap™ retention gap.

[Find out more.](#)

### **Fast, Accurate FAMES Analyses of Biodiesel Fuel**

*Using a Stabilwax® Capillary GC Column*

As biodiesel fuel continues to stimulate interest worldwide as an energy source, several gas chromatographic methods have been developed to determine the quality of B100 fuel. Here we show excellent peak symmetry, resolution, and reproducibility for determining the fatty acid methyl ester (FAME) and linolenic acid methyl ester content in B100 biodiesel fuel, using European standard method EN 14103 on a Stabilwax® fused silica GC column.

[Find out more.](#)

### **Separate Argon from Oxygen Above Ambient Temperatures**

*Using an Rt-Msieve™ 5A PLOT Column*

A Restek PLOT column can be your best solution for difficult separations of gaseous analytes. Rt-Msieve™ 5A PLOT columns offer fast, efficient separation of argon/oxygen, hydrogen/helium, and other permanent gases, including permanent gases in refinery or natural gas. You can make difficult separations without subambient temperatures, e.g.: separate oxygen from argon to baseline in approximately 4 minutes.

[Find out more.](#)

### **Biodiesel Analysis by European Methodology**

*Exceptional Peak Symmetry, Using an Rtx®-Biodiesel GC Column*

Glycerin is a notoriously difficult challenge in GC, particularly at the levels involved in biodiesel oil analysis, but an Rtx®-Biodiesel column provides a symmetric peak that makes quantification easier and more reliable. The column performs well at elevated temperatures: peaks for glycerin and glycerides exhibit minimal tailing, and bleed is low at 370°C, as specified in European method DIN EN14105.

[Find out more.](#)

### **Analyze Biodiesel Oil for Glycerin**

*Using Restek's Robust Rtx®-Biodiesel Capillary GC Column*

We challenged our Rtx®-Biodiesel column with analysis for glycerin in biodiesel according to method ASTM D-6584-00. Excellent linearity was established for glycerin, triolein, monolein, and diolein, with  $r^2$  values exceeding the method criteria for all compounds. Mono-, di-, and triglycerides resolved well from other compounds in B100 biodiesel oil. Column performance was strong at high temperatures, with low bleed even at 380°C. An Alumaseal™ connector and guard column were used to extend column life.

[Find out more.](#)

### **GC Analysis of Total Reduced Sulfurs at ppbv Levels**

*Using an Rxi™-1ms Column and Sulfur Chemiluminescence Detection*

Ultra-low bleed and exceptional inertness assure complete separation of sulfur compounds (hydrogen sulfide, carbonyl sulfide, dimethyl sulfide, mercaptans) on our new column, with excellent peak shapes and reliable quantification at ppbv levels. A Sulfinert® treated sampling/transfer system assures no adsorption losses of these very reactive compounds.

[Find out more.](#)

### **Sulfinert®-Treated Sample Cylinders Store Active Sulfur Compounds at ppb Levels**

Recovery of a 17ppbv test standard of hydrogen sulfide exceeded 85% after 54 hours in a Sulfinert®-treated cylinder; recoveries of methyl mercaptan, ethyl mercaptan, carbonyl sulfide, and dimethyl disulfide exceeded 90%. A Sulfinert®-treated sampling/transfer system can assure accurate sulfur content data for natural gas, beverage-grade carbon dioxide, or other samples.

[Find out more.](#)

### Analyze Hydrocarbons on OPN/Res-Sil™ C Bonded GC Packing

In process GC analyses, this material offers unique selectivity for the difficult-to-separate saturated and unsaturated C4 hydrocarbons, eluting *cis*-2-butene before 1,3-butadiene. Innovative bonding chemistry assures batch-to-batch reproducibility, excellent thermal stability, and long column life.

[Find out more.](#)

### Res-Sil™ C Packings for Analyses of Light Hydrocarbons

*n*-Octane on Res-Sil™ C packing provides excellent, reproducible separations of volatile hydrocarbons in petroleum products, including the difficult-to-separate saturated and unsaturated C4 compounds. An OPN on Res-Sil™ C column separates C1-C5 hydrocarbons in half the time required by alternative columns.

[Find out more.](#)

**Want more? Click here to view Petrochemical Literature**

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## CLINICAL/FORENSICS

### LC/MS/MS Analysis of Diuretics in Urine:

#### Proper Column Choice Takes Matrix out of the Equation

< Added October 2009

Ultra II™ Biphenyl columns improve the accuracy of diuretics analysis in urine by separating target diuretics from isobaric matrix interferences. Fast, reliable separation can be achieved for compounds that coelute on phenyl hexyl columns.

[Find out more](#)

### Reduce Downtime and Cost of Materials with Rxi®-5Sil MS GC Columns

< Added July 2009

New Rxi®-5Sil MS columns produce consistent results for amphetamine—even after 400 injections of derivatizing reagent—resulting in less time and money spent on column maintenance and replacement.

[Find out more](#)

### High Sensitivity EtG and EtS Method Reduces Costs and Analysis Time

< Added July 2009

A new LC method for analyzing ethanol metabolites using ion-pairing provides higher retention, faster analysis times, and improved MS sensitivity for EtG and EtS, compared to conventional methods.

[Find out more](#)

### 5 Minute Analysis of Vitamin D in Serum by LC/MS/MS

< Added May 2009

Conventional techniques for vitamin D analysis often lack adequate sensitivity, specificity, and speed. This LC/MS/MS assay results in highly symmetric peaks that elute in just 5 minutes.

[Find out more](#)

### Fast Screening and Confirmation of Gamma-Hydroxybutyrate (GHB) in Urine

< Added February 2009

The headspace (HS) analysis of gamma-hydroxybutyrate (GHB) described here reduces contamination and eliminates time-consuming derivatization. Confirmation testing using an Rtx®-5MS column, provides definitive results in less than 7 minutes.

[Find out more](#)

### Assure LC/MS/MS System Performance and Increase Sample Throughput

*Using a System Suitability Test Mix for Drug Analysis*

Restek and Applied Biosystems have developed a system suitability mix specifically for drug testing that contains compounds covering a wide range of molecular weights, polarities, and retention times. This mix is designed to verify system performance and identify problems. Data are automatically compared to expected results by Cliquid® Drug Screen & Quant Software. Use this mix to assure system performance, improve data quality, increase sample throughput, and simplify troubleshooting.

[Find out more](#)

### **Rapid Separation of Human Sex Hormones in Biological Samples**

*Using the JASCO X-LC System*

This application note describes a 6.1 min method for identifying a mixture of 8 sex hormones using Jasco X-LC. The compounds are separated by a gradient elution of water and acetonitrile on a Restek 1.9µm Pinnacle DB Biphenyl column.

[Find out more at \*\*www.jascoinc.com\*\*](#)

### **Accurate, Reproducible Amphetamines Analysis**

*Clean Up Procedure Improves Chromatography and Reduces Maintenance*

Analyzing amphetamines by GC/MS can be challenging whether they are derivatized or underivatized. Here we evaluate the effects of several sample pretreatment methods. The resulting method reported here produces symmetric peaks while reducing the amount of contamination that can enter the GC system. This method ensures accurate area count reproducibility, a clean GC system, and a stable baseline, even for GC/MS work.

[Find out more.](#)

### **Fast, Sensitive Analysis of Benzodiazepines by LC/MS/MS**

*Quantify an Order of Magnitude below Typical Methods*

An LC/MS/MS method for benzodiazepines was developed and offers several advantages over other techniques: minimal sample preparation, fast analysis times, multiple reaction monitoring transitions for quantification and confirmation, and sensitivity down to 0.10-10ng/mL. This method uses the Allure® PFP Propyl stationary phase, which retains compounds long enough to minimize matrix interferences and chromatographically separate compounds that share the same precursor ion.

