



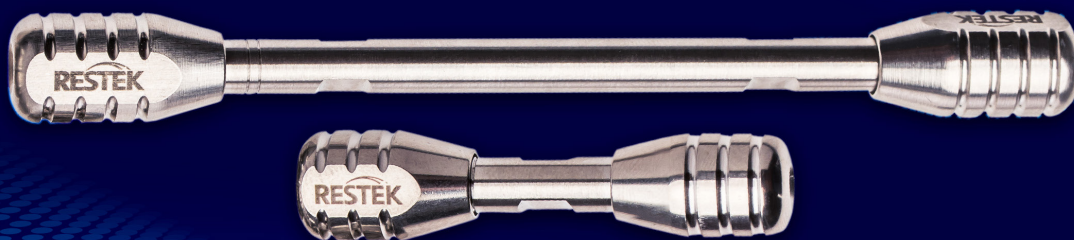
Restek LC

Accurately Analyze Metal-Sensitive Compounds

with Restek's New Inert LC Columns

- Improved peak shape without passivation or mobile phase additives.
- Increased response and analyte recovery, allowing lower detection limits.
- High accuracy and throughput with less variability.
- Less time-consuming conditioning and complicated passivation required.

INERT



RESTEK

Pure Chromatography

www.restek.com



**CHROMATOGRAPHIC⁺
SPECIALTIES INC.**

1-800-267-8103 • chromspec.com • tech@chromspec.com



Accurately Analyze Metal-Sensitive Compounds with Restek's New Inert LC Columns

Our new inert LC column technology helps labs improve their analysis of metal-sensitive compounds. A premium inert coating applied to the stainless-steel surface of our LC columns reduces nonspecific binding of chelating analytes, enabling sensitive analysis and smooth integration of peaks. Combined with Restek's selective stationary phases, these new inert LC columns are ideal for the analysis of metal-sensitive compounds, such as organophosphorus pesticides and mycotoxins.

Restek's inert LC columns can provide four key benefits:

- **Improved peak shape** without passivation or mobile phase additives.
- **Increased response and analyte recovery**, allowing lower detection limits.
- **High accuracy and throughput** with less variability.
- **Less time-consuming conditioning** and complicated passivation required.

Exceptional Inertness Brings Exceptional Performance

Analyzing compounds that have nonspecific adsorption (NSA) or nonspecific binding (NSB) to metal surfaces in LC columns have historically been a challenge. Poor peak shape and sensitivity are key indicators that polar, usually acidic compounds are interacting with the metal surfaces in the column, causing poor data quality. Our premium inert column technology is designed to eliminate NSA and NSB of active analytes to the column hardware, giving analysts greater confidence in their data when working with metal-sensitive analytes.

Pesticides

Pesticide panels benefit from the use of inert LC columns as they contain a wide variety of compounds. Phosphorylated, acidic, polar compounds, and/or metal chelating species, such as organophosphate pesticides, are reactive to the metal surfaces inside of the analytical column. Our new inert LC columns solve that problem easily to improve the overall performance of your pesticide panel.

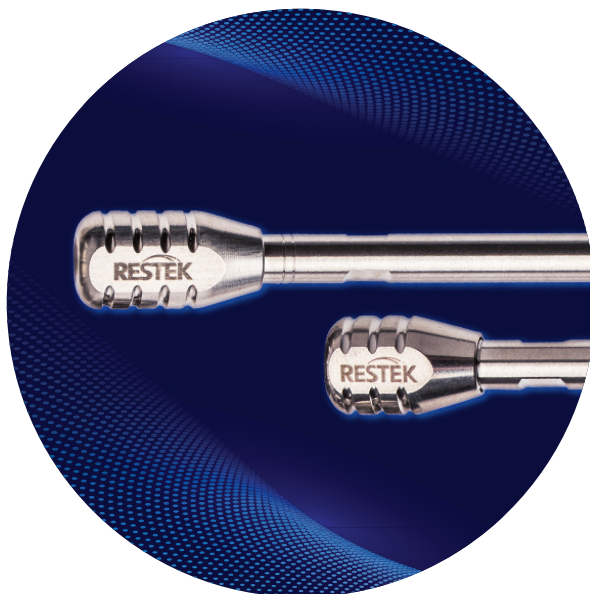
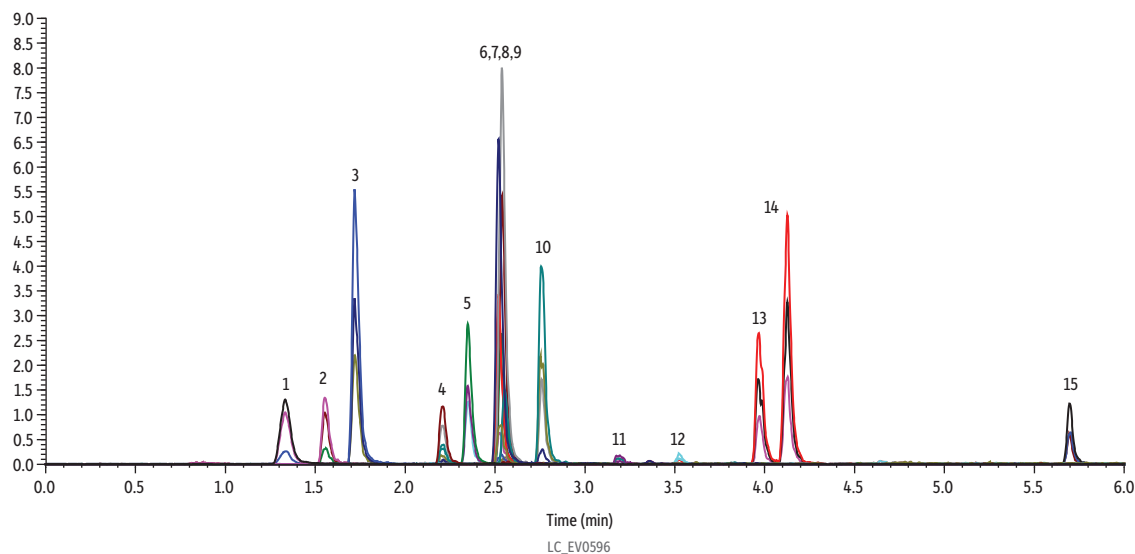


Figure 1: Our new Raptor inert ARC-18 columns offer increased sensitivity, recoveries, and lower detection limits without any column preconditioning.



