

# Rtx<sup>®</sup>-5Sil MS Columns

Enhanced Performance

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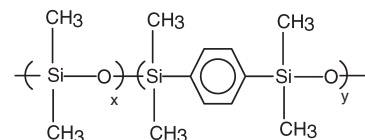
## Rtx®-5Sil MS Columns

- Inert, high temperature stable polymer (Figure 1).
- Faster analyses.
- Longer column lifetime.

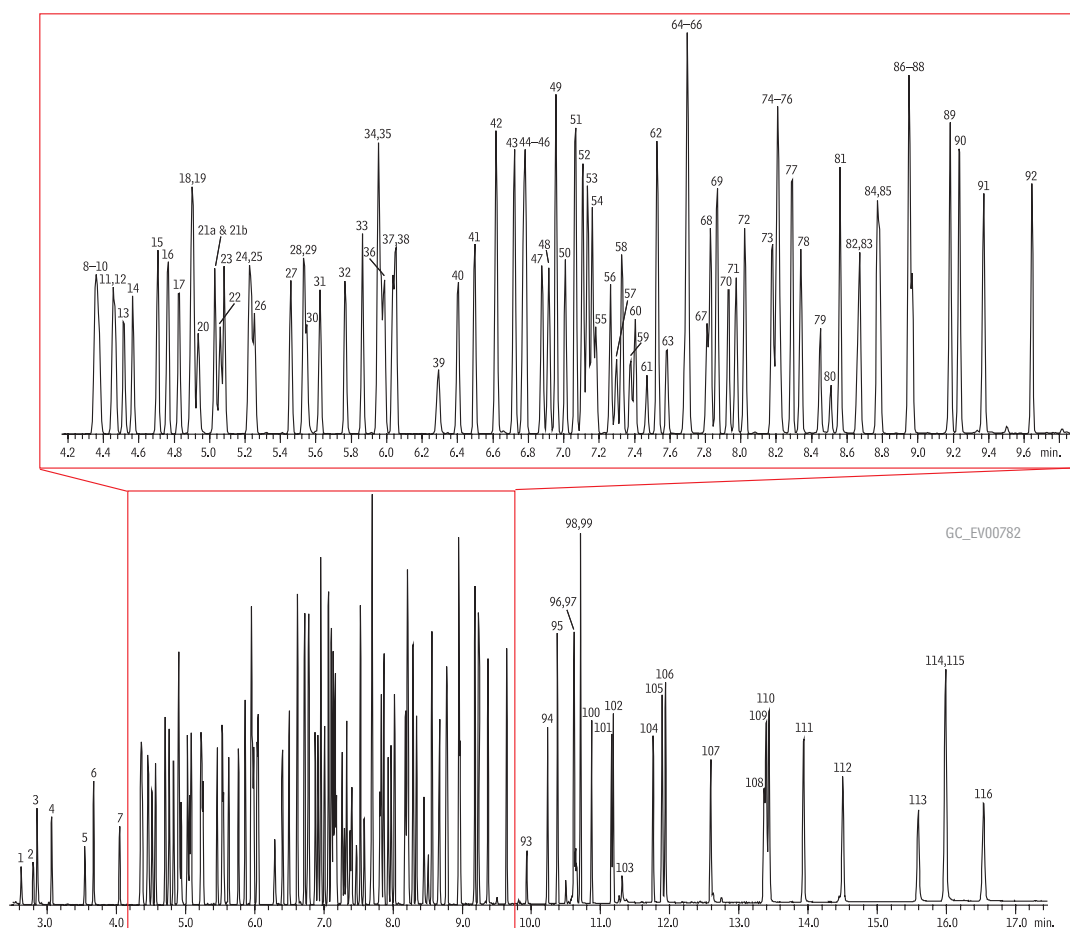
### Enhanced Column Performance

Our new polymer and new manufacturing process greatly enhance the performance of Rtx®-5Sil MS columns in analyses of semivolatile environmental compounds. Figure 2 shows a sub 17-minute analysis of more than 100 semivolatile environmental compounds, using a 30m x 0.25mm ID Rtx®-5Sil MS column. Typically, this many compounds, or more, are targets in these analyses. In most circumstances a 0.25mm ID Rtx®-5Sil MS column with a 0.50µm phase film best combines fast analysis time with extended column lifetime.

**Figure 1** Rtx®-5Sil MS polymer.



**Figure 2** 16.5-Minute analysis of semivolatile organics in US EPA Method 8270D Appendix IX, using a 30m x 0.25mm ID Rtx®-5Sil MS column.



