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# The Reporter

THE TECHNICAL NEWSLETTER FROM SUPELCO

## Efficient Separations of Analytes of Greatly Differing Properties Using Discovery HS PEG

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### Abstract

The Discovery HS PEG (polyethylene glycol) phase exhibits less hydrophobic character than C18 phases. In addition, the PEG phase may provide enhanced retention for more polar analytes. These attributes can be exploited in cases where analytes varying in octanol-water partition coefficient (log P) are to be separated. In this application the Discovery HS PEG is shown to be suitable for the efficient separation of acetaminophen and methadone, two analytes that differ widely in hydrophobicity.

### Introduction

Analgesics such as acetaminophen are formulated with a variety of narcotic analgesics, antitussives, and antihistamines. Simultaneous high-performance liquid chromatographic (HPLC) analysis of analytes with such differing properties is a challenge. The problem, however, is not obtaining the separation itself, but the time it takes to run the analyses.

### Properties of Discovery HS PEG

Bonded Phase:	Polyethylene Glycol
Endcap (yes / no):	No
Particle Platform:	Silica
Particle Shape:	Spherical
Particle Purity:	<10ppm metals
Particle Sizes (µm):	3, 5, 10
Pore Size (Å):	120
Surface Area (m <sup>2</sup> /g):	300
Packing Density (g/mL):	0.58
%C:	12
Coverage (µmoles/m <sup>2</sup> ):	3.8
pH Range:	2 to 8
Temperature Range:	<70°C

On traditional octadecylsilane (C18) stationary phases, acetaminophen is slightly retained, while many of the other co-formulated active ingredients take 30 minutes or longer to elute. Situations like this cost the laboratory unnecessary time when running quality control measurements.

The Discovery HS PEG stationary phase exhibits less hydrophobic character compared to C18 phases. In addition, many polar analytes show increased retention on PEG compared to C18 phases. This application shows the exploitation of these characteristics of the polyethylene glycol (PEG) stationary phase to provide more efficient separations of dissimilar analytes.

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### ! How to Obtain Related Information

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(continued from page 1)

### Results

Figure A shows a separation of acetaminophen and the narcotic analgesic methadone run on a popular C18 stationary phase. Acetaminophen, with an octanol-water partition coefficient (log P) of 0.46, is only modestly retained. Methadone, with a log P of 3.93 elutes at nearly 30 minutes under these conditions. To develop a more efficient analysis, an effective solution is shown in Figure B, where a PEG stationary phase is used in place of the C18 phase using similar mobile phase conditions. The result is a reduction in analysis time from approximately 30 minutes to 5 minutes. Refer to Table 1 for Capacity Factors.

Figure A. Separation of Acetaminophen and Methadone on C18

Column: Discovery C18, 15cm x 4.6mm ID, 5µm particles  
Cat. No.: 504955  
Mobile Phase: 75:25, 25mM KH<sub>2</sub>PO<sub>4</sub> (pH 3.0 w/ H<sub>3</sub>PO<sub>4</sub>):CH<sub>3</sub>CN  
Flow: 1mL/min  
Detection: UV, 220nm  
Temp.: 60°C  
Injection Vol.: 10µL  
Sample: 50µg/mL each in 90:10, buffer:CH<sub>3</sub>OH

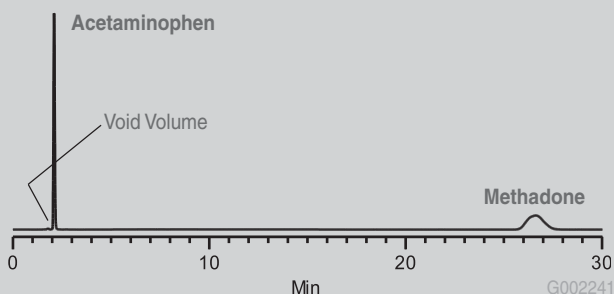


Figure B. Separation of Acetaminophen and Methadone on Discovery HS PEG

Column: Discovery HS PEG, 15cm x 4.6mm ID, 5µm particles  
Cat. No.: 567416-U  
Mobile Phase: 85:15, 25mM KH<sub>2</sub>PO<sub>4</sub> (pH 3.0):CH<sub>3</sub>CN  
Flow Rate: 1mL/min  
Temp.: 60°C  
Detection: UV, 220nm  
Injection Vol.: 10µL  
Sample: 50µg/mL each in 90:10 buffer:CH<sub>3</sub>OH

