Optimizing Method Standard HJ 834-2017 for GC-MS Semivolatiles Analysis

Increase Speed and Certainty with Highly Inert RMX-5Sil MS Columns

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Key Highlights

- Next-generation TriMax GC column deactivation creates a robust and exceptionally neutral sample flow path.
- Maximum symmetry reduces peak tailing for a wide range of challenging semivolatiles—including acids, bases, and neutrals—improving identification and quantification.
- Optimized GC-MS conditions speed up sample throughput while still meeting method criteria.

Abstract

RMX-5Sil MS columns feature a groundbreaking deactivation technology that creates a highly inert surface that is broadly effective across a wide range of semivolatile compound classes. In this study, we evaluated the columns performance against the data quality criteria in Method Standard HJ 834-2017. Method criteria for system suitability, linearity, and recovery were easily met with optimized conditions that reduced sample analysis time by 20 minutes.

Introduction

Semivolatile compounds are monitored worldwide to protect human health and the environment. Analysis can be done with a variety of detectors, with GC-MS techniques being among the most popular. The People's Republic of China Method Standard HJ 834-2017 is used for GC-MS analysis of semivolatiles in soil and sediment samples. To ensure laboratories generate accurate results, Method Standard HJ 834-2017 specifies criteria for key parameters, including system suitability, linearity, and recovery. Since semivolatiles comprise a wide range of compound chemistries, including reactive compounds, it is essential that the sample flow path be highly inert. Activity in the flow path may contribute to poor peak shape and drifting retention times, which can make it difficult to meet data quality requirements.

In this study, we demonstrate how exceptionally inert RMX-5Sil MS columns can help laboratories meet data quality objectives for Method Standard HJ 834-2017 semivolatiles analysis. RMX-5Sil MS columns undergo a unique TriMax surface deactivation that eliminates active sites (e.g., silanols) and is broadly effective across compound classes. The RMX-5Sil MS column contains a traditional 5sil polymer, so it is a direct 5sil replacement, but the highly neutral surface improves peak shape for a wide variety of compounds, making it easier to meet data quality requirements. In this study, in addition to demonstrating the effectiveness of the column for GC-MS semivolatiles analysis, we also developed optimized instrument conditions that speed up run times and improve sample throughput.

Experimental

Standard and Sample Preparation

Multicomponent semivolatiles standards were prepared at 1, 5, 10, 20, and 50 ppm in dichloromethane for calibration. Internal standards and surrogate standards were present at 40 ppm in each calibration standard.

Instrument Conditions

GC-MS semivolatiles analysis was performed following the conditions in Method Standard HJ 834-2017. In addition, semivolatiles analysis was run under optimized conditions to allow faster analysis times. Table I summarizes the instrument conditions for both approaches.

Table I: Instrument Conditions for GC-MS Semivolatiles Analysis

Parameter	Method Standard HJ 834-2017 Reference Conditions	Optimized Conditions
Column	RMX-5Sil MS, 30 m x 0.25 mm ID x 0.25 µm (cat.# 17323)	RMX-5Sil MS, 30 m x 0.25 mm ID x 0.25 µm (cat.# 17323)
Injection	1 µL, splitless, 280 °C	1 µL, splitless, 280 °C
Carrier gas	Helium at 1 mL/min (constant flow)	Helium at 1 mL/min (constant flow)
Oven	35 °C (hold 2 min) to 150 °C at 15 °C/min (hold 5 min) to 290 °C at 3 °C/min (hold 2 min)	**Faster oven conditions speed up analysis:** 35 °C (hold 1 min) to 290 °C at 8 °C/min to 350 °C at 12 °C/min (hold 5 min)
Detector	EI; 70 eV; 230 °C source; 150 °C quad; scan 35-450 m/z; solvent delay 5 min; 280 °C transfer line	EI; 70 eV; 230 °C source; 150 °C quad; scan 35-450 m/z; solvent delay 2 min; 280 °C transfer line

