



Oils and Fats Analysis



AUSTRALIA & PACIFIC REGION

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EUROPE

INDIA

JAPAN

MIDDLE EAST

USA

About SGE

SGE Analytical Science began manufacturing syringes over 50 years ago and now manufactures a vast array of products for chromatography and mass spectrometry. SGE is an ISO accredited company and is proud that all major analytical science instrument manufacturers rely on and incorporate SGE manufactured components in their systems. SGE is heavily committed to ongoing research and development that will allow the company to continue to bring innovative technologies and solutions to analytical science.

SGE GC Capillary Columns

- Five decades of capillary column innovation.
- End to end capillary column manufacture.
- Providing separation solutions.

Each SGE GC capillary column is tested at the maximum operating temperature for the column, and specific tests are undertaken based on the target application of the column. This means you can be confident of a reliable separation, column after column.

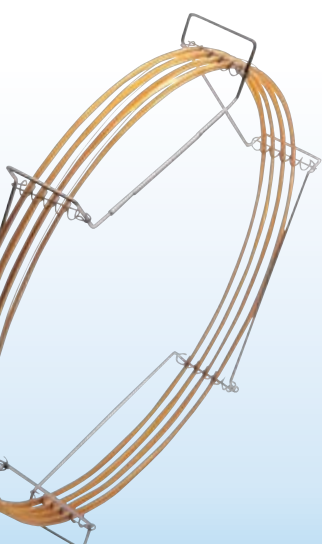


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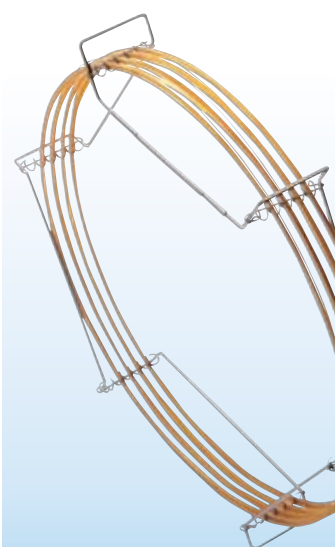
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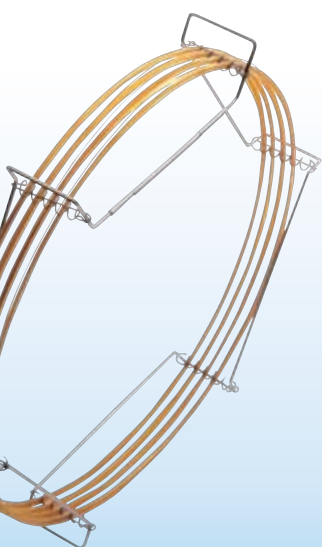
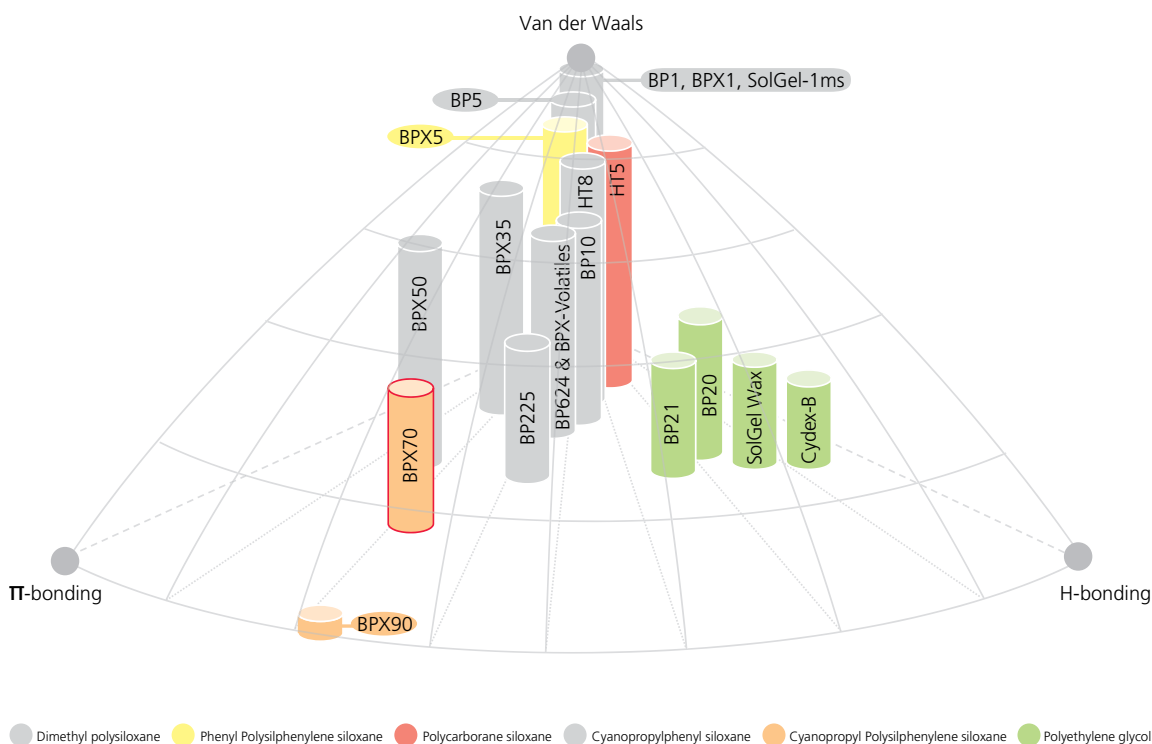


SGE GC Column Stationary Phase Polarity

GC column phase chemistry dictates column selectivity. Phase chemistry references polarity – polarity in general terms and where phases fit along a linear polarity scale – but this is an over simplification. There are different types of interactions based on the different functionality of the stationary phase polymer.

