New Rxi Fused Silica Columns: Revolutionary Thinking

Ultimate High-Performance Fused Silica Capillary Columns

Rxi columns were created at Restek's cutting-edge research facility, Restek West, in California. Our senior polymer chemists developed new column technology, based on our Crossbond® chemistry, to create this new column line. The columns we produce as a result of their work exhibit exceptional inertness and unsurpassed reproducibility, from column to column and lot to lot. Acidic or basic compounds chromatograph beautifully, at sub-nanogram on-column levels, with no peak tailing. Ultra-low bleed assures compatibility with sensitive detectors or in trace-level GC/MS analysis. We tuned this unique chemistry until polymer selectivity was locked in, to allow install-and-run use of Rxi columns with retention time-locking software.

What makes Rxi™ columns different from other columns?

Restek West
Shawn Reese, Gianna Barlupi, Roy Lautamo

First, and foremost, unique deactivation and our modified Crossbond® chemistry create columns with superior performance. The raw materials we use in the manufacturing process - both tubing and chemicals - are strictly controlled. Cleanliness and precision are critical to every step in the process. In addition, we looked in-depth at all other aspects of the column manufacturing process, to establish a highly reproducible process. In both performance and column-to-column consistency, Rxi columns are surpassed by no other columns.

In developing Rxi columns, our first step was to work with our fused silica tubing supplier to establish rigorous controls on internal diameter, outer diameter, ovality, and surface activity. These controls guarantee our tubing is a known starting point. Then, we treat this highly uniform tubing with our unique deactivation chemistry, producing a consistent, inert surface on which to apply the polymer.

Next, we reformulated our polymers, taking steps to ensure neutrality and to fine tune selectivity for retention time locking. A neutral polymer and a neutral tubing surface are important contributors toward excellent peak shape for both acidic and basic compounds.

To complement these efforts, we developed a new column manufacturing process that creates a very reproducible product. This is critical, because our customers' workdays are simplified when every new column they purchase performs exactly as its predecessor.

Overall, the results of these efforts are columns that define *unsurpassed inertness, ultra-low bleed, and totally reliable column-to-column performance*.

Guaranteed Quality and Reliability

Restek is committed to supplying the most reliable GC columns in the industry. Every Rxi column is individually challenged to pass our stringent requirements for film thickness, coating efficiency, selectivity, inertness, and bleed. We believe Rxi column technology produces the most reliable columns available, anywhere, and we promise that every Rxi column you receive will be exactly as good as the one it replaces.

RESTEK PRODUCTS

- **Rxi GC Columns**
  Rxi -1ms
  Rxi -5ms

ALSO OF INTEREST

- Sensitive GC/MS Analysis for Drugs of Abuse
- An introduction to the Rxi family of columns

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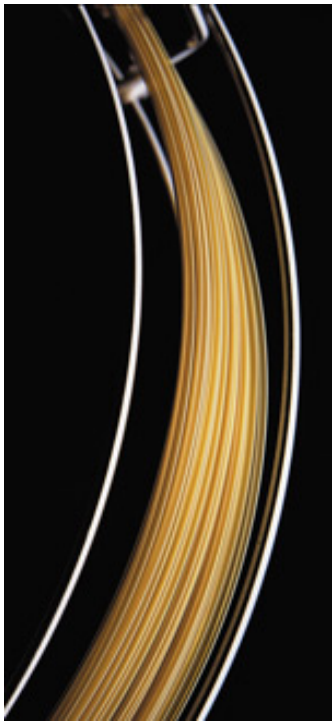
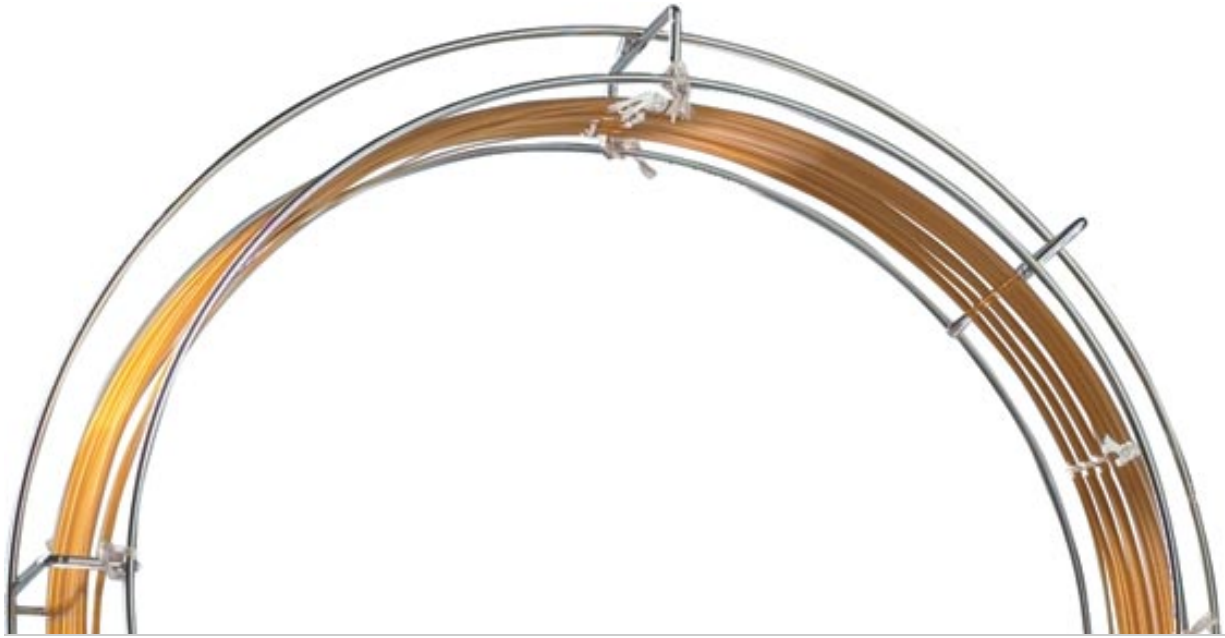
Introducing...



Restek's exceptionally inert (Rxi) fused silica capillary columns:
In addition to control of inertness and bleed, column-to-column uniformity has been elusive - see editorial *The "Replacement" Column A*



Recurring Problem in Gas Chromatography, by guest editor Professor Walter Jennings.

The processes we use to make new Rxi columns enable us to **guarantee** highly uniform performance, column to column and lot to lot, including perfect match-up with retention time-locking software. It is our promise and commitment to you that every Rxi column you receive will be **exactly** as good as the one it replaces.

New Rxi Fused Silica Columns

Ultimate High-Performance Fused Silica Capillary Columns

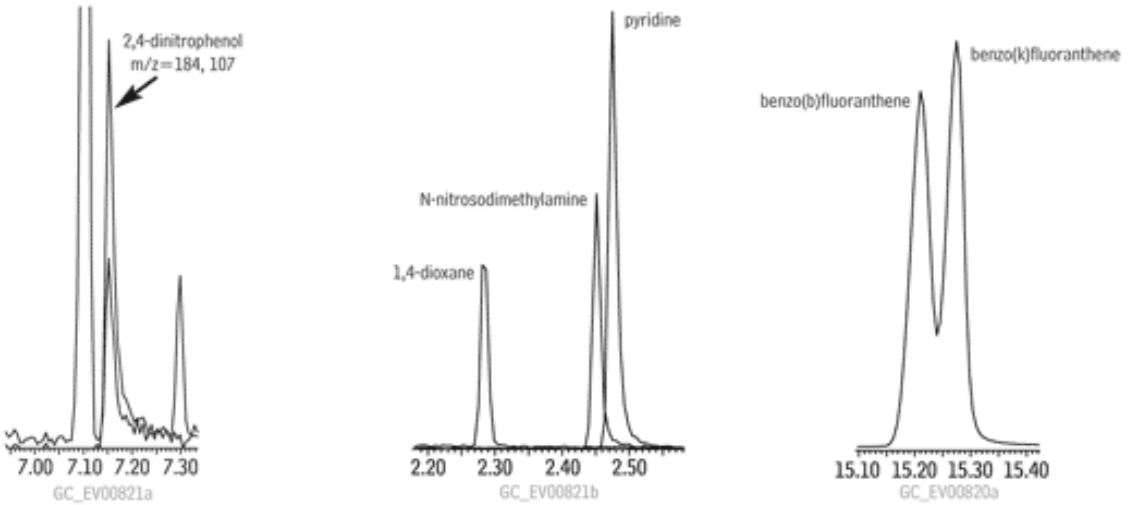
- Unsurpassed inertness for low-level acidic or basic compounds.
- Ultra-low bleed.
- Reliable performance, guaranteed column-to-column reproducibility.
- Guaranteed to work perfectly with retention time-locking software.

In recent years there have been few advances in capillary GC column technology. Through new, innovative technology, Restek has developed and optimized a column-making procedure that assures unsurpassed inertness, ultra-low bleed, and exceptionally reproducible columns, batch to batch.

Unsurpassed Inertness

Rxi columns improve chromatography for many acidic or basic compounds. Surface activity in a column is revealed by the sensitivity and peak shapes for analytes such as 2,4-dinitrophenol (acidic) and pyridine (basic). Sub-nanogram quantities of these compounds are a stringent test of inertness. Rxi columns' unsurpassed inertness allows analysis of acidic or basic compounds under the same conditions, as shown here.

Figure 1 Rxi -5ms columns have excellent sensitivity and symmetry for difficult compounds.



Ultra-Low Bleed

Bleed from Rxi columns is the lowest in the industry, simplifying trace-level analysis with mass spectrometric detectors (MSD, ion trap, etc.), electron capture detection (ECD), nitrogen-phosphorus detection (NPD), or other sensitive detection methods.

Figure 2 Profiles for widely used columns prove Rxi -5ms has the lowest bleed!

RESTEK PRODUCTS

- **Rxi GC Columns**
  Rxi -1ms
  Rxi -5ms

ALSO OF INTEREST

- Sensitive GC/MS Analysis for Drugs of Abuse
- Rxi Columns: Revolutionary Thinking
- Excellent Responses in GC/MS Analysis of Semivolatiles
- Analysis of Semivolatile Organics

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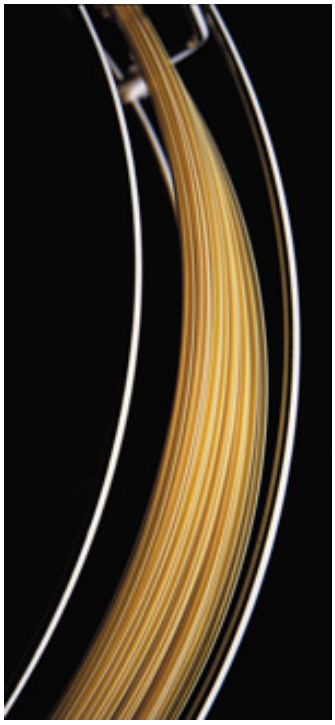
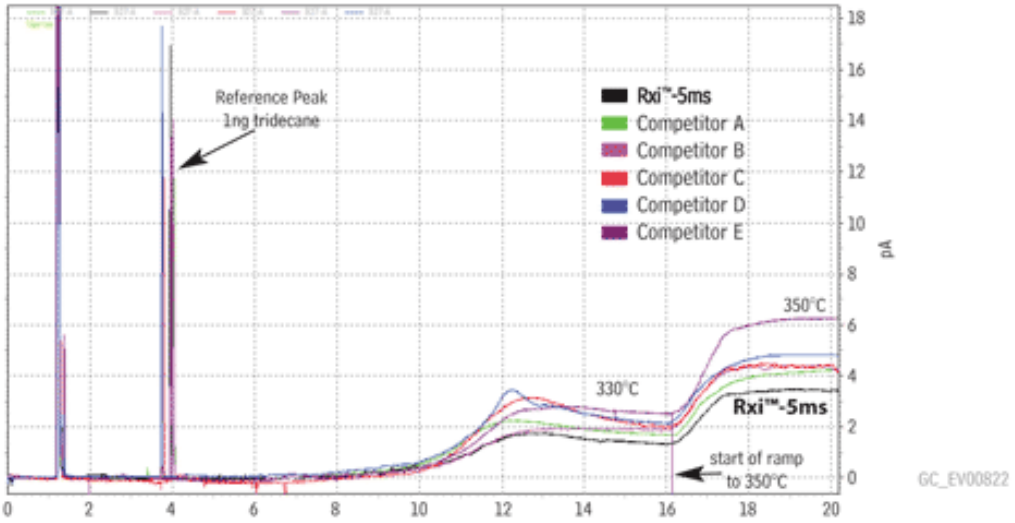


Restek's exceptionally inert (Rxi) fused silica capillary columns:
In addition to control of

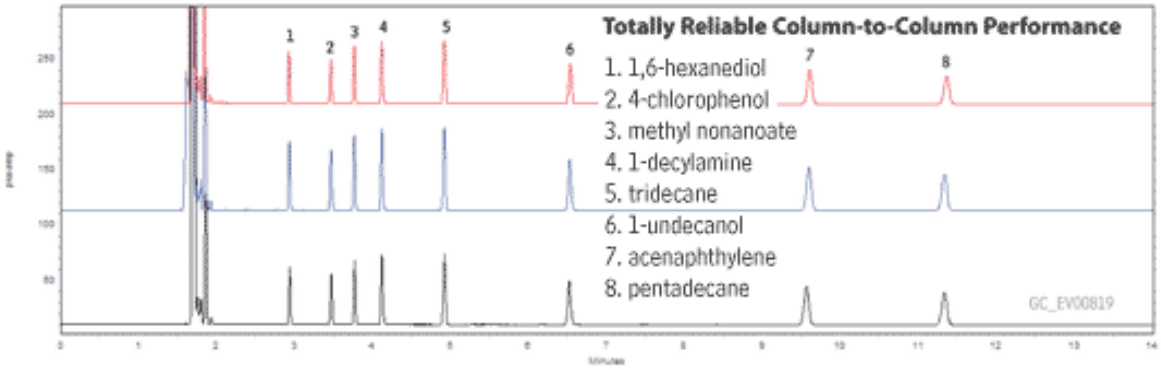


inertness and bleed, column-to-column uniformity has been elusive - see editorial *The "Replacement" Column A Recurring Problem in Gas Chromatography*, by guest editor Professor Walter Jennings.

