

# Foods Flavors & Fragrances In-Review

Restek manufactures many chromatography columns and sample preparation products for foods, flavors, or fragrances analyses.

Helpful **free technical literature** relative to these applications is summarized in this review. To obtain any of these publications, simply check and return the enclosed business reply card, or visit our website:

**[www.restekcorp.com](http://www.restekcorp.com)**



# Foods

## Analysis of Cholesterol and Other Dietary Sterols (lit. cat.# 59581)

Analyze many sterols without derivatization, using inert capillary GC columns. Capillary GC is a time-saving, efficient, and accurate approach for qualitative and quantitative analyses of sterols. Nonpolar stationary phases generally are suitable for monitoring dietary sterols, but a more polar column sometimes is needed to resolve complex mixtures. This 2-page note describes and illustrates analyses of derivatized and underivatized sterols.

## Analyzing Free Fatty Acids (lit. cat.# 59583)

Avoid derivatizing samples and save time, effort, and expense

Typical sample preparation procedures for fatty acids analysis call for derivatizing these analytes, but a properly designed GC analysis of the free acids saves valuable time, effort, and materials. Read this 4-page note for information about selecting a column, and steps to take to ensure accurate results, when analyzing free fatty acids.

## High-Resolution Analyses of Fatty Acid Methyl Esters (FAMES) by Gas Chromatography (lit. cat.# 59489A)

Characterizing fats and oils, or determining fat content in food, calls for highly efficient separations of fatty acid methyl esters (FAMES) on capillary GC columns. A properly chosen column can provide accurate information about total fat, *trans* fat, or total omega-3 polyunsaturate content.

Polyethylene glycol-type stationary phases typically are used for separating, identifying, and quantifying saturated and unsaturated FAMES. More polar biscyanopropyl phases are needed to resolve *cis* and *trans* isomers of polyunsaturates or quantify total *trans* fat. This 4-page note discusses these challenging separations.

## HPLC Analysis of Vitamins (lit. cat.# 59181)

Monitor fat-soluble or water-soluble vitamins in foods or dietary supplements

The need to accurately quantify vitamins in food products and dietary supplements necessitates simple, reliable, and accurate analytical procedures. Our 2-page note describes an HPLC column and conditions for analyzing fat-soluble vitamins and equivalent information for analyzing water-soluble vitamins.

## Detection of Synthetic and Natural Antioxidants in Food (lit. cat.# 59582)

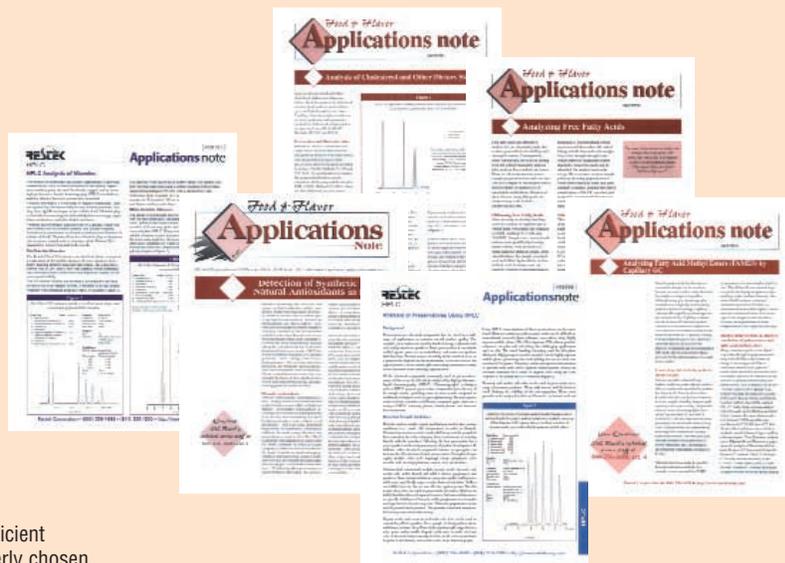
Analyze antioxidants, using capillary GC

Phenolic antioxidants (BHA, BHT, etc.) can be analyzed simultaneously—quickly and effectively—on an intermediate-polarity capillary GC column. In addition, inert capillary GC columns save time in tocopherols analysis because the analytes do not have to be derivatized. This 2-page note describes analytical columns and conditions for antioxidants analyses.