Therefore SGE has created a 3D polarity scale that is qualitative and shows the ability of phases to interact with a range of analytes. Each phase fits as a point on a plot of three classic bonding mechanisms – ‘Van der Waals’, H-bonding and π -bonding.

Van der Waals - Phase Polarity



Focus on BPX70 – The Industry Standard FAME GC Column

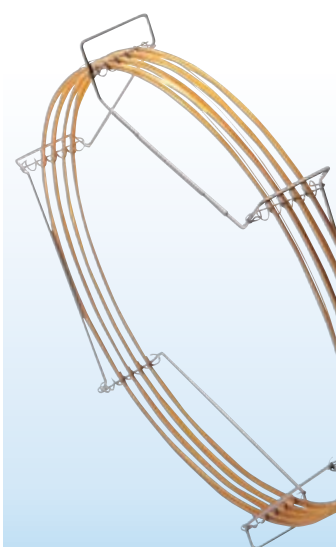
- BPX70 is equivalent to and behaves like a 70% cyanopropyl siloxane but with silphenyl end substituted backbone for stability. This column was introduced in 1987 and remained the most polar thermally stable phase for some time.
- This GC column was specifically designed for separation of FAMES and is the industry standard for FAME analysis.
- Long operating life.
- High temperature limit - maximum continuous operating temperature 250 °C and maximum cycling temperature limit 260 °C.
- Bonded and cross-linked.
- Able to be solvent rinsed.

Example BPX70 Application

Use of the BPX70 60-m GC columns for screening the fatty acid composition of industrial cookies.

Vingering, N. Ledoux, M. *Eur J Lipid Sci Technol*, 2009; 111: 669-77

This study evaluated a middle-length highly polar column, BPX70 60m, to balance analysis efficiency and duration. The column was evaluated by analysing the Fatty Acid (FA) composition of ten cookies made with different kinds of fats, including milk fat, and pure and/or partially hydrogenated vegetable oils. Overall, the BPX70 column could be used for rapid screening of the FA composition of simple foods. Analysis of the FA composition of a complex matrix, such as a dairy product, and specific analysis of trans-FA required a longer highly polar column, possibly after fractionation by silver-ion chromatography. Compared to other GC phases, the BPX70 enabled effective isolation of 18:3 isomers although these isomers co-eluted with 20:1 isomers on other highly polar GC phases. However, some CLA isomers co-eluted with other FA on this column, and a specific analysis of these special FA would require another phase and/or different chromatographic conditions.



Key Technical Poster Summaries

For full product listing, specifications and ordering information visit www.sge.com/gc or look in SGE's Product Selection Guide



Approaches to The Analysis of Saturated and Mono-Unsaturated FAME Using Highly Polar GC Phases

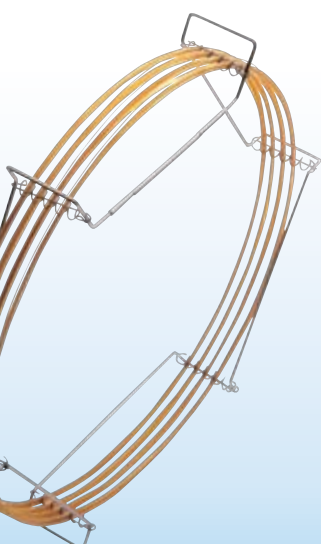
TP-0197-M

Paul Wynne¹, Roy Hibbert¹ and Naza Lahoutifard². ¹SGE Analytical Science, Ringwood, Victoria, Australia. ²SGE Europe, Courtaboeuf, France.

The resolution of complex fatty acid (FA) mixtures is becoming an increasingly important task in the analysis of fats and oils for determining nutritional or nutraceutical value, the detection of adulterants and anti-nutrients (e.g. trans acids) and for the isolation of novel compounds. The use of highly polar GC phases is common for such analyses. While these phases are particularly effective for resolving analytes on the basis of unsaturation and carbon chain length, they suffer some loss of resolving power.

This study describes the first part of our investigation into alternative strategies for FA analysis by GC and GCMS in which the analyte chemistry is modified to influence chromatographic behavior.

The study successfully identifies and demonstrates the separation of derivatized FA on a polar GC phase (SGE BPX70 column). The technique increases the relative retention of unsaturated FA relative to saturated FA, allows the separation of FA from co-eluting peaks and shows increased selectivity.



GCMS Based Structure Assignment for Furan Fatty Acids Isolated from European Carp

TP-0181-C

Paul Wynne¹, Laura Jenkinson², Glen Marrow², Naza Lahoutifard³, Lynn Hodges² and Theo Macrides². ¹SGE Analytical Science, Ringwood, Victoria, Australia. ²School of Medical Sciences, RMIT University, Bundoora, Victoria, Australia. ³SGE Europe, France.

