



Column Watch

This month's "Column Watch" is the conclusion of a two-part series in which Ron Majors examines the trends in column introductions at Pittcon 2002. In part II, he discusses gas and supercritical fluid chromatography columns, sample preparation products, and hardware and accessories for chromatography and sample preparation.

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New Chromatography Columns and Accessories at the 2002 Pittsburgh Conference, Part II

Pittcon 2002 — the 53rd Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy — ended its stay in New Orleans, Louisiana, last month. Approximately 23,000 attendees visited the conference and participated in its presentations and exhibition. The purpose of this two-part report is to provide information about many of the new separation consumable and accessory products that were displayed at the show (1). In some cases, products that were introduced during 2001 but after Pittcon 2001 have been included for reasons of completeness. The information is based upon manufacturers' responses to a questionnaire mailed in December 2001. Because of space limitations and the fact that some manufacturers did not respond to the questionnaire, this report cannot be considered an exhaustive listing of all new products introduced in New Orleans this year.

As in previous years, columns and other products recommended by their manufacturers primarily for biomolecule separations are denoted in the tables with the designation *BIO*. Some of these products can be used for general-purpose high performance liquid chromatography (HPLC) separations as well, but their main applications are in bioseparations. I cite specific information about bioapplications where appropriate. Manufacturers plan to introduce many products for biochromatography, drug discovery, and combinatorial chemistry this year; I discuss these products in the sections that best fit the manufacturers' intended applications.

In last month's column, I described new introductions for high performance liquid, reversed-phase, normal- and bonded-phase, ion-exchange and ion, size-exclusion, large- and preparative-scale, and specialty chromatography columns. This month, I will discuss gas chromatography (GC) and

supercritical fluid chromatography (SFC) columns, sample preparation products, and small hardware and accessories for chromatography and sample preparation.

Gas and Supercritical Fluid Chromatography Columns

Six companies contributed information for new GC and SFC columns introduced at Pittcon 2002. Table I lists these 11 new phases. Capillary columns with inner diameters ranging from 0.18 mm (small bore) to 0.53 mm (large bore or megabore) were the most popular introductions. All of the introduced columns were wall-coated open tubular (WCOT); no new porous-layer open tubular (PLOT) column lines were included. New chiral micropacked columns suitable for use in SFC were introduced, but I included them in the "Large- and Preparative-Scale Chromatography Columns" section in last month's column (1).

Many of the general-purpose GC capillary columns displayed at Pittcon 2002 were cross-linked alternatives to popular coated phases. These cross-linked, chemically bonded, or immobilized phases are more stable, and they provide lower bleed and the ability to operate at higher temperatures than coated phases. Another advantage of the bonded phases is their compatibility with solvents for rinsing. If a column becomes contaminated by high-boiling-point compounds, inorganic compounds, or other nonvolatile impurities that can cause drifting baselines, bleed, and other undesirable occurrences, then it can be disconnected, washed (in the outlet-to-inlet direction) with various solvents, and placed back in a gas chromatograph for additional use.

Most of the phases listed in Table I are either expansions of existing lines of GC stationary phases or refined versions of