Results and Discussion

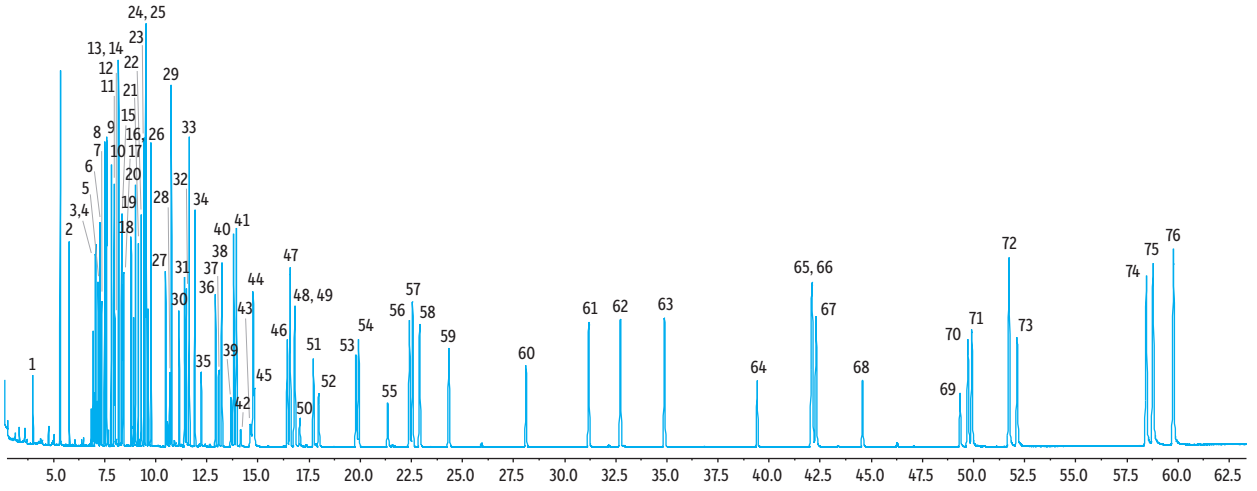
System Suitability

The instrument was tuned with DFTPP in accordance with Method Standard HJ 834-2017, and then system suitability was assessed by evaluating the degradation of DDT to DDE and DDD. The requirement to not exceed 15% was easily met with DDT degradation to both DDE and DDD being <1%.

Chromatographic Performance

As shown in Figure 1, the RMX-5Sil MS column produced sharp, symmetrical peaks for 64 monitored semivolatiles, six surrogates, and six internal standards (76 compounds total) at 5 ppm under both the original Method Standard HJ 834-2017 conditions and the modified GC-MS conditions. While some coelutions occurred, these compounds could easily be differentiated by their ion m/z ratios. The standard method conditions produced good results, but the >60-minute run time limits the number of samples that can be analyzed. The improved method conditions resulted in a faster 40-minute run time, which is beneficial to high-throughput labs that have many samples to analyze under tight deadlines.

Figure 1: TIC Chromatogram of Method Standard HJ 834-2017 Conditions (>60 minutes)



	Peaks	tR (min)
1.	Bis(N-methoxy-N-methylamino)methane	3.989
2.	Phenol, 2-fluoro-	5.769
3.	Phenol-d6-	7.057
4.	Phenol	7.069
5.	Bis(2-chloroethyl) ether	7.194
6.	Phenol, 2-chloro-	7.269
7.	Benzene, 1,3-dichloro-	7.496
8.	1,4-Dichlorobenzene-D4	7.579
9.	Benzene, 1,4-dichloro-	7.602
10.	Benzene, 1,2-dichloro-	7.825
11.	Phenol, 2-methyl-	7.956
12.	Bis(2-chloro-1-methylethyl) ether	7.995
13.	1-Propanamine, N-nitroso-N-propyl-	8.183
14.	p-Cresol	8.183
15.	Ethane, hexachloro-	8.336
16.	Nitrobenzene-D5	8.393
17.	Benzene, nitro-	8.421
18.	Isophorone	8.795
19.	Phenol, 2-nitro-	8.915
20.	Phenol, 2,3-dimethyl-	9.002
21.	Methane, bis(2-chloroethoxy)-	9.146
22.	Phenol, 2,4-dichloro-	9.290
23.	Benzene, 1,2,4-trichloro-	9.427
24.	Naphthalene-D8	9.508
25.	Naphthalene	9.540