[Find out more.](#)

### **Simplify and Speed Up Opiates Analysis**

*Using LC/MS/MS & an Allure® PFP Propyl HPLC Column*

The analysis of opiates typically requires derivatization when using gas chromatography/mass spectrometry (GC/MS), which leads to longer sample preparation time. An alternative liquid chromatography tandem mass spectrometry (LC/MS/MS) method presented here eliminates sample derivatization and offers fast analysis times, resulting in increased sample throughput. In addition, the Allure® PFP Propyl column used here produces baseline resolution for compounds that have very similar mass spectra.

[Find out more.](#)

### **Why Derivatize?**

*Improve GC Separations with Derivatization*

Derivatizing compounds is often necessary to obtain acceptable, reproducible results. Here we review reasons for derivatization and the three basic types of derivatization reactions for gas chromatography: silylation, acylation, and alkylation. An example procedure for derivatizing hormones, including chromatography, is given.

[Find out more.](#)

### **Reliably Confirm Cannabinoids by GC/MS**

*Using a 12m x 0.20mm ID 0.33µm Rxi®-5ms Column*

Screening for evidence of marijuana use is typically done using an immunoassay method to detect derivatives in urine, but confirmation of positive results requires GC/MS. Here we describe a GC/MS method, using an Rxi®-5ms column, that resolves all major cannabinoid metabolites to baseline and exhibits very low bleed, even at 300°C. We also prolonged column life by baking at 340°C to remove derivatization by-products.

[Find out more.](#)

### **Fast Screening and Confirmation for Gamma-Hydroxybutyrate (GHB)**

*Using Restek Columns in Headspace GC or GC/MS Systems*

We adapted Rtx®-BAC1 and Rtx®-BAC2 columns, with their proven performance in blood alcohol analysis, to a screening procedure for GHB, followed by confirmation and quantification on a highly inert Rxi®-5ms column. Use of a system and column already in use for blood alcohol analysis eliminates the need for additional equipment, reduces system maintenance, and allows rapid and reliable screening, confirmation, and quantification.

[Find out more.](#)

### Drugs of Abuse Analytical Reference Materials

These exempted materials include amphetamine and methamphetamine, barbiturates, benzodiazepines, cannabidiol and cannabinol, cocaine/cocaine metabolites, methadone/methadone metabolites, opiates/opiate metabolites, and other drugs, a range of blood alcohol standards from 0.010g/dl to 0.4g/dl, and a blood alcohol resolution control standard.

Find out more about:

[Exempted Drug of Abuse Reference Materials](#)

[Blood Alcohol Standards](#)

[Blood Alcohol Mix Resolution Control Standard](#)

### Rapid Analysis of Steroid Hormones by GC/MS

*Using the New Rxi®-1ms Column*

GC/MS analysis of urinary steroid hormones is a demanding application, and the Rxi®-1ms column meets the requirements for low bleed and inertness better than any column we have tested. We analyzed a variety of derivatized steroid sex hormones in less than 25 minutes, with excellent resolution and symmetric peaks. At 300°C or above, bleed from the Rxi®-1ms column was negligible.

[Find out more.](#)

### GC Inlet Liner Deactivations for Basic Drug Analysis

Basic drugs can interact with active sites on the surface of the inlet liner, reducing responses. The combination of a base-deactivated liner and a base-deactivated Rtx®-5Amine column ensures the greatest responses in analyses for these compounds.

[Find out more.](#)

### Sensitive GC/MS Analysis for Drugs of Abuse

An Rxi®-5ms column will resolve acidic/neutral or free basic drugs under one set of conditions. There is no interference from column bleed — not even at 330°C. This is one of the first published applications for our new family of Rxi® columns.

[Find out more.](#)

### Rapid, Sensitive HPLC/TOF-MS Analysis for Cocaine

A high-organic mobile phase and an Allure™ PFP Propyl column offers adequate retention, short analysis times, and excellent sensitivity for cocaine and cocaine metabolites, without mobile phase modifiers. Target compounds are eluted within 3 minutes, with excellent sensitivity at 5.0pg on-column.

[Find out more.](#)

**Want more? Click here to view Clinical/Forensic Literature**

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## ENVIRONMENTAL

### Analyze Haloacetic Acids in Under 13 Minutes with Rtx®-CLPesticides Columns

< Added September, 2009

Sample throughput for haloacetic acids in drinking water can be increased significantly using Rtx®-CLPesticides/Rtx®-CLPesticides2 columns. Target HAAs were fully resolved in under 13 minutes.

[Find out more](#)

### New Wool Ensures More Accurate Semivolatiles Analyses

< Added September, 2009

New Semivolatiles Wool liners are designed specifically for semivolatiles analysis and result in more accurate results at lower levels, compared to similar products.

[Find out more](#)

### 3-Fold Faster Polybrominated Diphenyl Ether (PBDE) Short Column Method

< Added August, 2009

Sample throughput for PBDE analysis can be significantly increased using a 15m Rtx®-1614 column. Excellent responses and peak shapes are obtained for all congeners, including BDE-209, in just 20 minutes.



[Find out more](#)

### **New Column Option for Reliable LC Separation of Explosives**

< Added May, 2009

Ultra II Aromax and Ultra C8 columns were determined to provide better separations for the routine analysis of explosives by LC than conventional phases.

[Find out more](#)

### **Reduce Acetonitrile Use by Analyzing PAHs with Methanol-Based Mobile Phase**

< Added April, 2009

Switching to a methanol based mobile phase for polycyclic aromatic hydrocarbon analysis—using the method shown here—is an effective way to save money by reducing acetonitrile consumption.

[Find out more](#)

### **Detect Down to 10pg with Sensitive SIM GC/MS Multiresidue Method**

As labs operate in an extremely competitive market, the demand for more sensitive multiresidue pesticide methods is increasing. Here we demonstrate linearity down to 10pg on-column for a wide range of pesticides differing in volatility, compound class, and degree of activity. The inertness of the Rxi®-5Sil MS column ensures linear performance and more accurate low level quantification for multiresidue pesticide methods.

[Find out more](#)

### **PTV On-Column Liner Gives You Two Inlets in One**

Programmable temperature vaporization inlets are versatile, yet normally do not accommodate on-column injection. Now, using a PTV On-Column liner, the capabilities of PTV can be expanded to include true on-column injections.

[Find out more](#)

### **Isomer-Specific Analysis and Large Volume Sampling of Estrogens and their Conjugates in Water Samples**

Estrogens and conjugates, including estradiol sulfates and estradiol glucuronides, were separated and detection limits were lowered using an Allure AK column and an LC/MS/MS system. Initial results from large volume sample testing are also reported.

[Download](#) (1.09 MB PDF)

### **One Stop Shop for EPA Method 535**

*Reliably Analyze Acetamide Herbicide Degradates by LC/MS/MS*

An optimized EPA Method 535 procedure offers superior sensitivity for the ethanesulfonic acid (ESA) and oxanilic acid (OA) degradates of chloroacetanilide herbicides alachlor, acetochlor, and metolachlor. Alachlor ESA and acetochlor ESA isomers are reliably resolved, and the procedure is simplified with a full line of Method 535 products, including reference standards, solid phase extraction cartridges, and HPLC columns.

[Find out more](#)

### **Reliable Quantification of Brominated Flame Retardants by GC/MS**

*Using a New Rtx®-1614 Column for PBDE Analysis*

The new Rtx®-1614 column is ideal for analyzing polybrominated diphenyl ethers (PBDEs) according to EPA Method 1614 due to its selectivity, sensitivity, and inertness. Data show this column meets the method requirements for resolution of critical pairs, tailing factors, and retention. Congeners 49 and 71 are fully resolved and a greater response for BDE-209 is seen. Optimized conditions can improve performance.