Peaks	tr (min)	Precursor Ion	Product Ion 1	Product Ion 2	Peak Area	Peak Height
1. Methamidophos	1.33	142.0	94.0	125.1	428941	105189
2. Acephate	1.55	184.0	143.0	48.9	300642	104729
3. Omethoate	1.72	214.0	125.0	182.9	892008	337690
4. Monocrotophos	2.21	224.1	127.0	193.1	215810	78425
5. Dicrotophos	2.35	238.1	112.1	72.0	404916	159292
6. Dimethoate	2.52	230.0	125.0	199.0	807805	342939
7. Trichlorfon	2.53	257.0	108.9	220.8	173942	63266
8. Vamidothion	2.54	288.0	146.0	118.0	1333829	547308
9. Mevinphos isomer 1	2.55	241.9	126.9	192.9	311274	129961
10. Mevinphos isomer 2	2.76	241.9	126.9	192.9	74030	29802
11. Carbaryl	3.18	202.1	145.0	127.0	39671	11924
12. Isocarbophos	3.52	291.1	231.1	121.1	33294	11941
13. Dimethomorph isomer 1	3.96	388.2	300.9	165.1	511766	172977
14. Dimethomorph isomer 2	4.13	388.2	300.9	165.1	877031	328826
15. Temephos	5.70	467.1	124.9	418.9	164310	64751

Column Raptor Inert ARC-18 (cat.# 9314A12-T)
Dimensions: 100 mm x 2.1 mm ID
Particle Size: 2.7 µm
Pore Size: 90 Å
Temp.: 50 °C
Standard/Sample LC multiresidue pesticide standard #1 (cat.# 31972)
Diluent: Water, 0.1% formic acid
Conc.: 1 ng/mL
Inj. Vol.: 5 µL
Mobile Phase
A: Water, 2 mM ammonium formate, 0.1% formic acid
B: Methanol, 2 mM ammonium formate, 0.1% formic acid

Time (min)	Flow (mL/min)	%A	%B
0.00	0.4	95	5
2.00	0.4	40	60
4.00	0.4	25	75
6.00	0.4	0	100
7.50	0.4	0	100
7.51	0.4	95	5
9.00	0.4	95	5

Max Pressure: 258 bar
Detector Shimadzu LCMS-8060
Ion Mode: ESI+
Mode: MRM
Instrument Shimadzu Nexera X2

Figure 2: Compared to a conventional, stainless-steel column, our new Raptor inert ARC-18 columns provide exceptional analyte recoveries.