## Analysis of Preservatives, Using HPLC (lit. cat.# 59398)

Optimize retention and selectivity

HPLC is a powerful tool for quantifying these compounds in food and beverage products. Analyses illustrated in this 6-page note include benzoic and sorbic acids, parabens, phenolic antioxidants, and tocopherols.



# Nutraceuticals

## Analyzing Nutraceutical Products by Liquid and Gas Chromatography (lit. cat.# 59364)

HPLC and GC methodologies meet the varied challenges of herbal products analysis

HPLC analyses of allicin in garlic, hyperforin in St. John's wort, and phenolics in Echinacea, and GC analysis of fatty acids in saw palmetto, described in our 4-page note, show HPLC and GC to be excellent tools for analyzing marker compounds in botanical materials.

## The Institute for Nutraceutical Advancement (INA) Validates GC Methods for Saw Palmetto, Using Rtx®-5 and Stabilwax® Columns (lit. cat.# 59136)

Gas chromatography is a useful tool for monitoring marker compounds in saw palmetto

Among the methods established by the INA are capillary GC analyses of fatty acids (as FAMES) and of phytosterols in saw palmetto. This 2-page note presents the analytical conditions for these analyses, using Stabilwax® and Rtx®-5 columns, respectively.

## Determination of Omega-3 (n-3) and Omega-6 (n-6) Fatty Acid Composition in Evening Primrose Oil, Flax Seed Oil, Black Currant Oil, and Borage Oil (lit. cat.# 59128)

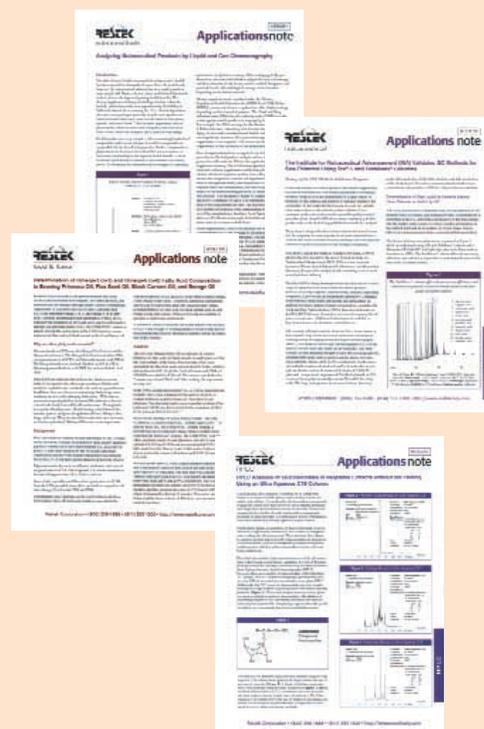
Capillary GC is an ideal approach to monitoring essential fatty acids in plant oils

This 4-page note describes and illustrates capillary GC analyses of omega-3 and omega-6 essential fatty acids in plant oils. The polar polyethylene glycol-based column resolves saturated and monounsaturated FAMES from the EFAs of interest, and resolves the isomers of linolenic acid as well.

## HPLC Analysis of Glucosinolates in Vegetable Extracts, without Ion Pairing, Using an Ultra Aqueous C18 Column (lit. cat.# 59335)

Convenient, reproducible analyses for hydrophilic molecules with widely varying polarity

Glucosinolates with hydrophilic functional groups are very difficult to retain by conventional reversed phase HPLC, and when the functional groups in a sample are diverse, polarity can differ widely, complicating the problem. Until now, reversed phase HPLC with an ion pairing reagent has been the inconvenient, but necessary, approach to these analyses. This 2-page note describes a column and conditions for analyses of glucosinolates, without ion pairing.