The European carp (*Cyprinus carpio*) is an established pest species in Australian inland rivers and studies that investigate alternative routes to exploitation or bioregulation are of interest for river management plans. The species expresses a family of unusual furan substituted fatty acids that are of interest for their potential to be either anti-nutrients or useful therapeutic substances.

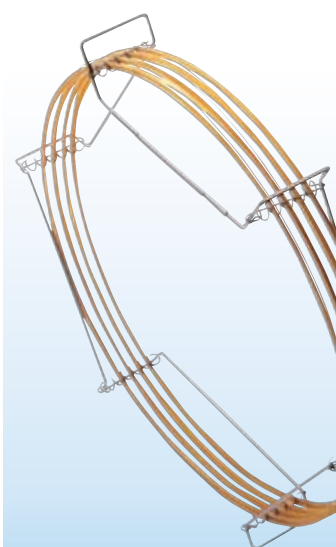
While this poster does not establish the physiological significance of the obtained data, it does describe a multi-dimensional GC approach to detecting the presence of structural variants of furan fatty acids. Orthogonality of separation was provided by the unique selectivity of the carborane (HT8) and biscyanopropyl (BPX90) phases relative to the 5 % phenyl substituted phases that may be applicable to other similar analyses.

Analysis of Unusual Seed Oil Fatty Acids from *Exocarpus Cupressiformis* Using Multiple GC Column Phases

TP-0182-C

Paul Wynne¹, Melissa Vanjek², Nicolette Kalafatis², Naza Lahoutifard³, Lynn Hodges² and Theo Macrides². ¹SGE Analytical Science, Ringwood, Victoria, Australia. ²School of Medical Sciences, RMIT University, Bundoora, Victoria, Australia. ³SGE Europe, Courtaboeuf, France.

The Cherry Ballart (*Exocarpus cupressiformis*) is a small semi-parasitic tree native to Eastern Australia. The seed oil has been found to contain a number of unique fatty acids that are of interest for their potential physiological activity. In this poster, the chromatographic behavior of the fatty acid methyl esters derived from the species are described in terms of steric barriers to their interaction with different phases. The poster demonstrates the usefulness of GC phases that are capable of exhibiting different types of interactions with π -electron containing analytes such as SGE's BP5, HT8, BPX5 and BPX90, in fatty acid analysis.



Key Technical Poster Summaries Continued

For full product listing, specifications and ordering information visit www.sge.com/gc or look in SGE's Product Selection Guide

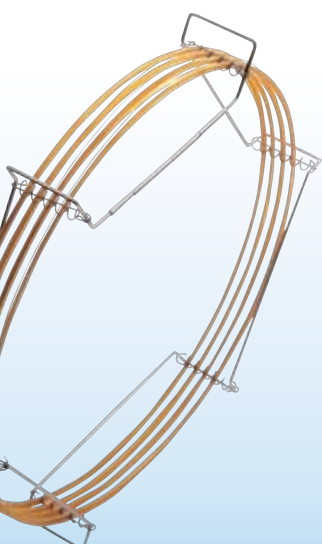


Analysis of Functional Foods: The Fine Line Between Nutritional and Therapeutic Effects

TP-0137-C

Peter van Wensveen and Paul Wynne, SGE International Pty. Ltd. 7 Argent Place, Ringwood 3134 Victoria, Australia. Theodore Macrides, Division of Laboratory Medicine, RMIT University, Bundoora 3083 Victoria, Australia.

The market for foods with value beyond the nutritional has been well established and is often referred to as the 'Nutraceutical' market. Examples of popular nutraceuticals include cholesterol lowering spreads, bread and eggs enriched with omega-3 and more recently palatable soy flour. Justifying the claims of functionality is difficult given the nature of the substances, route of delivery and mechanism of action. The study demonstrates analytical techniques and process applied to two popular functional ingredients; fish oil and Thiamine. The successful separations outline the range of phases available within SGE's GC column range to separation scientists serving functional food industries. The authors suggest that food functionality may require mechanical bioassay after administration to identify efficacy in susceptible individuals.



Analysis of Omega-3 Fatty Acids using a Selective Capillary Column

TP-0111-C

*Dan DiFeo Jr. SGE, Incorporated. 2007 Kramer Lane, Austin, Texas 78758 USA.
Angus Hibbert, Gerard Sharp SGE International Pty. Ltd. 7 Argent Place, Ringwood 3134, Australia.*

Omega-3 fatty acids have been associated with lowering blood cholesterol and therefore potentially lowering the risk of heart disease. The developed consumer market for Omega-3 products requires the successful identification and quantitation for both consumer information and regulatory compliance with labelling standards.

This poster demonstrates an example of successful separation of Omega-3 fatty acids using an optimized GC capillary column, SGE's BPX70. This thermally stable column makes it suitable for commercial or research FAME applications.

Comparison of Cyano and Wax GC Column Phases for the Analysis of FAMES

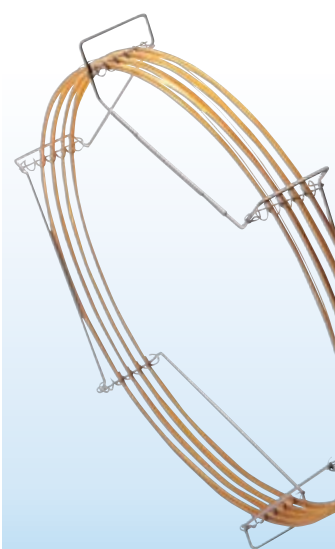
TP-0110-C

*Dan DiFeo Jr. SGE, Incorporated. 2007 Kramer Lane, Austin, Texas 78758 USA.
Angus Hibbert, Gerard Sharp SGE International Pty. Ltd. 7 Argent Place, Ringwood 3134, Australia.*

The importance of fatty acid (FA) profiling of food has increased from both an economic and health point of view.