[Find out more](#)

### **Increase Polycyclic Aromatic Hydrocarbon Sample Throughput**

*With UHPLC and HPLC Column Options*

Here we analyze polycyclic (polynuclear) aromatic hydrocarbons (PAHs) from the US EPA, European Union (EU), and Portugal lists by UHPLC and HPLC. Procedures shown use two optimized stationary phases (Pinnacle™ DB PAH and Pinnacle™ II PAH) and provide 3.5 to 6 minute analyses, allowing labs to achieve significantly faster sample throughput.

[Find out more](#)

### **Characterizing All 136 Tetra- to Octachlorinated Dioxins and Furans**

*Using the Rtx®-Dioxin2 Column*

The Rtx®-Dioxin2 column has a unique selectivity for dioxins and furans, including specificity for 2,3,7,8-



TCDD and 2,3,7,8-TCDF. Here we characterize all 136 tetra- through octachlorine dioxins and furans and define all possible coelutions. While commonly used cyanopropyl columns are limited by a low maximum operating temperature of 240°C, the Rtx®-Dioxin2 column is stable up to 340°C, extending column lifetime and improving the analyses of dioxins and furans.

[Find out more.](#)

### **Enhancing Air Monitoring Methods with Thermal Desorption**

The use of carbon disulfide (CS<sub>2</sub>) extraction as an air monitoring method for vapor-phase organic compounds (VOCs) is fundamentally limited with respect to detection limits. Thermal desorption (TD) is a complementary gas extraction technique whereby sorbent tubes are heated in a flow of carrier gas. Trapped vapors desorb from the sample tubes into the gas stream and are transferred into the GC/MS analyzer. Here, we summarize the key advantages of thermal desorption versus solvent extraction.

[Find out more.](#)

### **13 Minute Chlorophenoxyacid Herbicides Analysis**

*On New Rtx®-CLPesticides & Rtx®-CLPesticides2 Columns*

The Rtx®-CLPesticides and Rtx®-CLPesticides2 column pair is an excellent choice for chlorophenoxyacid herbicide analysis. Now, with an optimized film thickness for the 0.32mm ID version, this difficult analysis can be made in less than 13 minutes on both the primary and confirmation columns. Near baseline resolution is achieved for all analytes except for bentazon/picloram on the Rtx®-CLPesticides column; however, this pair is fully resolved on the Rtx®-CLPesticides2.

[Find out more.](#)

### **Accurately Quantify PAHs Down to 5pg On-Column**

*GC/MS SIM Analysis with the New Rxi®-5Sil MS Column*

Semivolatiles methods, such as EPA Method 8270, place stringent demands on gas chromatography (GC) columns. Here we demonstrate the performance of Rxi®-5Sil MS columns for semivolatiles analysis in terms of bleed, efficiency, and activity. Excellent sensitivity and resolution are seen, even for difficult PAHs such as benzo(b)fluoranthene & benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene and dibenzo(a,h)anthracene. Both basic and acidic compounds show good response even at low levels.

[Find out more.](#)

### **Fast, Accurate Semivolatiles Analysis!**

*Using New Rxi®-5Sil MS GC Columns*

Semivolatiles methods, such as EPA Method 8270, place stringent demands on gas chromatography (GC) columns. Here we evaluate the performance of Rxi®-5Sil MS columns for semivolatiles analysis in terms of bleed, efficiency, and activity. We demonstrate excellent sensitivity and resolution, even for difficult PAHs such as benzo(b)fluoranthene & benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene and dibenzo(a,h)anthracene. Both basic and acidic compounds show good response even at low levels.

[Find out more.](#)

### **Complete Resolution of 13 Difficult Carbonyls**

*Using the New Allure® AK HPLC Column*

The new Allure® AK HPLC column was developed specifically for the analysis of aldehydes and ketones, including the 13 carbonyl compounds specified in the California Air Resources Board (CARB) Method 1004. The data shown in this article demonstrate excellent resolution, even of buteraldehyde and methyl ethyl ketone (MEK), in less than 12 minutes using a 200mm Allure® AK HPLC column.

[Find out more.](#)

### **Faster Organochlorine Pesticide Sample Throughput**

*On New Rtx®-CLPesticides & Rtx®-CLPesticides2 Columns*

Increasing sample throughput is an effective way to reduce operating costs for environmental labs. Here we introduce new film thicknesses for the Rtx®-CLPesticide and Rtx®-CLPesticide2 GC columns, optimized for complete separations and short analysis times. Using these new columns, all US EPA Method 8081 organochlorine pesticides are resolved in <9 min. We also show complete separation of these compounds in <5 min. using these columns and a Gerstel MACH column heating system.

[Find out more.](#)

### **Resolving the Benzo(j)fluoranthene Challenge**

*Separate New PAHs Quickly Using the Rxi®-17 GC Column*

Polynuclear aromatic hydrocarbons are a significant, and wide-spread, source of pollution. The US EPA mandates testing of the 16 PAHs they designate as most hazardous; the target list in other countries is expanding and includes new compounds that are difficult to separate. Here we demonstrate the ability of

the Rxi®-17 column to effectively resolve dibenzo pyrene isomers, as well as to separate benzo(j)fluoranthene from benzo(b)fluoranthene and benzo(k)fluoranthene.

[Find out more.](#)

### Choosing a Liner for Semivolatiles Analysis

Liner choice is a critical decision in semivolatiles analysis. Liners containing wool packing are recommended to minimize molecular weight discrimination. Attributes of different types of liners, including the Drilled Uniliner, are discussed.

[Find out more.](#)

### 8-Minute Dual Column Analysis of Organochlorine Pesticides

*Using Rtx®-CLPesticides / Rtx®-CLPesticides2 Columns*

Unique selectivities make the Rtx®-CLPesticides / Rtx®-CLPesticides2 column pair an excellent choice for analyzing pesticides by US EPA Method 8081, or equivalent methods. A 0.53mm ID guard column allows sample injection onto high-efficiency 20m x 0.18mm ID thin film columns, for baseline resolution in greatly reduced analysis time. Sharp, symmetric peaks help assure reliable quantification data.

[Find out more.](#)

### Superior Chromatography for Semivolatile Organics

*Using the Rtx®-5Sil MS Capillary GC Column*

Combining an optimized stationary phase and deactivation that assures unsurpassed inertness and excellent responses for active analytes, Rtx®-5Sil MS columns address the challenging demands of semivolatiles analyses. Phenyl rings in the polymer backbone stiffen the siloxane chain, ensuring thermal stability and reducing bleed. Selectivity is similar to that of conventional 5% diphenyl phases, but improved, e.g.: separation of isomers benzo(b)- and benzo(k)fluoranthene is increased.

[Find out more.](#)

### High Throughput of Semivolatiles Samples by GC/MS

*Using a 20m x 0.18mm x 0.30µm Rxi®-5ms Column*

We developed the 20m x 0.18mm x 0.30µm Rxi®-5ms column to balance the demand for shorter analysis times with the need to maintain both column capacity and column efficiency. Here we establish conditions for eluting more than 90 semivolatiles, including 7 surrogates and 6 internal standards, in less than 12 minutes. Benzo(b) and benzo(k)fluoranthene were resolved well and sample throughput was improved by 75%. This highly inert, low bleed column is ideal for GC/MS analysis.

[Find out more.](#)

### Resolving Benzo(j)fluoranthene from Other PAHs

*Using a Pinnacle™ II PAH Column*

Nineteen polycyclic aromatic hydrocarbons (PAHs), including benzo(b) and benzo(j)fluoranthene, were fully resolved using a Pinnacle™ II PAH column. Greater sensitivity was achieved by coupling UV and fluorescence detection. This HPLC method offers improved resolution compared to standard GC techniques.