	Peaks	tR (min)
26.	p-Chloroaniline	9.630
27.	1,3-Butadiene, 1,1,2,3,4,4-hexachloro-	9.767
28.	Phenol, 2-chloro-5-methyl-	10.486
29.	Naphthalene, 1-methyl-	10.766
30.	Hexachlorocyclopentadiene	11.140
31.	Phenol, 2,4,6-trichloro-	11.412
32.	Phenol, 2,4,5-trichloro-	11.486
33.	1,1'-Biphenyl, 2-fluoro-	11.640
34.	Naphthalene, 1-chloro-	11.915
35.	Dimethyl (2-nitroanilino)maleate	12.221
36.	Dimethyl phthalate	12.926
37.	Benzene, 2-methyl-1,3-dinitro-	13.078
38.	Biphenylene	13.231
39.	m-Nitroaniline	13.680
40.	Acenaphthene-d10	13.813
41.	Acenaphthene	13.947
42.	Phenol, 2,4-dinitro-	14.149
43.	Phenol, 4-nitro-	14.626
44.	Dibenzofuran	14.763
45.	Benzene, 1-methyl-2,4-dinitro-	14.820
46.	Diethyl phthalate	16.434
47.	Fluorene	16.576
48.	Benzene, 1-chloro-4-phenoxy-	16.802
49.	Benzene, 1-chloro-3-phenoxy-	16.802
50.	Phenol, 2-methyl, 4,6-dinitro-	17.043

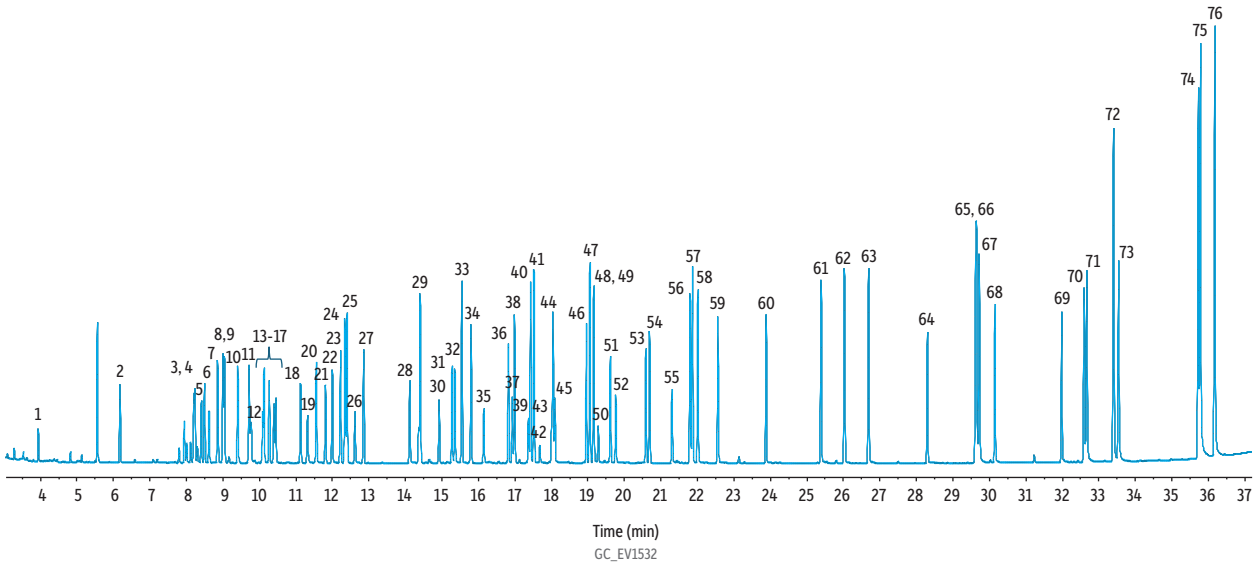
	Peaks	tR (min)
51.	Azobenzene	17.714
52.	Phenol, 2,4,6-tribromo-	17.972
53.	Benzene, 1-bromo-4-phenoxy-	19.798
54.	Benzene, hexachloro-	19.924
55.	Phenol, pentachloro-	21.347
56.	Phenanthrene-D10	22.411
57.	9H-Fluorene, 9-methylene-	22.561
58.	Anthracene	22.911
59.	Carbazole	24.334
60.	Dibutyl phthalate	28.107
61.	Fluoranthene	31.814
62.	Pyrene	32.727
63.	p-Terphenyl-d14	34.881
64.	Benzyl butyl phthalate	39.418
65.	Benz[a]anthracene	42.103
66.	Chrysene-D12	42.103
67.	Chrysene	42.298
68.	Bis(2-ethylhexyl) phthalate	44.571
69.	Phthalic acid, hept-4-yl octyl ester	49.346
70.	Benzo[b]fluoranthene	49.728
71.	Benzo[k]fluoranthene	49.915
72.	Benzo[a]pyrene	51.738
73.	Perylene - D12	52.132
74.	Indeno[1,2,3-cd]pyrene	58.454
75.	Diben[a,h]anthracene	58.786
76.	Benzo[ghi]perylene	59.786