FAs in foodstuffs are normally analysed in the derivatized FAME format due to easier and more reproducible separation of these compounds by optimized GC capillary.

This poster investigates the benefits of optimized FAME GC columns compared to general purpose wax columns for the separation of FAMES. The results show that optimized FAME columns (SGE's BPX70) provide lower separation times ideal for high throughput requirements, and Wax phases (SGE's SolGel-WAX™) may be more useful for research analyses and where high boiling point contaminants are present.



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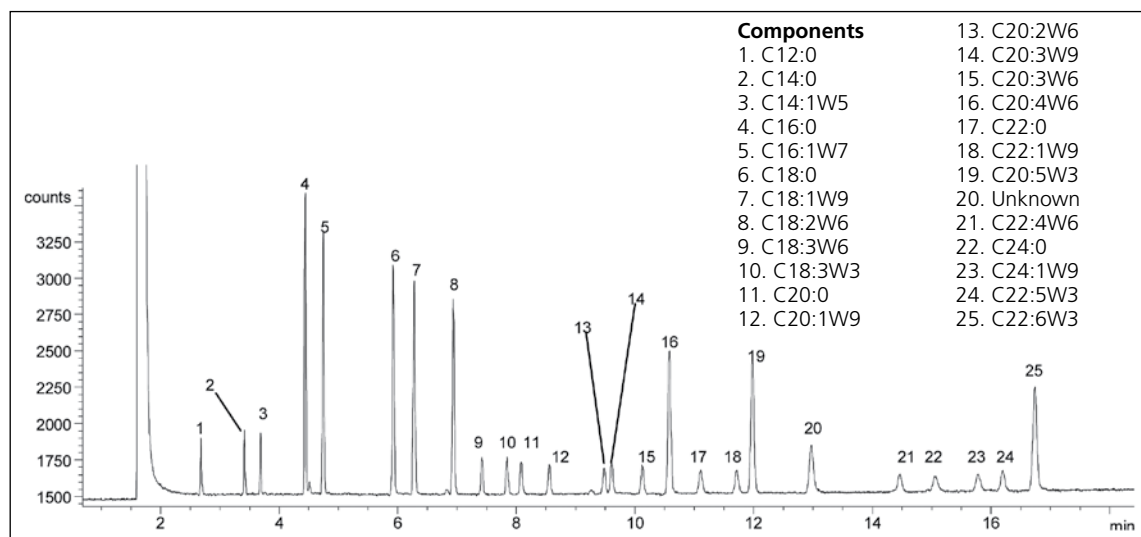


Analysis of a 24 Component FAME Mixture on BPX70

Column Part No.: 054622

Phase:	BPX70, 0.25 µm film
Column:	30 m x 0.25 mm ID
Sample:	100 ppm in Hexane
Initial Temp:	150 °C, 0.5 min.
Rate 1:	10 °C/min to 180 °C
Rate 2:	1.5 °C/min to 220 °C
Rate 3:	30 °C/min to 260 °C
Final Temp:	260 °C, 5 min.
Detector Type:	FID
Detector Temp:	280 °C
Carrier Gas:	He, 20.7 psi

Carrier Gas Flow:	1.3 mL/min.
Constant Flow:	On
Ave. Linear Velocity:	35 cm/sec at 150 °C
Injection Mode:	Split
Split Ratio:	15:1
Injection Volume:	1 µL
Injection Temp.:	250 °C
Liner Type:	4 mm ID
	Single Taper Liner
Liner Part Number:	092017