Table I: Gas Chromatography Columns at Pittcon 2002

Product Name	Supplier	Type	Phase	Film Thickness (μm)	Inner Diameter (mm)	Length (m)	Comments*
AT-AquaWax-DA capillary column	Alltech	WCOT	Polyethylene glycol	0.25	0.25 and 0.32	30 and 60	Recommended for analyzing flavor and odor components of alcoholic beverages, underivatized free fatty acids, and acidic organic compounds without derivatization; repeated splitless and aqueous injections; bonded phase is esterified with nitroterephthalic acid; rinseable; 250 °C upper temperature limit.
HP-5 MS Semivolatiles column	Agilent Technologies	WCOT	5% Phenylmethylpolysiloxane	0.5	0.25	30	Recommended for U.S. Environmental Protection Agency (EPA) semivolatile Methods 8270 and 525 and other methods requiring base, neutral, and acid inertness; 325/350 °C upper temperature limits.
MXT-1HT Sim Dist GC column	Restek	WCOT	100% Polydimethylsiloxane	0.10	0.53	5	Recommended for high-temperature simulated distillation by ASTM method 6352; temperature stability to 430 °C; can analyze hydrocarbons as large as C ₁₁₀ ; uses new proprietary polymer synthesis technology; metal tubing coated with the company's Silcosteel passivation coating for increased sensitivity and improved peak shape.
Optima FFAP column	Macherey-Nagel	WCOT	Polyethylene glycol 2-nitroterephthalate	0.2–0.5	0.2–0.53	10–60	Recommended for analyzing solvents, polar compounds, and fatty acid methyl esters; USP G 35 column with selectivity similar to the company's Permabond FFAP column; 250/270 °C upper temperature limits.
Optima Wax column	Macherey-Nagel	WCOT	Polyethylene glycol 20,000	0.2–0.5	0.2–0.53	10–60	Recommended for analyzing solvents, fatty acid methyl esters, and alcohols; USP 16 phase with selectivity identical to the company's Permabond CW20M column; 250/270 °C upper temperature limits.
Rtx-35 Amine GC column	Restek	WCOT	35% Diphenyldimethylpolysiloxane	0.5, 1.0, 1.5, and 3.0	0.25, 0.32, and 0.53	15 and 30	Recommended for analyzing basic compounds without derivatization; polarity is similar to that of the company's Rtx-35 column; uses proprietary base-deactivation procedure; 340 °C upper temperature limit.
SolGel-1ms column	SGE	WCOT	Sol gel and polydimethylsiloxane	0.25	0.25	60	General-purpose column that can be used for EPA Method 8270 compounds; 250 phase ratio; 380 °C upper temperature limit.
SolGel-Wax column	SGE	WCOT	Sol gel and polyethylene glycol	0.25	0.25	60	Polar phase recommended for separating solvents, alcohols, fatty acid methyl esters, and ketones; 250 phase ratio; 300 °C upper temperature limit.
VB-210 column	VICI Gig Harbor	WCOT	50% Trifluoropropylmethylpolysiloxane	Unspecified	0.18, 0.25, 0.32, and 0.53	Various	Bonded and cross-linked phase on fused-silica tubing; low bleed; 40 to 320/340 °C temperature range; applications include nitroaromatic and herbicide analysis.
VB-225 column	VICI Gig Harbor	WCOT	50% Cyanopropylphenylpolysiloxane	Unspecified	0.18, 0.25, 0.32, and 0.53	Various	Bonded and cross-linked phase on fused-silica tubing; low-bleed mass spectrometry (MS) grade; applications include fatty acid methyl ester, carbohydrate, and natural steroid analysis.
VB-275 column	VICI Gig Harbor	WCOT	Dicyanoallylpolysiloxane	Unspecified	0.18, 0.25, 0.32, and 0.53	Various	Bonded and cross-linked highly polar phase on fused-silica tubing; low-bleed MS grade; applications include polyunsaturated fatty acid and resin acid analysis.

*Some items list two temperature limits separated by a solidus (/). The lower of the two temperatures is the highest temperature at which a column can be operated isothermally. The higher temperature is the high-temperature limit for short-term periods (less than 10 min) in a temperature program. A column should not

be operated continuously at this temperature because phase breakdown could occur.

earlier phases that provide better selectivity, efficiency, or more-inert column deactivation procedures. For example, a stationary phase can be more acid- or base-friendly if the manufacturer carefully deactivates the fused-silica capillary tube used to prepare a column before bonding. Untreated surfaces can result in tailing or compound loss at trace levels for acids and bases. A couple of this year's entries were this type of stationary phase.

The newest type of capillary column introduced was the sol-gel column. Although sol gels are used to prepare high-efficiency HPLC columns, the technology has been used only recently to prepare coated GC capillary columns. The phase is contained entirely in a synthetic glass lattice, which yields an inert polymer that is then bonded onto the surface of the fused silica. The result is a capillary column with a high degree of inertness. As the sol gel effectively shields the active sites, interactions occur only between the sample and the phase. The technique could enable the creation of tailor-made surfaces to achieve a wide range of selectivity and solute migration characteristics (2).

Sample Preparation Products

As Table II indicates, Pittcon 2002 reflected another productive year for sample preparation products and product families, with 15 new products displayed. Most of these products fit into the solid-phase extraction (SPE) category, with formats ranging from the traditional cartridges and disks to SPE pipette tips and several new 96-well plate configurations. Among the introductions, 1 alumina, 7 polymeric, 10 silica-based, and 2 Florisil inorganic sorbent packings were presented.