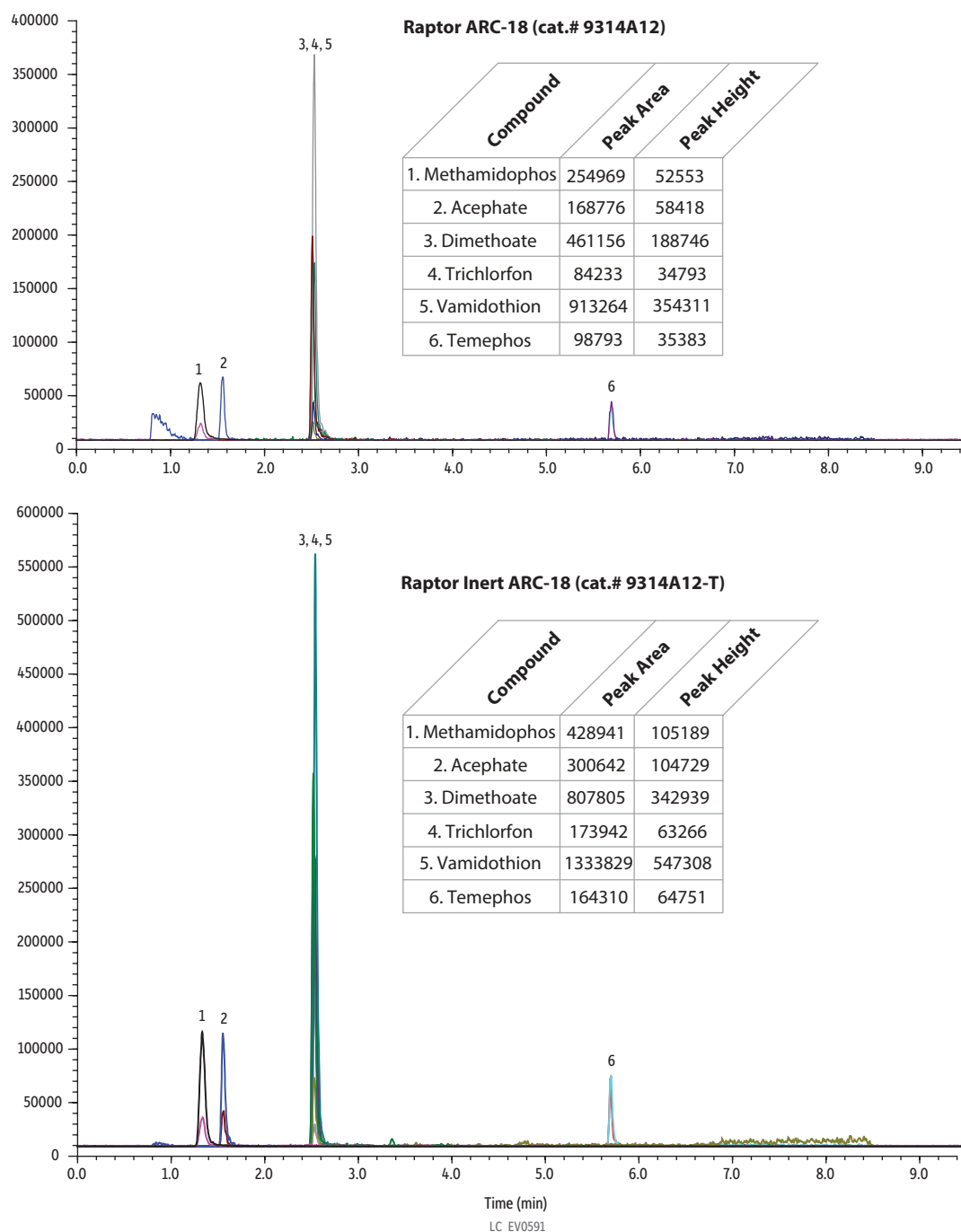


Figure 3: Peak area and peak height are greatly improved for the analysis of pesticides.

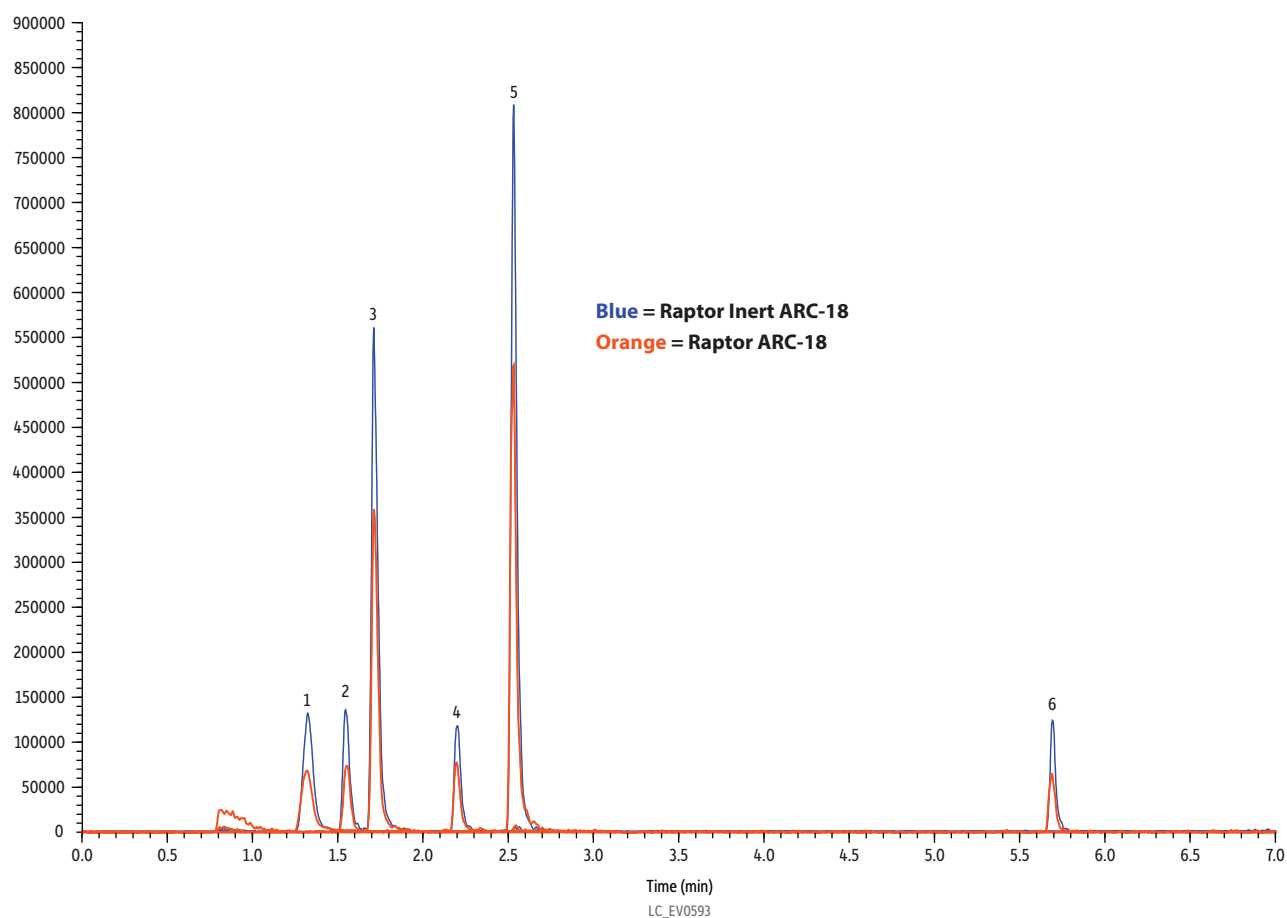


Table I: Restek's new inert columns showed up to 2X improvement in peak area and peak height over stainless-steel columns in this analysis of pesticides.