# Flavors and Fragrances

## Analyzing the Heat Level of Spicy Foods, Using an Ultra C18 HPLC Column

(lit. cat.# 59199)

*Add zest to spicy foods—but keep their analysis bland*

As society's taste for spicy foods grows, so does the need to test and classify raw materials and final products for pungency. This 2-page note describes an HPLC column and analytical conditions for monitoring capsaicin and related compounds - major contributors to "heat" levels in chili pepper-containing foods. Samples require only minimal preparation, and results can be converted to traditional organoleptic Scoville heat units (SHU).

## Analysis of Vanillin and Ethyl Vanillin in Vanilla Flavors, Using Ultra C8 Column

(lit. cat.# 59186)

*A fast, efficient, and sensitive HPLC analysis for primary flavor components*

AOAC Method 990.25 describes an HPLC analysis of flavor compounds in vanilla extract and artificial vanilla flavors. The analysis takes approximately 40 minutes, and the ethyl vanillin peak is significantly broadened. An Ultra C8 column and conditions presented in our 2-page note ensure a more efficient analysis, while reducing the run time by 15 minutes.

## GC Analysis of Chiral Flavor Compounds in Apple Juices, Using the Rt-BDEXsm™ and Rt-BDEXse™ Columns

(lit. cat.# 59546)

*Detect adulteration by examining enantiomer ratios of chiral molecules*

Many flavor constituents are chiral compounds. In nature one enantiomer usually is prevalent, but when synthetically prepared the same compound is an equal (racemic) mixture. Consequently, gas chromatographic resolution and quantification of the enantiomers is a sensitive and reliable approach to detecting synthetic adulterants. The 4-page note describes this principle, using example chromatographic separations.

## A Guide to the Analysis of Chiral Compounds by GC

(lit. cat.# 59889)

*Resolve critical enantiomer pairs quickly and reliably*

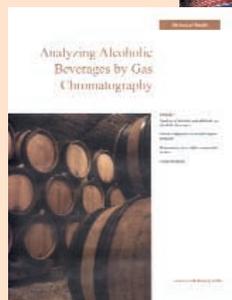
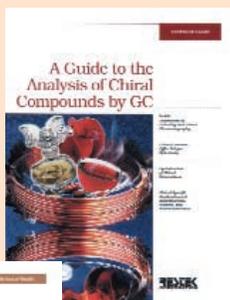
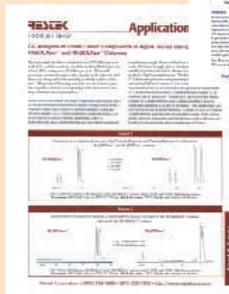
In flavor and fragrance analyses, enantiomers often must be resolved for separate quantification. Five cyclodextrin-based Restek chiral capillary GC columns offer a unique range of selectivities, to enable you to accomplish these often-difficult separations. Many example chromatograms in this 24-page guide will help you find the best column - or columns - for your particular need.

## Analyzing Alcoholic Beverages by Gas Chromatography

(lit. cat.# 59462)

*Selectivity, sensitivity, and minimal sample preparation make GC a powerful tool for monitoring alcoholic beverage composition*

Volatile component profiles of alcoholic beverages reveal a wide range of compounds: acids, alcohols, aldehydes, and others. This 16-page guide describes packed column GC and capillary GC approaches to monitoring these complex mixtures of analytes. A separate section is devoted to detailed information about quantifying trace sulfur compounds in beer.



Visit us online at [www.restekcorp.com/cgrmsrch.htm](http://www.restekcorp.com/cgrmsrch.htm) to search Restek's entire on-line chromatogram archive of both GC and HPLC applications!