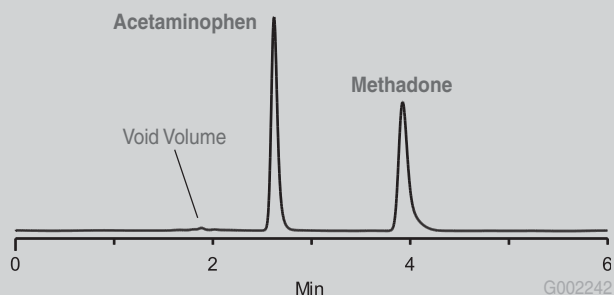


Table 1. Capacity Factors

Bonded Phase	k' Acetaminophen	k' Methadone
Discovery C18	0.11	13.32
Discovery HS PEG	0.40	1.11

### Conclusions

When developing chromatographic methods intended for use in quality control laboratories, the time required for the analysis becomes an important factor to consider. For analytes that differ widely in hydrophobicity, stationary phases based on C18 chemistries may provide too much retention and selectivity. The added analysis time is costly. Exploiting the separation characteristics of the Discovery HS PEG column provides an effective solution to this problem without compromising analytical integrity.

### ! Related Information

For more information, request our Discovery brochure: *Rediscover Method Development*, T402075 (EWS).

### Did you know...?

When using the PEG in RP mode, reduce the % organic by at least 25% over what you would use on a C18. If retention is not obtained on C18 (except for very polar analytes capable of hydrogen bonding, like polyphenols) the likelihood of retention on PEG is small.

A Discovery HS PEG column can be successfully used under normal phase conditions. Remember to flush thoroughly with isopropyl alcohol or another suitable intermediate solvent before going from one mode to the other.

### RELATED PRODUCTS

	Cat. No.
Discovery C18, 15cm x 4.6mm ID, 5µm particles .....	504955
Discovery HS PEG, 15cm x 4.6mm ID, 5µm particles .....	567416-U
Acetaminophen .....	A 5000
Methadone .....	M 0267
Acetonitrile .....	43,913-4

For a complete listing of all Sigma-Aldrich products, log on to our website: [sigma-aldrich.com](http://sigma-aldrich.com)

### Trademarks

CombiPAL - CTC Analytics  
Discovery, Equity, Sigma-Aldrich, Thermogreen - Sigma-Aldrich Co.  
Pittcon - The Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy  
Shimadzu - Shimadzu Corp.  
Teflon, Viton - E.I. du Pont de Nemours & Co., Inc.

### Patents

SPME - Technology licensed exclusively to Supelco. US patent #5,691,206; European patent #523,092



Related Products: **HPLC Accessories**

## Supelco Mobile Phase Filtration Apparatus

Protect your instrument and columns by removing particles and gases from solvents and other mobile phase components. Nylon 66 membrane filters are compatible with all solvents commonly used in HPLC.

**Filtration Apparatus 1** (connects to 1000mL sidearm flask) - Includes 250mL glass reservoir, funnel base and stopper, clamp, stainless steel holder and screen, 10 Teflon gaskets, 50 Nylon 66 filters (47mm, 0.45µm pores). Flask not included.

**Filtration Apparatus 2** (connects to aspiration line) - Includes 250mL glass reservoir, (3) 34/45 tapered funnel base, (3) 34/45 tapered 1000mL flask and glass cap, clamp, stainless steel holder and screen, 10 Teflon gaskets, 50 Nylon 66 filters (47mm, 0.45µm pores).

### Supelco Mobile Phase Filtration Apparatus

Description	Cat. No.
Filtration Apparatus 1	<b>58061</b>
Filtration Apparatus 2	<b>58062-U</b>
<b>Replacement Glass Parts For Filtration Apparatus 1</b>	
Reservoir, 250mL	<b>58063</b>
Reservoir, 500mL	<b>58074</b>
Funnel Base and Stopper	<b>58064</b>
<b>Replacement Glass Parts For Filtration Apparatus 2</b>	
Tapered Funnel Base	<b>58068</b>
Tapered Flask, 1000mL	<b>58070-U</b>
Tapered Flask, 2000mL	<b>58075</b>
Cap for Flask	<b>58071</b>
<b>Replacement Filter Parts for Both Apparatus</b>	
Filter Holder and Screen, SS	<b>58065</b>
Gaskets, Teflon (pk. of 10)	<b>58066</b>
Filter, Nylon 66, 47mm (pk. of 50)	
0.45µm pores	<b>58067</b>
0.20µm pores	<b>58060-U</b>
Clamp, Spring Action	<b>58053</b>
Vacuum Flask, 1000mL, with Sidearm	<b>Z290459-1EA</b>

### Membrane Filter Disks, fits all 47mm Filtration Units

Description	Pore Size (µm)	Qty.	Cat. No.
Nylon 66	0.45	50	<b>58067</b>
	0.20	50	<b>58060-U</b>
Teflon	1.0	10	<b>58097</b>
	1.5	10	<b>58086</b>
Cellulose	0.22	100	<b>58188</b>

### Nylon 46 Membrane Filters

Hydrophilic, compatible with a wide range of chemicals.