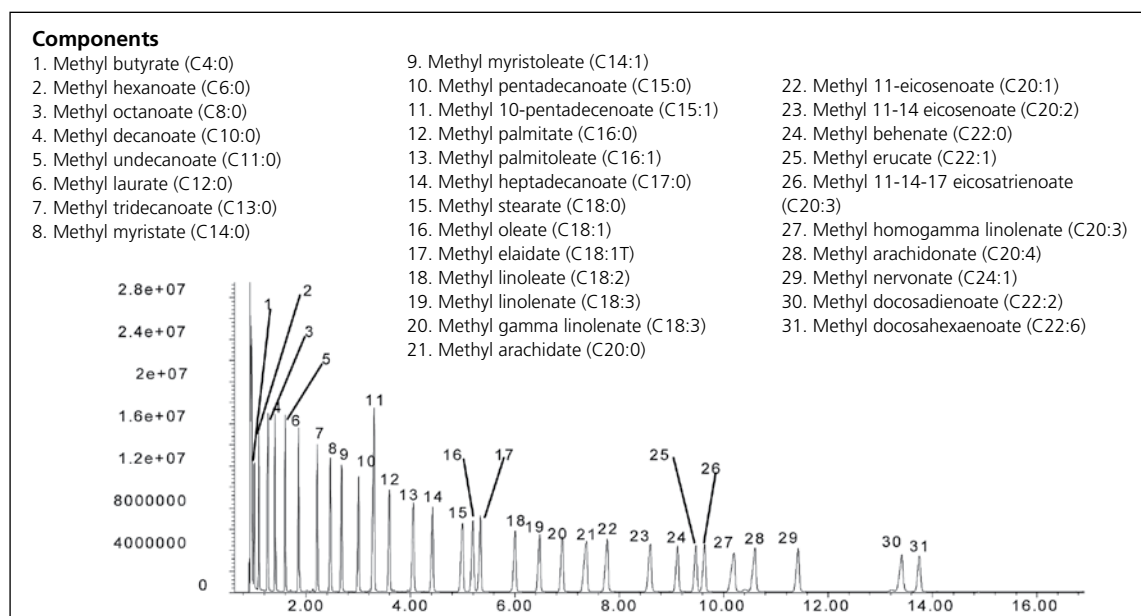


FAME Reference Standard on BPX70

Column Part No.: 054602

Phase:	BPX70 0.25 µm film
Column:	25 m x 0.22 mm ID
Sample:	200 ppm in dichloromethane
Initial Temp:	155 °C,
Rate 1:	2 °C/min to 180 °C,
Rate 2:	4 °C/min to 220 °C
Final Temp:	220 °C, 5 min.
Detector Type:	MSD
Carrier Gas:	He, 35.3 psi
Carrier Gas Flow:	1.6 mL/min.

Constant Flow:	On
Ave. Linear Velocity:	35 cm/sec at 155 °C
Injection Mode:	Split
Split Ratio:	80:1
Injection Volume:	0.5 µL
Injection Temperature:	250 °C
Liner Type:	4 mm ID
	Double Taper Liner
Liner Part Number:	092018
Full Scan / SIM:	Full scan 45-450

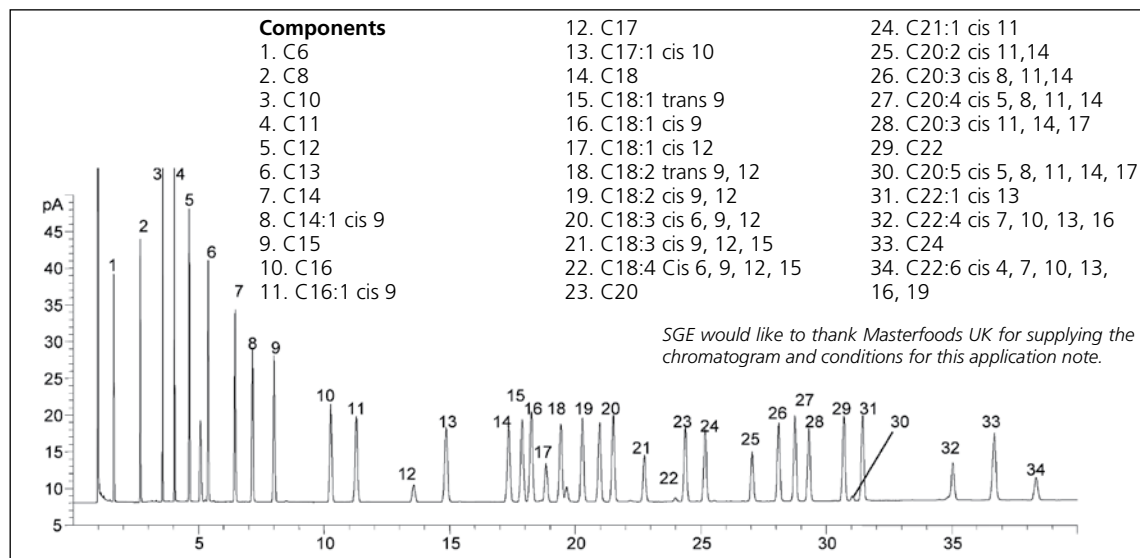


Analysis of FAME Compounds on BPX70

Column Part No.: 054606

Phase:	BPX70, 0.25 µm film
Column:	25 m x 0.32 mm ID
Sample:	100 ppm in hexane
Initial Temp.:	80 °C, 2 min.
Rate 1:	50 °C/min to 130 °C, 10 min
Rate 2:	2 °C/min to 172 °C,
Final Temp.:	172 °C, 6 min.
Detector Type:	FID
Detector Temp.:	300 °C
Carrier Gas:	He, 11.8 psi

Carrier Gas Flow:	2.2 mL/min.
Constant Flow:	On
Average Linear Velocity:	38 cm/sec at 80 °C
Injection Mode:	Split
Split Ratio:	58:1
Injection Volume:	0.4 µL
Injection Temperature:	250 °C
Liner Type:	4 mm ID FocusLiner™
Liner Part Number:	092002