The processes we use to make new Rxi columns enable us to **guarantee** highly uniform performance, column to column and lot to lot, including perfect match-up with retention time-locking software. It is our promise and commitment to you that every Rxi column you receive will be **exactly** as good as the one it replaces.

Totally Reliable Column-to-Column Performance
Chromatographers need to know every column they receive is going to perform in the same way as the column it replaces. Rxi column technology has enabled us to tighten our quality control standards, and guarantee reproducibility. Columns from each of three manufacturing batches show the excellent reproducibility assured by the new manufacturing process.

Figure 3 Three manufacturing batches of Rxi columns show excellent reproducibility.



Guaranteed Quality and Reliability
Rxi columns are already proving to be the best columns on the market, for inertness, ultra-low bleed, and column-to-column uniformity. It is our promise and commitment to you that every Rxi column you receive will be exactly as good as the one it replaces.

Typical Applications
Alcohols, amines, aromatic hydrocarbons, bile acids, drugs, US EPA methods, esters, fatty acid methyl esters (FAMEs), flavors and aromas, glycerides, halogenated hydrocarbons, herbicides, hydrocarbons, organic acids, oxygenates, polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides, phenols, polymers, solvents, steroids, sugars, sulfur compounds.

Excellent Responses in GC/MS Analysis of Semivolatiles

For Low Level GC/MS Analysis

By Robert Freeman, Environmental Innovations Chemist

- Inert, low-bleed column for reliable results from low-level GC/MS analyses.
- Save time – analyze acidic and basic compounds under the same conditions.
- Guaranteed reproducible performance, column to column.

The second column in our new Rxi GC column line – the Rxi -1ms column – will provide the same outstanding performance as the Rxi -5ms column, with equally superior inertness, ultra-low bleed, and excellent batch to batch reproducibility.

Our first test for this 100% dimethylpolysiloxane phase column was an analysis of a complex mixture of semivolatile organic compounds. The extensive target list was comprised of many classes of compounds including chloroacetanilides, chlorotriazines, triazinones, uracils, polycyclic aromatic hydrocarbons, and phthalates. Figure 1 shows peak shape and selectivity are equally good for all of these diverse compounds, and all are eluted in an acceptable analysis time.[1]

Excellent Inertness

In addition to analyzing these compounds, we analyzed an acidic compound (2,4-dinitrophenol) and a basic compound (pyridine), each at 0.5ng on column, to assess column inertness. Column activity reveals itself through poor response and peak tailing for such active compounds, and these two compounds present both varying difficulties in a GC/MS analysis and differing modes of degradation. Figure 2 shows the excellent peak shapes and responses for these compounds on the 30m x 0.25mm ID, 0.25µm film column.

Phenols are notorious for breakdown and peak tailing, caused by interaction with the surface of an active inlet liner or an active column. Nitrophenols and pentachlorphenol, for example, very often exhibit poor peak shape and/or poor response. Figure 3 shows the 30m x 0.25mm ID, 0.25µm Rxi -1ms column provides very good peak shapes for phenols. Peak responses are well above method requirements.

Ultra-Low Bleed

In addition to excellent inertness, Rxi -1ms columns exhibit very low bleed. Figure 4 is focused on the end of the chromatogram for semivolatiles. At 330°C, bleed is much lower than the signals for 0.5ng of target analytes. This exceptional signal-to-noise differential for late eluting compounds assures better detection limits.

Based on these results, we highly recommend the new Rxi -1ms column for low-level analyses that require a 100% dimethylpolysiloxane phase.

Figure 1 Excellent selectivity and peak shapes for common drinking water semivolatiles at 10ng, using an Rxi -1ms column.

RESTEK PRODUCTS

- **GC Column**
  Rxi -1ms Columns
- **GC Accessories**
  4mm Drilled Uniliner® Inlet Liner

ALSO OF INTEREST

- A 12-Minute Analysis for Volatiles
- Improved SPE Cartridges for Massachusetts EPH Analysis
- New Reference Mix of Canadian Drinking Water Volatiles
- Analysis of Semivolatile Organics

FOOTNOTE

1 The Drilled Uniliner®

RESTEK TECHNICAL ARTICLES

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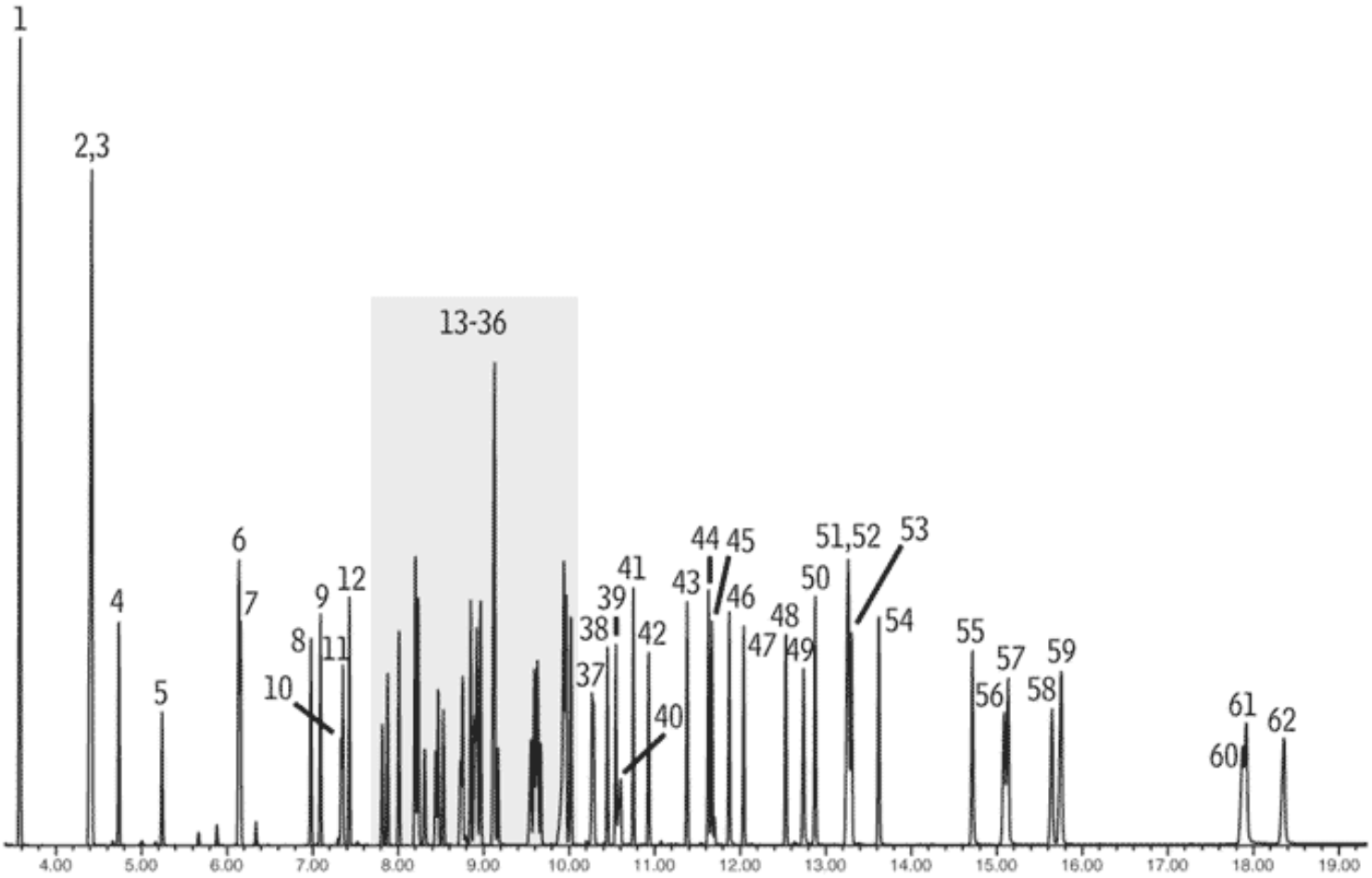
1. 2-fluorophenol (surr.)
2. bis(2-chloroethyl)ether
3. phenol-d6 (surr.)
4. 1,4-dichlorobenzene-d4 (int. std.)*
5. nitrobenzene-d5 (surr.)
6. naphthalene-d8 (int. std.)*
7. naphthalene
8. 1-methylnaphthalene
9. 2-methylnaphthalene
10. hexachlorocyclopentadiene
11. EPTC
12. 2-fluorobiphenyl (surr.)
13. 2,6-dinitrotoluene
14. dimethylphthalate
15. acenaphthylene
16. acenaphthene-d10 (int. std.)*
17. acenaphthene
18. 2,4-dinitrotoluene
19. 1-naphthalenamine
20. molinate
21. 2-naphthaleneamine
22. 5-nitro-*o*-toluidine
23. diethylphthalate
24. fluorene
25. propachlor
26. diphenylamine
27. 2,4,6-tribromophenol (surr.)
28. simazine
29. prometon
30. atrazine
31. hexachlorobenzene
32. 4-aminobiphenyl
33. terbacil
34. phenanthrene-d10 (int. std.)*
35. phenanthrene
36. anthracene
37. metribuzin
38. acetochlor
39. alachlor
40. bromacil
41. di-*n*-butylphthalate
42. metolachlor
43. fluoranthene
44. pyrene
45. butachlor
46. *p*-terphenyl-d14 (surr.)
47. *p*-dimethylaminoazobenzene
48. benzyl butyl phthalate
49. 2-acetylaminofluorene
50. bis(2-ethylhexyl)adipate
51. benzo(a)anthracene
52. chrysene-d12 (int. std.)*
53. chrysene
54. bis(2-ethylhexyl)phthalate
55. di-*n*-octylphthalate
56. benzo(b)fluoranthene
57. benzo(k)fluoranthene
58. benzo(a)pyrene
59. perylene-d12 (int. std.)*
60. indeno(1,2,3-cd)pyrene
61. dibenzo(a,h)anthracene
62. benzo(ghi)perylene



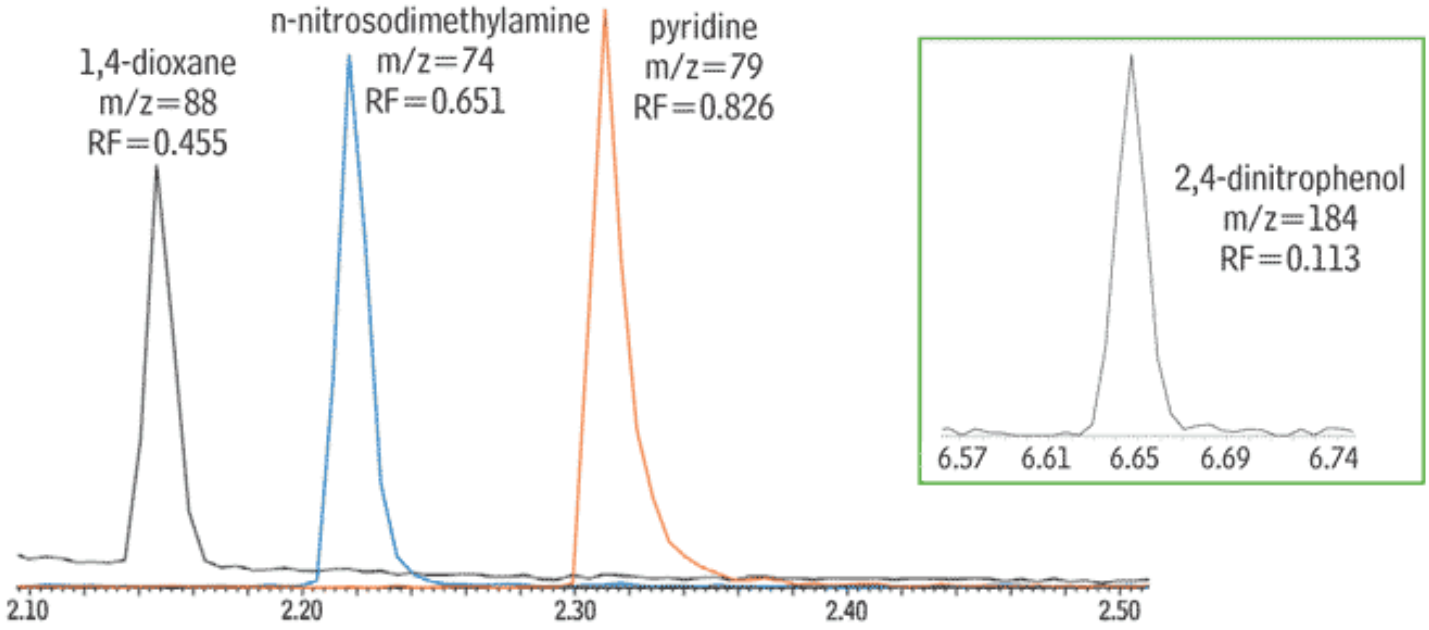
GC_EV00833

Column:	Rxi -1ms, 30m, 0.25mm ID, 0.25µm (cat.# 13323)
Sample:	US EPA Method 525.2 mix: custom 525.2 calibration mix, SV Internal Standard Mix (cat.# 31206), B/N Surrogate Mix (4/89 SOW) (cat.# 31024), Acid Surrogate Mix (4/89 SOW) (cat.# 31025)
Inj.:	1.0µL, 10µg/mL each analyte (internal standards 100µg/mL), split (10:1) 4mm Drilled Uniliner® inlet liner (hole at bottom) (cat.# 20756)
Instrument:	Agilent 6890
Inj. temp.:	250°C
Carrier gas:	helium, constant flow
Flow rate:	1.2mL/min.
Oven temp.:	50°C (hold 1 min.) to 265°C @ 20°C/min., to 330°C @ 6°C/min. (hold 1 min.)
Det.:	Agilent 5973 MSD

Transfer line temp.:	280°C
Scan range:	35-550 amu
Solvent delay:	3.20 min.
Tune:	DFTPP
Ionization:	EI

*Internal standards at 100ng on-column.