In the past three years, the 96-well SPE plate design has become very popular. The predominant driving force has been the high-throughput requirements placed upon sample preparation—chromatography—mass spectrometry (MS) laboratories by the pharmaceutical industry for drug screens, combinatorial chemistry needs, and proteomics investigations. As analysis loads increase to hundreds of samples per day, the need for rapid turnaround of analytical results dictates automation, and robotics and liquid-handling systems have geared up to meet this demand. This year, four new products or families of products debuted. In a typical 96-well configuration, 96 small

SPE disks or packed beds are embedded in a plastic holder that can be fed samples or solvents manually or automatically. The holder fits over a standard 96-well microtiter plate, so fractions can be eluted directly from the 96 wells into a collection plate for additional characterization or analysis. A trend in 96-well plates is the availability of individual, removable wells in which analysts can configure their own arrays of SPE phases based upon sorbent or bed mass requirements. These products frequently are called arrays or flexible plates. These configurations permit the construction of customized plates well suited for method development and method optimization. Loose tubes (wells) with prepacked stationary phases and base plates can be purchased separately or as assembled plates.

This year, one manufacturer debuted a 24-tube plate. This configuration allows the use of larger SPE cartridges in a microtiter-plate format. It has the same footprint as the 96-well plate, and it can be used with existing vacuum manifolds or centrifuges and automated liquid-handling systems. It is useful for users who need to prepare a

larger mass of analyte, who have a particularly dirty sample, or who require a greater capacity than the 96-well plates (25–100 mg packing/well) provide.

Another configuration that is becoming popular with people working with automated systems is the 96-well filter plate. Most often used in the measurement of drugs and drug metabolites in blood plasma and serum and in urine, the filter

plate has individual wells that each contain a membrane filter similar to the ones used to prepare samples for HPLC injection. Users first add acetonitrile (sometimes containing a small amount of trifluoroacetic acid) to each well in the plate and then add and mix a small-volume sample, typically 100–200 μ L, into the well. The protein in the plasma precipitates and the supernatant is filtered into a collection plate for addi-

tional processing. Because all nonprecipitated compounds remain in the supernatant, more sample preparation could be necessary to obtain the cleanest extract. If analysts use liquid chromatography (LC)–MS or LC–MS–MS after protein precipitation and filtration, the extract cleanliness may be sufficient.

Several companies displayed specialty SPE phases for the preparation of environ-

mental water samples, catecholamines, and acidic and basic drugs in biological fluid extractions and for on-line protein digests using a trypsin-bonded phase. The last product can be tied on-line to a multidimensional chromatographic system for fully automated LC–MS characterization of proteins. Mixed-mode SPE media are becoming quite popular for drug analyses because they use hydrophobic and ionic

mechanisms simultaneously, which enable a higher degree of compound selectivity. The molecularly imprinted polymers could be the most selective SPE phase type (3) because they are synthesized using the target molecule as the template. Thus, each phase is customized. If chemists must analyze large numbers of samples, it might be worth the time and investment to obtain selective SPE cartridges.

Multidimensional chromatography seems to be getting more attention from users and manufacturers alike. One viable application of LC–LC is as a replacement technique for two-dimensional (2-D) gel electrophoresis for peptide fragment separation. Two-dimensional chromatography also can be used as a sample cleanup technique for biological fluids when a precolumn is plumbed in a system and used as a