Compound	Peak Area		Areas Ratio (Inert/Stainless Steel)	Peak Height		Height Ratio (Inert/Stainless Steel)
	Stainless Steel	Inert		Stainless Steel	Inert	
Methamidophos	254969	428941	1.68	52553	105189	2.00
Acephate	168776	300642	1.78	58418	104729	1.79
Omethoate	579502	892008	1.54	216157	337690	1.56
Monocrotophos	140095	215810	1.54	51402	78425	1.53
Dicrotophos	340978	404916	1.19	135380	159292	1.18
Dimethoate	461156	807805	1.75	188746	342939	1.82
Trichlorfon	84233	173942	2.07	34793	63266	1.82
Vamidothion	913264	1333829	1.46	354311	547308	1.54
Mevinphos isomer 1	213632	311274	1.46	82105	129961	1.58
Mevinphos isomer 2	56093	74030	1.32	29070	29802	1.03
Carbaryl	43590	39671	0.91	14563	11924	0.82
Isocarbophos	21587	33294	1.54	9062	11941	1.32
Dimethomorph isomer 1	462425	511766	1.11	166990	172977	1.04
Dimethomorph isomer 2	896109	877031	0.98	311657	328826	1.06
Temephos	98793	164310	1.66	35383	64751	1.83

Mycotoxins

Mycotoxins analysis can be challenging and often requires a great deal of column conditioning and equilibration to achieve acceptable peaks. This is due to the reactive nature of the compounds, which contain acidic, polar, or otherwise metal chelating groups. Our new inert column hardware, combined with our stationary phases, helps simplify methods and improve the response and peak shape of these compounds.

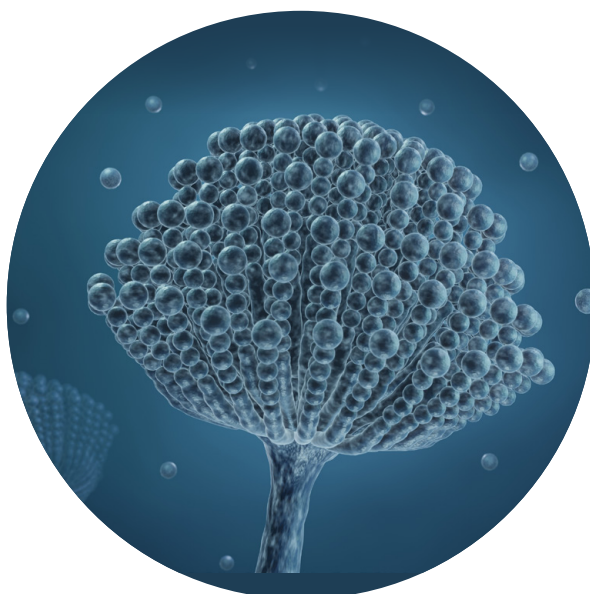
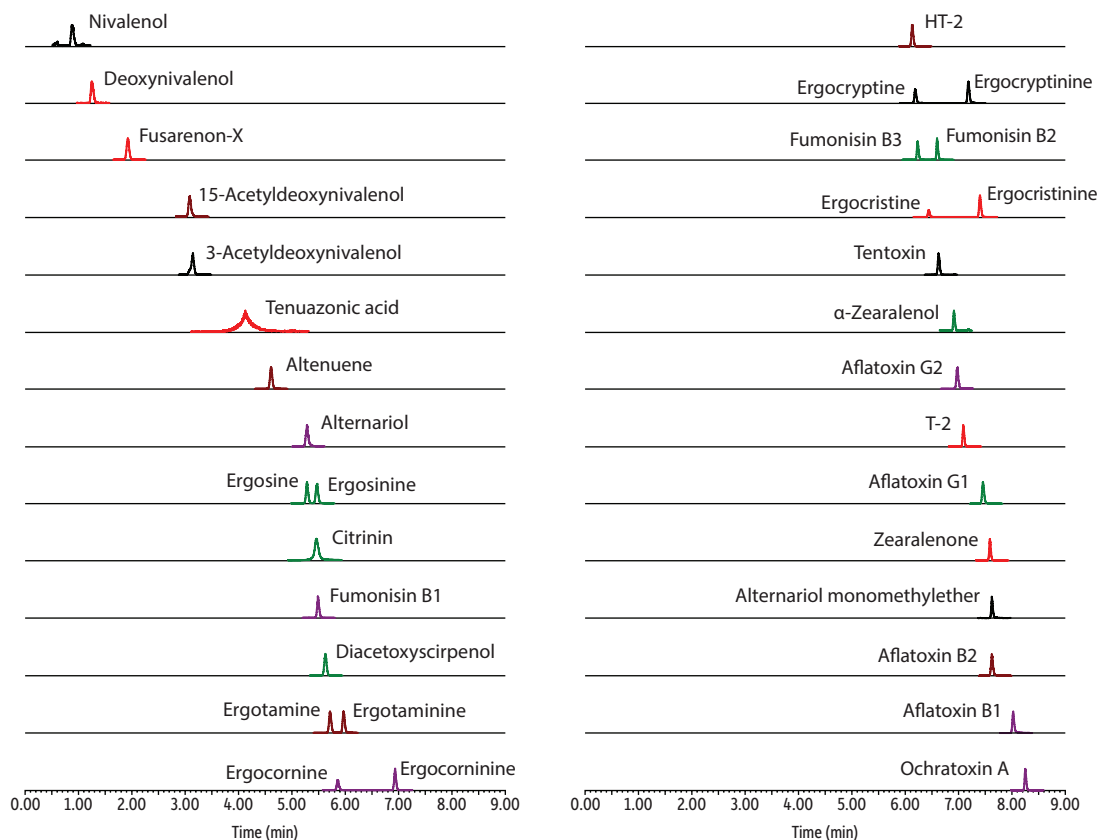


Figure 4: Achieve excellent peak shape without acid additional passivation or mobile phase additives when analyzing mycotoxins with our new Raptor inert biphenyl columns.