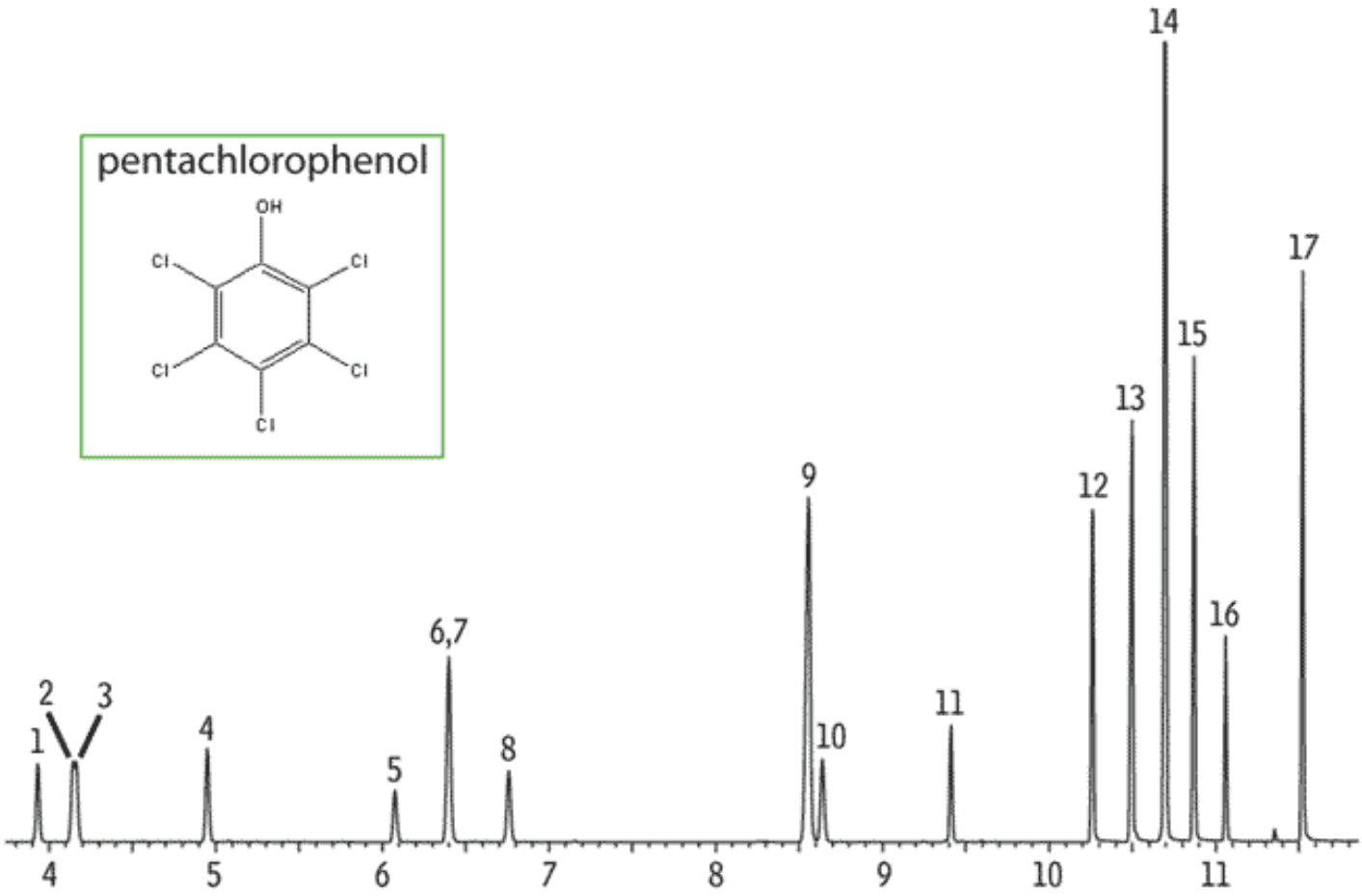
Figure 2 An Rxi -1ms column has excellent selectivity for basic or acidic compounds, under the same conditions (0.5ng each; extracted ion chromatograms).



GC_EV00830

Figure 3 Symmetric peaks for acidic analytes at 5.0ng on an Rxi -1ms column (extracted ion chromatogram).

1. phenol
2. 2-chlorophenol-d4 (surr.)
3. 2-chlorophenol
4. 2-methylphenol (*o*-cresol)
5. 2-nitrophenol
6. 2,4-dimethylphenol-3,5,6-d3 (surr.)
7. 2,4-dimethylphenol
8. 2,4-dichlorophenol
9. 3-nitro-*o*-xylene (int. std.)
10. 4-chloro-3-methylphenol
11. 2,4,6-trichlorophenol
12. 2,4-dinitrophenol
13. 4-nitrophenol
14. 2,3,4,5-tetrachlorophenol (int. std.)
15. 2-methyl-4,6-dinitrophenol
16. 2,4,6-tribromophenol (surr.)
17. pentachlorophenol

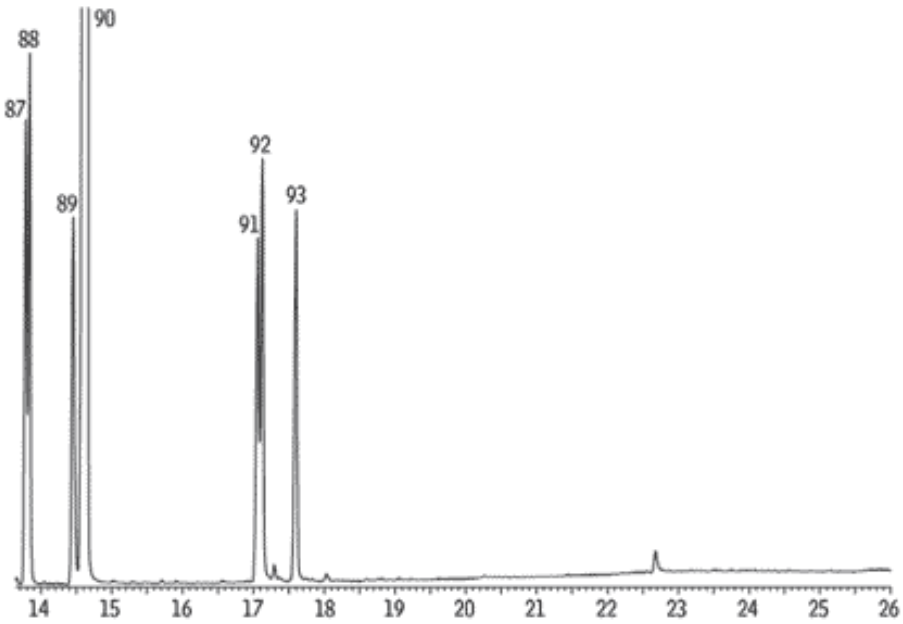


GC_EV00834

Column:	Rxi -1ms, 30m, 0.25mm ID, 0.25µm (cat.# 13323)
Sample:	US EPA Method 528 Mix: Phenols Fortification Mix, EPA 528 (cat.# 31695), Internal Standard Mix, EPA 528 (cat.# 31696), Surrogate Standard Mix, EPA 528 (cat.# 31697)
Inj.:	1.0µL, 5µg/mL each analyte (internal standards 25µg/mL), split (10:1) 4mm Drilled Uniliner® inlet liner (hole at bottom) (cat.# 20771)
Instrument:	Agilent 6890
Inj. temp.:	250°C
Carrier gas:	helium, constant flow
Flow rate:	1.2mL/min.
Oven temp.:	70°C (hold 0.5 min.) to 130°C @ 8°C/min., to 300°C @ 50°C/min. (hold 1 min.)
Det.:	Agilent 5973 MSD

Figure 4 Negligible bleed for an Rxi -1ms column at 330°C (end of analysis for 5ng on-column standard).

87. benzo(b)fluoranthene
88. benzo(k)fluoranthene
89. benzo(a)pyrene
90. perylene-d12 (int. std.)
91. indeno(1,2,3-cd)pyrene
92. dibenzo(a,h)anthracene
93. benzo(ghi)perylene

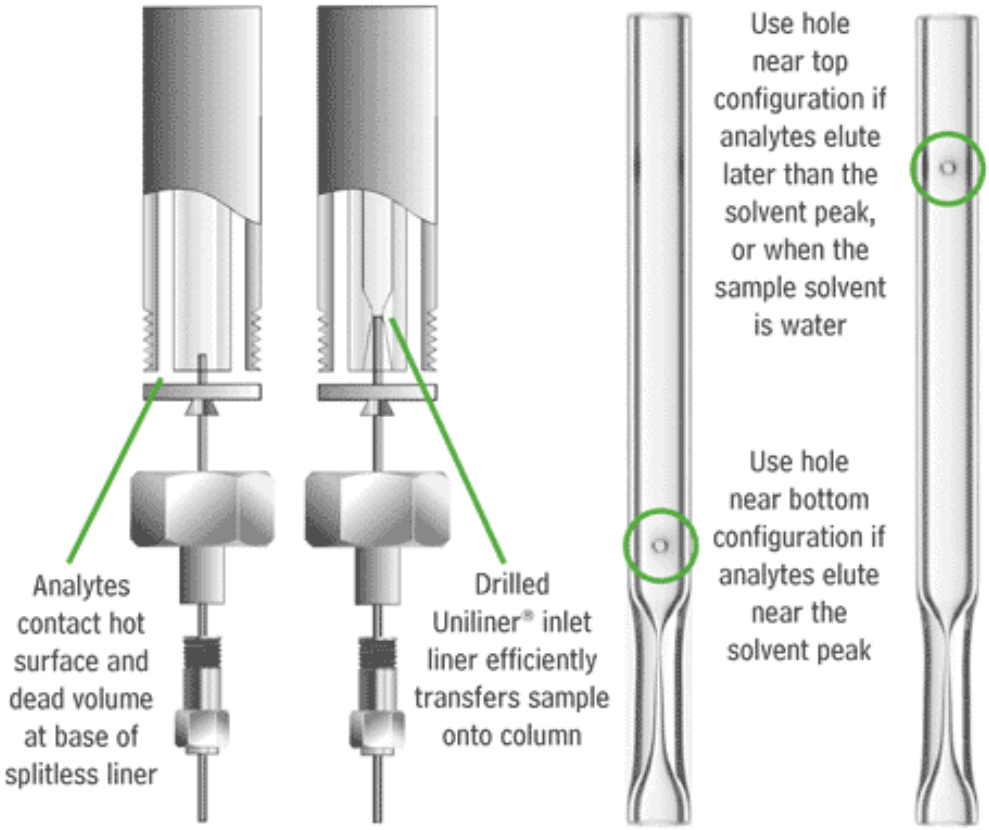


GC_EV00856

Column:
Rxi -1ms, 30m, 0.25mm ID, 0.25µm (cat.# 13323)

restek innovation!

The Drilled Uniliner® (Footnote 1)
To reduce the effects of surface activity in the injection port liner, and focus on the effects of the column on active analytes, we used a Drilled Uniliner® inlet liner for this work. This liner connects directly to the column, eliminating contact between the active compounds and active metal surfaces in the injector, and ensuring an inactive sample pathway for analyte transfer from the injection port to the column.



Sensitive GC/MS Analysis for Drugs of Abuse

1ng Limit of Detection for Acidic/Neutral or Basic Drugs on New Rxi -5ms Column

By Kristi Sellers, Clinical/Forensic Innovations Chemist

- New stationary phase, inert to acidic or basic drugs.
- Unique deactivation allows 1ng LOD.
- Column technology specially developed for GC/MS.

GC/MS is considered the standard for confirming the presence of abused drugs in body fluids, including acidic drugs (e.g., methaqualone), neutral drugs (e.g., phenobarbital), and basic drugs (e.g., methamphetamine). These methods are well established, and the positive identifications that mass spectral data generate are accepted as confirming evidence in courts of law. The accepted stationary phase for these analyses is a 5% phenyl / 95% methyl polysiloxane phase, because it provides the best selectivity for separating the drugs and their metabolites. Unfortunately, not all 5% phenyl columns provide the inertness needed to accurately quantify low concentrations of reactive acidic or basic drugs.

Now, Restek's R&D chemists have developed a new 5% phenyl stationary phase and a unique column deactivation technology specifically for GC/MS. The product of this combination - the Rxi -5ms column - ensures enhanced inertness for acidic or basic compounds, while maintaining the selectivity of a conventional 5% phenyl column.

Using mixtures of underivatized acidic/neutral drugs and basic drugs, at an on-column concentration of 1ng for each drug, we evaluated a 30m, 0.25mm ID, 0.25µm Rxi -5ms column for resolution and inertness. Figure 1 shows chromatography for acidic/neutral drugs and basic drugs analyzed by GC/MS. In either analysis, all compounds are resolved to baseline and exhibit symmetric peaks. Note that a Siltek® treated inlet liner contributes to these results: our unique Siltek® surface passivation process assures the liner will have the inertness needed for accurate low-level analyses of reactive acids or bases.