Column: Rtx®-5Sil MS 30m, 0.25mm ID, 0.50µm (cat.# 12738)  
 Sample: US EPA Method 8270D Appendix IX mix  
 8270 MegaMix® (cat.# 31850)  
 Appendix IX Mix #2 (cat.#31806)  
 Acid Surrogate Mix (4/89 SOW) (cat.# 31063)  
 B/N Surrogate Mix (4/89 SOW) (cat.# 31062)  
 Inj.: 0.5µL, splitless, 100ppm each compound (50ng on column)  
 2mm Cyclo double gooseneck splitless inlet liner  
 (cat.# 20907), 0.3 min. splitless hold time, 0.4 min.  
 pressure pulse @ 30psi  
 Inj. temp.: 250°C  
 Carrier gas: helium, constant flow  
 Flow rate: 1.1mL/min.

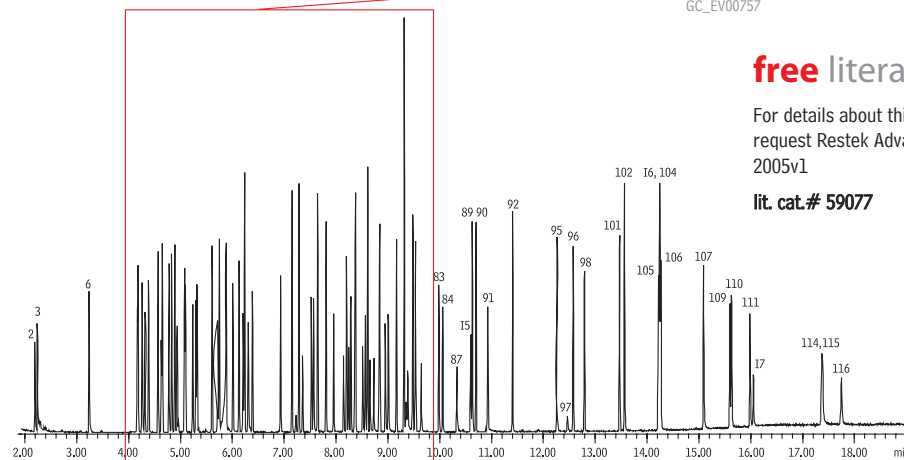
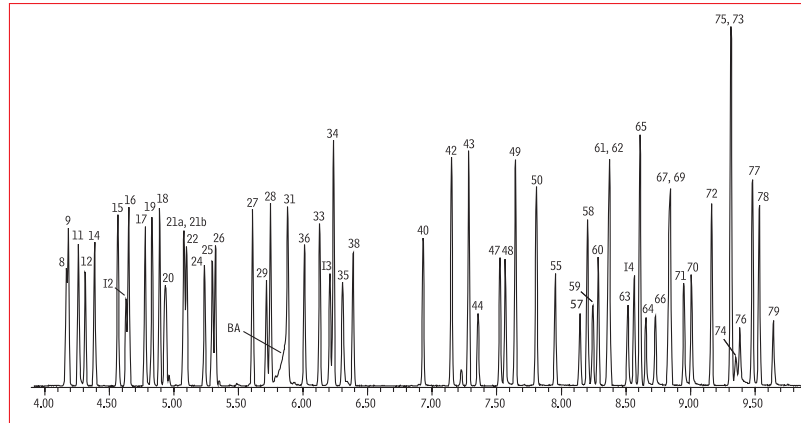
Oven temp.: 50°C (hold 0.5 min.) to 310°C @ 25°C/min.  
 (hold 0 min.) to 330°C @ 4°C/min. (hold 4 min.)  
 Det.: MS  
 Det. temp.: 280°C  
 Transfer line  
 temp.: 280°C  
 Scan range: 35-550 amu  
 Solvent Delay: 1 min.  
 Tune: DFTPP  
 Ionization: EI  
 Instrument: Agilent 6890 / 5973

Some analysts prefer using shorter, narrower ID columns to analyze for semivolatiles. When using such columns, both matrix interferences and on-column amounts of target compounds must be reduced, so the column is not overloaded, and to maintain column lifetime. Figure 3 shows an 18-minute analysis of 90 semivolatile pollutants, surrogates, and internal standards on a 20m x 0.18mm ID, 0.36µm film Rtx®-5Sil MS column. A splitless injection was used, but results are equivalent with split injections.