LC_FS0552

Peaks	tr (min)	Conc. (ng/mL)	Precursor Ion	Product Ion	Peak Area	Peak Height
1. Nivalenol	0.88	10	295.1	137.1	4182	64495
2. Deoxynivalenol	1.25	10	297.2	231.0	17346	281906
3. Fusarenol-X	1.92	10	355.1	137.1	7668	121790
4. 15-Acetyldeoxynivalenol	3.08	10	339.2	137.1	31369	517570
5. 3-Acetyldeoxynivalenol	3.14	10	339.2	213.1	22613	296396
6. Tenuazonic acid	4.11	10	198.1	125.0	47828	197658
7. Alternuene	4.60	10	293.2	257.1	113850	2059699
8. Alternariol	5.27	10	259.0	185.1	73272	1302192
9. Ergosine	5.28	10	548.4	208.1	486620	9366601
10. Citrinin	5.46	10	251.2	233.1	1007880	9828889
11. Ergosinine	5.46	10	548.4	208.1	496734	8740527
12. Fumonisin B1	5.48	10	722.5	352.3	122878	2415567
13. Diacetoxyscirpenol	5.62	10	384.2	247.1	68139	1208825
14. Ergotamine	5.71	10	582.4	223.2	493003	9274155
15. Ergocornine	5.85	10	562.4	268.2	387025	7732744
16. Ergotaminine	5.96	10	582.4	223.2	462119	9237991
17. HT-2	6.13	10	447.2	345.1	15221	323765
18. Ergocryptine	6.19	10	576.4	268.2	522204	11360838
19. Fumonisin B3	6.23	10	706.4	336.2	143302	3444421
20. Ergocristine	6.44	10	610.4	223.2	195562	4450058
21. Fumonisin B2	6.59	10	706.4	336.2	151719	3869822
22. Tentoxin	6.62	10	415.2	312.2	95175	2131906
23. α-Zearalenol	6.91	10	303.1	285.1	30224	702420
24. Ergocorninine	6.93	10	562.4	268.2	704029	14389283
25. Aflatoxin G2	6.97	10	331.2	189.0	262824	5274353
26. T-2	7.09	10	489.2	387.1	56535	1394735
27. Ergocryptinine	7.18	10	576.4	268.2	778972	16765348
28. Ergocristinine	7.40	10	610.4	223.2	1583053	32975663
29. Aflatoxin G1	7.45	10	329.1	199.7	304389	6102959
30. Zearalenone	7.59	10	319.2	283.1	37162	927455
31. Alternariol monomethylether	7.62	10	273.0	199.1	31024	640689
32. Aflatoxin B2	7.63	10	315.1	287.0	295648	5724754
33. Aflatoxin B1	8.02	10	313.2	241.1	223520	4425821
34. Ochratoxin A	8.25	10	404.1	239.0	190060	4411953

Column		Raptor Inert Biphenyl (cat.# 9309A12-T)			
Dimensions:		100 mm x 2.1 mm ID			
Particle Size:		2.7 µm			
Pore Size:		90 Å			
Temp.:		60 °C			
Standard/Sample		Aflatoxins standard (cat.# 34121)			
		Ochratoxin A standard (cat.# 34122)			
Diluent:		50:50 Water:methanol			
Conc.:		10 ng/mL			
Inj. Vol.:		5 µL			
Mobile Phase					
A:		Water, 0.05% formic acid			
B:		Methanol, 0.05% formic acid			
		Time (min)	Flow (mL/min)	%A	%B
		0.00	0.4	75	25
		5.00	0.4	50	50
		9.00	0.4	0	100
		9.01	0.4	75	25
		11.0	0.4	75	25
Max Pressure:		440 bar			
Detector		Waters Xevo TQ-S			
Ion Mode:		ESI+			
Mode:		MRM			
Instrument		Waters ACQUITY UPLC I-Class			

Figure 5: In this analysis of fumonisins, our new Raptor inert biphenyl columns achieve a dramatic increase in peak area compared to conventional, stainless-steel columns.