In combination, an Rxi -5ms column and aSiltek® treated inlet liner represent a complete solution for analyzing acidic, neutral, and basic drugs by GC/MS.

RESTEK PRODUCTS

- **GC Column** Rxi -5ms
- **Analytical Reference Materials** Exempted Drug of Abuse Reference Materials
- **SPE Cartridges** Specialty Resprep SPE Cartridges

ALSO OF INTEREST

- Rapid, Sensitive HPLC/TOF-MS Analysis for Cocaine
- GC Inlet Liner Deactivations for Basic Drug Analysis

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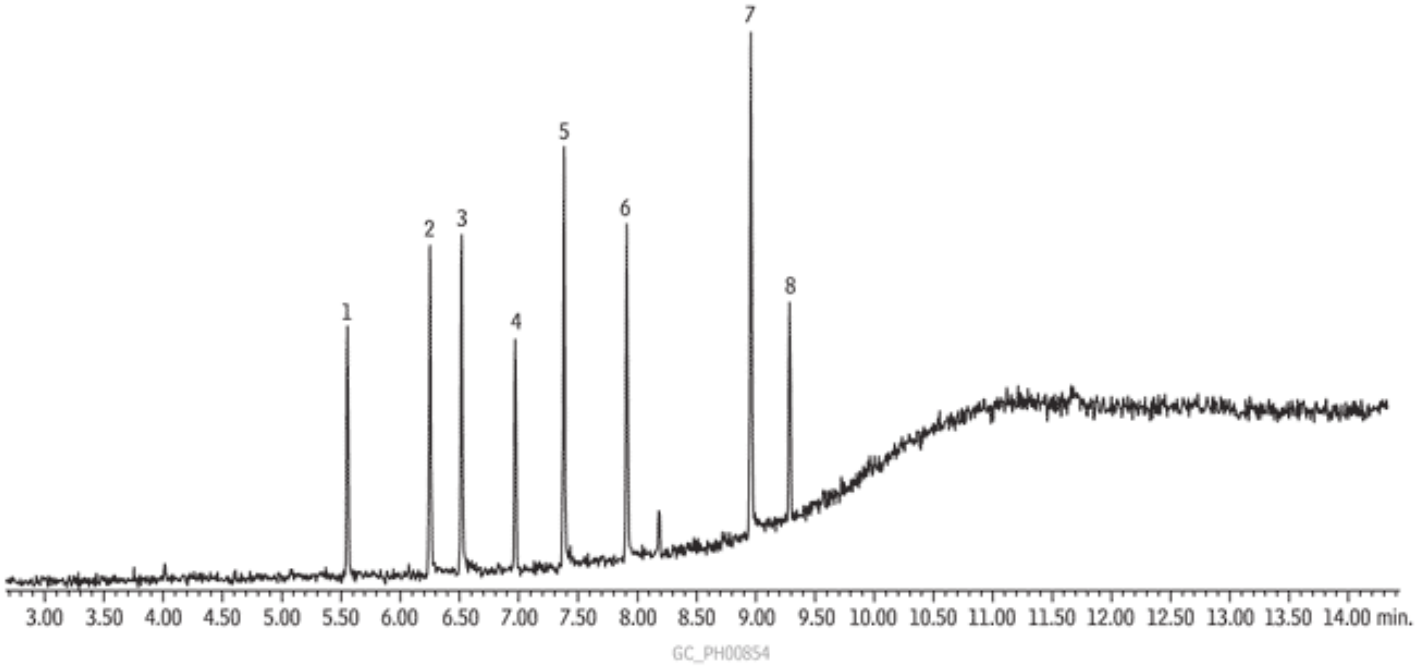
Figure 1 Analyze underivatized acidic drugs or basic drugs under the same conditions, using an Rxi -5ms column.

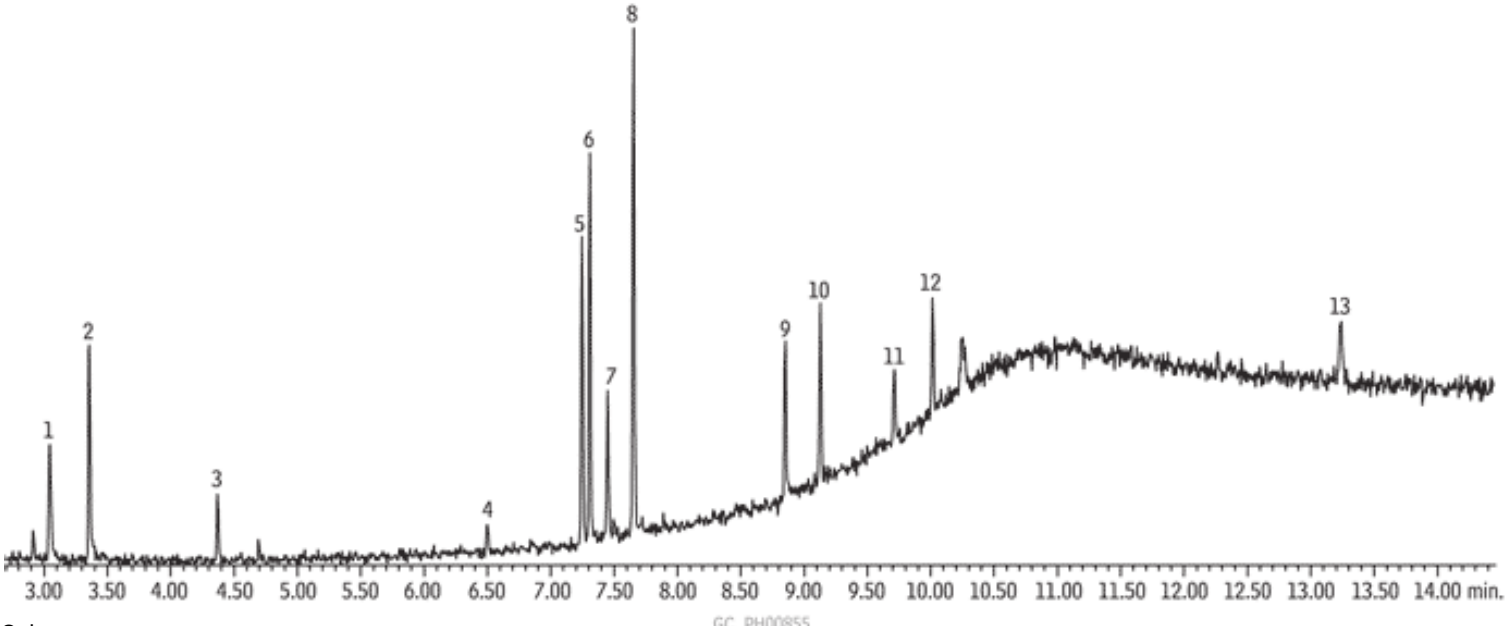
Acidic/neutral drugs resolved to baseline

1. methprylon
2. butalbital
3. amobarbital
4. meprobamate
5. glutethimide
6. phenobarbital
7. methaqualone
8. primidone



Sensitive analysis for basic drugs in free base form

1. amphetamine
2. methamphetamine
3. nicotine
4. cotinine
5. caffeine
6. benzphetamine
7. ketamine
8. phencyclidine
9. methadone
10. cocaine
11. scopolamine
12. codeine
13. alprazolam



Column:	Rxi -5ms 30m, 0.25mm ID, 0.25µm (cat.# 13423)
Sample:	10µg/mL each acidic/neutral and basic drugs in methanol
Inj.:	1.0µL split (10:1), 1ng each compound on column; Siltek® treated 4mm single gooseneck inlet liner (cat # 20798-214.1)
Inj. temp.:	250°C
Carrier gas:	helium, constant pressure
Flow rate:	1mL/min.
Oven temp.:	100°C to 300°C @ 20°C/min. (hold 5 min.)
Det.:	MS
Transfer line temp.:	300°C
Scan range:	35-550 amu
Ionization:	EI

Analysis of Semivolatile Organics

Using the new Rxi -5ms Capillary GC Column

by Robert Freeman, Environmental Innovations Chemist, and
Christopher M. English, Innovations Group Leader

- Low column bleed, outstanding inertness, excellent column-to-column reproducibility.
- Symmetric peaks and good response factors for acidic or basic analytes.
- Resolve 94 analytes in less than 18 minutes.

Sub-nanogram Analysis of Semivolatile Organics

Analyzing basic or acidic semivolatile environmental pollutants at low nanogram-on-column concentrations puts demands on the entire analytical system. Using our new Rxi -5ms column, we have developed an analytical procedure that assures good performance for both acids and bases.

Rxi -5ms Column Offers Sensitivity for Acids and Bases

One of the most active basic compounds listed in semivolatiles methods is pyridine. This early-eluting compound can elicit poor performance in the injection port and on the column, and many currently available columns give a poor peak shape for pyridine. Columns with a slightly basic surface can perform well with pyridine, but will perform poorly with the acidic compounds, such as 2,4-dinitrophenol.

Figure 1 combines extracted ion chromatograms for the initial three US EPA Method 8270D target compounds, at 0.5ng per compound on-column. The extracted ion for 1,4-dioxane shows that injection port and oven conditions were optimized. The pyridine and N-nitrosodimethylamine peaks are symmetric, even at this low level of detection. An excessively tailing pyridine peak, or a pyridine peak smaller than that for 1,4-dioxane at the same concentration, would indicate on-column activity. With an Rxi -5ms column, and the conditions listed for Figure 3, pyridine can be detected reliably at low concentrations.

Analytically, 2,4-dintrophenol is considered the most problematic compound in the Method 8270 target list. 2,4-Dinitrophenol and the other system performance check compounds (SPCC) - N-nitroso-di-*n*-propylamine, hexachlorocyclopentadiene, and 4-nitrophenol - must exhibit a minimum average response factor (RF) of 0.050. An optimized system generally will provide response factors greater than 0.1 for these compounds, but the lower the calibration curve for these compounds, the more difficult it is to achieve passing response factors. If any of these compounds fails to meet the Method 8270 response factor criterion, system maintenance must be performed to bring response factors to passing before samples can be analyzed. Figure 2 shows the inertness of the Rxi -5ms column, which exhibits a response factor of 0.136 for 0.5ng on-column of 2,4-dinitrophenol.

The total ion chromatogram for our optimized analysis is shown in Figure 3. There are at least five scans across each target analyte, which assures good spectral integrity and good peak shape, and the last compound is eluted in less than 18 minutes.

The Result

The Rxi -5ms column introduces a new generation of Restek columns that exhibit low bleed, outstanding inertness, and excellent column-to-column reproducibility.

An Rxi -5ms column, used in an optimized system, provides excellent chromatography for Method 8270 semivolatile compounds, including difficult-to-analyze acidic or basic compounds, at low on-column concentrations. These new columns give the performance needed, at the sensitivity required, column after column.

RESTEK PRODUCTS

- **GC Column**
  Rxi -5ms Columns
- **GC Accessories**
  4mm Drilled Uniliner® Inlet Liner
- **Analytical Reference Materials**
  Semivolatiles MegaMix

ALSO OF INTEREST

- A 12-Minute Analysis for Volatiles
- Improved SPE Cartridges for Massachusetts EPH Analysis
- New Reference Mix of Canadian Drinking Water Volatiles
- Excellent Responses in GC/MS Analysis of Semivolatiles

