SLB™-5ms Fast GC Columns for Semivolatile Analysis

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Introduction

US EPA Method 8270 mandates that the GC-MS instrument be tuned prior to the analysis of any standards or samples. Once an acceptable tune has been achieved, analysis may begin. For an analysis to be considered valid, the injection must occur within twelve hours of the time the tuning solution was injected. This twelve hours of time is often referred to as "tune time."

In an environmental laboratory that analyzes semivolatiles, there are few options to increase sample throughput. Some of these, such as the purchase of additional instrumentation, requiring a capital expense, or adding a second or third shift, requiring additional payroll, may not be feasible. An alternative is to decrease the actual analysis time on the instrument. This can be done by converting to a shorter, narrower bore column. The shorter analysis time will result in a greater number of injections and thus more billable samples completed during "tune time."

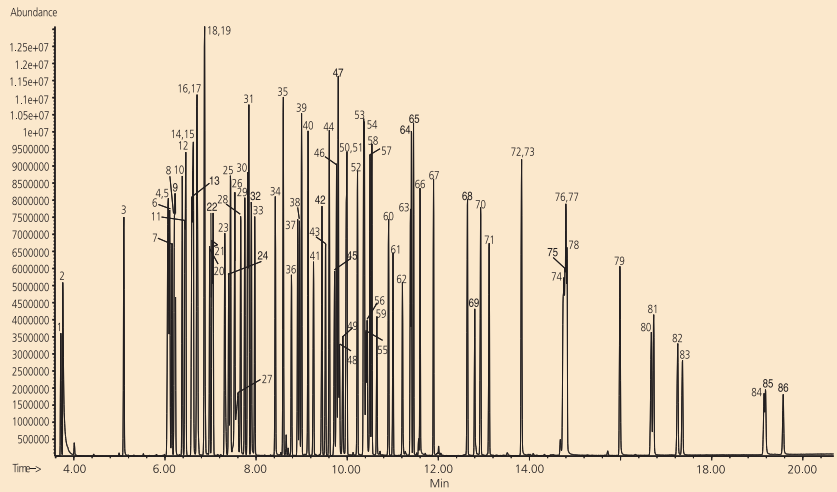
Fast GC

Without sacrificing the quality of the analysis, Fast GC uses column and instrument improvements combined with run conditions that give 3- to 10-times faster analyses. It is typically performed using short, 0.10 mm or 0.18 mm I.D. capillary columns with rapid temperature programming rates and high carrier gas linear velocities.

Figure 1. Semivolatiles on the 0.25 mm I.D. SLB-5ms

column: SLB-5ms, 30 m x 0.25 mm I.D., 0.25 µm (28471-U)
oven: 40 °C (2 min.), 22 °C/min. to 240 °C, 10 °C/min. to 330 °C (1 min.)
inj.: 250 °C
MSD interface: 330 °C
scan range: m/z 40-450
carrier gas: helium, 1.0 mL/min. (11 min.), 10 mL/min² to 1.5 mL/min. (hold remainder of run)
injection: 0.5 µL, splitless (0.50 min.)
liner: 2 mm I.D., straight
sample: 50 ng on-column of a 72 component semivolatile standard and 8 surrogate compounds, plus 6 internal standards (at 40 ng on-column)

1. N-nitrosodimethylamine
2. Pyridine
3. 2-fluorophenol (surr.)
4. Phenol-d_6 (surr.)
5. Phenol
6. Aniline
7. Bis(2-chloroethyl)ether
8. 2-chlorophenol-d_4 (surr.)
9. 2-chlorophenol
10. 1,3-dichlorobenzene
11. 1,4-dichlorobenzene-d_4 (I.S.)
12. 1,4-dichlorobenzene
13. Benzyl alcohol
14. 1,2-dichlorobenzene-d_4 (surr.)
15. 1,2-dichlorobenzene
16. 2-methylphenol
17. Bis(2-chloroisopropyl)ether
18. N-nitroso-di-n-propylamine
19. 4-methylphenol
20. Hexachloroethane
21. Nitrobenzene-d_5 (surr.)
22. Nitrobenzene
23. Isophorone
24. 2-nitrophenol
25. 2,4-dimethylphenol
26. Bis(2-chloroethoxy)methane
27. Benzoic acid
28. 2,4-dichlorophenol
29. 1,2,4-trichlorobenzene
30. Naphthalene-d_8 (I.S.)
31. Naphthalene
32. 4-chloroaniline
33. Hexachlorobutadiene
34. 4-chloro-3-methylphenol
35. 2-methylnaphthalene
36. Hexachlorocyclopentadiene
37. 2,4,6-trichlorophenol
38. 2,4,5-trichlorophenol
39. 2-fluorobiphenyl (surr.)
40. 2-chloronaphthalene
41. 2-nitroaniline
42. Dimethyl phthalate
43. 2,6-dinitrotoluene
44. Acenaphthylene
45. 3-nitroaniline
46. Acenaphthene-d_{10} (I.S.)
47. Acenaphthene
48. 2,4-dinitrophenol
49. 4-nitrophenol
50. Dibenzofuran
51. 2,4-dinitrotoluene
52. Diethyl phthalate
53. 4-chlorophenyl phenyl ether
54. Fluorene
55. 4-nitroaniline
56. 2-methyl-4,6-dinitrophenol
57. N-nitrosodiphenylamine
58. Azobenzene
59. 2,4,6-tribromophenol (surr.)
60. 4-bromophenyl phenyl ether
61. Hexachlorobenzene
62. Pentachlorophenol
63. Phenanthrene-d_{10} (I.S.)
64. Phenanthrene
65. Anthracene
66. Carbazole
67. Di-n-butyl phthalate
68. Fluoranthene
69. Benzidine
70. Pyrene
71. Terphenyl-d_{14} (surr.)
72. 3,3'-dimethylbenzidine
73. Butylbenzyl phthalate
74. 3,3'-dichlorobenzidine
75. Benzo(a)anthracene
76. Bis(2-ethylhexyl)phthalate
77. Chrysene-d_{12} (I.S.)
78. Chrysene
79. Di-n-octyl phthalate
80. Benzo(b)fluoranthene
81. Benzo(k)fluoranthene
82. Benzo(a)pyrene
83. Perylene-d_{12} (I.S.)
84. Indeno(1,2,3-cd)pyrene
85. Dibenzo(a,h)anthracene
86. Benzo(g,h,i)perylene