**Figure 3** 90 semivolatile analytes separated in 18 minutes on a 20m x 0.18mm ID Rtx®-5Sil MS column.

**Compounds in Figures 2 & 3**

1. 1,4-dioxane
2. N-nitrosodimethylamine
3. pyridine
4. ethyl methacrylate
5. methyl methanesulfonate
6. 2-fluorophenol
7. ethyl methanesulfonate
8. phenol-d6
9. phenol
10. benzaldehyde
11. aniline
12. bis(2-chloroethyl)ether
13. pentachloroethane
14. 2-chlorophenol
15. 1,3-dichlorobenzene
16. 1,4-dichlorobenzene
17. benzyl alcohol
18. 2-methylphenol
19. 1,2-dichlorobenzene
20. bis(2-chloroisopropyl)ether
- 21a. 4-methylphenol
- 21b. 3-methylphenol
22. N-nitroso-di-n-propylamine
23. acetophenone
24. hexachloroethane
25. nitrobenzene-d5
26. nitrobenzene
27. isophorone
28. 2,4-dimethylphenol
- BA. benzoic acid\*
29. 2-nitrophenol
30. diallate (isomer)
31. bis(2-chloroethoxy)methane
32. 2,4-dichlorophenol
33. 1,2,4-trichlorobenzene
34. naphthalene
35. 4-chloroaniline
36. 2,6-dichlorophenol
37. hexachloropropene
38. hexachlorobutadiene
39. ε-caprolactam
40. 4-chloro-3-methylphenol
41. isosafrole (cis)
42. 2-methylnaphthalene
43. 1-methylnaphthalene
44. hexachlorocyclopentadiene
45. isosafrole (trans)
46. 1,2,4,5-tetrachlorobenzene
47. 2,4,6-trichlorophenol
48. 2,4,5-trichlorophenol
49. 2-fluorobiphenyl
50. 2-chloronaphthalene
51. biphenyl
52. safrole
53. 1-chloronaphthalene
54. diphenyl ether
55. 2-nitroaniline
56. 1,4-naphthoquinone
57. 1,4-dinitrobenzene
58. dimethylphthalate
59. 1,3-dinitrobenzene
60. 2,6-dinitrotoluene
61. 1,2-dinitrobenzene
62. acenaphthylene
63. 3-nitroaniline
64. 2,4-dinitrophenol
65. acenaphthene
66. 4-nitrophenol
67. 2,4-dinitrotoluene
68. pentachlorobenzene
69. dibenzofuran
70. 2,3,5,6-tetrachlorophenol
71. 2,3,4,6-tetrachlorophenol
72. diethyl phthalate
73. 4-chlorophenyl phenyl ether
74. 4-nitroaniline
75. fluorene
76. 4,6-dinitro-2-methylphenol
77. diphenylamine
78. azobenzene
79. 2,4,6-tribromophenol
80. 1,3,5-trinitrobenzene
81. phenacetin
82. diallate
83. 4-bromophenyl phenyl ether
84. hexachlorobenzene
85. atrazine
86. pronamide
87. pentachlorophenol
88. pentachloronitrobenzene
89. phenanthrene
90. anthracene
91. carbazole
92. di-n-butylphthalate
93. 4-nitroquinoline-N-oxide
94. isodrin
95. fluoranthene
96. pyrene
97. benzidine
98. p-terphenyl-d14
99. Aramite
100. chlorobenzilate
101. benzyl butyl phthalate
102. bis(2-ethylhexyl)adipate
103. Kepone
104. bis(2-ethylhexyl)phthalate
105. benzo(a)anthracene
106. chrysene
107. di-n-octyl phthalate
108. 7,12-dimethylbenzo(a)anthracene
109. benzo(b)fluoranthene
110. benzo(k)fluoranthene
111. benzo(a)pyrene
112. 3-methylcholanthrene
113. dibenzo(a,j)acridine
114. indeno(1,2,3-cd)pyrene
115. dibenzo(a,h)anthracene
116. benzo(ghi)perylene



GC\_EV00757

**free literature**

For details about this analysis, request Restek Advantage 2005v1

lit. cat.# 59077

16. chrysene-d12\*

- 106. chrysene
- 107. di-n-octyl phthalate
- 108. 7,12-dimethylbenzo(a)anthracene
- 109. benzo(b)fluoranthene
- 110. benzo(k)fluoranthene
- 111. benzo(a)pyrene
- 112. 3-methylcholanthrene
- 113. dibenzo(a,j)acridine
- 114. indeno(1,2,3-cd)pyrene
- 115. dibenzo(a,h)anthracene
- 116. benzo(ghi)perylene

\* Present in Figure 3 only

Column: Rtx®-5Sil MS, 20m, 0.18mm ID, 0.36µm (cat.# 42704)  
 Sample: US EPA Method 8270D analytes, 10ppm each (10ng on column)  
 8270 MegaMix® (cat.# 31850),  
 Benzidine (cat.# 31441),  
 Benzoic Acid (cat.# 31415),  
 2,4-Dinitrophenol (cat.# 31291),  
 Acid Surrogate Mix (4/89 SOW) (cat.# 31063),  
 B/N Surrogate Mix (4/89 SOW) (cat.# 31062)  
 Inj.: 1.0µL, splitless, 4mm ID gooseneck splitless inlet liner  
 (cat.# 20798), splitless hold time 0.15 min.,  
 pressure pulse 0.20 min. @ 30psi