Table II: Sample Preparation Products at Pittcon 2002

Product Name	Supplier	Product Type	Modes	Base Material	Functional Group	Dimensions	Comments
Captiva 0.2- μ m filter plate	Ansys Technologies	Filter plate	Not applicable	Polypropylene	Not applicable	96-well plate	Recommended for filtration of precipitated plasma, microsomes, and general laboratory samples; provides faster analysis than centrifugation; compatible with automated liquid-handling systems; wells contain depth filters to reduce clogging.
CAT-PBA cartridge	Iris Technologies	SPE cartridge	Affinity	Silica	Phenylboronic acid	30 mm \times 4 mm	Column filled with bonded Tosoh Biosep TSKgel media with phenylboronic acid modification; recommended for on-line SPE of catecholamines in plasma, urine, or general biological fluids; matrix is eliminated and catecholamines are retained; material is similar to restricted-access media used with column switching.
Chromabond Multi-96 SPE plate	Macherey-Nagel	96-well SPE plate	Reversed and normal phase	Silica and polymeric	C2–C18, phenyl, diol, nitro, cyano, amino, strong anion and cation exchange, alumina, Florisil, and polymeric	25–100 mg/well	Total of 42 different phases available, including special application phases, mixed-bed, and kieselguhr for liquid–liquid extraction; designed for use in high-throughput and automated liquid-handling systems.
Inert II SPE cartridge	Burdick & Jackson	SPE cartridge	Reversed and normal phase	Silica and Florisil	C8, C18, cyclohexyl, diol, alumina, Florisil, and silica	0.5, 1.0, and 2.0 g/cartridge	Recommended for the cleanup of water samples for contract laboratory program analyses; specially cleaned stationary phases; polytetrafluoroethylene frits, polyethylene cartridges; alternative to glass SPE columns.
Isolute Array-24 SPE plate	International Sorbent Technology	SPE plate	Reversed and normal phase and strong anion and cation exchange	Silica, alumina, Florisil, and polymeric	Various	0.5, 1.0, and 2.0 g/6 mL	A 24-position microtiter plate with increased sorbent capacity and larger volumes compared with 96-well plates; all the company's sorbents are available in 6-mL tabless format; compatible with 96-well vacuum manifold systems and automated liquid-handling systems.
Isolute HAX SPE cartridges and 96-well plates	International Sorbent Technology	SPE cartridge and 96-well SPE plate	Reversed phase and strong anion exchange	Silica	C8–strong anion exchange	See Comments	The cartridges and 96-well plates have 25 mg/1 mL to 100 mg/1 mL capacity; recommended for mixed-mode extraction of acidic drugs from biological fluids using generic methodology to minimize method development time; 50- μ m d_p silica base with 60- \AA pore diameter.
Isolute HXC-Q SPE cartridges and 96-well plates	International Sorbent Technology	SPE cartridge and 96-well plate	Reversed phase and weak anion exchange	Silica	C8–carboxyl	See Comments	The cartridges and 96-well plates have 25 mg/1 mL to 100 mg/1 mL capacity; recommended for mixed-mode extraction of quaternary amines and other strongly basic drugs from biological fluids; weak-cation-exchange function allows elution of quaternary amines under acidic conditions; 50- μ m d_p silica base with 60- \AA pore diameter.
MIPS4SPE Prospekt-2 cartridge	Spark Holland	SPE cartridge	Molecular imprinting	Polymeric	Molecular imprint group	Prospekt-2 cartridge	Custom molecularly imprinted polymer phases synthesized by MIP Technologies and packed into Prospekt-2 cartridges for use with an automated on-line column-switching system for selective sample cleanup for LC and LC–MS.
Polyamide Bio SPE cartridge	Jordi Associates	SPE cartridge	Reversed and normal phase, ion exchange, and size exclusion	Polydivinylbenzene	Polydivinylbenzene	Unspecified	Polymeric materials have pH 1–14 range; can be used at high temperatures if necessary; wide pores for biomolecular analysis; <i>BIO</i> .
SPEC IQe SPE cartridge–disk	Ansys Technologies	SPE cartridge–disk	Reversed phase	Silica glass microfiber	Polar-modified C18	Various formats	Recommended for polar compound extraction of preclinical and clinical samples for pharmacokinetics and absorption, distribution, metabolism, and excretion tests; disk format; three formats: 3-mL syringe barrel, 96-well SPE plate, and SPE pipette tip; depth filter prevents clogging.
Strata X SPE cartridge	Phenomenex	SPE cartridge	Reversed phase	Polymeric	Unspecified	Various	A universal, high-capacity polymeric sorbent for general SPE work with acidic, basic and neutral compounds, especially for pharmaceuticals, environmental, and forensics samples; 33- μ m average particle diameter; 90- \AA average pore diameter; surface area is greater than 700 m ² /g; sorbent can dry out and still function.
StyroZyme Trypsin column	OraChrom	On-line digestion column	Not applicable	PS–DVB–methacrylate	Trypsin	50 mm \times 0.25–2.1 mm	Part of a kit for multidimensional protein identification technology; this column is used for protein digestion followed by 2-D capillary chromatography and MS analysis; protein digestion time reduced to 5 min at 37 $^{\circ}$ C; eliminates interference of enzyme autolysis fragments during analysis; based on 5- μ m d_p gigaporous polymeric material with single-layer covalent trypsin binding; stainless steel and polyetheretherketone (PEEK) construction; <i>BIO</i> .
Upti-Clean S series SPE cartridge	Interchim	SPE cartridge	Reversed and normal phase	Silica	C8, C18, cyano, and silica	1–150 mL	Three series: S for standard use (60- \AA , 500-m ² /g, 50- μ m average particle size); S2F for complex matrices such as blood and urine (60- \AA , 500-m ² /g, 140- μ m average particle size); SHP for sensitive needs (similar to S series but with ultrahigh-purity silica).
Upti-Clean SPE cartridge-packing services	Interchim	SPE cartridge	Reversed and normal phase, ion exchange, and affinity	Silica and polymeric	Wide variety	Various	Custom SPE cartridge packing service for unusual quantities, proprietary sorbents, or special phases such as affinity or biosorbents.
Zorbax SPE C8 cartridges and 96-well plates	Agilent Technologies	SPE cartridge and 96-well SPE plate	Reversed phase	Silica	C8	See Comments	The cartridges have 25 mg/1 mL to 1000 mg/6 mL capacity; the 96-well plates have 25 mg to 100 mg/well capacity; available in fixed and flexible 96-well plate designs; 8.3% carbon loading; spherical Type B silica with 45- μ m average particle diameter and 80- \AA pore diameter provides low pressure drop and homogeneous gravity-fed flow.