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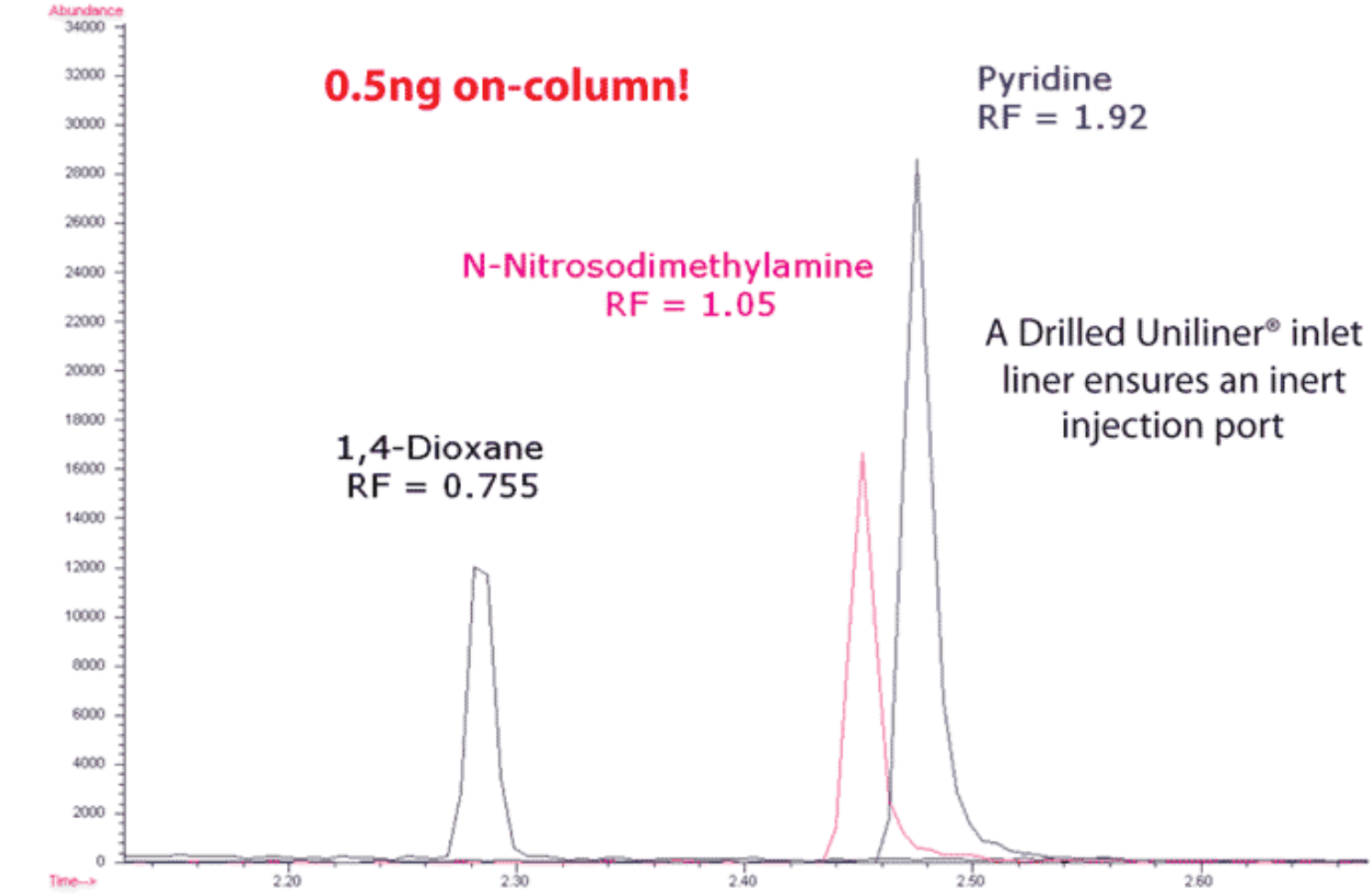
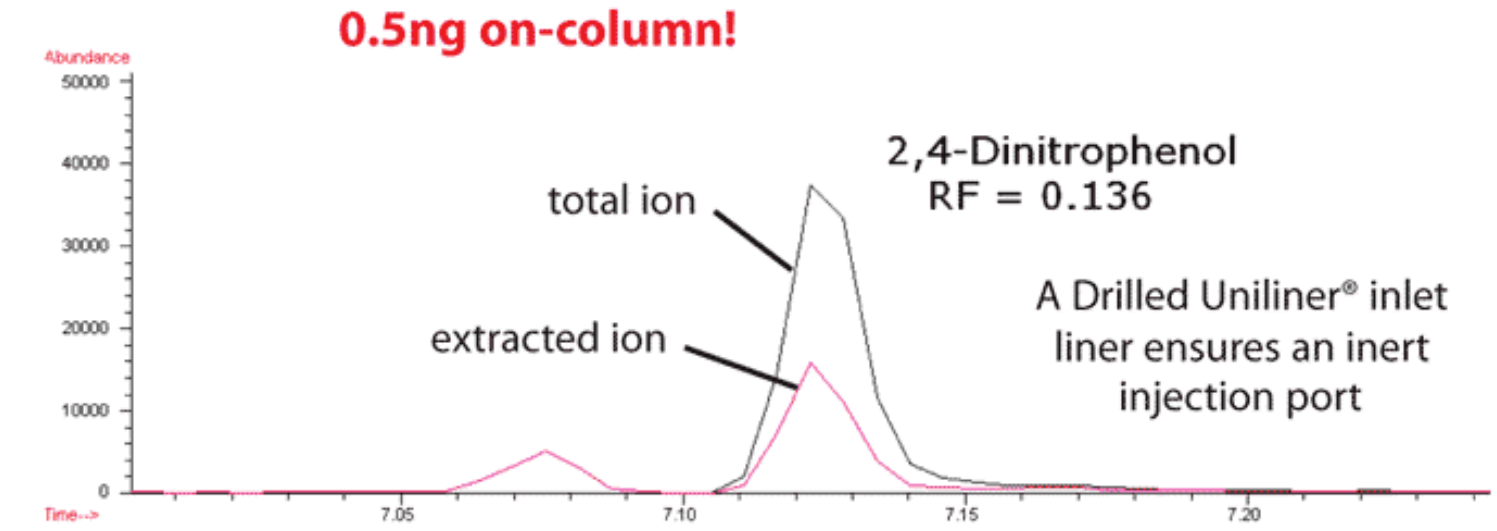
Figure 1 An Rxi -5ms column provides sharp, easily quantified peaks for active analytes (extracted ion chromatograms).



GC_EV00821b

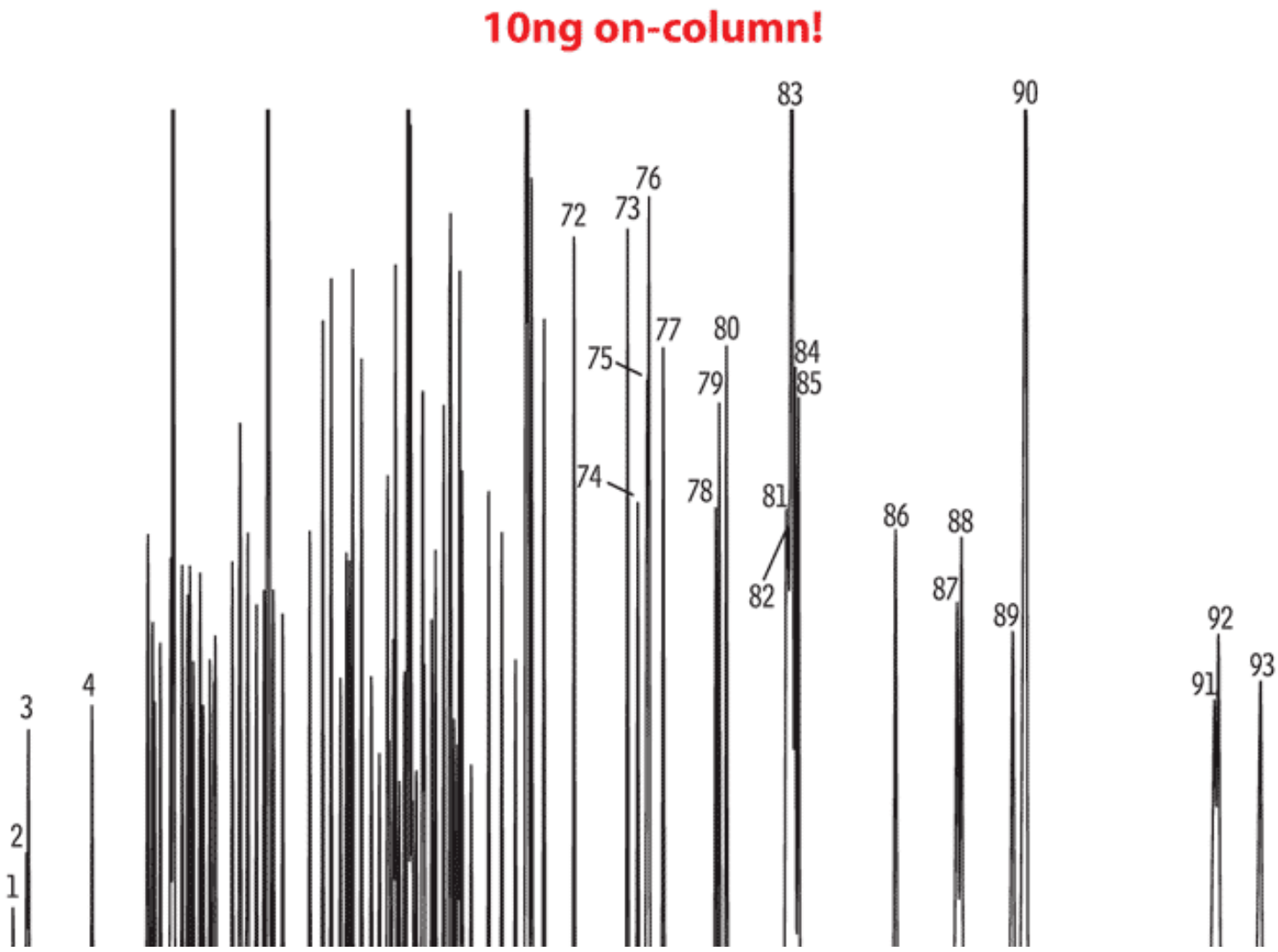
Figure 2 Excellent response for 0.5ng 2,4-dintrophenol on an Rxi -5ms column.

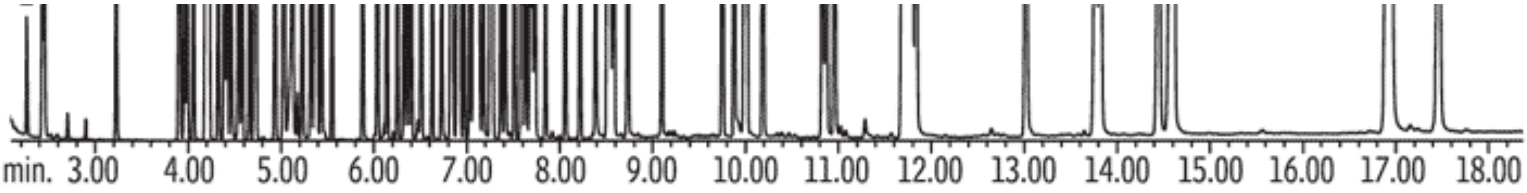


GC_EV00829

Figure 3 Separate 94 semivolatile compounds in less than 18 minutes, using an Rxi -5ms column.

1. 1,4-dioxane
2. N-nitrosodimethylamine
3. pyridine
4. 2-fluorophenol
5. phenol-d6
6. phenol
7. aniline
8. bis(2-chloroethyl) ether
9. 2-chlorophenol
10. 1,3-dichlorobenzene
11. 1,4-dichlorobenzene-d4
12. 1,4-dichlorobenzene
13. benzyl alcohol
14. 1,2-dichlorobenzene
15. 2-methylphenol
16. bis(2-chloroisopropyl) ether
17. a. 4-methylphenol
    b. 3-methylphenol
18. N-nitroso-di-*n*-propylamine
19. hexachloroethane
20. nitrobenzene-d5
21. nitrobenzene
22. isophorone
23. 2-nitrophenol
24. 2,4-dimethylphenol
25. benzoic acid
26. bis(2-chloroethoxy)methane
27. 2,4-dichlorophenol
28. 1,2,4-trichlorobenzene
29. naphthalene-d8
30. naphthalene
31. 4-chloroaniline
32. hexachlorobutadiene
33. 4-chloro-3-methylphenol
34. 2-methylnaphthalene
35. 1-methylnaphthalene
36. hexachlorocyclopentadiene
37. 2,4,6-trichlorophenol
38. 2,4,5-trichlorophenol
39. 2-fluorobiphenyl
40. 2-chloronaphthalene
41. 2-nitroaniline
42. 1,4-dinitrobenzene
43. dimethyl phthalate
44. 1,3-dinitrobenzene
45. 2,6-dinitrotoluene
46. acenaphthylene
47. 1,2-dinitrobenzene
48. 3-nitroaniline
49. acenaphthene-d10
50. acenaphthene
51. 2,4-dinitrophenol
52. 4-nitrophenol
53. dibenzofuran
54. 2,4-dinitrotoluene
55. 2,3,4,6-tetrachlorophenol
56. 2,3,5,6-tetrachlorophenol
57. diethyl phthalate
58. 4-chlorophenyl phenyl ether
59. fluorene
60. 4-nitroanaline
61. 4,6-dinitro-2-methylphenol
62. N-nitrosodiphenylamine
    (as diphenylamine)
63. 1,2-diphenylhydrazine
    (as azobenzene)
64. 2,4,6-tribromophenol
65. 4-bromophenyl phenyl ether
66. hexachlorobenzene
67. pentachlorophenol
68. phenanthrene-d10
69. phenanthrene
70. anthracene
71. carbazole
72. di-*n*-butyl phthalate
73. fluoranthene
74. benzidine
75. pyrene-d10
76. pyrene
77. *p*-terphenyl-d14
78. 3,3′-dimethylbenzidine
79. butyl benzyl phthalate
80. bis(2-ethylhexyl) adipate
81. 3,3′-dichlorobenzidine
82. benzo(a)anthracene
83. chrysene-d12
84. chrysene
85. bis(2-ethylhexyl) phthalate
86. di-*n*-octyl phthalate
87. benzo(b)fluoranthene
88. benzo(k)fluoranthene
89. benzo(a)pyrene
90. perylene-d12
91. indeno(1,2,3-cd)pyrene
92. dibenzo(a,h)anthracene
93. benzo(ghi)perylene





GC_EV00823

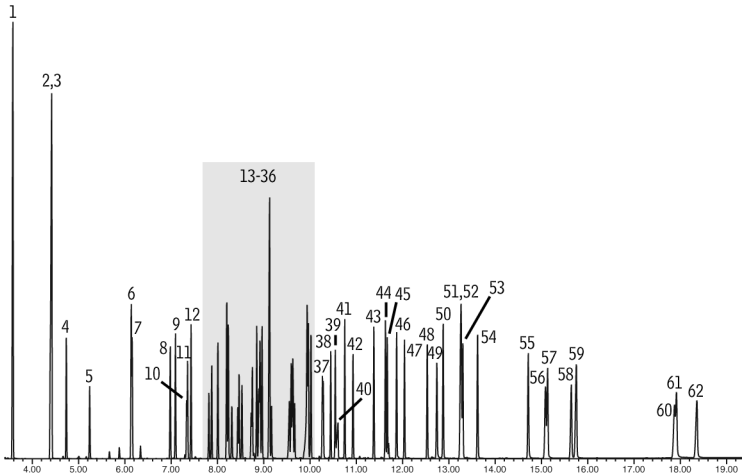
Column:	Rxi -5ms, 30m, 0.25mm ID, 0.25µm (cat.# 13423)
Sample:	US EPA Method 8270D mix: 8270 MegaMix (cat.# 31850), Benzoic Acid Standard (cat.# 31879), Benzidine Standard (cat.# 31852), Acid Surrogate Mix (cat.# 31025), B/N Surrogate Standard Mix (cat.# 31887), 1,4-Dioxane (cat.# 31853)
Inj.:	1.0µL, 10ppm each analyte (10ng on column), splitless (hold 0.1 min.) **4mm Drilled Uniliner® inlet liner (hole at bottom) (cat.# 20756)**
Instrument:	Agilent 6890
Inj. temp.:	250°C
Carrier gas:	helium, constant flow
Flow rate:	1.2mL/min.
Oven temp.:	50°C (hold 0.5 min.) to 265°C @ 25°C/min., to 330°C @ 6°C/min. (hold 2 min.)
Det.:	Agilent 5973 GC/MS
Transfer line temp.:	280°C
Scan range:	35-550 amu
Solvent delay:	2 min.
Tune:	DFTPP
Ionization:	EI