Column	RMX-5Sil MS, 30 m, 0.25 mm ID, 0.25 µm (cat.# 17323)
Standard/Sample	
	1000 ppm HJ 834-2017 VOC and SVOCs mixture 155 (LGC)
	1000 ppm HJ 834-2017 substitutes mixture 156 (LGC)
	1000 ppm HJ 834-2017 internal standard mixture 174 (internal standard)
Diluent:	Dichloromethane
Conc.:	5 µg/mL
Injection	
Inj. Vol.:	1 µL splitless (hold 1 min)
Liner:	Topaz 4.0 mm ID single taper inlet liner w/wool (cat.# 23303)
Inj. Temp.:	280 °C
Oven	
Oven Temp.:	35 °C (hold 2 min) to 150 °C at 15 °C/min (hold 5 min) to 290 °C at 3 °C/min (hold 2 min)
Carrier Gas	He, constant flow
Flow Rate:	1 mL/min @ 35 °C
Detector	MS
Mode:	Scan
Scan Program:	

Group	Start Time (min)	Scan Range (amu)	Scan Rate (scans/sec)
1	2.5	35-450	

Transfer Line Temp.:	280 °C
Source Temp.:	230 °C
Quad Temp.:	150 °C
Electron Energy:	70 eV
Tune Type:	PFTBA
Ionization Mode:	EI
Instrument	Agilent 7890B GC & 5977B MSD
Sample Preparation	Reference standards were diluted to 5 ppm in dichloromethane.

Figure 2: TIC Chromatogram of Optimized Method Conditions (40 minutes)



Peaks	t_R (min)
1. Bis(N-methoxy-N-methylamino)methane	3.941
2. Phenol, 2-fluoro-	6.189
3. Phenol-d6-	8.226
4. Phenol	8.252
5. Bis(2-chloroethyl) ether	8.417
6. Phenol, 2-chloro-	8.502
7. Benzene, 1,3-dichloro-	8.861
8. 1,4-Dichlorobenzene-D4	9.01
9. Benzene, 1,4-dichloro-	9.048
10. Benzene, 1,2-dichloro-	9.411
11. Phenol, 2-methyl-	9.726
12. Bis(2-chloro-1-methylethyl) ether	9.784
13. 1-Propanamine, N-nitroso-N-propyl-	10.101
14. p-Cresol	10.133
15. Ethane, hexachloro-	10.273
16. Nitrobenzene-D5	10.421
17. Benzene, nitro-	10.468
18. Isophorone	11.137
19. Phenol, 2-nitro-	11.322
20. Phenol, 2,3-dimethyl-	11.561
21. Methane, bis(2-chloroethoxy)-	11.822
22. Phenol, 2,4-dichloro-	12.006
23. Benzene, 1,2,4-trichloro-	12.23
24. Naphthalene-D8	12.36
25. Naphthalene	12.411
26. p-Chloroaniline	12.622

Peaks	t_R (min)
27. 1,3-Butadiene, 1,1,2,3,4,4-hexachloro-	12.859
28. Phenol, 2-chloro-5-methyl-	14.122
29. Naphthalene, 1-methyl-	14.409
30. Hexachlorocyclopentadiene	14.927
31. Phenol, 2,4,6-trichloro-	15.284
32. Phenol, 2,4,5-trichloro-	15.362
33. 1,1'-Biphenyl, 2-fluoro-	15.564
34. Naphthalene, 1-chloro-	15.806
35. Dimethyl (2-nitroanilino)maleate	16.158
36. Dimethyl phthalate	16.837
37. Benzene, 2-methyl-1,3-dinitro-	16.945
38. Biphenylene	16.995
39. m-Nitroaniline	17.381
40. Acenaphthene-d10	17.45
41. Acenaphthene	17.533
42. Phenol, 2,4-dinitro-	17.692
43. Phenol, 4-nitro-	18.011
44. Dibenzofuran	18.05
45. Benzene, 1-methyl-2,4-dinitro-	18.104
46. Diethyl phthalate	18.972
47. Fluorene	19.061
48. Benzene, 1-chloro-4-phenoxy-	19.168
49. Benzene, 1-chloro-3-phenoxy-	19.175
50. Phenol, 2-methyl, 4,6-dinitro-	19.301
51. Azobenzene	19.626
52. Phenol, 2,4,6-tribromo-	19.78