reusable SPE column. One such application is the extraction of catecholamines from biological fluids such as urine using a selective affinity phase. Iris Technologies' CAT-PBA column is a small extraction column filled with a bonded phenylboronic acid stationary phase. When used under mild alkaline conditions at pH 8.7, this phase selectively binds and concentrates 1,2-diol compounds such as catechol-

amines through the formation of a cyclic ester. Figure 1 shows how the entire extraction and HPLC assay can be automated using a valve setup in five steps. Step 1 involves passing a urine or plasma sample through the extraction column using a secondary pump (pump 1). In step 2, the biological residual matrix (proteins and non-1,2-diol components) is eluted to waste. In step 3, the valve is switched, and

the pH 3 mobile phase is passed through the extraction column by pump 2. Under acidic conditions, the cyclic boronic acid is hydrolyzed, and the 1,2-diol components are swept to the HPLC column where catecholamines such as noradrenaline, adrenaline, and dopamine are separated isocratically using a phosphate buffer. The naturally fluorescent catecholamines can be detected fluorimetrically or electrochemically. While the HPLC separation is occurring, the extraction column is regenerated and prepared for another sample.

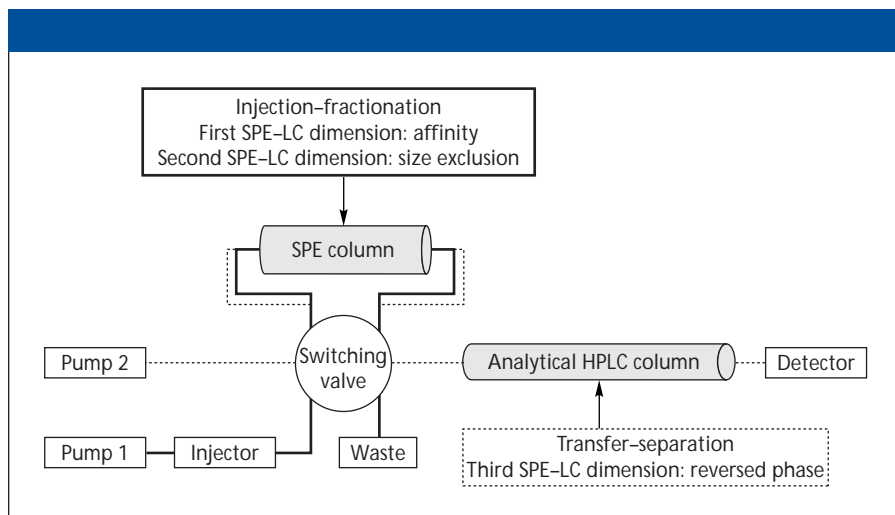


Figure 1: Diagram of a multidimensional SPE-LC system for the separation of catecholamines in biological fluids. (Courtesy of Iris Technologies.)