[Find out more.](#)

### Rxi®-1ms Capillary GC Column

*For Low Level GC/MS Analyses*

Our new, nonpolar, 100% dimethyl polysiloxane Rxi®-1ms column offers the same superior inertness, ultra-low bleed, and excellent batch to batch reproducibility exhibited by our Rxi®-5ms column. We analyzed a complex mixture of semivolatile analytes, including both acidic and basic compounds, at levels as low as 0.5ng on column. The selectivity, analyte breakdown, peak symmetry, and bleed results shown here are strong recommendations for the new column.

[Find out more.](#)

### Low-Level GC/MS for Semivolatiles in Drinking Water

*Excellent Responses at 10ng On Column, Using an Rxi®-5ms Column*

Using this new column, resolution and peak shapes for 88 semivolatile compounds commonly analyzed in drinking water are exceptionally good at 10ng each on column. Because the Rxi®-5ms column performs well with analytes in a diverse range of chemical classes, we highly recommend it for analyzing complex mixtures of semivolatiles.

[Find out more.](#)

### Fast, Sensitive LC/MS/MS Analysis of Paraquat and Diquat

*Using an API 3200™ Mass Spectrometer and an Ultra Quat HPLC Column*

Developed through collaboration with scientists at AB/MDS Sciex, this analysis allows complete resolution of paraquat and diquat with a simple, isocratic mobile phase. It is significantly faster than conventional methodologies and, with detection limits of 5ppb for paraquat or 0.1ppb for diquat, sensitivity is superior — without preconcentration.

[Find out more.](#)

#### **Analytical Reference Materials for Semivolatile Pollutants**

*Drinking Water: US EPA Method 525.2*

Listed reference mixes include organochlorine pesticides, organonitrogen pesticides, organophosphorus pesticides, PCB congeners, internal standards, surrogates, a performance check mix, and more.

[Find out more.](#)

#### **Excellent Responses in GC/MS Analysis of Semivolatiles**

The newest members of our new line of Rxi® columns, Rxi®-1ms columns, offer the same outstanding inertness, ultra-low bleed, and batch-to-batch reproducibility as our Rxi®-5ms columns. Rxi®-1ms columns provide excellent selectivity and symmetric peaks for the diverse chemicals that can make up a semivolatiles sample.

[Find out more.](#)

#### **Analysis of Semivolatile Organics**

Exceptional inertness and ultra-low bleed enable an Rxi®-5ms column to resolve sub-1ng quantities of acidic or basic analytes under a single set of conditions. In this example analysis, an Rxi®-5ms column separated 93 target analytes in US EPA Method 8270D in less than 18 minutes.

[Find out more.](#)

#### **Monitoring Petroleum Hydrocarbons by Solid Phase Extraction/GC**

New manufacturing processes for our Massachusetts TPH solid phase extraction cartridges reduce extractable contaminants almost to blank levels, and assure more reliable fractionation of aliphatics from aromatics. Large, uniform lots of silica reduce the frequency of verifying fractionation results.

[Find out more.](#)

#### **Reference Mix of Canadian Drinking Water Volatiles**

This mix includes all 19 volatile compounds on the Canadian Drinking Water List. We recommend using an Rtx®-VMS column for the analysis, to assure sharp peaks for early eluters and resolution of the heavier compounds.

[Find out more.](#)

#### **A 12-Minute Analysis for Volatiles**

An Rtx®-VMS column provides rapid, baseline resolution of most volatile analytes in the CLP OLM 04.1 analysis for groundwaters or drinking waters from Superfund sites. A particularly challenging stipulation of the method, 90% resolution of the gaseous components, is easily attained.

[Find out more.](#)

**Want more? Click here to view Environmental Literature**

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## **FOODS, FLAVORS, & FRAGRANCES**

#### **Comprehensive Pesticide Residue Analysis by LC/MS/MS**

< Added May, 2009

Analysis of pesticide residues in foods is complicated by the large number of target compounds. LC/MS/MS analysis using an Aqueous C18 column provides more comprehensive results than GC alone.

[Find out more](#)

#### **Meet New Requirements for Melamine Analysis at 1µg/g in Infant Formula**

< Updated April, 2009

The recent establishment of a 1µg/g safety threshold for melamine in infant foods has led to an immediate need for more sensitive methods. Here we established GC/MS conditions for highly

reproducible analyses and evaluated the effectiveness of both solvent-based and matrix-matched standards. Using this method, melamine and cyanuric acid were reliably detected at and below 1µg/g in infant formula.

[Find out more](#)

### **Prepare Samples in Half the Time**

*Using a Fraction of the Solvent with dSPE*

Simplify and speed up sample preparation with Restek dispersive SPE tubes! Here we show the extraction and clean-up of pesticide residues from olive oil samples — twice as fast as gel permeation chromatography (GPC), with only a fraction of the solvent required for conventional solid phase extraction (SPE).

[Find out more](#)

### **Prevent Fraud with Simple Analysis of Cholesterol and Glycerides**

Estimating cholesterol in food products is complicated, but often is part of the authentication testing of label claims regarding egg content. The method shown here simplifies fraud detection by incorporating glyceride testing. Easy comparison of the chromatographic profiles of egg and egg product (pasta) samples can be made using an Rtx®-65TG column, which is specifically tested to assure excellent separations and a reliable performance for glycerides.

[Find out more](#)

### **Fast, Simple Sample Cleanup**

*Using QuEChERS SPE Tubes*

Quick, Easy, Cheap, Effective, Rugged, and Safe, the QuEChERS ("catchers") method for extracting pesticides from food is based on USDA research and employs a novel dispersive solid phase extraction cleanup (dSPE). QuEChERS methods are convenient, rugged methods that simplify extract cleanup, reduce material costs, and improve sample throughput. Here we demonstrate the effectiveness of QuEChERS sample cleanup using a multiresidue analysis of pesticides on strawberries.

[Find out more.](#)

### **Rapid Screening Method for Carbamates in Orange Oil**

*Using an Ultra Carbamate HPLC Column*

EPA Method 531.1 addresses the analysis of carbamate pesticides in water, but not in more complex matrices, which often contain interferences and require time-consuming sample preparation. We developed an easy, accurate screening method for carbamates in a complex matrix using an Ultra Carbamate HPLC column in conjunction with the Leco Unique TOF- MS. This method requires no sample preparation and provides fast analysis times, significantly increasing sample throughput.

[Find out more](#)

### **Using Thermal Desorption to Enhance Aroma Profiling by GC/MS**

*Lower Detection Limits with Latest Technology*

Thermal desorption offers an automatic, high-sensitivity alternative to conventional liquid extraction methods for aroma profiling by GC/MS. It allows vapor profile constituents to be cleanly separated from the sample matrix and often facilitates selective purging of volatile interferences. This ensures that the vapor profile analyzed is most representative of the aroma perceived by consumers and that key compounds can be identified and measured at the lowest levels possible.

[Find out more](#)

### **High Sensitivity Melamine GC/MS Analysis of Cat Food**

*Modified Conditions Save Costs and Reduce Maintenance*

Melamine contamination was implicated in a large pet food recall that occurred in 2007 when animals died after eating contaminated pet food. Here, a modified GC/MS method, based on an FDA method, was used to analyze for melamine & related compounds cyanuric acid, ammelide, and ammeline in dry cat food. Analytes were easily identified by retention time matching and mass spectra.