Analysis on 0.25 mm I.D. Column

An 86-component US EPA Method 8270 standard (72 analytes, 8 surrogates, and 6 internal standards) was analyzed on a 30 m x 0.25 mm I.D., 0.25 µm SLB-5ms column. The resulting chromatogram is shown in Figure 1. Flow rate was programmed to achieve an analysis time of 19.6 minutes.

Analysis on 0.18 mm I.D. Column

The principles of Fast GC were applied to analyze the same 86-component US EPA Method 8270 standard on a 20 m x 0.18 mm I.D., 0.18 µm SLB-5ms column. The resulting chromatogram is shown in Figure 2. The analysis time of 8.1 minutes equates to a time savings greater than 11 minutes. A narrow bore injection liner and split injection was used to compensate for the lower sample capacity of the narrow bore column.

Conclusion

Switching from the 30 m x 0.25 mm I.D., 0.25 µm SLB-5ms column to the 20 m x 0.18 mm I.D., 0.18 µm SLB-5ms column resulted in a per run time savings greater than 11 minutes, with all analytes still mass resolved. This translates into approximately fourteen additional runs than can be completed per "tune time."

If shorter run times are desired, consider converting your semivolatile application to a 0.18 mm I.D. SLB-5ms column.

Featured Products

Description	β	Cat. No.
SLB-5ms, 20 m x 0.18 mm I.D., 0.18 µm	250	**28564-U**
SLB-5ms, 30 m x 0.25 mm I.D., 0.25 µm	250	**28471-U**

Related Products - Fast GC Dimensions

Description	β	Cat. No.
Volatiles		
VOCOL, 20 m x 0.18 mm I.D., 1.0 µm	45	**28463-U**
SPB-624, 20 m x 0.18 mm I.D., 1.0 µm	45	**28662-U**
Semivolatiles, Pesticides		
SLB-5ms, 10 m x 0.10 mm I.D., 0.10 µm	250	**28465-U**
SLB-5ms, 15 m x 0.10 mm I.D., 0.10 µm	250	**28466-U**
SLB-5ms, 20 m x 0.18 mm I.D., 0.18 µm	250	**28564-U**
SLB-5ms, 12 m x 0.18 mm I.D., 0.30 µm	150	**28566-U**
SLB-5ms, 30 m x 0.18 mm I.D., 0.30 µm	150	**28575-U**
SLB-5ms, 20 m x 0.18 mm I.D., 0.36 µm	125	**28576-U**
Pesticides		
Equity-1701, 15 m x 0.10 mm I.D., 0.10 µm	250	**28343-U**
Aromatics		
TCEP, 15 m x 0.10 mm I.D., 0.18 µm	139	**28348-U**
cis/trans Isomers		
SP-2560, 75 m x 0.18 mm I.D., 0.14 µm	321	**23348-U**
Many Uses		
SUPELCOWAX 10, 5 m x 0.10 mm I.D., 0.10 µm	250	**25025-U**
SUPELCOWAX 10, 10 m x 0.10 mm I.D., 0.10 µm	250	**25026-U**
SUPELCOWAX 10, 15 m x 0.10 mm I.D., 0.10 µm	250	**24343**
General Purpose		
Equity-1, 15 m x 0.10 mm I.D., 0.10 µm	250	**28039-U**

Related Information

For more information on Supelco Low Bleed SLB-5ms capillary columns, request T405130 (IKA) or visit **sigma-aldrich.com/slb**

Figure 2. Semivolatiles on the 0.18 mm I.D. SLB-5ms

column: SLB-5ms, 20 m x 0.18 mm I.D., 0.18 µm (28564-U)
oven: 40 °C (0.7 min.), 55 °C/min. to 240 °C, 28 °C/min. to 330 °C (2 min.)
inj.: 250 °C
MSD interface: 330 °C
scan range: m/z 40-450
carrier gas: helium, 40 cm/sec, constant
injection: 0.5 µL, 10:1 split
liner: 2 mm I.D., fast FocusLiner inlet liner with taper (2879501-U)
sample: 80 component semivolatile standard at 50 ppm plus 6 internal standards (at 40 ppm) in methylene chloride

Peak IDs the same as Figure 1