Related Information

- Drinking Water Semivolatiles at 10ng on Rxi-1ms
- Acidic Analytes at 5.0ng on Rxi-1ms (extracted ion chromatogram)
- Pyridine and 2,4-dinitrophenol EPA Method 8270D on Rxi-1ms
- 2,4-dinitrophenol EPA method 8270D on Rxi-1ms
- Steroid Sex Hormones on Rxi-5ms
- Sulfur Compounds on Rxi-1ms
- Semivolatiles EPA Method 8270D on Rxi-1ms
- Phthalate & Adipate Esters on Rxi-1ms
- Hazardous Substances on Rxi-1ms
- Base/Neutrals US EPA Method 525.2 on Rxi-1ms
- Hazardous Substances on Rxi-1ms
- Pesticides Minn Ag List 1 on Rxi-1ms
- Lubrication Range Organics on Rxi-1ms

Drinking Water Semivolatiles at 10ng on Rxi™-1ms

1. 2-fluorophenol (surr.)
2. bis(2-chloroethyl)ether
3. phenol-d6 (surr.)
4. 1,4-dichlorobenzene-d4 (int. std.) •
5. nitrobenzene-d5 (surr.)
6. naphthalene-d8 (int. std.) •
7. naphthalene
8. 1-methylnaphthalene
9. 2-methylnaphthalene
10. hexachlorocyclopentadiene
11. EPTC
12. 2-fluorobiphenyl (surr.)
13. 2,6-dinitrotoluene
14. dimethylphthalate
15. acenaphthylene
16. acenaphthene-d10 (int. std.) •
17. acenaphthene
18. 2,4-dinitrotoluene
19. 1-naphthalenamine
20. molinate
21. 2-naphthalenamine
22. 5-nitro-*o*-toluidine
23. diethylphthalate
24. fluorene
25. propachlor
26. diphenylamine
27. 2,4,6-tribromophenol (surr.)
28. simazine
29. prometon
30. atrazine
31. hexachlorobenzene
32. 4-aminobiphenyl
33. terbacil
34. phenanthrene-d10 (int. std.) •
35. phenanthrene
36. anthracene
37. metribuzin
38. acetochlor
39. alachlor
40. bromacil
41. di-*n*-butylphthalate
42. metolachlor
43. fluoranthene
44. pyrene
45. butachlor
46. *p*-terphenyl-d14 (surr.)
47. *p*-dimethylaminoazobenzene
48. benzyl butyl phthalate
49. 2-acetylaminofluorene
50. bis(2-ethylhexyl)adipate
51. benzo(a)anthracene
52. chrysene-d12 (int. std.) •
53. chrysene
54. bis(2-ethylhexyl)phthalate
55. di-*n*-octylphthalate
56. benzo(b)fluoranthene
57. benzo(k)fluoranthene
58. benzo(a)pyrene
59. perylene-d12 (int. std.) •
60. indeno(1,2,3-cd)pyrene
61. dibenzo(a,h)anthracene
62. benzo(ghi)perylene



GC_EV00833

Column:	Rxi™-1ms, 30m, 0.25mm ID, 0.25μm (cat.# 13323)
Sample:	US EPA Method 525.2 mix: custom 525.2 calibration mix, SV Internal Standard Mix (cat.# 31206), B/N Surrogate Mix (4/89 SOW) (cat.# 31024), Acid Surrogate Mix (4/89 SOW) (cat.# 31025)
Inj.:	1.0μL, 10μg/mL each analyte (internal standards 100μg/mL), split (10:1) 4mm Drilled Uniliner® inlet liner (hole at bottom) (cat.# 20756)
Instrument:	Agilent 6890
Inj. temp.:	250°C
Carrier gas:	helium, constant flow
Flow rate:	1.2mL/min.
Oven temp.:	50°C (hold 1 min.) to 265°C @ 20°C/min., to 330°C @ 6°Cmin. (hold 1 min.)
Det.:	Agilent 5973 MSD
Transfer line temp.:	280°C
Scan range:	35-550 amu
Solvent delay:	3.20 min.
Tune:	DFTPP
Ionization:	EI

• Internal standards at 100ng on-column.

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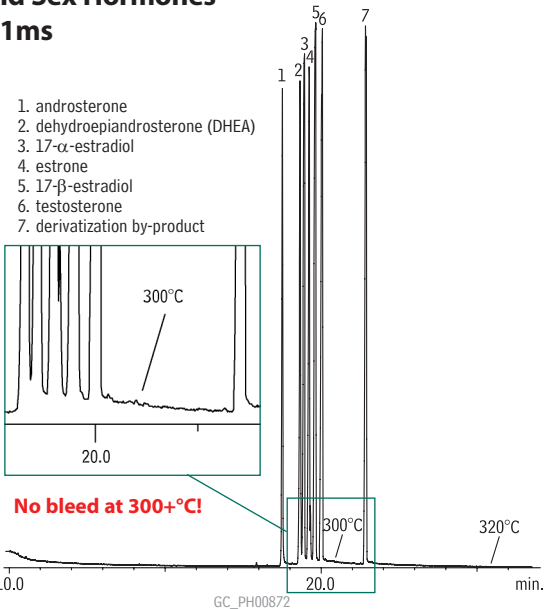
Steroid Sex Hormones
Rxi™-1ms



Column:	Rxi™-1ms 30m, 0.25mm ID, 0.25μm (cat.# 13323)
Sample:	100μg/mL each hormone in methanol or ethanol; compounds derivatized using 2% methoxylamine HCl (CH_3ONH_2) in pyridine, then N-trimethylsilylimidazole (TMSI), then analyzed
Inj.:	1.0μL splitless (hold 0.5 min.), 3.5mm single gooseneck inlet liner (cat.# 20961)
Inj. temp.:	250°C
Carrier gas:	helium, constant flow
Flow rate:	1mL/min.
Oven temp.:	100°C to 320°C @ 10°C/min. (hold 10 min.)
Det:	MS: Shimadzu 17A with QP5000
Transfer line temp.:	280°C
Scan range:	40-700 amu
Ionization:	EI
Mode:	scan

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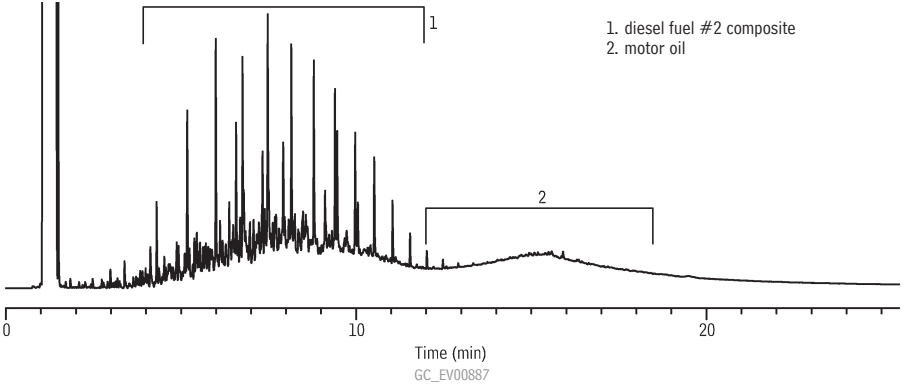
Lubrication Range Organics
Diesel Fuel #2/Motor Oil
Rxi™-1ms



Column:	Rxi™-1ms, 20m, 0.18mm ID, 0.18μm (cat.# 13302)
Sample:	Diesel #2/ Motor Oil (cat.# 31682) 5000μg/mL each component in hexane
Inj.:	0.5μL, split, split ratio 20:1, 3.5mm Precision™ inlet liner (cat.# 21021)
Instrument:	Shimadzu GC-2010
Inj. temp.:	275°C
Carrier gas:	hydrogen, constant pressure
Linear velocity:	55cm/sec. @ 40°C
Oven temp.:	40°C (hold 1 min.) to 330°C @ 20°C/min. (hold 10 min.)
Det.:	FID @ 350°C

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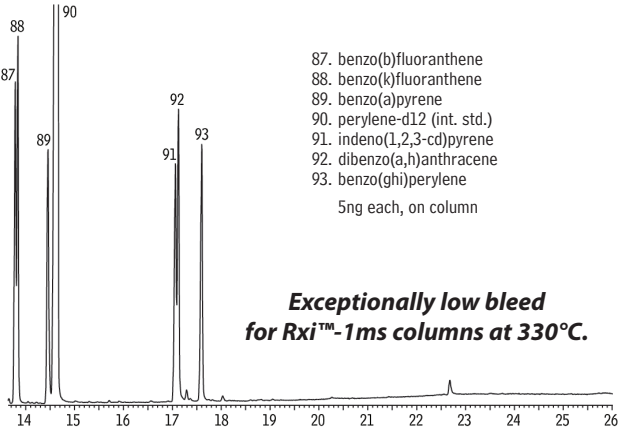
Semivolatiles
US EPA Method 8270D
Rxi™-1ms



Column:	Rxi™-1ms, 30m, 0.25mm ID, 0.25µm (cat.# 13323)
Sample:	US EPA Method 8270D mix,: 8270 MegaMix™ (cat.# 31850), Benzoic Acid Standard (cat.# 31879), Benzidine Standard (cat.# 31852), Acid Surrogate Mix (cat.# 31025), B/N Surrogate Standard Mix (cat.# 31887), 1,4-Dioxane (cat.# 31853)
Instrument:	Agilent 6890
Inj.:	1.0µL, 5µg/mL each component (5ng on column) (internal standards at 50µg/mL / 50ng), split (10:1), 4mm Drilled Uniliner®, hole in bottom (cat#20771)
Inj. temp.:	250°C
Carrier gas:	helium, constant flow
Flow rate:	1.2mL/min.
Oven temp.:	50°C (0.5 min.) to 245°C @ 25°C/min., to 330°C @ 6°C/min. (5 min.)
Det.:	Agilent 5973 MS
Interface line temp.:	280°C
Scan range:	35-260 amu
Solvent delay:	2 min.
Tune:	DFTPP
Ionization:	EI

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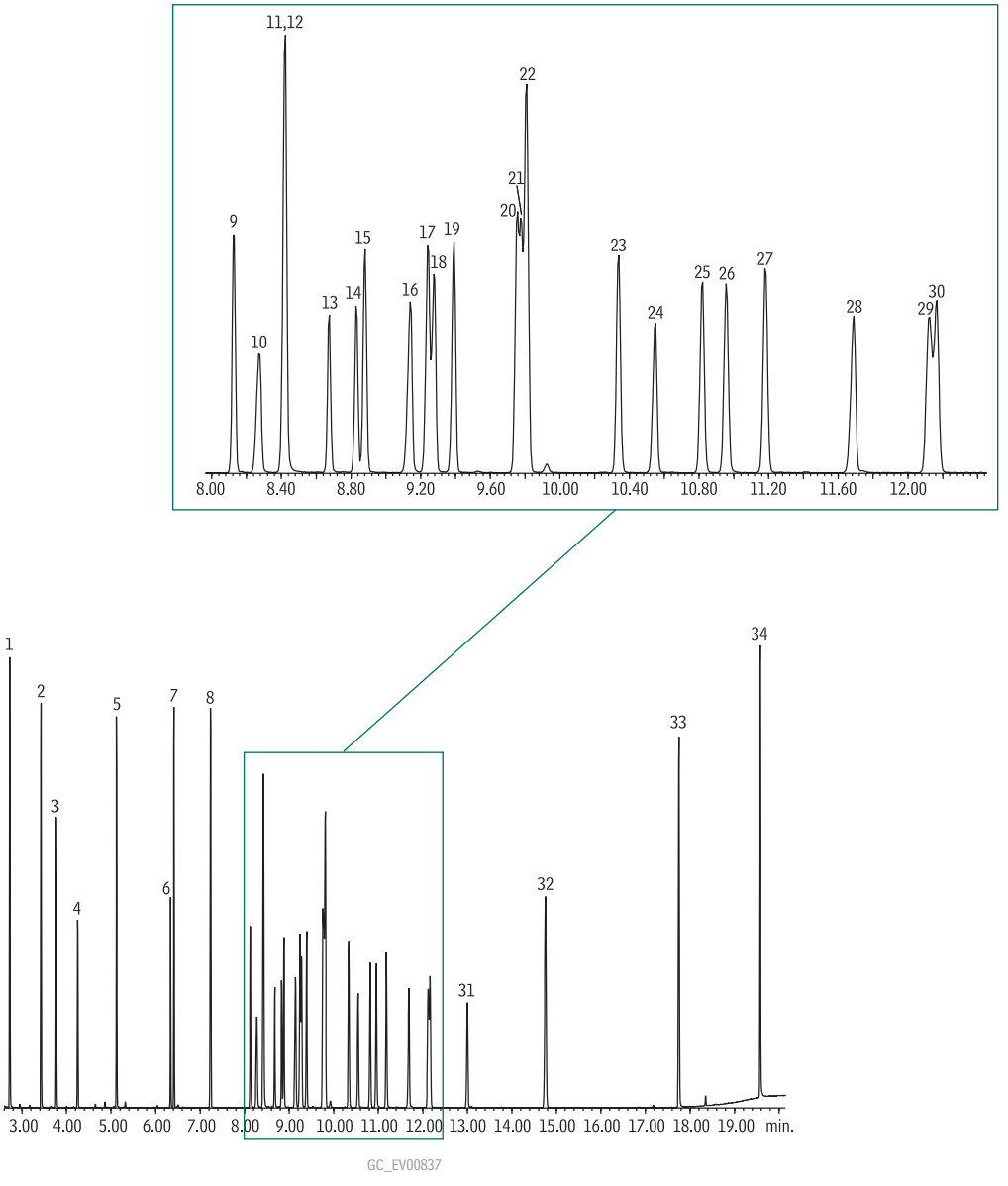
Pesticides
Minnesota Ag List 1
Rxi™-1ms