Companies Listed in This Column

Agilent Technologies Inc., Wilmington, Delaware
 Alltech Associates, Inc., Deerfield, Illinois
 Analytical Scientific Instruments, Inc., El Sobrante, California
 Ansys Technologies, Inc., Lake Forest, California
 Burdick & Jackson, Muskegon, Michigan
 Interchim, Montluçon, France
 International Sorbent Technology Ltd., Hengoed, United Kingdom
 Iris Technologies, Lawrence, Kansas
 Joint Analytical Systems, Inc., Ludlow, Kentucky
 Jordi Associates, Inc., Bellingham, Massachusetts
 Leap Technologies, Carrboro, North Carolina
 Macherey-Nagel GmbH & Co. KG, Düren, Germany
 Merck KGaA/EM Science, Darmstadt, Germany
 MIP Technologies, Lund, Sweden
 OraChrom, Woburn, Massachusetts
 Phenomenex Inc., Torrance, California
 Restek Corp., Bellefonte, Pennsylvania
 SGE, Inc., Austin, Texas
 Silica Physics, LLC, Glendale, Arizona
 Spark Holland BV, Emmen, The Netherlands
 Supelco, Bellefonte, Pennsylvania
 Thermo Finnigan, San Jose, California
 Thermo Hypersil-Keystone, Bellefonte, Pennsylvania
 Tosoh Biosep LLC, Montgomeryville, Pennsylvania
 Upchurch Scientific, Oak Harbor, Washington
 Valco Instruments Co., Inc., Houston, Texas
 VICI Gig Harbor Group, Inc., Gig Harbor, Washington