Peaks	t_R (min)
53. Benzene, 1-bromo-4-phenoxy-	20.596
54. Benzene, hexachloro-	20.697
55. Phenol, pentachloro-	21.316
56. Phenanthrene-D10	21.822
57. 9H-Fluorene, 9-methylene-	21.88
58. Anthracene	22.025
59. Carbazole	22.57
60. Dibutyl phthalate	23.889
61. Fluoranthene	25.396
62. Pyrene	26.035
63. p-Terphenyl-d14	26.717
64. Benzyl butyl phthalate	28.309
65. Benz[a]anthracene	29.638
66. Chrysene-D12	29.684
67. Chrysene	29.744
68. Bis(2-ethylhexyl) phthalate	30.159
69. Phthalic acid, hept-4-yl octyl ester	31.991
70. Benzo[b]fluoranthene	32.608
71. Benzo[k]fluoranthene	32.683
72. Benzo[a]pyrene	33.417
73. Perylene - D12	33.583
74. Indeno[1,2,3-cd]pyrene	35.743
75. Diben[a,h]anthracene	35.798
76. Benzo[ghi]perylene	36.197

Column	RMX-5Sil MS, 30 m, 0.25 mm ID, 0.25 µm (cat.# 17323)
Standard/Sample	
	1000 ppm HJ 834-2017 VOC and SVOCs mixture 155 (LGC)
	1000 ppm HJ 834-2017 substitutes mixture 156 (LGC)
	1000 ppm HJ 834-2017 internal standard mixture 174 (internal standard)
Diluent:	Dichloromethane
Conc.:	5 µg/mL
Injection	
Inj. Vol.:	1 µL splitless (hold 1 min)
Liner:	Topaz 4.0 mm ID single taper inlet liner w/wool (cat.# 23303)
Inj. Temp.:	280 °C
Oven	
Oven Temp.:	35 °C (hold 1 min) to 290 °C at 8 °C/min to 350 °C at 12 °C/min (hold 5 min)
Carrier Gas	He, constant flow
Flow Rate:	1 mL/min @ 35 °C
Detector	MS
Mode:	Scan
Scan Program:	

Group	Start Time (min)	Scan Range (amu)	Scan Rate (scans/sec)
1	2.5	35-450	

Transfer Line Temp.:	280 °C
Source Temp.:	230 °C
Quad Temp.:	150 °C
Electron Energy:	70 eV
Tune Type:	PFTBA
Ionization Mode:	EI
Instrument	Agilent 7890B GC & 5977B MSD
Sample Preparation	Reference standards were diluted to 5 ppm in dichloromethane.

Quantitative Performance

Good peak shape improves signal-to-noise ratios, which allows reliable integration at low concentrations and minimizes the need for time-consuming user intervention. Accurate integration across the calibration range increases confidence that method performance criteria will be met, even for difficult reactive compounds. Method performance was assessed by evaluating linearity (unweighted, R>0.990); relative response factor (RSD <30%); and recovery of a midpoint standard (70-130% recovery at 10 ppm).

Limits of detection and quantitation were determined using generally accepted methods where LOD = 3.3 x standard deviation of the lowest calibration point/calibration slope, and LOQ = 10 x standard deviation of the lowest calibration point/calibration slope. Values were compared to the LOD and LOQ values described in the method. The method requirements show LOD and LOQ as sample concentrations. Since matrix was not used in this study, sample concentrations were converted to extract concentrations based on a theoretical sample mass of 20 g, and final extract volume of 1 mL (Table II). Without matrix, the differences between column performance can be separated from the efficacy of the sample preparation.

For quantitative analysis, calibration was performed using the optimized instrument conditions. Summarized results are presented in Table II and the values for individual semivolatiles are given in Table III. All compounds (excluding internal standards and surrogates) passed linearity criteria of RRF RSD <30% and R>0.990. RSD values ranged 2.1-22.5% and R ranged 0.999-1.00. While not required for HJ 834, R2 was also evaluated because it is often employed in other methods. In this study R^2 was >0.995 for each compound, ranging 0.997-1.0.

Table II: Results Summary for Method Standard HJ 834-2017 GC-MS Semivolatiles Analysis (Optimized Conditions)

	RRF %RSD (<30%)	R^{2*} (>0.990)	R (>0.990)	LOD (Method HJ 834-2017)	LOQ (Method HJ 834-2017)	%Recovery
Acceptable	64	64	64	64	64	64
Unacceptable	0	0	0	0	0	0
Maximum	23%	1.000	1.000	0.89	2.98	109%
Minimum	2%	0.997	0.999	0.02	0.05	75%

*R^2 is not specified in Method Standard HJ 834-2017. It is included because it is a commonly used linearity metric in other methods for GC-MS semivolatiles analysis.