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# Catalogs and Technical Guides

## **Foods, Flavors, & Fragrances** (lit. cat.# 59260)

*A brief summary of many applications and chromatography products*

This 48-page guide is a good overview of the foods - flavors - fragrances applications for which Restek GC and HPLC columns have been used. Application areas include amino acids, carbohydrates, chiral separations, essential oils, fats and oils, flavors and fragrances, organic acids, preservatives, and vitamins. Includes a handy index of retention times for many flavor and fragrance compounds on a dimethylpolysiloxane or a PEG-type capillary GC column.

## **Genuine Restek Replacement Parts for Agilent GCs** (lit. cat.# 59627C)

*Restek chromatography supplies and accessories - designed by chromatographers, for chromatographers.*

This 44-page reference manual lists the consumer-replaceable items, supplies, and accessories you need to keep your Agilent GC running at top performance: injector and inlet supplies, detector parts and supplies, gas system components, tools, vials, syringes, and much more. Many items have been designed to save you time or improve your results, and are exclusive to Restek. Many other items are manufactured specifically to the instrument manufacturer's specifications.

## **Inlet Supplies** (lit. cat.# 59893A)

*for Agilent - PerkinElmer - Shimadzu - Thermo Finnigan - Varian gas chromatographs.*

Most gas chromatography problems can be traced to the inlet or the injection. When you pay a little extra attention to the inlet - by changing liners, septa, and ferrules at regular intervals, changing the style of inlet liner when you change the type of analysis you are performing, etc. - you often avoid unanticipated downtime. Our handy, pocket-sized, 44-page guide lists inlet liners, seals, septa, ferrules, and other necessities to ensure the supplies you need are at hand.

## **Selection Guide for Polar WAX GC Column Phases** (lit. cat.# 59890)

*Confusion about "wax" columns resolved.*

Polyethylene glycol-based stationary phases are the most versatile and thermally stable polar GC phases, but PEG-based columns from different manufacturers can differ significantly in chemical makeup and performance. Restek PEG-based capillary columns are designed for specific categories of applications, for low bleed, excellent inertness, and unsurpassed column-to-column reproducibility. This 16-page guide discusses the performance characteristics of and applications for Restek PEG-based columns.

## **A Technical Guide for Static Headspace Analysis, Using GC** (lit. cat.# 59895A)

*A wealth of information about a time- and money-saving technique*

Static headspace analysis will save you time and money when assaying a variety of sample matrices - and often is easier than alternative sampling approaches. This 20-page guide discusses basic principles, instrumentation, applications, and troubleshooting. Restek capillary GC columns and an extensive selection of accessories will simplify getting started.

## **Operating Hints for Using Split/Splitless Injectors** (lit. cat.# 59880A)

*A popular Restek guide revised, updated, and expanded*

What design of inlet liner is best for analyzing dirty samples by split injection? What design minimizes analyte breakdown in splitless injections? Learn about the advantages of these commonly used sample injection techniques—and their disadvantages—to obtain the best results and avoid problems. This 36-page guide is focused on system optimization, maintenance, and troubleshooting. An extensive selection of inlet liners and other products is included.



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- Volatiles in Food Packaging (Purge and Trap GC/MS)** (lit. cat.# 59348)
- Acrylamide Analysis by GC** (lit. cat.# 59485)
- Organophosphorus Pesticides (GC)** (lit. cat.# 59359)
- Chlorinated Pesticides (GC)** (lit. cat.# 59892)
- SPE Cleanup of Chlorinated Pesticides** (lit. cat.# 59110)
- SPE Cleanup of Organophosphorus Pesticides and Herbicides** (lit. cat.# 59142)
- GC Wall Chart** (lit. cat.# 59668A)
- HPLC Column Selection Guide** (lit. cat.# 59454)
- HPLC Accessories** (lit. cat.# 59362)
- Trident Direct Guard Column System** (lit. cat.# 59314)
- Cholesterol / Dietary Sterols** (lit. cat.# 59581)