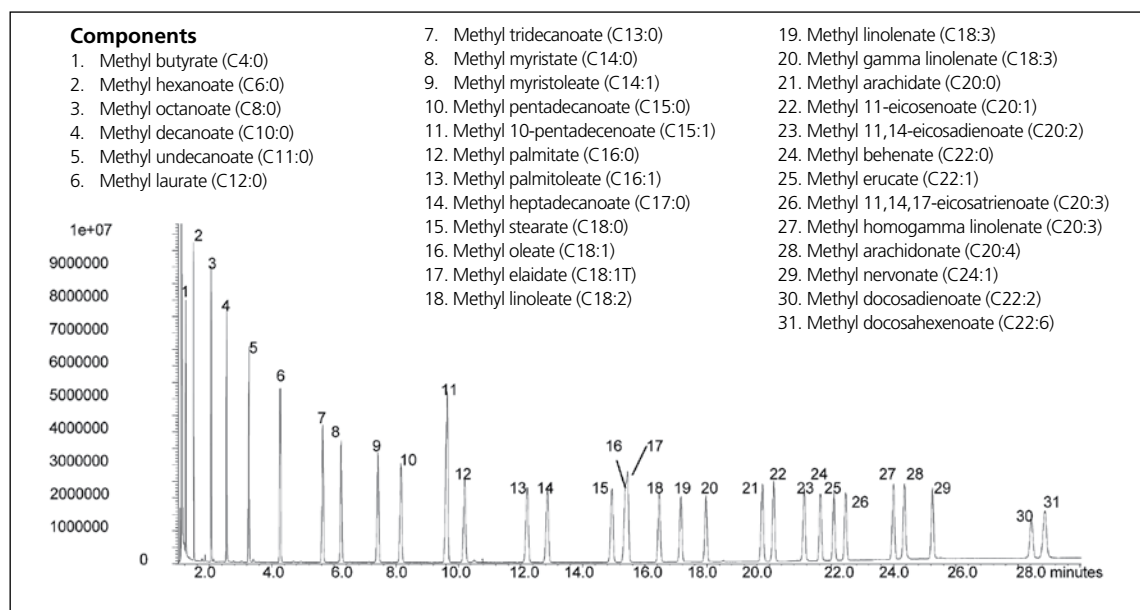


FAME Reference Standard on SolGel-WAX™

Column Part No.: 054796

Phase:	SolGel-Wax™, 0.25 µm film
Column:	30 m x 0.25 mm ID
Sample:	200 ppm in dichloromethane
Initial Temp:	155 °C,
Rate 1:	2 °C/min to 180 °C,
Rate 2:	4 °C/min to 220 °C
Final Temp:	220 °C, 5 min.
Detector Type:	MSD
Carrier Gas:	He, 35.3 psi
Carrier Gas Flow:	1.6 mL/min.

Constant Flow:	On
Average Linear Velocity:	35 cm/sec at 155 °C
Injection Mode:	Split
Split Ratio:	80:1
Injection Volume:	0.5 µL
Injection Temperature:	250 °C
Liner Type:	4 mm ID Double Taper Liner
Liner Part Number:	092018
Full Scan / SIM:	Full scan 45-450



For full product listing, specifications and ordering information visit www.sge.com/gc or look in SGE's Product Selection Guide



Fatty Acid Methyl Ester Analysis (FAMES) – Salmon Fish Oil on BPX70

Column Part No.: 054622

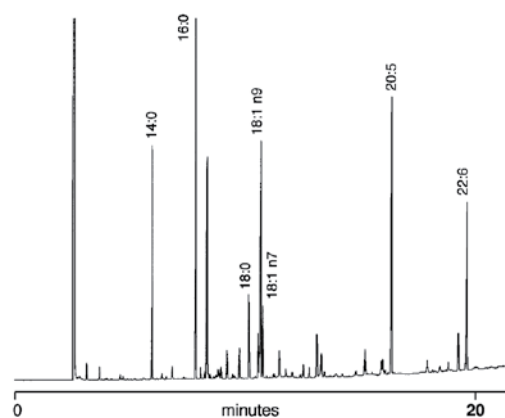
Phase:	BPX70 0.25 µm film
Column:	30 m x 0.25 mm ID
Initial Temp:	150 °C , 1 min
Rate 1:	10 °C/min to 170 °C
Rate 2:	4 °C/min to 240 °C
Final Temp:	240 °C, 0 min
Detector Type:	FID, 280 °C
Carrier Gas:	He, 40.1 psi
Carrier Gas Flow :	1.27 mL/min
Constant Flow:	On
Average Linear Velocity:	30 cm/sec at 150 °C
Injection Mode:	Split, 47.3:1
Purge On Time:	N/A
Purge On (Split) Vent Flow:	60 mL/min
Injection Volume:	1 µL
Injection Temperature:	240 °C
Autosampler:	Yes
Liner Type :	4 mm ID FocusLiner™ with single taper
Liner Part Number:	092003

Column Part No.: 054600

Phase:	BPX70, 0.20 µm film
Column:	10 m x 0.10 mm ID
Initial Temp.:	150 °C , 1 min
Rate 1:	12 °C/min to 240 °C
Rate 2:	N/A
Final Temp:	240 °C, 0 min
Detector Type:	FID, 280 °C
Carrier Gas:	He, 45.8 psi
Carrier Gas Flow :	0.335 mL/min
Constant Flow:	On
Average Linear Velocity:	35 cm/sec at 150 °C
Injection Mode:	Split, 89.6:1
Purge On Time:	N/A
Purge On (Split) Vent Flow:	30 mL/min
Injection Volume:	0.1 µL
Injection Temperature:	240 °C
Autosampler:	Yes
Liner Type :	2.3 mm ID FocusLiner™
Liner Part Number:	092005

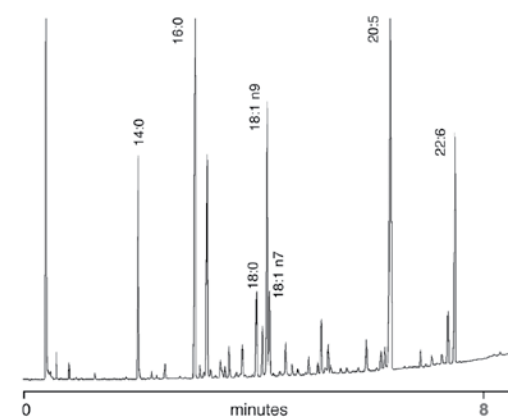
NORMAL

Chromatogram showing separation of Fatty Acid Methyl Esters (FAMES) using a conventional 30 m x 0.25 mm ID BPX70 column with a 0.25 micron film.