Diameter (mm)	Pore Size (µm)	Qty.	Cat. No.
25	0.45	100	<b>Z290815-100EA</b>
47	0.2	100	<b>Z290807-100EA</b>
47	0.45	100	<b>Z290793-100EA</b>
90	0.45	25	<b>Z290785-25EA</b>



Table 1. Solvents and Solutions Compatible with Nylon 66 and Nylon 46 Filters

Recommendations		
<b>Acids</b>		
Acetic acid, 1%		
<b>Bases</b>		
Potassium hydroxide, 6N		
<b>Alcohols</b>		
Amyl alcohol	Ethanol	Isopropanol
Benzyl alcohol	Ethylene glycol	Methanol
Butyl alcohol	Glycerine (glycerol)	Methyl Cellosolve
Butyl Cellosolve	Isobutyl alcohol	Propanol
<b>Solvents</b>		
Acetone	Dimethylformamide	Methyl ethyl ketone
Acetonitrile	Dimethylsulfoxide	Methyl isobutyl ketone
Amyl acetate	Dioxane	Nitrobenzene
Benzene <sup>1</sup>	Ethyl ether	Methylene chloride <sup>1</sup>
Bromoform	Ethylene dichloride	Pentane
Butyl acetate	Formaldehyde	Perchloroethylene
Carbon tetrachloride <sup>1</sup>	Freon 113	Tetrahydrofuran <sup>1</sup>
Cellosolve (2-ethoxyethanol)	Gasoline	Trichloroethylene
Chloroform <sup>1</sup>	Hexane	Toluene <sup>1</sup>
Cyclohexane	Isopropyl acetate	Trichlorethane
Cyclohexanone	Kerosene	Triethylamine
Diethylacetamide	Methyl acetate	Xylene <sup>1</sup>
<b>Note:</b> Controlled vacuum is recommended to prevent boiling of volatile solvents.		
<sup>1</sup> Limited stability in neat solvent.		

ordering: 800-247-6628 (us only) / 814-359-3441 technical service: 800-359-3041 (us only) / 814-359-3041



LC

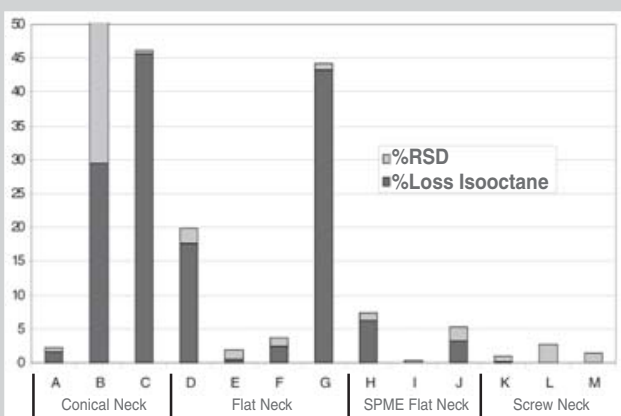
## Vials and Closures for Optimizing SPME Performance

**Bob Shirey**  
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Researchers at CTC Analytics looked at a wide range of vials, caps, and septa in various combinations to determine the significance of their effect on analytical results. In addition they looked at the force required for the SPME needle to penetrate the septa, which is important so that fibers aren't damaged during use.

Samples of isooctane were stored at ambient temperature in vials with various combinations of caps and septa and analyzed immediately and after a 24-hour storage. Loss of isooctane was determined over the 24-hour period and expressed in percent loss in Figure A. The results show that screw cap vials with steel caps and thin septa (1.3-1.6mm thick) sealed well with 0.0 – 0.1% loss of analytes. The vials with the SPME neck also performed very well. Black Viton septa yielded only 0.0 – 0.1% loss, and the vials sealed with PTFE lined silicone septa had a 3.2% average loss of isooctane. Some combinations however are not advised, such as conical vials sealed with 3mm butyl rubber and steel caps which resulted in a loss of 45% of isooctane.