Table III: Individual Results by Compound for Method Standard HJ 834-2017 GC-MS Semivolatiles Analysis (Optimized Conditions)

Compound	RRF %RSD (<30%)	R^{2*}	R	Method HJ 834-2017 LOD (ppm)	Method HJ 834-2017 LOQ (ppm)	LOD (ppm)	LOQ (ppm)	%Recovery of 10 ppm
Bis(N-methoxy-N-methylamino)methane	2%	1.000	1.000	1.60	6.40	0.36	1.22	105%
Phenol	4%	0.998	0.999	2.00	8.00	0.33	1.11	95%
Bis(2-chloroethyl) ether	3%	0.999	1.000	2.00	8.00	0.17	0.58	99%
Phenol, 2-chloro-	4%	0.999	0.999	2.00	8.00	0.16	0.55	96%
Benzene, 1,3-dichloro-	5%	0.999	0.999	1.80	7.20	0.20	0.68	100%
Benzene, 1,4-dichloro-	5%	1.000	1.000	1.20	4.80	0.19	0.62	97%
Benzene, 1,2-dichloro-	7%	1.000	1.000	1.60	6.40	0.13	0.45	96%
Phenol, 2-methyl-	5%	0.998	0.999	1.60	6.40	0.25	0.82	101%
Bis(2-chloro-1-methylethyl) ether	6%	0.999	0.999	1.60	6.40	0.34	1.13	104%
1-Propanamine, N-nitroso-N-propyl-	3%	1.000	1.000	2.00	8.00	0.43	1.43	109%
p-Cresol	6%	1.000	1.000	2.00	8.00	0.11	0.38	100%
Ethane, hexachloro-	10%	1.000	1.000	2.00	8.00	0.53	1.77	97%
Benzene, nitro-	7%	0.999	1.000	1.40	5.60	0.23	0.76	102%
Isophorone	6%	1.000	1.000	2.00	8.00	0.09	0.30	99%
Phenol, 2-nitro-	10%	1.000	1.000	2.00	8.00	0.15	0.50	96%
Phenol, 2,3-dimethyl-	6%	1.000	1.000	1.80	7.20	0.25	0.84	99%
Methane, bis(2-chloroethoxy)-	5%	1.000	1.000	1.40	5.60	0.09	0.31	100%
Phenol, 2,4-dichloro-	13%	1.000	1.000	4.00	16.00	0.09	0.30	98%
Benzene, 1,2,4-trichloro-	11%	1.000	1.000	1.80	7.20	0.16	0.54	98%
Naphthalene	9%	0.998	0.999	1.60	6.40	0.16	0.54	99%
p-Chloroaniline	8%	0.999	0.999	1.40	5.60	0.17	0.57	94%
1,3-Butadiene, 1,1,2,3,4,4-hexachloro-	5%	1.000	1.000	1.40	5.60	0.29	0.98	97%
Phenol, 2-chloro-5-methyl-	6%	1.000	1.000	1.80	7.20	0.23	0.77	93%
Naphthalene, 1-methyl-	10%	0.999	0.999	1.80	7.20	0.07	0.22	98%
Hexachlorocyclopentadiene	22%	0.998	0.999	1.20	4.80	0.27	0.92	89%
Phenol, 2,4,6-trichloro-	21%	0.999	1.000	1.20	4.80	0.13	0.44	92%
Phenol, 2,4,5-trichloro-	21%	0.999	0.999	1.60	6.40	0.27	0.91	92%
Naphthalene, 1-chloro-	15%	0.999	1.000	2.00	8.00	0.10	0.32	95%
Dimethyl (2-nitroanilino)maleate	21%	0.999	1.000	2.00	8.00	0.62	2.05	89%
Dimethyl phthalate	15%	1.000	1.000	2.00	8.00	0.12	0.39	93%
Benzene, 2-methyl-1,3-dinitro-	20%	0.998	0.999	2.00	8.00	0.56	1.87	90%
Biphenylene	18%	1.000	1.000	2.00	8.00	0.10	0.32	99%
m-Nitroaniline	22%	0.999	1.000	1.60	6.40	0.89	2.98	90%
Acenaphthene	10%	0.998	0.999	1.80	7.20	0.02	0.08	99%
Phenol, 2,4-dinitro-	16%	0.997	0.999	1.40	5.60	0.69	2.32	75%
Phenol, 4-nitro-	13%	1.000	1.000	1.60	7.20	0.23	0.75	85%
Dibenzofuran	14%	1.000	1.000	2.00	8.00	0.09	0.29	99%
Benzene, 1-methyl-2,4-dinitro-	23%	1.000	1.000	2.00	8.00	0.13	0.42	91%
Diethyl Phthalate	13%	1.000	1.000	2.00	8.00	0.05	0.18	96%
Fluorene	15%	0.999	1.000	1.80	7.20	0.04	0.14	98%
Benzene, 1-chloro-4-phenoxy-	8%	1.000	1.000	1.80	7.20	0.12	0.39	103%
Benzene, 1-chloro-3-phenoxy-	13%	1.000	1.000	4.00	16.00	0.33	1.11	95%
Phenol, 2-methyl, 4,6-dinitro-	22%	0.998	0.999	1.60	6.40	0.39	1.30	103%
Azobenzene	6%	0.999	0.999	6.00	24.00	0.15	0.50	104%