FAST

Chromatogram showing separation of Fatty Acid Methyl Esters (FAMES) using a FAST BPX70 column.



Analysis of PUFA - 2: FAME on BPX70

Column Part No.: 054623

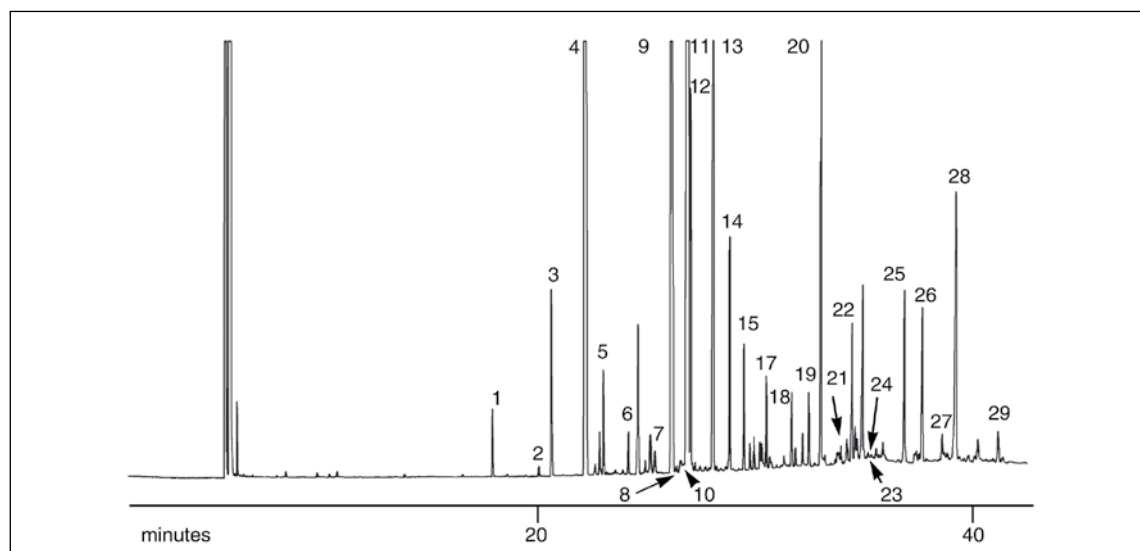
Phase:	BPX70, 0.25 μ m
Column:	60 m x 0.25 mm I.D.
Initial Temp.:	120 $^{\circ}$ C
Rate:	3 $^{\circ}$ C/min

Final Temp.:	245 $^{\circ}$ C
Carrier Gas:	He, 30 psi
Detector:	FID 280 $^{\circ}$ C
Gas velocity:	25 cm/sec 120 $^{\circ}$ C

Notes: ECL numbers of unsaturated C18 FAMES

PEAK No.	FAME	ECL #1
1	C14:0	14.00
2	C15:0	15.00
3	C15:1	15.54
4	C16:0	16.00
5	C16:1	16.43
6	C17:0	17.00
7	C16:3n4	17.62
8	C18:0	18.00
9	C18:1n9t	18.21
10	C18:1n7t	18.23
11	C18:1n9c	18.37
12	C18:1n7c	18.47
13	C18:2n6c	19.02
14	C18:3n6	19.44
15	C18:3n3	19.78

PEAK No.	FAME	ECL #1
16	C20:0	20.00
17	C20:1n9	20.39
18	C20:2	21.06
19	C20:3n6	21.49
20	C20:3n3	21.79
21	C22:1n9	22.42
22	C20:5n3	22.65
23	C23:0	23.00
24	C22:2	23.12
25	C24:0	24.00
26	C24:1	24.46
27	C22:5n3	24.87
28	C22:6n3	24.14
29	C26:0	26.00



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Analysis of PUFA-1: FAME on BPX70