Figure A. Percent Loss of Isooctane and %RSD for Various Vials and Closures



- A. Conical neck vials w/3mm silicone PTFE septa and aluminum/tin closures with 8mm hole
- B. Conical neck vials w/3mm silicone PTFE septa and steel closures with 5mm hole
- C. Conical neck vials w/3mm butyl black septa and steel closures with 5mm hole
- D. Flat neck vials w/3mm silicone PTFE septa and steel closures with 5mm hole
- E. Flat neck vials w/3mm silicone PTFE septa and aluminum/tin closures with 8mm hole
- F. Flat neck vials w/3mm butyl black PTFE septa and steel closure with 5mm hole
- G. Flat neck vials w/3mm butyl black septa and steel closure with 5mm hole
- H. SPME flat neck vials w/0.5mm Viton septa and steel closure with 8mm hole
- I. SPME flat neck vials w/1.0mm Viton septa and steel closure with 8mm hole
- J. SPME flat neck vials w/1.5mm silicone PTFE septa and steel closure with 8mm hole
- K. Screw neck vial w/1.5mm silicone PTFE septa and steel closure with 8mm hole
- L. Screw neck vial w/1.3mm silicone PTFE septa and steel closure with 8mm hole
- M. Screw neck vial w/1.5mm butyl PTFE septa and steel closure with 8mm hole

The screw cap vial is a new approach for the headspace SPME technique and is a good alternative to crimping. The screw caps give excellent results and are easy to handle. The sealing and opening process is much easier than the crimping and de-capping process.

Also critically important to SPME is the hardness of the septum, which allows proper penetration without damage to the needle. While the only measurement of hardness on septa is Shore A, it is a poor indicator of ease of penetration by an SPME needle. To measure this aspect of the septum an additional test was developed to assess the force (Newton) required to penetrate the septa using an SPME needle. Listed below in Table 1 is the thickness, hardness and penetration force data for various septa materials and thickness.

Table 1. Septa Hardness and Degree of Penetration

Septum Composition	Thickness mm	Hardness Shore A	Penetration in Newton	
			Headspace Needle Gauge 23 Cone Tip	SPME Needle Gauge 23 Blunt Tip
<b>Silicone</b>				
/PTFE – 1	3.0	35	7.0	15.5
/PTFE – 2	3.0	35	5.5	13.0
/PTFE – 3	3.0	45	5.5	15.0
/PTFE – 4	3.0	45	6.0	15.5
/PTFE – 5	3.0	45	6.0	11.0
/PTFE – 6	3.0	45	6.5	15.5
/High Temperature	3.0	35	8.0	12.0
/PTFE – 1	1.5	60	3.0	9.0
/PTFE – 2	1.5	60	4.0	11.0
/PTFE – 3	1.5	60	4.0	7.5
<b>Butyl Rubber</b>				
Butyl Rubber	3.0	50	11.5	19.0
/PTFE – 1	3.0	50	14.0	24.5
/PTFE – 2	3.0	50	13.0	20.0
/PTFE	1.6	55	9.0	14.0
<b>Chlorobutyl Rubber</b>				
Chlorobutyl Rubber	3.0	50	17.0	28.0
/PTFE	3.0	50	14.0	23.0

Based upon the results of this study and upon studies involving SPME fiber durability with the CombIPAL system, it is important that thinner septa be used to seal vials for SPME use. We recommend 1.5mm silicone PTFE lined septa with SPME neck vials or screw cap vials. A steel cap should be used with screw top vials and either aluminum/tin or steel can be used with the SPME neck vial. 1mm thick Viton septa work best with screw cap vials. Butyl rubber septa are not recommended for SPME use. For SPME use, we strongly recommend that caps with an 8mm hole be used instead of a 5mm hole.

Conical vials with 3mm thick septa should not be used with the CombiPAL in the SPME mode. However, conical vials or flat neck vials with 3mm septa are better suited for standard headspace use. We recommend that only aluminum/tin closures be used with conical vials. For standard headspace vials, closures with either 5mm or 8mm opening are suitable.

CTC and Supelco recommend the following list of vials, caps and septa for use in SPME headspace analysis.

**!** Related Information

For more information on SPME, request our CD: *SPME Application Guide and Additional SPME Literature*, T199925 (CJQ).