[Find out more.](#)

### **Rapid Characterization of Garlic Volatiles—No Sample Prep Requires!**

*Using Headspace GC/MS and an Rxi®-5ms Capillary Column*

Chromatographic methods for garlic and garlic powder are used by the food and dietary supplement industries to monitor product quality. Here we present a headspace gas chromatography mass spectrometry (HS GC/MS) method for garlic flavor and odor components using an Rxi®-5ms column. This method eliminates sample preparation making the bench work simple and fast. The experimental set-up is ideal for both screening analysis and low-level trace analysis.

[Find out more.](#)

### **Simple, Reliable HPLC Analyses of Organic Acids**

*Using Water-Compatible Allure® or Ultra C18 Columns*

Commonly used organic acid methods (e.g. AOAC method 986.13) depend on reversed phase HPLC and C18 columns, however these columns are vulnerable to phase collapse when used with the aqueous mobile phases necessary for optimal organic acid analysis. Restek's Ultra Aqueous C18, Allure® Aqueous C18, and Allure® Organic Acids columns all withstand phase collapse and resolve organic acids in a 100% aqueous mobile phase, compared to a conventional C18 column which shows a complete loss of retention.

[Find out more.](#)

### **Analysis of Nitrofurans in Honey**

*Using LC/MS/MS and an Ultra C18 Column*

Nitrofurans are a class of veterinary antibiotics used to increase growth rate and prevent or treat disease in animals. Determining levels of nitrofurans in animal tissue, or even products such as honey, is important in studying drug resistance and allergies in humans. The Ultra C18 HPLC column is an excellent choice for LC/MS/MS analysis of nitrofurans at low levels in complex matrices such as honey. Here we show excellent sensitivity, resolution, and peak shape at trace levels.

[Find out more.](#)

### **Evaluating Undiluted Essential Oils**

Essential oils are complex natural products containing many components across a wide concentration range. This complexity makes their analysis especially challenging. Many methods involve sample dilution to prevent syringes from clogging but this is not always necessary and can compromise analytical quality, especially for less abundant compounds near the solvent peak. Here we provide steps for optimizing your method to allow essential oils to be analyzed without dilution.

[Find out more.](#)

### **Monitor Antioxidants in Tea Extract**

*Using an Ultra Aqueous C18 HPLC Column and Unique® TOFMS*

An Ultra Aqueous C18 column enables you to use the conditions most effective for this analysis: gradient elution in high aqueous mobile phases. The C18 chains will not collapse in the presence of a high water content. Use this chromatographic system to extract data for specific compounds of interest and to manually inspect spectra for phenolic glycosides, esters of phenolic acid, or other compounds.

[Find out more.](#)

### **Robust 9-Minute GC Analysis of Cholesterol**

*Excellent Sample Throughput with an Rxi™-5ms Column*

Conditions are established for analyzing both derivatized and underivatized cholesterol on a highly inert Rxi™-5ms column. Methods described include both an isothermal analysis for use when interferences are minimal, but sample throughput is critical, and a temperature program for use when separation of analytes from contaminants or interfering compounds is the primary concern. Results for both derivatized and underivatized samples were highly reproducible.

[Find out more.](#)

### **Rapid, Reproducible HPLC Analysis for Flavonoids in Cocoa**

*Using a Leco Unique® LC-TOFMS System and an Ultra Aqueous C18 Column*

We separated flavonoids in cacao or cocoa powder samples and returned conditions to the initial mobile phase composition in 15 minutes. For compounds common to both samples, retention times were equal to within 0.01 seconds. Flavonoid marker compound profiles for 38%, 49%, and 65% cacao were easily distinguished.

[Find out more.](#)

### **80% Faster GC/MS Analysis of Essential Oils**

A 10-meter, 0.10mm ID, 0.10µm film Rtx®-5 column reduces analysis time for bergamot oil or patchouli oil by 80%, for five-fold greater sample throughput and sharply reduced cost per analysis. Sample resolution is unchanged for bergamot oil and is slightly improved for patchouli oil.

[Find out more.](#)

### **trans Fat: Resolving cis and trans FAME Isomers by GC**

The highly polar Rt-2560 stationary phase has the selectivity needed for resolving cis and trans FAME isomers to comply with US FDA food labeling guidelines. Restek reference materials will help you

accurately characterize your materials.

[Find out more.](#)

### Detecting Illegal Dyes in Foods: Identify Four Sudan Dyes in One HPLC Analysis

Using an Ultra Aqueous C18 column, a simple, isocratic mobile phase, and detection at two UV wavelengths (488nm for Sudan I and II and 520nm for Sudan III and IV), the four dyes are separated and identified in approximately 20 minutes.

[Find out more.](#)

### Simple HPLC Analysis for Sudan Dyes

Sudan dyes are illegal as food additives according to the US FDA and the EU. A reversed phase HPLC separation of Sudan I, Sudan II, Sudan III, and Sudan IV (Scarlet Red) is simple, yet efficient, requiring only a simple mobile phase, isocratic elution, and detection at two wavelengths. An Ultra Aqueous C18 column provides the selectivity needed to assure the separation.

[Find out more.](#)

### Malachite Green and Leucomalachite Green Analysis

Illegal use of malachite green (MG), an inexpensive fungicide, can allow MG to enter water cycles, where it is easily absorbed by fish tissue, and thus enters the human food supply. Reversed phase HPLC often is used to analyze for MG and its stored metabolite, leucomalachite green. Methods that facilitate detection of both compounds are discussed.

[Find out more.](#)

**Want more? Click here to view Foods, Flavors, & Fragrances Literature**

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## PHARMACEUTICAL

### Improve Pass Rates for Residual Solvents by USP <467>

#### Using the new Rxi®-624Sil MS GC Column

< Added October 2009

Not all G43 columns are equivalent. New Rxi®-624Sil MS columns reliably produce improved resolution and sensitivity, increasing system suitability pass rates and ensuring more productive laboratory time.

[Find out more](#)

### Achieve Faster Analyses on Any HPLC System Using Ultra II™ Columns

< Added July 2009

Significant savings can be obtained without the costly upgrade to UHPLC. This famotidine example illustrates how a 90% reduction in analysis time and solvent volume resulted from strategic HPLC column choices.

[Find out more.](#)

### Column Choice: A Critical Factor for Successful UHPLC Integration

< Added April 2009

Column choice is a critical factor in successfully transferring methods between UHPLC and HPLC. Here, we discuss the column qualities that contribute to the successful integration of UHPLC technology.

[Find out more.](#)

### Novel Column Chemistry—High Impact, Low Cost Technology

< Added April 2009

Novel column chemistries are a simple change in an already budgeted consumable that can lead to optimized and more reliable methods—giving a fast return on a minimal investment.

[Find out more.](#)

### Beyond C18 — Increase Retention of Hydrophilic Compounds Using Biphenyl Columns

The Pinnacle® DB Biphenyl column offers enhanced retention and alternate selectivity for aromatic, unsaturated, and sulfur-containing hydrophilic compounds. Here we demonstrate significantly greater retention of sulfone- and sulfoxide-containing drug probes, compared to phenyl, phenyl hexyl, and alkyl (C18) columns. Only the Biphenyl column, using pi-pi interactions, separated both test probes to  $k' > 2$ ,



the level needed to ensure separation from unretained matrix contaminants.

[Find out more.](#)

## **Two Options for Analyzing Potential Genotoxic Impurities in Active Pharmaceutical Ingredients**

Two options for the analysis of PGIs in API have been developed by Merck and Restek to meet different laboratory needs. The first option is a fast method for the analysis of sulfonate esters on the Rxi®-5Sil MS column. The second option is a comprehensive method for the analysis of both sulfonate esters and alkyl halides on the Rtx®-200 column. Both methods require very little sample preparation, which helps increase laboratory productivity.