Table III: Chromatography and Sample Preparation Accessories at Pittcon 2002

Product Name	Supplier	Application Areas	Product Type	Suggested Applications	Comments
CAP kit	Supelco	GC	Column and maintenance kit	General GC	An optimized package of products that includes a capillary column and a selection of accessories such as inlet liners, septa, ferrules, inlet seals, O-ring seals, and column nuts; when used with a preventive maintenance routine, the kit will reduce risk of chromatographic problems and instrument downtime.
Chromolith guard cartridge and kit	Merck KGaA/EM Science	HPLC	Guard column	Protecting analytical columns	Guard column is a monolithic silica rod with an endcapped C18-bonded phase with 18% carbon loading; the monolith has 2- μm macropores and 13-nm mesopores; 5 and 10 mm \times 4.6 mm column dimensions; a column holder is required; kit comprises guard cartridges and a holder.
Flow splitters	Analytical Scientific Instruments	HPLC	Flow splitters	Adjustable flow splitting for LC and LC-MS	Three types: fixed-, multiport, and adjustable-flow splitters; the fixed-flow splitter has 1:1 to 20,000:1 split ratio unaffected by viscosity or pressure, inlet filter, and <1- μL internal dead volume; the multiport flow splitter splits flow into three to eight channels for fraction collection or multiple detectors; the adjustable-flow splitter has the same ratios as fixed-flow splitter, incorporates an adjustable metering valve that enables users to dial a desired split ratio, has <2- μL dead volume, and has a replaceable inlet filter; all splitters will operate at 5000–10,000 psi pressures, depending upon the design; recommended for LC-MS, flow fractionation, pre- or postcolumn flow splitting, and capillary chromatography.
Fluoropolymer centrifuge vials	Upchurch Scientific	HPLC	Chemically resistant vials	High-sensitivity, high-recovery applications	Highly inert vials with tight tolerances, so they are less likely to get stuck in centrifuge carrier racks; contain no plasticizers or mold-release compounds, so they produce fewer extractables with organic solvents; <i>BIO</i> .
Flushnut fittings	Upchurch Scientific	LC	Endfittings	Tight-space applications	Recommended for applications in which typical nut heads interfere with each other; when combined with an appropriate ferrule, these nuts stop nearly flush with the top of a port; several thread sizes are available; stainless steel fittings are compatible with PEEK or ethyl-tetrafluoroethylene polymer ferrules; can withstand pressures as great as 15,000 psi.
Fused-silica liners	Joint Analytical Systems	GC	GC inlet liner	Applications requiring an inert liner	Multiple-baffle GC liners made from fused-silica material; single-, double-, and pentabaffles aid in sample vaporization through the Bernoulli effect.
Nano Flow Solution kit	Thermo Finnigan	HPLC	Kit for nano-LC-MS	Nano-LC-MS	All-in-one consumable kit that contains columns, spray tips, fittings, tubing, and ferrules; columns include Thermo Hypersil-Keystone's Aquasil C18 Picofrit with 15- μm spray tip, HyPurity C8 (150 mm \times 0.18 mm), and Aquasil C18 (150 mm \times 0.32 mm); the kit is recommended for protein and peptide analyses and synthesis, natural product isolation, and metabolism studies.
Nano Scale LC products	Upchurch Scientific	HPLC	Series of products for nanoscale LC	Separations and sample enrichment	Products include a microvalve, a nanoscale mixer, a sample trap column, a nanoscale manifold, fluidic connections, and ferrules; the 10-port microvalve has a 25-nL port-to-port volume; the Nanomixer uses hyperdiffusion between flow laminate technology, has a maximum internal volume of no more than 60 μL , and is recommended for gradient mixing and postcolumn derivatization; the sample trap column can be used for isolating and purifying low concentrations of biological compounds; the NanoFold nanoscale manifold is designed for combining or splitting as many as seven streams with internal port volumes as low as 25 nL; the NanoPort fluidic connections are designed for laboratory-on-a-chip applications; the NanoFerrules can be used for direct connection to 360- μm o.d. fused-silica or capillary PEEK polymer tubing.
Nanovolume components	Valco Instruments	HPLC	Capillary LC components	Capillary LC	Cheminert nanovolume injectors (6-port) and switching valves (10-port) have 100- μm bore and 25-nL port-to-port volume; fittings include unions, reducing unions, tees, crosses, and Y fittings; available in PEEK construction; PEEK liners for using fused-silica tubing with nanovolume injectors and fittings.
New tools for GC	Restek	GC	Tools for inlet liner and general maintenance	Liner removal, liner packing, and rethreading	Rethreading tool repairs worn and damaged threads on GC fittings; liner-packing tool with gauge positions glass wool inside an inlet liner to accurate and specific depths for better reproducibility of sample vaporization; inlet-liner removal and installation tool removes inlet liners from GC injectors; made from high-temperature silicone to prevent fingers from getting burned; will not crack or chip the liner.
Opti-Guard 1-mm guard columns	Agilent Technologies	HPLC	Packed guard column	Protecting microbore columns	13 mm \times 1 mm column dimensions; packed with the company's 5- μm d_p Zorbax reversed phases; unique design with movable packed stem, which provides a perfect zero dead-volume connection every time; guard column connects directly into the inlet port of 1-mm Zorbax microbore columns.
Poroshell cartridge column	Agilent Technologies	HPLC	Cartridge column with integral guard column	High-speed separation of proteins and peptides	Packed integral analytical (75 mm \times 2.1 mm) and guard (7.5 mm \times 2.1 mm) stainless steel columns; Poroshell StableBond C18 is a 5- μm d_p superficially porous silica with 300- \AA pores and a C18-diisobutyl bonded phase; cartridge holder design is compatible with that of the Zorbax Rapid Resolution cartridge (with a longer barrel).
Process control interface	Joint Analytical Systems	GC and LC	Computer interface	Interfacing instrument computers with process computers	Allows a laboratory GC or LC ChemStation workstation to interface with a chromatography data system in a process-scale environment.
Quick Stop Luer connector	Upchurch Scientific	LC	Tubing connector	Connecting inlet lines of solvent pumps	This product allows researchers to break and remake connections quickly within inlet lines that lead to solvent pumps; a built-in check valve prevents solvents from draining from the line and thereby minimizes spills and the need to reprime the pump when restarted; constructed with PEEK, a perfluoro elastomer, or gold-plated steel.
Radel R-5500 tubing	Upchurch Scientific	HPLC	Chemically resistant tubing	Liquid transfer	Radel R is a polyphenylsulfone tube that has chemical and mechanical properties similar to those of PEEK, but it can be steam-sterilized many times because it is resistant to hydrolytic attack and maintains its mechanical strength; will withstand strong acids, bases, common solvents, and bleach; tubing is translucent and allows researchers to inspect fluid flow; superior aqueous wetting of the wall surface, so air bubbles will not cling.
Scotti sample tracking system	Joint Analytical Systems	HPLC, GC, and SFC	Sample tracking system	Maintaining audit trail through analytical process	Product uses chip technology as a replacement for bar-code technology; chip has memory in which information is transferred and stored by a receiver that is interfaced with a data system; chip can be permanently sealed into a vial for good laboratory practice requirements or in removable sleeve for reuse; recommended for assays that require chain of custody and audit trails.
Secure-Fit connectors	Restek	HPLC	Endfittings	Connecting lines and columns	Spring-loaded endfittings ensure that the tubing remains butted against the female endfitting of a column or union to create a void-free connection; no chance for tubing to pop out; available in several inner diameters and lengths; available in stainless steel or PEEK construction.
SiCol tubing	Silica Physics	LC, GC, CE, and CEC	Fused-silica capillary tubing	Connecting columns and lines	Fused-silica tubing with polymer coating (polyimide, FTFE AF) in standard column sizes; 400 $^{\circ}\text{C}$ upper temperature limit.
Valve Self-Washing system	Leap Technologies	LC	Washing system for automated system	Prolonging lifetime of syringes and valves	This accessory reduces carryover and helps to increase throughput and syringe life expectancy; when equipped with an accessory, the syringe- and valve-cleaning steps occur simultaneously and deliver greater volumes of wash fluids to the injection valve in a short time; designed for use with the company's HTS PAL sample loader system.