1. 2-fluorophenol (SS)
2. phenol-d6 (SS)
3. 1,4-dichlorobenzene-d4 (IS)
4. nitrobenzene-d5 (SS)
5. naphthalene-d8 (IS)
6. EPTC
7. 2-fluorobiphenyl (SS)
8. acenaphthene-d10 (IS)
9. propachlor
10. desisopropyl atrazine
11. desethyl atrazine
12. 2,4,6-tribromophenol (SS)
13. ethalfluralin
14. trifluralin
15. phorate
16. simazine
17. prometon
18. atrazine
19. propazine
20. terbufos
21. fonofos
22. phenanthrene-d10 (IS)
23. triallate
24. metribuzin
25. dimethenamid
26. acetochlor
27. alachlor
28. cyanazine
29. metolachlor
30. chlorpyrifos
31. pendimethalin
32. *p*-terphenyl-d14 (SS)
33. chrysene-d12 (IS)
34. perylene-d12 (IS)



GC_EV00837

Column:	Rxi™-1ms, 30m, 0.25mm ID, 0.25µm (cat.# 13323)
Sample:	Minnesota Ag List 1 Pesticides Mix A (cat.# 32406), Minnesota Ag List 1 Pesticides Mix B (cat.# 32407), SV Internal Standard Mix (cat.# 31206), B/N Surrogate Mix (4/89 SOW) (cat.# 31024), Acid Surrogate Mix (4/89 SOW) (cat.# 31025)
Inj.:	1.0µL, 10µg/mL each analyte (internal standards 25µg/mL), split (10:1) 4mm Drilled Uniliner® inlet liner (hole at bottom) (cat.# 20771)
Instrument:	Agilent 6890
Inj. temp.:	250°C
Carrier gas:	helium, constant flow
Flow rate:	1.2mL/min.
Oven temp.:	70°C (hold 1 min.) to 180°C @ 20°C/min., to 230°C @ 5°C/min., to 325°C @ 40°C/min. (hold 3.5 min.)
Det.:	Agilent 5973 MSD
Transfer line temp.:	280°C
Scan range:	35-550 amu
Solvent delay:	2.50 min.
Tune:	DFTPP
Ionization:	EI

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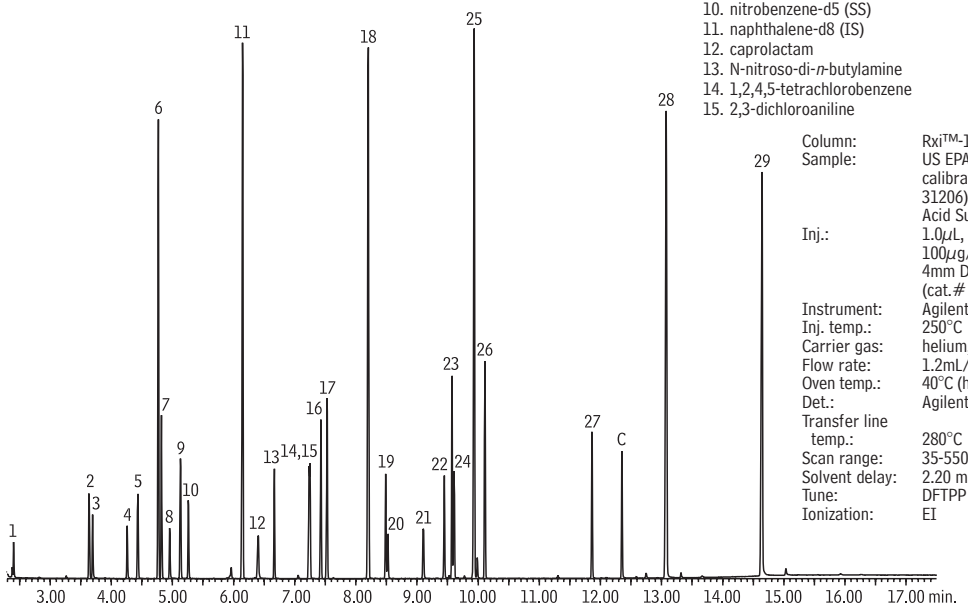
Hazardous Substances
Rxi™-1ms

1. 1,4-dioxane
2. 2-fluorophenol (SS)
3. N-nitrosodiethylamine
4. benzaldehyde
5. phenol-d6 (SS)
6. 1,4-dichlorobenzene-d4 (IS)
7. *n*-decane
8. N-nitrosopyrrolidine
9. acetophenone
10. nitrobenzene-d5 (SS)
11. naphthalene-d8 (IS)
12. caprolactam
13. N-nitroso-di-*n*-butylamine
14. 1,2,4,5-tetrachlorobenzene
15. 2,3-dichloroaniline
16. 2-fluorobiphenyl (SS)
17. biphenyl
18. acenaphthene-d10 (IS)
19. pentachlorobenzene
20. 2-naphthalenamine
21. 2,4,6-tribromophenol (SS)
22. dimethoate
23. heptadecane
24. atrazine
25. phenanthrene-d10 (IS)
26. *n*-octadecane
27. *p*-terphenyl-d14 (SS)
28. chrysene-d12 (IS)
29. perylene-d12 (IS)

C = contaminant



Column:	Rxi™-1ms, 30m, 0.25mm ID, 0.25μm (cat.# 13323)
Sample:	US EPA Method 525.2 mix: custom base/neutrals calibration mix, SV Internal Standard Mix (cat.# 31206), B/N Surrogate Mix (4/89 SOW) (cat.# 31024), Acid Surrogate Mix (4/89 SOW) (cat.# 31025)
Inj.:	1.0μL, 10μg/mL each analyte (internal standards 100μg/mL), split (10:1) 4mm Drilled Uniliner® inlet liner (hole at bottom) (cat.# 20771)
Instrument:	Agilent 6890
Inj. temp.:	250°C
Carrier gas:	helium, constant flow
Flow rate:	1.2mL/min.
Oven temp.:	40°C (hold 0.5 min.) to 320°C @ 20°C/min. (hold 3 min.)
Det.:	Agilent 5973 MSD
Transfer line temp.:	280°C
Scan range:	35-550 amu
Solvent delay:	2.20 min.
Tune:	DFTPP
Ionization:	EI

GC_EV00836

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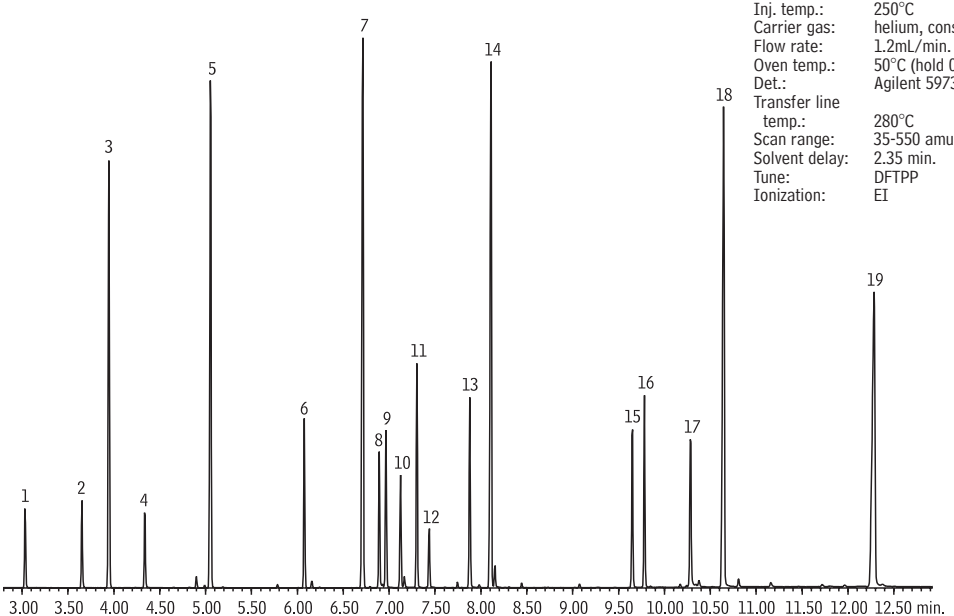
Hazardous Substances
Rxi™-1ms

Column:	Rxi™-1ms, 30m, 0.25mm ID, 0.25µm (cat.# 13323)
Sample:	Custom Appendix IX Mix, plus SV Internal Standard Mix (cat.# 31206), B/N Surrogate Mix (4/89 SOW) (cat.# 31024), Acid Surrogate Mix (4/89 SOW) (cat.# 31025)
Inj.:	1.0µL, 5µg/mL each analyte (internal standards 25µg/mL), split (10:1) 4mm Drilled Uniliner® inlet liner (hole at bottom) (cat.# 20771)
Instrument:	Agilent 6890
Inj. temp.:	250°C
Carrier gas:	helium, constant flow
Flow rate:	1.2mL/min.
Oven temp.:	50°C (hold 0.5 min.) to 300°C @ 25°C/min. (hold 5 min.)
Det.:	Agilent 5973 MSD
Transfer line temp.:	280°C
Scan range:	35-550 amu
Solvent delay:	2.35 min.
Tune:	DFTPP
Ionization:	EI



1. 2-fluorophenol (SS)
2. phenol-d6 (SS)
3. 1,4-dichlorobenzene-d4 (IS)
4. nitrobenzene-d5 (SS)
5. napthalene-d8 (IS)
6. 2-fluorobiphenyl (SS)
7. acenaphthene-d10 (IS)
8. 1-naphthalenamine
9. 2-naphthalenamine
10. 5-nitro-*o*-toluidine
11. diphenylamine
12. 2,4,6-tribromophenol (SS)
13. 4-aminobiphenyl
14. phenanthrene-d10 (IS)
15. *p*-terphenyl-d14 (SS)
16. *p*-dimethylaminoazobenzene
17. 2-acetylaminofluorene
18. chrysene-d12 (IS)
19. perylene-d12 (IS)

GC_EV00835

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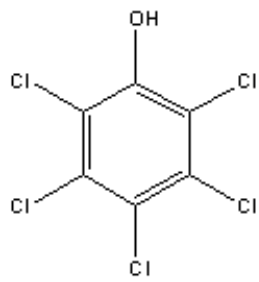
Acidic Analytes at 5.0ng
Rxi™-1ms
(extracted ion chromatogram)

1. phenol
2. 2-chlorophenol-d4 (surr.)
3. 2-chlorophenol
4. 2-methylphenol (*o*-cresol)
5. 2-nitrophenol
6. 2,4-dimethylphenol3,5,6-d3 (surr.)
7. 2,4-dimethylphenol
8. 2,4-dichlorophenol
9. 3-nitro-*o*-xylene (int. std.)
10. 4-chloro-3-methylphenol
11. 2,4,6-trichlorophenol
12. 2,4-dinitrophenol
13. 4-nitrophenol
14. 2,3,4,5-tetrachlorophenol (int. std.)
15. 2-methyl-4,6-dinitrophenol
16. 2,4,6-tribromophenol (surr.)
17. pentachlorophenol

pentachlorophenol



GC_EV00834

Column:	Rxi™-1ms, 30m, 0.25mm ID, 0.25µm (cat.# 13323)
Sample:	US EPA Method 528 Mix: Phenols Fortification Mix, EPA 528 (cat.# 31695), Internal Standard Mix, EPA 528 (cat.# 31696), Surrogate Standard Mix, EPA 528 (cat.# 31697)
Inj.:	1.0µL, 5µg/mL each analyte (internal standards 25µg/mL), split (10:1) 4mm Drilled Uniliner® inlet liner (hole at bottom) (cat.# 20771)
Instrument:	Agilent 6890
Inj. temp.:	250°C
Carrier gas:	helium, constant flow
Flow rate:	1.2mL/min.
Oven temp.:	70°C (hold 0.5 min.) to 130°C @ 8°C/min., to 300°C @ 50°C/min. (hold 1 min.)
Det.:	Agilent 5973 MSD

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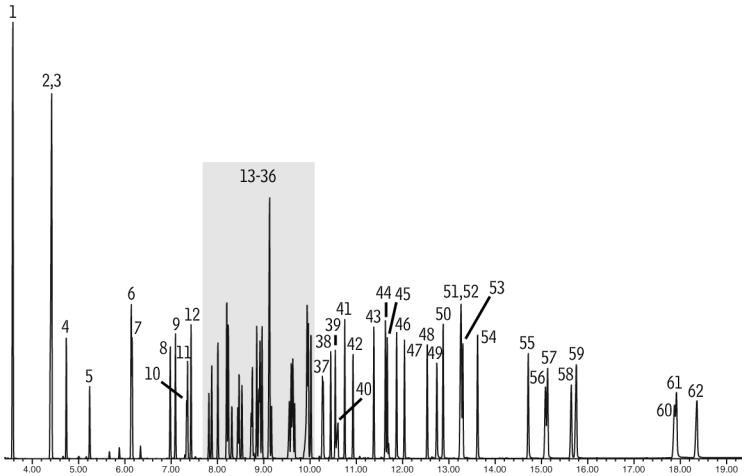
Drinking Water Semivolatiles at 10ng on Rxi™-1ms