Table III: Individual Results by Compound for Method Standard HJ 834-2017 GC-MS Semivolatiles Analysis (Optimized Conditions)

Compound	RRF %RSD (<30%)	R^{2*}	R	Method HJ 834-2017 LOD (ppm)	Method HJ 834-2017 LOQ (ppm)	LOD (ppm)	LOQ (ppm)	%Recovery of 10 ppm
Benzene, 1-bromo-4-phenoxy-	13%	1.000	1.000	2.00	8.00	0.20	0.67	95%
Benzene, hexachloro-	8%	1.000	1.000	2.00	8.00	0.02	0.07	99%
Phenol, pentachloro-	11%	0.998	0.999	2.00	8.00	0.39	1.30	89%
9H-Fluorene, 9-methylene-	8%	0.998	0.999	2.00	8.00	0.03	0.11	101%
Anthracene	13%	1.000	1.000	4.00	16.00	0.03	0.09	104%
Carbazole	11%	0.998	0.999	2.00	8.00	0.07	0.24	96%
Dibutyl phthalate	12%	0.999	0.999	2.00	8.00	0.03	0.10	99%
Fluoranthene	10%	1.000	1.000	4.00	16.00	0.07	0.22	100%
Pyrene	9%	1.000	1.000	2.00	8.00	0.03	0.11	101%
Benzyl butyl phthalate	12%	0.998	0.999	2.00	8.00	0.20	0.68	94%
Benz[a]anthracene	5%	0.999	0.999	2.00	8.00	0.08	0.26	95%
Triphenylene	7%	0.999	1.000	2.00	8.00	0.13	0.42	106%
Bis(2-ethylhexyl) phthalate	15%	1.000	1.000	4.00	16.00	0.09	0.29	102%
Phthalic acid, hept-4-yl octyl ester	18%	1.000	1.000	2.00	8.00	0.02	0.05	103%
Benzo[b]fluoranthene	17%	0.999	1.000	2.00	8.00	0.09	0.31	96%
Benzo[k]fluoranthene	16%	1.000	1.000	4.00	16.00	0.09	0.32	102%
Benzo[a]pyrene	15%	0.999	0.999	2.00	8.00	0.08	0.26	104%
Indeno[1,2,3-cd]pyrene	11%	0.999	1.000	2.00	8.00	0.05	0.18	96%
Diben[a,h]anthracene	5%	0.999	0.999	2.00	8.00	0.10	0.35	107%
Benzo[ghi]perylene	7%	1.000	1.000	4.00	16.00	0.04	0.15	106%

*R^2 is not specified in Method Standard HJ 834-2017, but it is included here because it is a statistical metric that is commonly used to demonstrate linearity in other methods for GC-MS semivolatiles analysis.

Conclusion

This study demonstrated that the highly inert RMX-5Sil MS column produced method-compliant results for a wide range of challenging semivolatiles. The inertness of the column surface produced sharp, symmetrical peaks that simplified integration and resulted in excellent results for system suitability; linearity (RRF %RSD and R^2); LOD; LOQ; and recovery. In addition to meeting Method Standard HJ 834-2017 requirements and producing highly linear calibration curves, the optimized GC-MS conditions that were developed here reduced sample analysis time from 60 to 40 minutes, allowing high-throughput laboratories to improve sample throughput.