- Free Fatty Acids** (lit. cat.# 59583)
- FAMES by Capillary GC** (lit. cat.# 59584A)
- Analysis of Vitamins (HPLC)** (lit. cat.# 59181)
- Synthetic and Natural Antioxidants in Food** (lit. cat.# 59582)
- Analysis of Preservatives (HPLC)** (lit. cat.# 59398)
- Nutraceuticals by Liquid and Gas Chromatography** (lit. cat.# 59364)
- GC Methods for Saw Palmetto** (lit. cat.# 59136)
- Omega-3 (n-3) and Omega-6 (n-6) Fatty Acids in Oils** (lit. cat.# 59128)
- Glucosinolates by HPLC** (lit. cat.# 59335)
- Heat Level of Spicy Foods (HPLC)** (lit. cat.# 59199)
- Vanillin and Ethyl Vanillin in Vanilla Flavors (HPLC)** (lit. cat.# 59186)

- Chiral Flavor Compounds in Apple Juices (GC)** (lit. cat.# 59546)
- Chiral Compounds by GC** (lit. cat.# 59889)
- Analyzing Alcoholic Beverages** (lit. cat.# 59462)
- Foods, Flavors, & Fragrances Guide (GC / HPLC)** (lit. cat.# 59260)
- Restek Parts for Agilent GCs** (lit. cat.# 59627C)
- Inlet Supplies** (lit. cat.# 59893A)
- Polar WAX GC Column Phases** (lit. cat.# 59890)
- Static Headspace Analysis** (lit. cat.# 59895A)
- Operating Hints for Using Split/Splitless Injectors** (lit. cat.# 59880A)
- Restek Advantage Quarterly Newsletter**
- 2003 Chromatography Products Catalog** (lit. cat.# 59473)

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# Food Contaminants

## Monitoring Volatile Compounds in Food Contact Packaging, Using Purge and Trap GC/MS and an Rtx®-5MS Capillary Column

(lit. cat.# 59348)

*An optimized procedure for monitoring common volatiles released by food contact packaging*

All food packaging materials have a potential for generating volatile compounds when heated. These volatiles become a concern if they migrate into the food product in the package. This 4-page note summarizes one approach to testing food contact materials and describes an effective sampling - chromatography - detection system.

## Acrylamide Analysis by Gas Chromatography

(lit. cat.# 59485)

*GC is a simple, low-cost, efficient way of detecting acrylamide in prepared foods*

A proposed LC/MS/MS method for analyses of acrylamide in foods requires reversed phase HPLC in a highly aqueous mobile phase, a positive ion electrospray MS interface, and quantification based on comparison to a <sup>13</sup>C-labeled internal standard. The GC alternative described in this 2-page note is rapid and cost-effective. Detection limits can approach 0.01 µg/mL solution; for greater sensitivity, extracted acrylamide can be brominated, then quantified using an electron capture detector.

## Improved Analysis of Organophosphorus Pesticides, Using Rtx®-OPPesticides and Rtx®-OPPesticides2 Columns

(lit. cat.# 59359)

*Fast analyses with notably few coelutions*

To ensure sensitivity for low ppb levels of target compounds, dual-column GC analyses with ion-specific detectors (e.g., NPD / FPD) are used in analyses of organophosphorus pesticides. An Rtx®-OPPesticides / Rtx®-OPPesticides2 column pair minimizes the number of analyte coelutions and separates more than 50 OPPs in less than 25 minutes. This 4-page note describes conditions for both dual column / ion-specific detection and GC/MS analyses.

## A Guide to Preparing and Analyzing Chlorinated Pesticides

(lit. cat.# 59892)

*Invaluable information that can simplify a challenging analysis*

Analyses of chlorinated pesticides can be difficult because samples often are contaminated with non-target compounds (e.g., lipids), and the method can require rigorous quality control. Our 24-page guide covers sample extraction methodology, sample cleanup, and chromatography. A chromatographic analysis of widely used chlorinated herbicides also is illustrated. One of our most popular technical guides.