[Find out more.](#)

## **How do intrinsically base-deactivated phases work?**

Analyzing basic compounds can be somewhat troublesome on traditional alkyl stationary phases, namely conventional C18 columns. This is largely due to the interaction of analyte molecules with silanol groups present on the silica surface. To better understand the workings of silanol interactions, it is important to consider the composition of the support material. Silica is the most commonly used support in the production of HPLC columns, mainly because it is well-suited to high-pressure chromatographic separations, giving high efficiencies and good reproducibility. Silica offers bed and pressure stability and is highly porous, which ultimately gives rise to its large surface area, increased bonding capacity and high peak efficiencies. Silica also possesses widely-studied and effective bonding chemistries, making possible diverse analyte selectivities through a wide variety of bonded stationary phases.

[Find out more.](#)

## **Multi-task with an Ultra IBD Column**

### *A Versatile Column with Many Applications*

The Ultra IBD HPLC column addresses the inherent problems attributed to linear alkyl phases, providing excellent peak shape for basic compounds and heightened retention of hydrophilic compounds. Here we demonstrate the versatility of this polar embedded column, and its ability to overcome some of the common limitations of conventional C18 columns. The versatility of the Ultra IBD makes it an excellent tool for the practicing method developer.

[Find out more.](#)

## **Easy Transfer of HPLC Methods to UHPLC**

### *Using Fully Scalable Pinnacle™ DB Columns*

Ultra High Pressure Liquid Chromatography (UHPLC) is a rapidly growing technique that can provide faster analysis times. Scaling conventional HPLC methods down to UHPLC can be an effective way to take advantage of shorter run times and increase sample throughput. Here we review the factors that must be considered when scaling down an existing method. A sulfonamides method transfer is used as an example; chromatograms and formulas for all required calculations are included.

[Find out more.](#)

## **Explaining the Small Particle Advantage**

### *Faster Sample Throughput on a 1.9µm Pinnacle™ DB column*

Small particle HPLC columns can offer faster analysis times but only if the particle size distribution is tightly controlled. Restek's 1.9µm Pinnacle™ DB columns have tight, symmetric particle size distributions and contain no particles less than 1µm. Here we demonstrate how our stringent quality requirements translate into faster, more reproducible results compared to competitor columns. Greater column efficiency and reproducibility mean faster throughput and more consistent results.

[Find out more.](#)

## **Revised USP 467 Residual Solvent Method**

### *Satisfy New Method Requirements with Restek Columns and Standards*

The United States Pharmacopeia recently revised the general chapter on residual solvent analysis, USP <467>, to mirror the International Conference on Harmonization (ICH) guidelines for the identification, control and quantification of residual solvents. This revision, effective July 1, 2007, replaces previous methods that were not consistent with the ICH guidelines. Here we provide an overview, chromatograms, and technical tips for successfully running the new procedure.

[Find out more.](#)

## **Optimize Selectivity & Efficiency in UHPLC Separations**

### *With More Stationary Phase Choices on 1.9µm Pinnacle™ DB HPLC Columns*

Ultra-high pressure liquid chromatography (UHPLC) can significantly increase efficiency and produce



faster separations. The small particle sizes used in UHPLC improve efficiency; however selectivity is still the most important factor affecting compound resolution. Here we demonstrate the importance of stationary phase choice in UHPLC separations. By optimizing selectivity for your analytes of interest, faster separations can be achieved without compromising resolution.

[Find out more.](#)

### **Choosing the Correct Liner for Headspace Injections**

*Pass System Suitability Requirements with a Smaller Bore Liner*

For headspace applications involving a transfer line, a smaller bore liner (preferably 1 mm) can improve system suitability pass rates. This lower liner volume decreases band broadening and allows quicker sample transfer by increasing the linear velocity through the inlet.

[Find out more.](#)

### **Simplifying Column Selection for ICH Residual Solvents**

*Using a Retention Time Index for Fast and Accurate OVI Separations*

To make column selection for residual solvents easy, Restek has benchmarked the ICH Class 1, 2 and 3 residual solvents on our most popular OVI columns.

[Find out more.](#)

### **Separating NSAIDs through Aromatic Selectivity**

*Improve Retention by Using an Allure® Biphenyl HPLC Column*

Non-steroidal anti-inflammatory drugs (NSAIDs) are typically separated on C18 phases. Separations on our Allure® Biphenyl HPLC column are based on pi-pi interactions, resulting in optimized retention and selectivity. Increased retention requires higher organic content in the mobile phase, increasing desolvation efficiency in LC/MS. Simple mobile phase changes enhance selectivity, making this column a great alternative to conventional phenyl phase columns, especially in method development.

[Find out more.](#)

### **Assaying Local Anesthetics by GC/FID**

*Optimizing System Suitability, Using an Rxi™-5ms Column*

An Rxi™-5ms column and a wool-packed inlet liner provide the stability and inertness needed for these basic, active analytes. Chromatography from a six-replicate system suitability analysis was well within normal acceptance criteria. USP tailing factors were approximately 1.00 for all analytes; retention times and area responses were very stable.

[Find out more.](#)

### **Optimized RP-HPLC Analysis of Hydroxybenzoic Acids**

*An Ultra Aqueous C18 Column Provides the Best Retention of Polar and Weakly Polar Compounds*

Among hydroxybenzoic acids, hydroxyl groups on the benzene ring vary by position and number, creating differences in overall polarity and solubility. The unique bonding chemistry of the Ultra Aqueous C18 phase assures high resolving power, the best separations across a broad range of analyte polarity, and compatibility with 100% aqueous mobile phases.

[Find out more.](#)

### **8-Minute GC Analysis of Residual Solvents**

Single-injection, dual-column detection/confirmation assay is feasible for regulated solvents in pharmaceutical products, but no temperature program provides sufficient resolution on both columns. Using a Restek G43/G16 column pair and independent temperature programs in a Gerstel MACH column heating system, we analyzed and confirmed 23 Class 2 solvents in 8 minutes.

[Find out more.](#)

### **Simple, Optimized HPLC Analysis of Catecholamines**

An Allure™ PFP Propyl column exhibits the retention needed to resolve these active, basic compounds, without derivatization or ion-pairing agents. Selectivity can be adjusted simply by changing the organic modifier in the mostly aqueous mobile phase.

[Find out more.](#)

### **RP-HPLC Analysis of Selective Serotonin Reuptake Inhibitors**

Two Restek columns provide good retention, selectivity, and peak shape for SSRIs, without ion-pairing chromatography. Choose an Allure™ Basix column and neutral pH conditions, or an Ultra PFP column and acidic conditions — either will improve performance for these basic compounds, relative to alkyl phases.

[Find out more.](#)

### Developing a Simple, Rugged HPLC Assay for Tetracyclines

Overall, three columns provide excellent repeatability in a simple analysis: Allure™ PFP Propyl, Ultra C18, and Allure™ Biphenyl. An Allure™ Biphenyl column employs  $\pi$ - $\pi$  bonding with the ring structures of the tetracycline molecules to ensure good capacity, high selectivity, and the most symmetric peaks.

[Find out more.](#)

### Using $\pi$ - $\pi$ Interactions to Enhance Selectivity for Unsaturated Compounds

*The Allure™ Biphenyl HPLC Column*

Relative to phases that separate via hydrophobic or polar interactions, the Allure™ Biphenyl stationary phase offers better retention, selectivity, and efficiency, when analyzing compounds with differences in the numbers and locations of unsaturated bonds in the hydrocarbon ring structure.

[Find out more.](#)

**Want more? Click here to view Pharmaceutical Literature**

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## AIR SAMPLING

### New Market Opportunities for VOC Air Sampling Labs

< Added May, 2009

VOC testing laboratories can expand into new markets using existing air sampling canisters and thermal desorption tubes, due to the broad applicability of these techniques.