Chromatography and Sample Preparation Accessories

Table III lists new hardware products and accessories for HPLC, GC, capillary electrophoresis (CE), capillary electrochromatography (CEC), SFC, and sample preparation. All the product introductions were practical devices designed to make chromatographers' lives easier.

HPLC and ion chromatography products: Guard columns continue to be popular products. They protect analytical columns by trapping contaminants from samples and mobile phases before they get to the analytical columns. Some guard columns fit only one manufacturer's columns; others are universal. Several new guard columns appeared this year.

Cartridge columns also are becoming important, especially for the fast columns shorter than 30 mm. Often the limiting factor in creating a short column is the space required for the endfittings. Standard compression fittings can be used on columns of approximately 30 mm or longer. Shorter columns require some type of low dead-volume cartridge holder. New column nuts could help in that regard.

As the use of micro- and nano-LC technology grows, the proper choice of system components will prove important for successful analyses. Tiny devices for connecting tubes, mixing, endfittings, flow splitters, and so on will be necessary to minimize band spreading associated with these components. Low-flow rate solvent delivery and small-volume detection cells will be equally important.

GC and SFC products: Injection port liners are essential for the successful use of GC. If sensitive compounds are injected into the stainless steel inlet, thermal sample breakdown can occur. Most liners are made of glass, so the proper choice of liner,

its state of inertness, and design can influence the volatilization process.

Joint Analytical Systems debuted some fused-silica liners that could prove to be quite inert for high-sensitivity applications. Figure 2 shows the various configurations of these inlet liners, including single-, double-, and pentabaffles, which enable adequate sample mixing and improved injection efficiency. The liners' inert surfaces provide extremely low levels of analyte decomposition.

Sample preparation products: Molded fluoropolymer centrifuge tubes could prove advantageous for biochemists because the inert surfaces should provide better recovery for biological compounds. Instead of using bar codes, these centrifuge tubes use chip technology for sample tracking and chain of custody. This technology could be more automatable because the chip-embedded vials that contain the sample and subsequent daughter fractions, grand-daughter fractions, and so forth can be measured easily along the sample analysis path.

Acknowledgment

I would like to thank the manufacturers and distributors that kindly furnished the requested information in advance of Pittcon 2002, thus allowing a timely report on new product introductions. For those manufacturers that would like to be considered for inclusion in Pittcon 2003 coverage, please send the name of the primary company contact, mailing address, fax number, and e-mail address to "Column Watch" Pittcon 2003, LCGC, 859 Willamette Street, Eugene, OR 97401.

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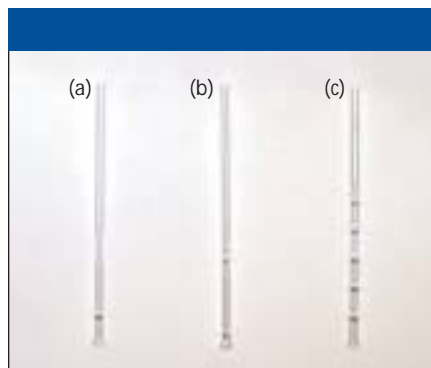


Figure 2: Fused-silica GC inlet liners. Shown are (a) single-, (b) double-, and (c) pentabaffle designs. (Courtesy of Joint Analytical Systems.)

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