## CarboPrep™ SPE Cleanup of Method 8081A Chlorinated Pesticides

(lit. cat.# 59110)

*Conserve solvent, ensure cleaner extracts and high recovery of target pesticides*

A good companion publication to chlorinated pesticides guide 59892, this 2-page note describes the benefits of using graphitized carbon-based CarboPrep™ SPE tubes and presents an example extraction and GC analysis. Reduced solvent consumption during the extraction process, cleaner extracts, and excellent recovery rates for target pesticides make CarboPrep™ SPE tubes an excellent choice for this application.

## CarboPrep™ SPE Cleanup of Method 8141A Organophosphorus Pesticides and Herbicides

(lit. cat.# 59142)

*Reduced solvent consumption, cleaner extracts, high recovery of target compounds*

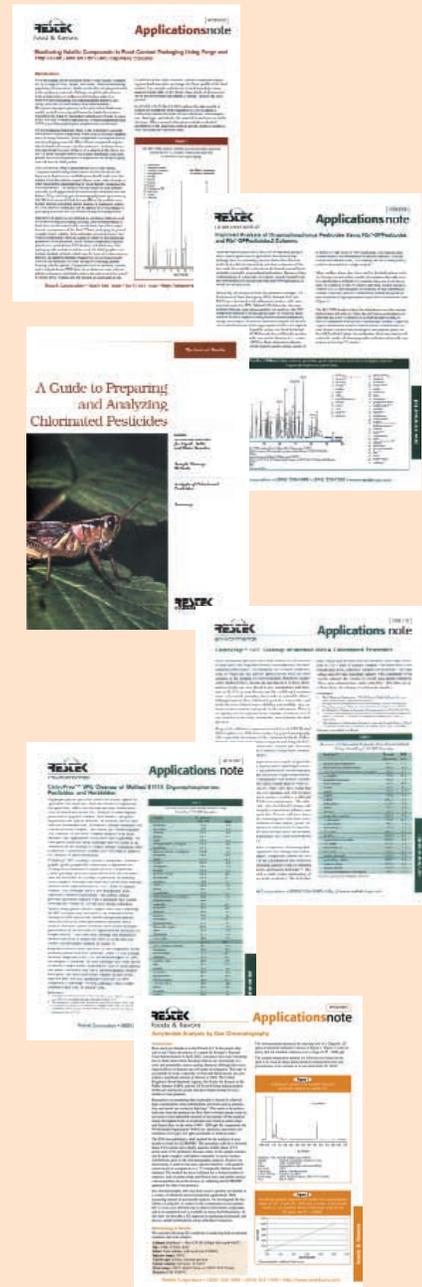
The same characteristics that make graphitized carbon-based CarboPrep™ SPE tubes an excellent choice for extracting chlorinated pesticides make them a better option than GPC or Florisil® SPE in analyses of organophosphorus pesticides and herbicides. The 2-page note describes the extraction procedure and GC analysis, and summarizes recovery data for more than 40 common OPPs.

## GC Wall Chart (lit. cat.# 59668A)

*Important information that saves time; could save a capillary column.*

## HPLC Column Selection Guide (lit. cat.# 59454)

*Keep this useful chart with your workbooks, or post it on a wall*  
Quickly scan important characteristics of Restek HPLC columns. Includes brief, practical guidelines for choosing stationary phase, particle size, pore diameter, and column dimensions.



## HPLC Accessories (lit. cat.# 59362)

This 4-page Fast Facts includes a balanced selection of replacement items and products that are optional, but which can make life in your laboratory easier.

## Trident™ Direct Guard Column System

(lit. cat.# 59314)

*The ultimate combination of convenience and column protection*

The Trident™ Direct system gives you three options for column protection: protection from particles, protection from particles and sample impurities, and protection from particles and heavy contamination. Cut costs by matching the level of column protection to your particular need. This 2-page Fast Facts summarizes the features and benefits of the Trident™ system and answers commonly asked questions.



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### Restek's 2003 Chromatography Products Catalog (lit. cat.# 59473)

Put this on your lab bench! Your link to 700+ pages of product descriptions, tech tips, cross-reference charts, and hundreds of application chromatograms.



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Lit. Cat.# 59489

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