1. 2-fluorophenol (surr.)
2. bis(2-chloroethyl)ether
3. phenol-d6 (surr.)
4. 1,4-dichlorobenzene-d4 (int. std.) •
5. nitrobenzene-d5 (surr.)
6. naphthalene-d8 (int. std.) •
7. naphthalene
8. 1-methylnaphthalene
9. 2-methylnaphthalene
10. hexachlorocyclopentadiene
11. EPTC
12. 2-fluorobiphenyl (surr.)
13. 2,6-dinitrotoluene
14. dimethylphthalate
15. acenaphthylene
16. acenaphthene-d10 (int. std.) •
17. acenaphthene
18. 2,4-dinitrotoluene
19. 1-naphthalenamine
20. molinate
21. 2-naphthalenamine
22. 5-nitro-*o*-toluidine
23. diethylphthalate
24. fluorene
25. propachlor
26. diphenylamine
27. 2,4,6-tribromophenol (surr.)
28. simazine
29. prometon
30. atrazine
31. hexachlorobenzene
32. 4-aminobiphenyl
33. terbacil
34. phenanthrene-d10 (int. std.) •
35. phenanthrene
36. anthracene
37. metribuzin
38. acetochlor
39. alachlor
40. bromacil
41. di-*n*-butylphthalate
42. metolachlor
43. fluoranthene
44. pyrene
45. butachlor
46. *p*-terphenyl-d14 (surr.)
47. *p*-dimethylaminoazobenzene
48. benzyl butyl phthalate
49. 2-acetylaminofluorene
50. bis(2-ethylhexyl)adipate
51. benzo(a)anthracene
52. chrysene-d12 (int. std.) •
53. chrysene
54. bis(2-ethylhexyl)phthalate
55. di-*n*-octylphthalate
56. benzo(b)fluoranthene
57. benzo(k)fluoranthene
58. benzo(a)pyrene
59. perylene-d12 (int. std.) •
60. indeno(1,2,3-cd)pyrene
61. dibenzo(a,h)anthracene
62. benzo(ghi)perylene



GC_EV00833

Column:	Rxi™-1ms, 30m, 0.25mm ID, 0.25μm (cat.# 13323)
Sample:	US EPA Method 525.2 mix: custom 525.2 calibration mix, SV Internal Standard Mix (cat.# 31206), B/N Surrogate Mix (4/89 SOW) (cat.# 31024), Acid Surrogate Mix (4/89 SOW) (cat.# 31025)
Inj.:	1.0μL, 10μg/mL each analyte (internal standards 100μg/mL), split (10:1) 4mm Drilled Uniliner® inlet liner (hole at bottom) (cat.# 20756)
Instrument:	Agilent 6890
Inj. temp.:	250°C
Carrier gas:	helium, constant flow
Flow rate:	1.2mL/min.
Oven temp.:	50°C (hold 1 min.) to 265°C @ 20°C/min., to 330°C @ 6°Cmin. (hold 1 min.)
Det.:	Agilent 5973 MSD
Transfer line temp.:	280°C
Scan range:	35-550 amu
Solvent delay:	3.20 min.
Tune:	DFTPP
Ionization:	EI

• Internal standards at 100ng on-column.

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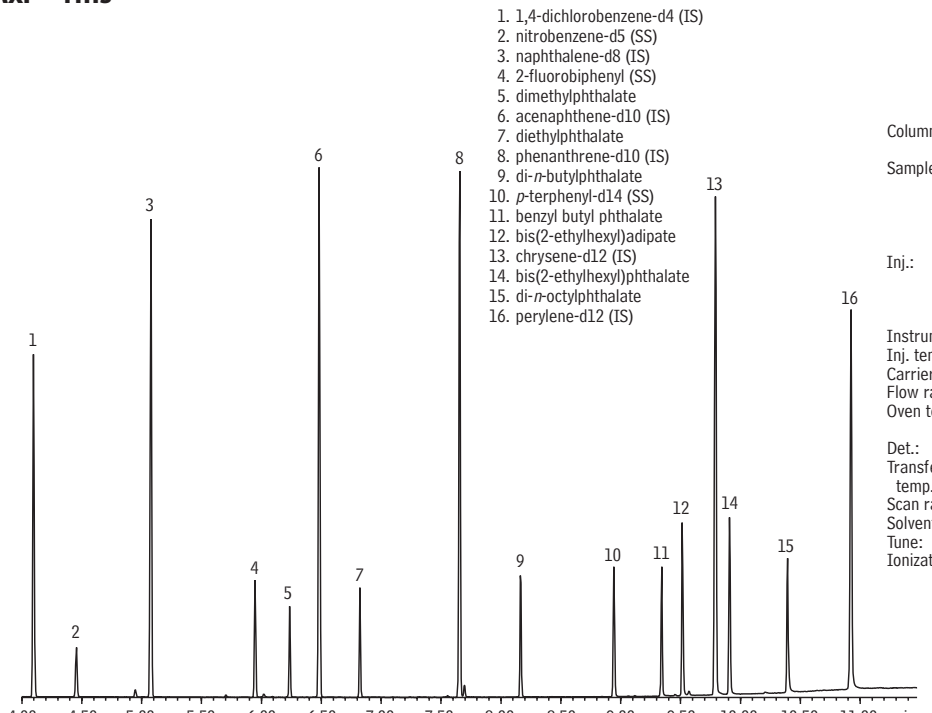
Phthalate & Adipate Esters
US EPA Method 506
Rxi™-1ms



GC_EV00832

Column:	Rxi™-1ms, 30m, 0.25mm ID, 0.25µm (cat.# 13323)
Sample:	US EPA Method 506 mix: 506 Calibration Mix (cat.# 31845), SV Internal Standard Mix (cat.# 31206), B/N Surrogate Mix (4/89 SOW) (cat.# 31024)
Inj.:	1.0µL, 5µg/mL each analyte (internal standards 25µg/mL), split (10:1) 4mm Drilled Uniliner® inlet liner (hole at bottom) (cat.# 20771)
Instrument:	Agilent 6890
Inj. temp.:	250°C
Carrier gas:	helium, constant flow
Flow rate:	1.2mL/min.
Oven temp.:	50°C (hold 1 min.) to 330°C @ 30°C/min. (hold 2 min.)
Det.:	Agilent 5973 MSD
Transfer line temp.:	280°C
Scan range:	35-550 amu
Solvent delay:	3.75 min.
Tune:	DFTPP
Ionization:	EI

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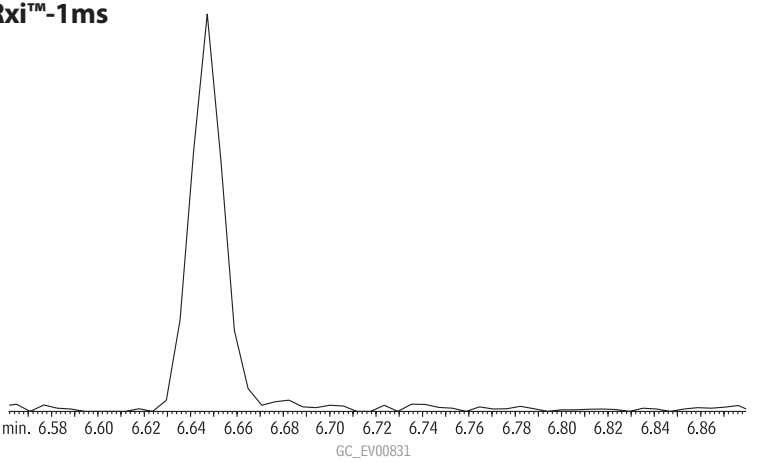
2,4-Dinitrophenol
US EPA Method 8270D
Rxi™-1ms



Column:	Rxi™-1ms, 30m, 0.25mm ID, 0.25μm (cat.# 13323)
Sample:	US EPA Method 8270D mix: 8270 MegaMix™ (cat.# 31850), Benzoic Acid Standard (cat.# 31879), Benzidine Standard (cat.# 31852), Acid Surrogate Mix (cat.# 31025), B/N Surrogate Standard Mix (cat.# 31887), 1,4-Dioxane (cat.# 31853)
Inj.:	1.0μL, 0.5μg/mL each analyte (0.5ng on column), split (10:1) 4mm Drilled Uniliner® inlet liner (hole at bottom) (cat.# 20771)
Instrument:	Agilent 6890
Inj. temp.:	250°C
Carrier gas:	helium, constant flow
Flow rate:	1.2mL/min.
Oven temp.:	50°C (hold 0.5 min.) to 245°C @ 25°C/min., to 330°C @ 6°C/min. (hold 5 min.)
Det.:	Agilent 5973 GC/MS
Transfer line temp.:	280°C
Scan range:	35-550 amu
Solvent delay:	2 min.
Tune:	DFTPP
Ionization:	EI

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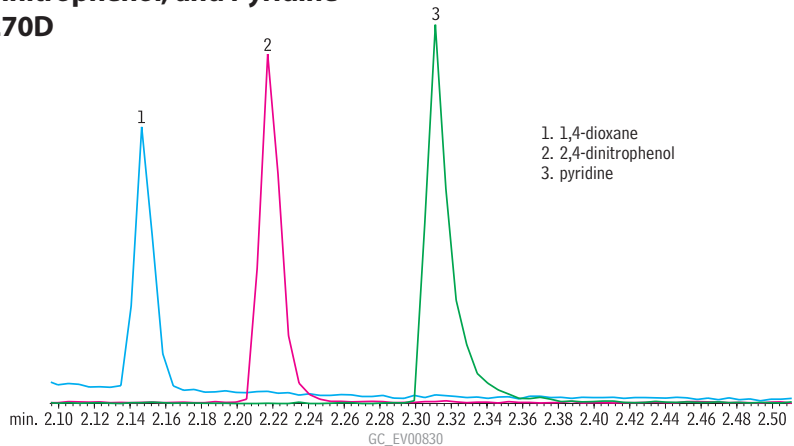
1,4-Dioxane, 2,4-Dinitrophenol, and Pyridine
US EPA Method 8270D
Rxi™-1ms



Column:	Rxi™-1ms, 30m, 0.25mm ID, 0.25µm (cat.# 13323)
Sample:	US EPA Method 8270D mix: 8270 MegaMix™ (cat.# 31850), Benzoic Acid Standard (cat.# 31879), Benzidine Standard (cat.# 31852), Acid Surrogate Mix (cat.# 31025), B/N Surrogate Standard Mix (cat.# 31887), 1,4-Dioxane (cat.# 31853)
Inj.:	1.0µL, 0.5µg/mL each analyte (0.5ng on column), split (10:1) 4mm Drilled Uniliner® inlet liner (hole at bottom) (cat.# 20771)
Instrument:	Agilent 6890
Inj. temp.:	250°C
Carrier gas:	helium, constant flow
Flow rate:	1.2mL/min.
Oven temp.:	50°C (hold 0.5 min.) to 245°C @ 25°C/min., to 330°C @ 6°C/min. (hold 5 min.)
Det.:	Agilent 5973 GC/MS
Transfer line temp.:	280°C
Scan range:	35-550 amu
Solvent delay:	2 min.
Tune:	DFTPP
Ionization:	EI

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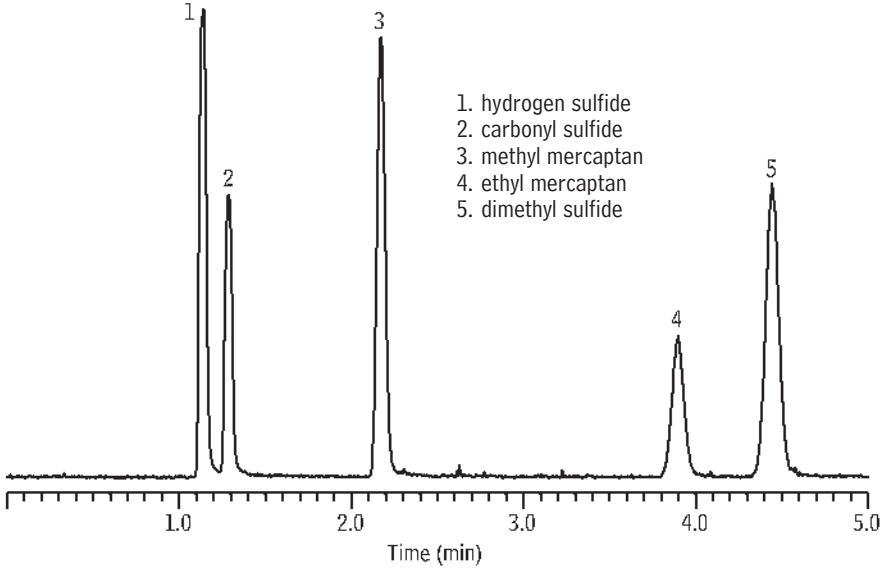
Sulfur Compounds
Rxi™-1ms



Column:	Rxi™-1ms, 30m, 0.32mm ID, 4.00μm (cat.# 13396)
Sample:	hydrogen sulfide, carbonyl sulfide, methyl mercaptan, ethyl mercaptan, dimethyl sulfide, 100 ppbv each in helium
Inj.:	1.mL splitless, direct
Sample loop temp.:	30°C
Carrier gas:	helium, constant pressure
Linear velocity:	48cm/sec. @ 30°C
Oven temp.:	30°C
Det.:	sulfur chemiluminescence detector
Det. temp.:	800°C

Sample storage & transfer:
SilcoCan™ air monitoring canister with Siltek® treated 1/4" valve (cat.# 24182-650); Sulfinert® treated gas sample loop, 1cc (cat.# 22848); Sulfinert® treated gas sample loop, 10cc (custom order)

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