Featured Products

RMX-5Sil MS GC Capillary Column

Catalog No.	Product Name	Units
17323	RMX-5Sil MS GC Capillary Column, 30 m, 0.25 mm ID, 0.25 µm	ea.

Topaz Single Taper Inlet Liner

Catalog No.	Product Name	Units
23303	Topaz, Single Taper Inlet Liner, 4.0 mm x 6.5 x 78.5, for Agilent GCs, w/Quartz Wool, Premium Deactivation	5-pk.

Restek Electronic Leak Detector

Catalog No.	Product Name	Units
28500	Restek Electronic Leak Detector (includes carrying case; universal AC power adaptor [U.S., UK, Europe, Australia, Japan]; 6-ft USB charging cable)	ea.

Benzo[a]pyrene

1000 µg/mL, Acetone, 1 mL/ampul

Catalog No.	Contains	Units
31271	Benzo[a]pyrene (50-32-8)	ea.

Dibenz[a,h]anthracene

1000 µg/mL, Methylene Chloride, 1 mL/ampul

Catalog No.	Contains	Units
31276	Dibenz[a,h]anthracene (53-70-3)	ea.

Indeno[1,2,3-cd]pyrene

1000 µg/mL, Methylene Chloride, 1 mL/ampul

Catalog No.	Contains	Units
31279	Indeno[1,2,3-cd]pyrene (193-39-5)	ea.

Benzo[g,h,i]perylene

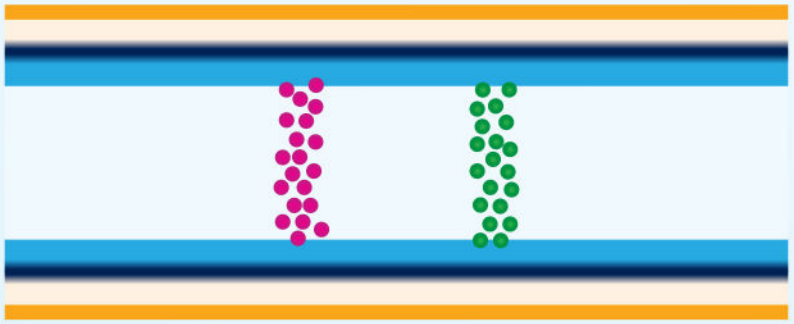
1000 µg/mL, Methylene Chloride, 1 mL/ampul

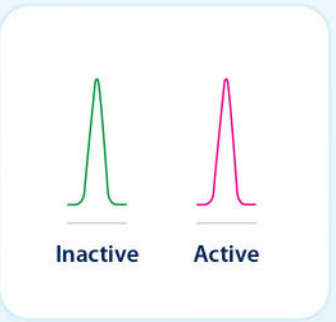
Catalog No.	Contains	Units
31273	Benzo[g,h,i]perylene (191-24-2)	ea.

What Makes RMX Columns Better?

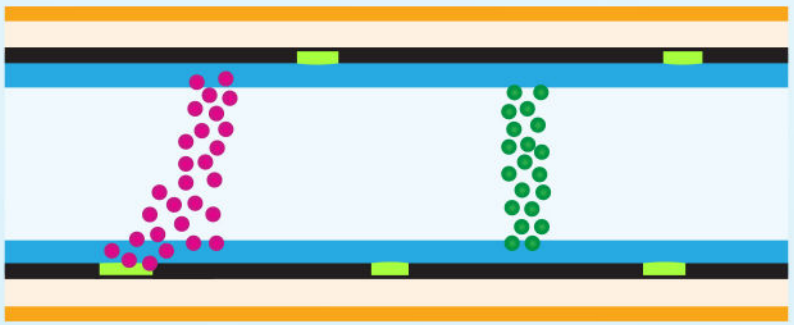
Highly Effective TriMax Deactivation Protects Analytes From Surface Interactions, Improving Peak Shape and Sensitivity for a Wide Range of Compound Chemistries

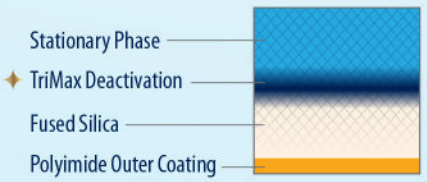
TriMax Deactivation





Non-TriMax Deactivation





- Inactive compounds: *alkanes, alkenes, alkynes, etc.*
- Active compounds: *acids, bases, alcohols, esters, ethers, etc.*
- Residual active site

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