**+** Related Products: **GC Accessories**

**Use Thermogreen LB-2 Septa in Shimadzu GC for Improved Performance**

Many of today's applications involve the analysis of semi-volatile compounds. Higher injection port temperatures are often necessary to completely volatilize these samples. As a result, low bleed septa should be used to minimize contamination of the GC system. The superior quality of Thermogreen LB-2 discs has long been known to the users of GC models accommodating this style of septa. The superior quality of LB-2 is now available to Shimadzu GC users. We compared our LB-2 plug septa for Shimadzu GCs to several competitive samples using a rigorous extraction procedure. The chromatograms in Figure A show a comparison of the extractable siloxanes between the LB-2 and several other brands. The LB-2 septa had the lowest levels of extractable siloxanes, which means that they will exhibit the lowest bleed when used in a Shimadzu GC. The next time you need septa for your Shimadzu GC, consider taking advantage of the superior bleed characteristics of LB-2 plug style septa.

Description	Qty.	Cat. No.
<b>Cylindrical, For Shimadzu Instruments</b>		
Plug Type	10	20608
Plug Type	50	20633

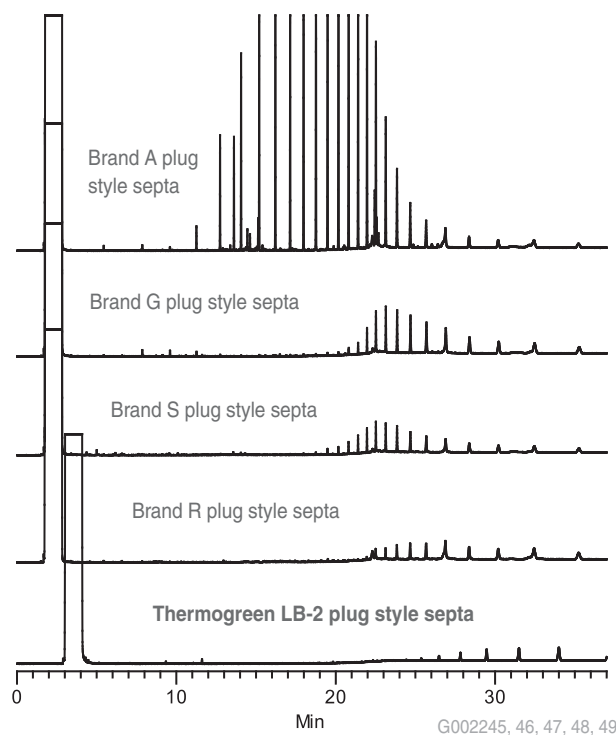
**Did you know...?**

An additional way to help minimize the occurrence of bent or distorted SPME fibers and overcome the challenges of existing septa materials is to use 23 gauge fibers. 23 gauge fibers have a heavier gauge needle that increases the fiber durability especially when used with autosamplers.

RELATED PRODUCTS	Color	Qty.	Cat. No.
<b>Screw Neck Vials and Closures</b>			
10mL round bottom	Clear	100	SU860099
10mL round bottom	Amber	100	SU860100
20mL round bottom	Clear	100	SU860097
20mL round bottom	Amber	100	SU860098
<b>Steel Magnetic Cap 8mm Hole</b>			
with 1.3mm thick silicone blue/PTFE white septa		100	SU860101
with 1.5mm thick silicone blue/PTFE white septa		100	SU860103
with 1.6mm thick butyl red/PTFE gray septa		100	SU860102
<b>SPME Flat Neck Vials and Closures</b>			
20mL round bottom	Clear	100	SU860104
<b>Steel Magnetic Crimp Caps, Gold, 8mm Hole</b>			
with 1.5mm thick silicone white/PTFE blue septa		100	SU860053
with 1.0mm Viton black septa		100	SU860106
20mm x 1.5mm thick silicone/PTFE septa		100	27541
20mm x 0.75mm thick Viton septa		100	27247

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Figure A. Siloxanes Extracted from Thermogreen LB-2 and Various Other Brands of Plug Style Septa



## Fast GC Analysis of Bacterial Acid Methyl Esters (BAMEs) on Equity-1 Columns

**Katherine Stenerson**  
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Every species of anaerobic bacteria produces its own, characteristic profile of C10-C20 cellular fatty acids. Bacteriologists in clinical and research laboratories have used these profiles routinely to identify anaerobic bacterial species. The procedure for this involves culturing the bacteria, collecting the cell mass, and saponifying the cells to liberate the fatty acids. The fatty acids are then methylated, and the resulting methyl esters analyzed by GC. Identifications are based on pattern recognition. Due to their ability to separate the fatty acid methyl esters of interest, nonpolar columns are often used for the GC analysis. Historically, this type of column has been used for this analysis, resulting in a large library of information on bacterial identification by GC.