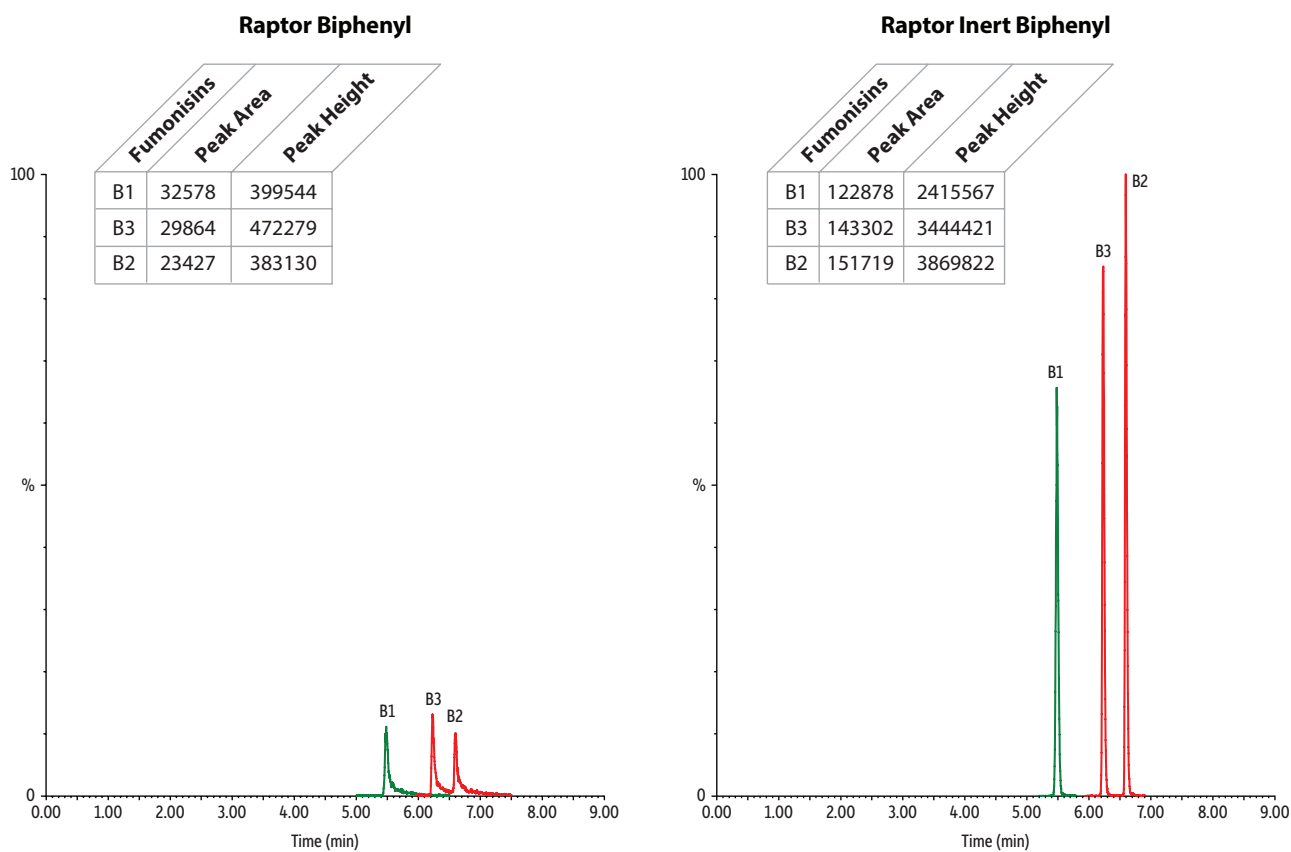


Figure 6: Peak area and peak height are greatly improved for the analysis of fumonisins.

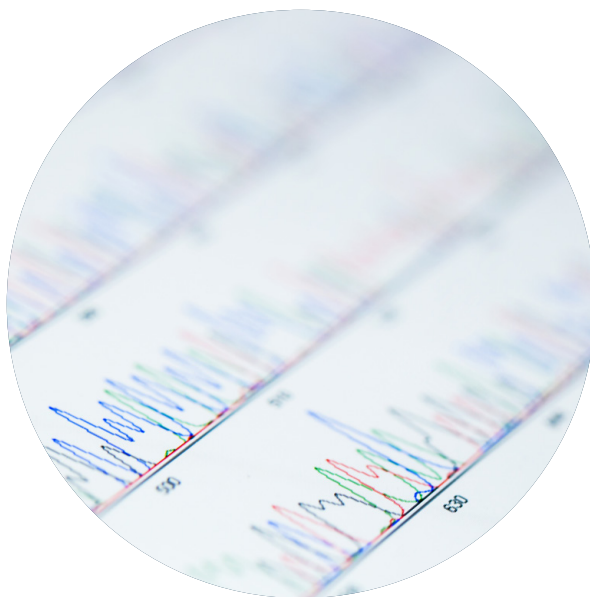
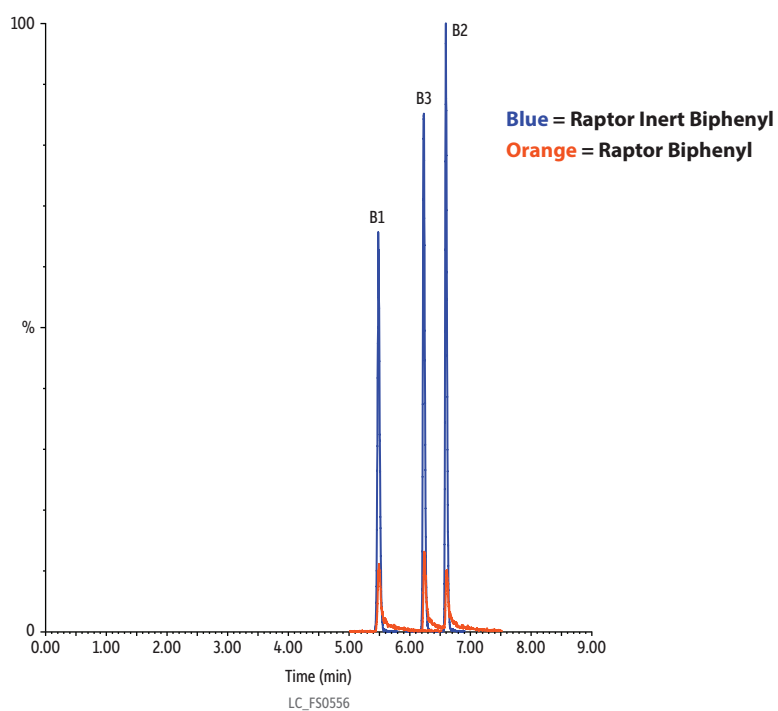


Table II: In this analysis of mycotoxins, our new inert columns can provide an up to 10X increase in peak height over conventional columns.