[Find out more](#)

### Early Detection of Structural Mold with SilcoCan™ Air Sampling Canisters

Early detection of structural mold is critically important to protecting human health and property values. Restek SilcoCan™ canisters allow low levels of microbial volatile organic compounds (MVOCs) to be detected in air samples before mold can be seen, providing an opportunity for structural repair and safer living conditions. The inertness of these canisters provides an exceptional storage environment, particularly for polar and high boiling point compounds.

[Find out more.](#)

### Sampling Volatile Organic Compounds in Air

*Restek Sampling Equipment Helps Assure Accurate Data*

TO-Can™ air sampling canisters are electropolished and extensively cleaned, to provide a high-quality, passivated surface for improved stability of analytes listed in USEPA Method TO-15 (ambient air monitoring). For reactive compounds, such as sulfur-containing components, SilcoCan™ canisters are your best choice — our exclusive Siltek® surface treatment ensures exceptional inertness and maximum sample stability, even for 1-20ppb sulfur compounds.

[Find out more.](#)

### Enhancing Air Monitoring Methods with Thermal Desorption

The use of carbon disulfide extraction as an air monitoring method for vapor-phase organic compounds (VOCs) is fundamentally limited. Thermal desorption is a complementary gas extraction technique whereby sorbent tubes are heated in a flow of carrier gas. Here, we summarize the key advantages of thermal desorption versus solvent extraction.

[Find out more](#)

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## SAMPLE PREPARATION

## Superior Fractionation of Extractable Petroleum Hydrocarbons

*Get More Accurate Results Using Restek SPE Tubes*

The Massachusetts Dept. of Environmental Protection's "Method for the Determination of Extractable Petroleum Hydrocarbons" is a method commonly used for underground storage tank testing. Commercially available SPE tubes are convenient, but vary in quality and consistency. Here we show that Restek's EPH SPE tubes have the highest silica activity and lowest overall level of coextractables among the tubes tested. These characteristics translate into more reliable and reproducible results.

[Find out more.](#)

## Faster Extraction and Cleanup of Pesticide Residue Samples

*With QuEChERS Products*

If you are frustrated by the time and cost involved with pesticide sample cleanup, we suggest you try the simple and economical QuEChERS method. Follow this approach to remove sugars, lipids, organic acids, sterols, proteins, pigments, and excess water, any of which often are present. To make your work even simpler, we offer QuEChERS extraction products in a variety of standard sizes and formats, and custom products by request.

[Find out more.](#)

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## BIOANALYTICAL

## Reduce Downtime with Robust Lipidomics Method

Labs can save days of downtime by using an Rxi®-5ms column in assays similar to this high-throughput test method for cholesterol and low-level sterol metabolites. Here, extremely reproducible results were obtained using an Rxi®-5ms column, which gave highly consistent separations — even after 10,000 injections. Consistent performance and long column lifetimes increase productivity by reducing downtime associated with column changes and revalidation.

[Find out more](#)

## Easily Resolve Oxytocin PEGylation Reaction Products

*Using Viva Wide Pore HPLC Columns*

Viva Wide Pore HPLC columns are ideal for the separation of large molecules, as target analytes can enter the larger pores and access more of the surface area. Here we demonstrate the added retentive power of these columns, using the PEGylation of oxytocin as an example. Separation of these large, closely related compounds demonstrates the suitability of Viva Wide Pore columns for monitoring PEGylation reactions, and other large molecule applications.

[Find out more](#)

## Improve Characterization of Complex Protein Digests

A Viva C18 wide pore HPLC column resolves a tryptic digest of bovine serum albumin primarily into 1-2 peptide peaks, versus peaks of 3 or more peptides typically provided by conventional C18 columns. This superior resolution helps ensure more reliable identification of peptides in complex mixtures.

[Find out more.](#)

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## RESTEK PERFORMANCE COATINGS

## Sulfinert® Treated Systems Preserve ppb Levels of Active Sulfur Compounds

Many volatile sulfur compounds adsorb strongly to the metal surfaces encountered during sampling, transfer, and storage. This adsorption can cause falsely low sample results and also prolong analysis

cycle times. Data shown here demonstrate the effectiveness of Sulfinert® treatment of system components. Sulfinert® treatment reduces adsorption, resulting in more accurate quantitation of sulfur compounds and reduced cycle times.

[Find out more.](#)

### **Assure Accurate Sampling and Reliable Sample Purity**

*Restek Sampling System Treatments Prevent Adsorption, Protect Components*

Siltek®/Sulfinert® surface treatments improve component performance by significantly reducing corrosion and adsorption problems in the sampling and sample transfer pathways. These treatments improve sampling accuracy, increase component lifetime, and cost less than super alloys. Treatments can be applied to cylinders, valves, fittings, tubing and more, and demonstrably improve detection of low-level sulfur, nitric oxide, and mercury compounds in a wide variety of applications and industries.

[Find out more.](#)

### **Prevent Mercury Loss During Transport and Storage**

*Use Siltek® Surface Treatment on Steel Components*

As concerns about mercury in the environment grow, new regulations and testing requirements emerge. To ensure accurate results, sample storage and transfer systems must be inert to elemental mercury. Here we demonstrate that Siltek® treatment provides an unreactive surface compared to stainless steel. Data shown demonstrate that Siltek® treatment of sampling systems will improve analytical accuracy. Siltek® treatment is available on many stock items and custom components can be treated upon request.

[Find out more.](#)

### **Protect Sample Integrity and Prolong Sampling System Lifetime**

*Using Hydroguard™ Deactivated/Silcosteel® Treated Tubing*

Tubing deactivated with Hydroguard™ and treated with Silcosteel® is preferred for situations in which water vaporization is encountered, such as in purge and trap systems. Hydroguard's™ unique deactivation chemistry creates an outer surface that prevents water vapor from contacting the Silcosteel® treated stainless steel surface below. This protected inert surface allows active analytes to pass through the tubing without adsorbing to the surface.

[Find out more.](#)

### **Extend Process Component Lifetime and Enhance Durability**

*Restek Surface Treatments Improve Sampling and Transfer Component Performance*

In sampling or process stream pathways, Siltek®/Sulfinert® treated tubing reduces uptake of active (e.g., sulfur) compounds by orders of magnitude, relative to untreated tubing, for reliable data about stream composition. Silcosteel®-CR treated tubing improves corrosion resistance by up to 10X over untreated tubing, reducing the need for maintenance and helping to ensure the purity of the sample or process stream.

[Find out more.](#)

### **Superior Protection Against Corrosion: Silcosteel®-CR**

*Treated Fittings and Tubing*

Silcosteel®-CR treatment is highly effective protection for stainless steel exposed to hydrochloric acid, nitric acid, or marine environments: in independent tests, Silcosteel®-CR treatment upgraded the corrosion resistance of 300-grade stainless steel by an order of magnitude. Now, electropolished stainless steel tubing and a wide selection of world-renowned Swagelok® fittings are available with Silcosteel®-CR treatment, from stock. Custom treatment of system components also is available.

[Find out more.](#)

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## **GENERAL INTEREST**

### **How Much Sensitivity is Needed in a Leak Detector?**

< Added, September 2009

Restek's Electronic Leak Detector is sensitive enough to find leaks below instrument pressure decay test

levels and is available at a fraction of the cost of other hand-held units.

[Find out more](#)

### **How to Understand and Deal with Overloading in GC**

*Content previously published in Separation Science*

< Added, June 2009

Overloading GC columns affects peak symmetry and can cause coelutions and retention time shifts. This article provides tips on diagnosing and correcting overloading problems.