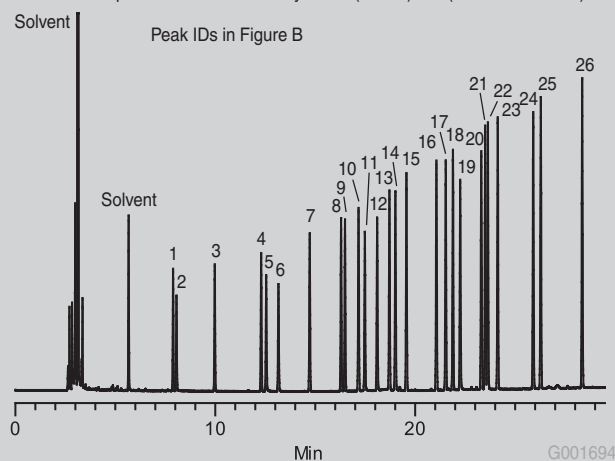
Fast GC can be especially useful for this application. Labs using GC to identify anaerobic bacteria are often faced with running large number of samples under strict time constraints. A typical GC analysis on a standard 30m poly(dimethylsiloxane) capillary column is around 30 minutes (Figure A). By utilizing the technique of fast GC, it is possible to achieve the same separation in as little as 3–4 minutes. This allows approximately 10X more samples to be analyzed in the same amount of time. The 15m x 0.10mm ID x 0.10 $\mu$ m Equity-1 capillary column was evaluated for such a purpose. This narrow-bore column was run in combination with a fast oven ramp rate and hydrogen carrier gas to produce the separation of 26 components in the Supelco BAME mix in just less than 3.5 minutes (Figure B). Narrow-bore columns have more theoretical plates per meter than wider-bore versions, and thus the efficiency of a separation can often be maintained despite the shorter analysis time.

### ! Related Information

For more information, request *Guide to Derivatization Reagents for GC*, T196909 (BGL).

Figure A. Bacterial Acid Methyl Ester (BAME) Mix on Equity-1

**Column:** Equity-1, 30m x 0.25mm ID, 0.25 $\mu$ m  
**Cat. No.:** 28046-U  
Oven: 150°C (4 min), 4°C/min to 250°C  
Inj.: 250°C  
Det.: FID, 280°C  
Carrier: He, 20cm/sec @ 150°C  
Injection: 1 $\mu$ L, split 100:1  
Liner: 4mm ID cup style  
Sample: Bacterial Acid Methyl Ester (BAME) mix (Cat. No. 47080-U)



### Did you know...?

When performing analyses by fast GC, the analyst must pay special attention to column overload. The capacity of 0.10mm ID columns is significantly less than wider bore capillaries. Depending on the type of column and the functionality of the analytes, a 0.10mm ID can have as much as fifty times less capacity than a 0.25mm ID capillary column. Overload can cause distorted peak shape and loss of resolution. To alleviate this problem, reduce the mass of sample injected onto the column. This can be achieved through dilution, an increased split ratio, or a decreased injection volume.

### RELATED PRODUCTS

Cat. No.

Product	Cat. No.
<b>BF<sub>3</sub>-Methanol (10% w/w)</b>	
20 x 1mL	33356
19 x 2mL	33020-U
10 x 5mL	33040-U
5mL	264121-5ML
250mL	264121-250ML
400mL	33021

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GC

technical service: 800-359-3041 (US only) / 814-359-3041  
ordering: 800-247-6628 (US only) / 814-359-3441

**SUPELCO**

Figure B. Fast GC Analysis of the Bacterial Acid Methyl Ester (BAME) Mix on Equity-1

Column: Equity-1, 15m x 0.10mm ID, 0.10µm

Cat. No.: 28039-U

Oven: 175°C, 30°C/min to 275°C (1 min)