Compound	Peak Area			Peak Height		
	Stainless Steel	Inert	Areas Ratio (Inert/Stainless Steel)	Stainless Steel	Inert	Height Ratio (Inert/Stainless Steel)
Fumonisin B1	32578	122878	3.77	399544	2415567	6.05
Fumonisin B2	23427	151719	6.48	383130	3869822	10.10
Fumonisin B3	29864	143302	4.80	472279	3444421	7.29
Ergocristine	171197	195562	1.14	3865898	4450058	1.15
Ergocristinine	1393116	1583053	1.14	29212317	32975663	1.13
Ergotamine	433635	493003	1.14	8149518	9274156	1.14
Ergotaminine	397370	462119	1.16	7885403	9237991	1.17
Ergocryptine	446481	522204	1.17	9671753	11360839	1.17
Ergocryptinine	658788	778972	1.18	13680420	16765348	1.23
Ergocornine	370509	387025	1.04	7248981	7732744	1.07
Ergocorninine	590167	704029	1.19	12052359	14389283	1.19
Ergosine	445243	486620	1.09	8630932	9366602	1.09
Ergosinine	439026	496734	1.13	7820785	8740527	1.12
T-2	43286	56535	1.31	1046233	1394735	1.33
HT-2	10183	15221	1.49	216703	323765	1.49
Tentoxin	70973	95175	1.34	1577164	2131907	1.35
Ochratoxin	173686	190060	1.09	4039682	4411953	1.09
Diacetoxyscirpenol	47850	68139	1.42	846403	1208826	1.43
Fusarenone X	3865	7668	1.98	60409	121790	2.02
15-acetyl-DON	17055	31369	1.84	269862	517570	1.92
3-acetyldeoxynivalenol	13353	22613	1.69	179204	296396	1.65
Aflatoxin G2	171597	262824	1.53	3429501	5274354	1.54
Aflatoxin G1	224058	304389	1.36	4607959	6102959	1.32
Ergometrine	301459	558555	1.85	2255203	4659031	2.07
Ergometrinine	217271	396109	1.82	1814997	4031002	2.22
ZON	25617	37162	1.45	656915	927455	1.41
Aflatoxin B2	159389	295648	1.85	3462489	5724754	1.65
Aflatoxin B1	265935	223520	0.84	5335576	4425821	0.83
Alpha-zearalenol	16202	30224	1.87	382092	702420	1.84
Deoxynivalenol	6935	17346	2.50	117927	281906	2.39
Nivalenol	1790	4182	2.34	25276	64495	2.55
Altenuene	63224	113850	1.80	1187958	2059700	1.73
Alternariol monomethyl ether	19537	31024	1.59	428922	640689	1.49
Alternariol	48204	73272	1.52	837410	1302192	1.56
Citrinin	499900	1007880	2.02	5031182	9828890	1.95
Tenuazonic acid	21503	47828	2.22	89293	197658	2.21

Exceptional Inertness Meets Exceptional Stationary Phases

We're introducing our inert LC column technology on three column types: Raptor Biphenyl, Raptor ARC-18, and Force Biphenyl. These new columns help bring the benefits of inert column technology to labs specializing in small molecule LC-MS/MS workflows.

Raptor LC Columns

Raptor LC columns combine the speed of 2.7 μm SPP with the resolution of Ultra Selective Liquid Chromatography (USLC) technology, improving separations and speeding up analysis times with standard HPLC instruments. When speed is your goal, Restek recommends the Raptor line of LC columns.

Learn more at www.restek.com/Raptor



Raptor Inert Biphenyl

The industry-leading Biphenyl is our most popular LC stationary phase. It is particularly adept at separating compounds that are hard to resolve or that elute early on C18 and other phenyl chemistries.

Raptor Inert ARC-18

The Raptor ARC-18 column features a well-balanced retention profile without the drawbacks of using an ordinary C18 in the harsh, acidic mobile phases needed for mass spectrometry. Even after extended use in these low-pH (≤ 2.0) conditions, the sterically protected ARC-18 offers consistent retention, peak shape, and response for charged bases, neutral acids, small polar compounds, and more.

Force LC Columns

Force fully porous particle (FPP) LC columns are designed and manufactured to handle high-pressure, high-stress conditions. They're long-lasting, reproducible, and premium quality—backed by our 100% Pure Satisfaction guarantee. When you need greater retention and sharper peaks, Force LC columns are ready to be put to work.

Learn more at www.restek.com/Force



Force Inert Biphenyl

The Force Inert Biphenyl column separates compounds that other phenyl and C18 chemistries can't. They allow the use of simple, MS-friendly mobile phases and are ideal for when you need to increase retention of hydrophilic aromatics.

Exceptional Inertness for Your Analysis

As chromatographers, we understand the importance of having confidence in your data. Whether you're analyzing pesticides, mycotoxins, or any analysis containing metal-sensitive compounds, these new LC columns provide the accuracy, throughput, and performance your lab needs.

Contact your local Restek representative today at www.restek.com/contact-us to pair the benefits of our inert technology with your analysis.

Columns



Raptor Inert Biphenyl HPLC Columns

- Inert LC column technology reduces nonspecific binding of chelating analytes, enabling sensitive analysis and smooth integration of peaks.
- Ideal for the analysis of metal-sensitive compounds, such as mycotoxins.
- Increased response and analyte recovery, allowing lower detection limits.
- Improved peak shape without additional passivation or mobile phase additives.
- Part of Restek's Raptor Biphenyl column line featuring 2.7 μm SPP core-shell silica.

ID	Length	Particle Size	Units	Cat.#
2.1 mm	100	2.7 μm	ea.	9309A12-T
3.0 mm	100	2.7 μm	ea.	9309A1E-T
2.1 mm	50	2.7 μm	ea.	9309A52-T
3.0 mm	50	2.7 μm	ea.	9309A5E-T



Raptor Inert ARC-18 HPLC Columns

- Inert LC column technology reduces nonspecific binding of chelating analytes, enabling sensitive analysis and smooth integration of peaks.
- Ideal for the analysis of metal-sensitive compounds, such as organophosphorus pesticides.
- Increased response and analyte recovery, allowing lower detection limits.
- Improved peak shape without additional passivation or mobile phase additives.
- Part of Restek's Raptor ARC-18 column line featuring 2.7 μm SPP core-shell silica.