GC: 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 330°C @ 18°C/min. (hold 3 min.)  
 Det.: Agilent 5973 GC/MS  
 Transfer line temp.: 280°C  
 Scan range: 35-550 amu  
 Solvent Delay: 1 min.  
 Tune: DFTPP  
 Ionization: EI



**Table 1.** Response factors and linearity for active semivolatile compounds.\*

Compound	CAS #	On-Column Quantity							Mean RRF	RSD (%)
		1ng	4ng	10ng	20ng	50ng	80ng	160ng		
N-nitrosodimethylamine	39885-14-8	0.876	0.940	0.980	0.969	0.940	0.958	0.946	0.956	2
pyridine	110-86-1	1.438	1.641	1.707	1.724	1.597	1.634	1.607	1.652	3
aniline	62-53-3	3.762	3.989	4.056	3.941	3.614	3.391	2.975	3.661	12
2,4-dichlorophenol	120-83-2	0.280	0.314	0.308	0.308	0.269	0.252	0.239	0.282	11
hexachlorocyclopentadiene	77-47-4	0.258	0.310	0.311	0.337	0.301	0.289	0.278	0.304	7
3-nitroaniline	99-09-2	0.344	0.433	0.437	0.417	0.419	0.408	0.367	0.413	6
2,4-dinitrophenol	51-28-5	0.075	0.123	0.153	0.162	0.185	0.176	0.155	0.159	14
4-nitrophenol	100-02-7	0.145	0.201	0.215	0.213	0.220	0.219	0.197	0.211	4
azobenzene	103-33-3	1.390	1.606	1.568	1.502	1.440	1.347	1.162	1.437	11
pentachlorophenol	87-86-5	0.096	0.128	0.146	0.147	0.143	0.141	0.141	0.141	5
benzidine	92-87-5	0.710	1.149	1.162	1.047	1.085	1.040	1.015	1.083	6
benzo(b)fluoranthene	205-99-2	1.117	1.289	1.405	1.383	1.280	1.273	1.320	1.325	4

\*The 1ng value is not included in the mean relative response factor (RRF) or relative standard deviation (RSD).

### Assured Column Quality

To guarantee individual column performance and column-to-column reproducibility, we test every Rtx®-5Sil MS column we make. Our isothermal test verifies coating efficiency, film thickness, inertness, and bleed.

### Rtx®-5Sil MS Columns (fused silica)

(Crossbond®, selectivity similar to 5% diphenyl/95% dimethyl polysiloxane)

ID	df (µm)	temp. limits	15-Meter	25-Meter	30-Meter	40-Meter	60-Meter
0.25mm	0.10	-60 to 330/350°C	12705		12708		
	0.25	-60 to 330/350°C	12720		12723		12726
	0.50	-60 to 330/350°C	12735		12738		12796
	1.00	-60 to 325/350°C	12750		12753		12797
0.28mm	0.25	-60 to 330/350°C	12790		12793		
	0.50	-60 to 330/350°C	12791		12794		
	1.00	-60 to 325/350°C	12792		12795		
0.32mm	0.10	-60 to 330/350°C	12706		12709		
	0.25	-60 to 330/350°C	12721		12724		12780
	0.50	-60 to 330/350°C	12736		12739		
	1.00	-60 to 325/350°C	12751	12781	12754		12782
0.45mm	1.50	-60 to 310/330°C				12798	
0.53mm	0.50	-60 to 320/340°C	12737		12740		
	1.00	-60 to 320/340°C	12752		12755		
	1.50	-60 to 310/330°C	12767		12770		
ID	df (µm)	temp. limits	10-Meter	12-Meter	20-Meter	25-Meter	50-Meter
0.18mm	0.18	-60 to 330/350°C	42703		42702		
	0.36	-60 to 330/350°C			42704		
0.20mm	0.20	-60 to 330/350°C				42706	42707
	0.33	-60 to 330/350°C		42705			
	0.35	-60 to 330/350°C		42708			42709

for **more info**

Rtx®-5Sil MS columns are optimized for use with conventional MS detectors but, for the fastest analyses, they are equally compatible with time-of-flight mass spectrometers. To see a 9-minute TOFMS analysis of semivolatiles on an Rtx®-5Sil MS column, request Restek Advantage 2005v1 (page 8).

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did you **know?**

Split injections of semivolatiles can reduce analysis time, relative to splitless injections, due to the characteristically sharp analyte focus at the column inlet.

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Lit. Cat.# 59204B

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