Inj.: 280°C

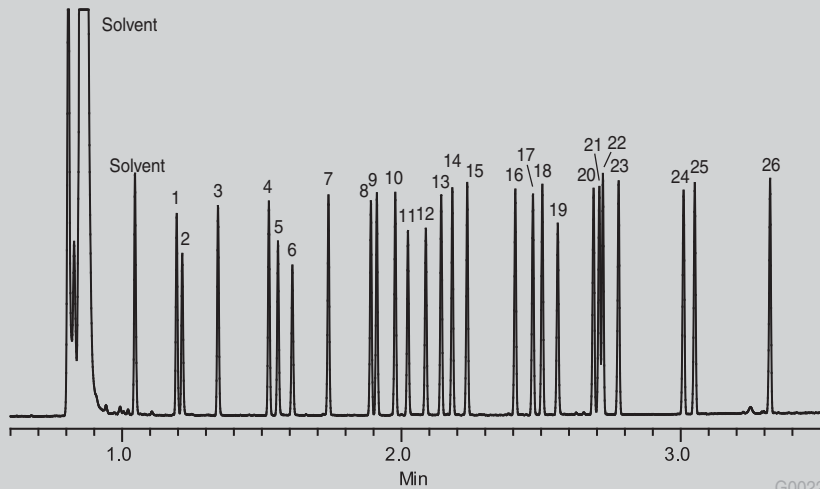
Det.: FID, 280°C

Carrier: Hydrogen, 45cm/sec, constant flow

Injection: 0.5µL, split 200:1

Liner: 4mm ID cup style

Sample: Bacterial Acid Methyl Ester (BAME) mix (Cat. No. 47080-U)



1. Methyl undecanoate (C11:0)
2. Methyl 2-hydroxydecanoate (2-OH C10:0)
3. Methyl dodecanoate (C12:0)
4. Methyl tridecanoate (C13:0)
5. Methyl 2-hydroxydodecanoate (2-OH C12:0)
6. Methyl 3-hydroxydodecanoate (3-OH C12:0)
7. Methyl tetradecanoate (C14:0)
8. Methyl 13-methyltetradecanoate (iC15:0)
9. Methyl 12-methyltetradecanoate (a-C15:0)
10. Methyl pentadecanoate (C15:0)
11. Methyl 2-hydroxytetradecanoate (2-OH C14:0)
12. Methyl 3-hydroxytetradecanoate (3-OH C14:0)
13. Methyl 14-methylpentadecanoate (iC16:0)
14. Methyl cis-9-hexadecenoate (C16:1<sup>9</sup>)
15. Methyl hexadecanoate (C16:0)
16. Methyl 15-methylhexadecanoate (iC17:0)
17. Methyl cis-9,10-methylenehexadecanoate (C17:0D)
18. Methyl heptadecanoate (C17:0)
19. Methyl-2-hydroxyhexadecanoate (2-OH C16:0)
20. Methyl cis-9,12-octadienoate (C18:2<sup>9,12</sup>)
21. Methyl cis-9-octadecenoate (c18:1<sup>9</sup>cis)
22. Methyl trans-9-octadecenoate & Methyl cis-11-octadecenoate (C18:1<sup>9</sup>trans, C18:1)
23. Methyl octadecanoate (C18:0)
24. Methyl cis-9,10-methyleneoctadecanoate (C19:0D)
25. Methyl nonadecanoate (C19:0)
26. Methyl eicosanoate (C20:0)



Related Products: **Chemical Standards**

## Analytical Standards

Sigma-Aldrich offers over 500 food and beverage standards ranging from amino acids to vitamins. The BAME standard relates to the products presented in the GC application. For a complete listing of food and beverage standards, see the Supelco catalog or visit us at [sigma-aldrich.com/supelco](http://sigma-aldrich.com/supelco).

## Supelco Custom Standards

Sigma-Aldrich offers over 8,000 standards and reference materials. If you still can't find the standard you require, Supelco can prepare a custom chemical standard for your application. Every custom standard is shipped with a material safety data sheet (MSDS) and a certificate of composition.

To obtain a custom quote, please call **800-359-3041** or email [techservice@sial.com](mailto:techservice@sial.com) for assistance.