ID	Length	Particle Size	Units	Cat.#
2.1 mm	100	2.7 μm	ea.	9314A12-T
3.0 mm	100	2.7 μm	ea.	9314A1E-T
2.1 mm	50	2.7 μm	ea.	9314A52-T
3.0 mm	50	2.7 μm	ea.	9314A5E-T

Force Inert Biphenyl HPLC Columns

- Inert LC column technology reduces nonspecific binding of chelating analytes, enabling sensitive analysis and smooth integration of peaks.
- Ideal for the analysis of metal-sensitive compounds, such as mycotoxins.
- Increased response and analyte recovery, allowing lower detection limits.
- Improved peak shape without additional passivation or mobile phase additives.
- Part of Restek's Force Biphenyl column line featuring 3 μm fully porous silica.

ID	Length	Particle Size	Units	Cat.#
2.1 mm	100	3 μm	ea.	9629312-T
3.0 mm	100	3 μm	ea.	962931E-T
2.1 mm	50	3 μm	ea.	9629352-T
3.0 mm	50	3 μm	ea.	962935E-T



Reference Standards

LC Multiresidue Pesticide Kit

- Accurately detect and quantify pesticides of global food safety concern in a wide range of fruits, vegetables, and other commodities by LC-MS/MS.
- Full kit contains 204 compounds of interest, covering many LC-determined pesticides listed by government agencies; individual ampuls also sold separately.



Cat. # 31972: LC Multiresidue Pesticide Standard #1 (13 components)
Organophosphorus Compounds
100 µg/mL each in acetonitrile,
1 mL/ampul

Cat. # 31974: LC Multiresidue Pesticide Standard #3 (38 components)
Carbamate/Uron Compounds
100 µg/mL each in acetonitrile,
1 mL/ampul

Cat. # 31976: LC Multiresidue Pesticide Standard #5 (30 components)
Organonitrogen Compounds
100 µg/mL each in acetonitrile,
1 mL/ampul

Cat. # 31978: LC Multiresidue Pesticide Standard #7 (7 components)
Organonitrogen Compounds
100 µg/mL each in acetonitrile,
1 mL/ampul

Cat. # 31980: LC Multiresidue Pesticide Standard #9 (7 components)
Carbamate/Uron Compounds
100 µg/mL each in acetonitrile,
1 mL/ampul

Cat. # 31973: LC Multiresidue Pesticide Standard #2 (16 components)
Carbamate/Uron Compounds
100 µg/mL each in acetonitrile,
1 mL/ampul

Cat. # 31975: LC Multiresidue Pesticide Standard #4 (63 components)
Organonitrogen Compounds
100 µg/mL each in acetonitrile,
1 mL/ampul

Cat. # 31977: LC Multiresidue Pesticide Standard #6 (28 components)
Organonitrogen Compounds
100 µg/mL each in acetonitrile,
1 mL/ampul

Cat. # 31979: LC Multiresidue Pesticide Standard #8
Organonitrogen Compounds
100 µg/mL each in acetonitrile,
1 mL/ampul

Cat. # 31981: LC Multiresidue Pesticide Standard #10
Carbamate/Uron Compounds
100 µg/mL each in methanol,
1 mL/ampul

Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
Contains 1 mL each of these mixtures.	Yes	6 months	On Ice	-20 °C or colder	kit	31971

* Note: When combining a large number of compounds with different chemical functionalities, mix stability can be an issue. In formulating these standards, we extensively studied the 204 compounds involved, then grouped them into as few mixes as possible while still ensuring maximum long-term stability and reliability. For quantitative analysis, we recommend analyzing each mix separately to ensure accurate results for every compound.

** Note: In this standard, fluazinam should only be used for qualitative analysis. A single-component standard (cat.# 31982) is available for quantitative analysis.



Aflatoxins (B1, B2, G1, G2) Standard

(4 components)

Ideal for mycotoxin analyses in cannabis and food testing labs.

Aflatoxin B1 (1162-65-8)
Aflatoxin B2 (7220-81-7)

Aflatoxin G1 (1165-39-5)
Aflatoxin G2 (7241-98-7)

Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	Data pack available?	qty.	cat.#
10 µg/mL, Acetonitrile, 1 mL/ampul	Yes	6 months	36 months	On Ice	0 °C or colder	No	ea.	34121

Ochratoxin A Standard

Ideal for mycotoxin analyses in cannabis and food testing labs.

Ochratoxin A (303-47-9)

Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	Data pack available?	qty.	cat.#
10 µg/mL, Acetonitrile, 1 mL/ampul	Yes	6 months	36 months	On Ice	0 °C or colder	No	ea.	34122

LC Passivation Solution

Used to passivate your LC system before your first analysis if you:

(a) are analyzing phosphorylated compounds or other polar molecules known to chelate or interact with metal ions in your LC (e.g., glyphosate);

and also

(b) have stainless steel in your instrument flow path.



Methylenediphosphonic acid (Medronic Acid) (1984-15-2)

Conc. in Solvent	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
1760 µg/mL, Methanol (HPLC grade)/ Water (50:50), 1 mL/ampul	6 months	36 months	Ambient	10 °C or colder	ea.	32475



Pure Chromatography

© 2024 Restek Corporation. All rights reserved. Printed in the U.S.A.

www.restek.com



Lit. Cat.# GNSS4155A-UNV
Feb 2024 (RK219)



CHROMATOGRAPHIC 
SPECIALTIES INC.

1-800-267-8103 • chromspec.com • tech@chromspec.com