[Find out more](#) (241kb pdf)

### **Minimizing Decomposition of Components during GC Analysis**

*Content previously published in Separation Science*

< Added, June 2009

Many compounds are susceptible to thermal degradation. This article explains how to diagnose and reduce analyte decomposition in both the GC inlet and column.

[Find out more](#) (1.3mb pdf)

### **Dual Vespel® Ring Inlet Seals**

*Washerless, Leak-Tight Seals for Agilent GCs*

< Added, May 2009

Restek's Dual Vespel® Ring inlet seal gives you a better seal with fewer parts. Data show that the soft Vespel® material has a much lower leak rate than a metal seal. Also, since less torque is required for installation, user variability is reduced.

[Find out more](#)

### **Troubleshooting the Acetonitrile Shortage**

< Added, March 2009

The current acetonitrile shortage has labs scrambling to adjust to limited supplies and increased costs. Here we discuss short- and long-term strategies to reduce acetonitrile consumption, including method development based on alternative solvents.

[Find out more](#)

### **Reducing Column Internal Diameter (HPLC)**

Scaling down column size is simple to do and can help reduce solvent use. Here is an easy-to-follow example that teaches you how to reduce column internal diameter.

[Find out more](#)

### **Under Pressure?**

*Reduce System Stress by Backflushing Your HPLC Column*

High pump pressures can be caused by heavily retained impurities building up in the head of the analytical column. Such contamination can cause poor chromatography, usually in the form of broad, split, or misshapen peaks, and ultimately can compromise results. Backflushing a contaminated analytical column, using the procedure outlined here, can help restore column performance and reduce pump pressure and system strain.

[Find out more](#)

### **Selecting the Right HPLC Guard Column**

Understanding the significant factors that affect HPLC guard column performance can help you protect your analytical column and save money by extending analytical column lifetime. Here we review available options in packings, dimensions, cartridge holders, and filters to help you select the best guard column system for your application.

[Find out more.](#)

### **The Forgotten Septum**

*How to Correctly Diagnose the Source of Bleed Contamination*

Septum bleed is generally attributed to the injection port septum; however, the vial cap septum also can be a source. Bleed contamination from any septum can cause interfering peaks and lead to inaccurate results, so it is important to correctly identify the source and understand how to eliminate or minimize bleed level. Here we discuss how to diagnose the source of the bleed and review considerations that can reduce the amount of contamination.

[Find out more.](#)

### **Warm-up Before You Run**

*Why Conditioning Your Inlet Parts After Maintenance Is Good Practice*

Background noise in a gas chromatography system can be eliminated by conditioning the system prior to sample analysis. In this article, we discuss warm-up procedures and use liners and liner installation to demonstrate the importance of conditioning the system to remove background peaks. Investing a little time in warming-up the system pays big dividends by preventing costly coelutions and avoidable reanalyses.

[Find out more.](#)

### **Affected by the Helium Shortage?**

#### *Switch Your GC Carrier Gas to Hydrogen*

Faced with helium shortages and prices that continue to soar upwards like a runaway party balloon? Consider switching to hydrogen as your carrier gas. High-quality hydrogen is readily available from either high-pressure cylinders or hydrogen generators. It is cost-effective and provides shorter analysis times (by half if running isothermally) than helium and many times yields better separations.

[Find out more.](#)

### **How to Maximize Column Oven Accuracy and Stability**

#### *Tips & Techniques for Long-term Instrument Performance*

Simple tips and techniques are presented to improve the accuracy and precision of your data by keeping your column oven at peak performance. Details on reducing variation around the oven set point through calibration and maintenance are given.

[Find out more.](#)

### **Get Connected!**

Do you need to connect a GC analytical column to a guard column or transfer line? Or repair a broken column? How about connecting two columns for primary and confirmation analysis from a single injection? Restek's extensive selection of GC connectors makes all of these connections possible. Here we review differences among our connectors and answer some frequently asked questions about our popular Press-Tight® connectors.

[Find out more.](#)

### **Considerations for Adapting an HPLC Method for MS Detection**

Most HPLC methods can be coupled with mass spectral detection provided appropriate attention is given to pump capabilities, column diameter, and system plumbing, and to sample matrix and mobile phase composition. Here we discuss these considerations and provide tips on adapting your method to include mass spectral detection using either electrospray ionization or atmospheric pressure chemical ionization.

[Find out more.](#)

### **Using Micropacked Columns**

Micropacked columns are 1-2 meter, 0.75-1.0mm ID packed stainless steel columns with performance characteristics intermediate between conventional packed columns and capillary columns. They are inexpensive, very durable, and easy to install and operate. They have a wide range of applications, but are especially useful for analyses of gas mixes, including sulfur compounds or light hydrocarbons, for which a packed column is needed to obtain baseline separations of sample components.

[Find out more.](#)

### **Restek's Knowledgeable Technical Support**

#### *Real People, Real Time and Real Results for YOU!*

Restek's Technical Support group includes more than 64 individuals with extensive experience in chemistry, chromatography, engineering, and related fields. When you call Restek, you have access to the combined expertise of everyone in this group. With more than 110 international distributors and dealers in 81 countries, we can understand and respond to your lab's unique challenges whether you are in North America, South America, Africa, Asia, Europe, the Pacific Rim or elsewhere.

[Find out more.](#)

### **Commonly Asked GC Questions**

The Restek Chromatography Information Services Group answers hundreds of questions each month. The answers provided here deal with inquiries about guard column chemistry, column temperature limits, ghost peaks in GC/MS analyses, pesticides breakdown on cyano-phase columns, and column cage options.

[Find out more.](#)

### **How to Condition a New Capillary GC Column**

Proper conditioning is essential for optimal performance from a capillary GC column, but inexperienced

chromatographers might not know the proper procedures for installing and conditioning a new column. Here, we summarize our recommendations for installation and conditioning procedures.

[Find out more.](#)

### **Leak Checking a GC System**

Analysts should use an electronic leak detector when installing a new column or fitting, changing a cylinder, or troubleshooting the system. The portable, reliable, easy-to-use Restek Electronic Leak Detector reveals minute leaks without contaminating the system.

[Find out more.](#)

### **Preventing Septum Problems**

Handy tips and tools for choosing the right septum for your application and instrument. Includes an overview of common septum problems including coring and bleed. Guidelines help you avoid extraneous peaks and optimize your system's performance.

[Find out more.](#)

### **How Hot is Your Septum?**

Inlet design, including placement of the heating element, differs among manufacturers and as a result the temperature at the septum differs from the actual set point and the degree of this difference varies among manufacturers. Septa brands, however, are given a single maximum operating temperature. Here we demonstrate the temperature gradients within inlets for several popular GC models and discuss the pros and cons of hotter and cooler inlets.

[Find out more.](#)

### **Supplies for Agilent Instrument Injection Ports**

*EZ Twist Top™ Split/Splitless Port for Agilent GCs*

Using our unique EZ Twist Top™ Injection Port, Septum Nut Removal Tool, and Inlet Liner Removal Tool, you can reduce maintenance time and frustration, eliminate tangled gas lines that can lead to leaks, and avoid contact with hot surfaces. The gas lines are attached to the EZ Twist Top™ Shell Weldment, not to the weldment — they are under the GC cover and cannot interfere with routine injection port maintenance. Changing inlet liners becomes a quick and simple task.

[Find out more.](#)

### **Injection Port Maintenance with FastPack™ Inlet Kits**

Regular injection port maintenance helps ensure the best results from your analyses, and helps minimize downtime. Each FastPack™ inlet kit includes all the parts you need to perform routine maintenance — inlet liner (choose from four styles), O-ring, inlet seal and inlet seal washer, and septum — in a sealed Mylar® bag.

[Find out more.](#)

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These publications are available in printed form or online, as downloadable pdf files.

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