Description	Qty.	Cat. No.
<b>BAME Standard</b>		
Bacterial Acid Methyl Ester (BAME) (10mg/mL total concentration, see Figure B above for analyte list)	1mL	<b>47080-U</b>
<b>FAME Standard</b>		
Supelco 37-Component FAME Mix (10mg/mL total concentration)	1mL	<b>47885-U</b>
1. C4:0 (Butyric)	25. C20:2 (cis-11,14-Eicosadienoic)	
2. C6:0 (Caproic)	26. C20:3n6 (cis-8,11,14-Eicosatrienoic)	
3. C8:0 (Caprylic)	27. C20:3n3 (cis-11,14,17-Eicosatrienoic)	
4. C10:0 (Capric)	28. C20:4n6 (Arachidonic)	
5. C11:0 (Undecanoic)	29. C20:5n3 (cis-5,8,11,14,17-Eicosapentaenoic)	
6. C12:0 (Lauric)	30. C21:0 (Henicosaenoic)	
7. C13:0 (Tridecanoic)	31. C22:0 (Behenic)	
8. C14:0 (Myristic)	32. C22:1n9 (Erucic)	
9. C14:1 (Myristoleic)	33. C22:2 (cis-13,16-Docosadienoic)	
10. C15:0 (Pentadecanoic)	34. C22:6n3 (cis-4,7,10,13,16,19-Docosahexaenoic)	
11. C15:1 (cis-1-Pentadecanoic)	35. C23:0 (Tricosanoic)	
12. C16:0 (Palmitic)	36. C24:0 (Lignoceric)	
13. C16:1 (Palmitoleic)	37. C24:1n9 (Nervonic)	
14. C17:0 (Heptadecanoic)		
15. C17:1 (cis-10-Heptadecanoic)		
16. C18:0 (Stearic)		
17. C18:1n9c (Oleic)		
18. C18:1n9t (Elaidic)		
19. C18:2n6c (Linoleic)		
20. C18:2n6t (Linolelaidic)		
21. C18:3n6 (g-Linolenic)		
22. C18:3n3 (a-Linolenic)		
23. C20:0 (Arachidic)		
24. C20:1n9 (cis-11-Eicosenoic)		

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### POSTER SESSIONS

Time	Session	Location	Title, Author
<b>Monday, March 8, 2004</b>			
Morning	LC Pharmaceutical	4200-1100 P	<i>Stationary Phase Selection: Practical Applications of Column Screening Data</i> , D.S. Bell, S.R. Wyatt
Afternoon	Pharmaceutical	7500-300 P	<i>Prepacked, Disposable Büchner Funnels for Medicinal Chemistry</i> , A. Trinh, T. Williams, M. Ye
Afternoon	Pharmaceutical	7500-1800 P	<i>Capillary Column Choices for the Analysis of Pharmaceutical Solvents</i> , K. Stenerson, L. Sidisky, R. Shirey, G. Baney, R. George
Afternoon	Pharmaceutical	7500-5300 P	<i>Advantages of Polar, Reversed-Phase HPLC Columns for the Analysis of Drug Metabolites</i> , D.S. Bell, C. Santasania,
<b>Tuesday, March 9, 2004</b>			
Afternoon	LC Techniques	10300-100 P	<i>HPLC of Hydrophilic Peptides with Reversed-Phase Solvent Systems</i> , D.S. Bell, H. Brandes
Afternoon	LC Techniques	10300-1200 P	<i>U-Shaped Retention Profiles as an Indicator of the Level of Activity of HPLC Silica Phases</i> , K. Duff, M. Sarker
<b>Wednesday, March 10, 2004</b>			
Morning	Various Extraction Techniques I	16400-900 P	<i>A Case Study in Improved Extraction Performance and Selectivity Using Dual Mode SPE Technology</i> , A. Trinh, Y. Yang, D.S. Bell
Morning	Various Extraction Techniques I	16400-1200 P	<i>Systematic Evaluation of Solid Phase Extraction (SPE) Chemistries for the Determination of Acidic, Neutral and Basic Drugs</i> , L. Marlatt, A. Trinh, D.S. Bell
Morning	Various Extraction Techniques I	16400-2200 P	<i>Improvements in Solid Phase Microextraction Fibers: Metal Fiber Cores Couple with an Automated Coating Process</i> , R. Shirey, L. Sidisky
Afternoon	LC Technology	19200-1600 P	<i>Reproducibility Study of Ion-Pair, High pH and Normal-Phase HPLC Methodologies</i> , D.S. Bell, H. Cramer
<b>Thursday, March 11, 2004</b>			
Morning	Bioanalysis By GC/LC/MS	21500-600 P	<i>A Case Study in Sample Prep Method Development for the Determination of Furosemide in Horse Serum Using SPE and HPLC Analysis</i> , A. Trinh, D.S. Bell
Morning	Bioanalysis By GC/LC/MS	21500-700 P	<i>The Extraction of Corticosteroids from Urine Using Monomerically Bonded Cyanopropyl SPE 96-Well Plate: A Case Study in SPE Method Development</i> , A. Trinh, D.S. Bell, Y. Ni, D. Vitkuske

### ORAL SESSIONS

Time	Session	Location	Title, Author
<b>Tuesday, March 9, 2004, Room S504D</b>			
3:25 PM	LC: Column Technology	12300-600	<i>Zirconia-Based Phases as a Powerful Complement to Silica-based Phases for LC and LC/MS under Non-extreme Mobile Phase Conditions</i> , R.A. Henry, D.S. Bell, S. Wyatt

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