Column Part No.: 054623

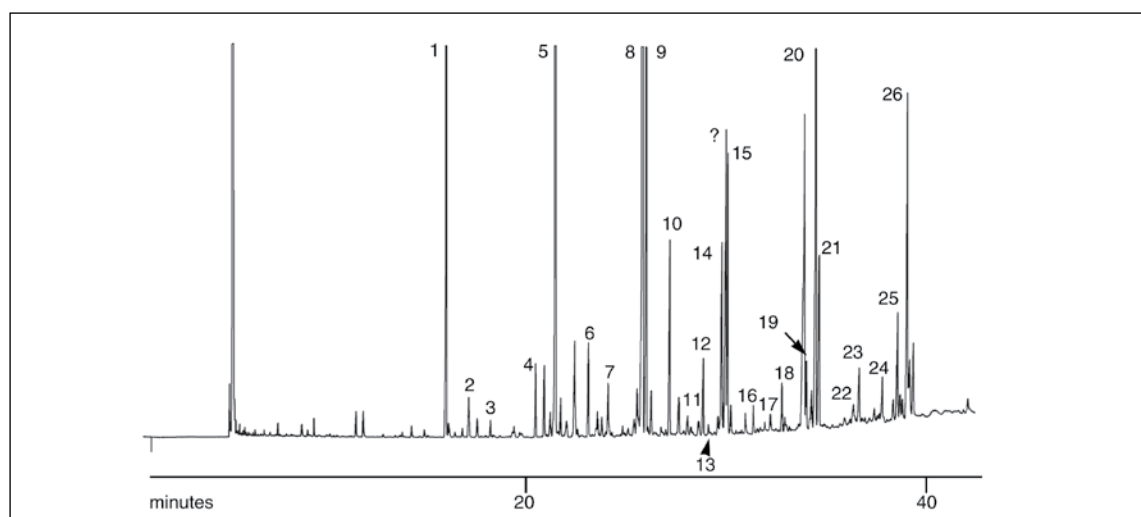
Phase:	BPX70, 0.25 µm
Column:	60 m x 0.25 mm I.D.
Initial Temp.:	120 °C
Rate:	3 °C/min

Final Temp.:	245 °C
Carrier Gas:	He, 30 psi
Detector:	FID 280 °C
Gas velocity:	25 cm/sec 120 °C

ECL numbers of unsaturated C18 FAMES

PEAK No.	FAME	ECL #1
1	C14:0	14.00
2	C14:1	14.53
3	C15:0	15.00
4	C16:0	16.00
5	C16:1	16.43
6	C16:2n4	17.18
7	C16:3n4	17.62
8	C18:1n9c	18.37
9	C18:1n7c	18.47
10	C18:2n6c	19.02
11	C18:3n6	19.45
12	C18:3n3	19.78
13	C18:4n3	20.00

PEAK No.	FAME	ECL #1
14	C20:3	20.33
15	C20:1n9	20.39
16	C20:2	21.06
17	C20:3n6	21.49
18	C20:3n3	21.79
19	C22:1n11	21.86
20	C22:1n9	22.42
21	C20:5n3	22.65
22	C21:5n3	23.66
23	C22:5n6	23.87
24	C24:1	24.46
25	C22:5n3	24.87
26	C22:6n3	25.14



Analysis of Menhaden Oil FAME on BPX70

Column Part No.: 054623

Phase:	BPX70, 0.25 µm
Column:	60 m x 0.25 mm I.D.
Initial Temp.:	120 °C
Rate:	3 °C/min

Final Temp.:	245 °C
Carrier Gas:	He, 30 psi
Detector:	FID 280 °C
Gas velocity:	25 cm/sec 120 °C

ECL numbers of unsaturated C18 FAMES

PEAK No.	FAME	ECL #1
1	C10:0	10.00
2	C12:0	12.00
3	C13:0	13.00
4	C14:0	14.00
5	C14:1	14.53
6	C15:0	15.00
7	C15:1	15.54
8	C16:0	16.00
9	C16:1	16.43
10	C17:0	17.00
11	C:16:2n4	17.18
12	C:17:1	17.44
13	C16:3n4	17.62
14	C18:0	18.00
15	C18:1n9t	18.21
16	C18:1n9c	18.37
17	C18:1n7c	18.47
18	C18:2n6t	18.65
19	C18:2n6c	19.02
20	C18:3n6	19.45
21	C18:3n4	19.69

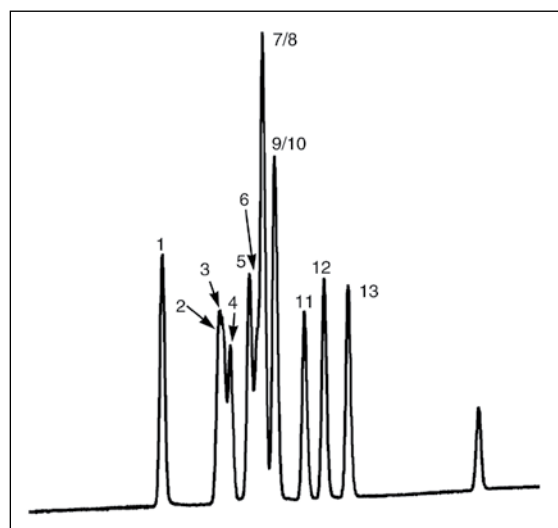
PEAK No.	FAME	ECL #1
22	C18:3n3	19.78
23	C20:0	20.00
24	C18:4n4	20.33
25	C20:1n11	20.33
26	C20:1n13	20.33
27	C20:1n9	20.39
28	C18:4n1	20.49
29	C20:2	21.06
30	C20:3n6	21.49
31	C20:3n3	21.79
32	C20:4n6	21.86
33	C22:0	22.00
34	C20:4n3	22.35
35	C22:1n9	22.42
36	C20:5n3	22.65
37	C21:5n3	23.66
38	C22:5n6	23.87
39	C24:0	24.00
40	C24:1n9	24.46
41	C22:5n3	24.87
42	C22:6n3	25.14

Analysis of C 18:1 cis/trans FAME on BPX70

Column Part No.: 054624

Phase:	BPX70, 0.25 µm
Column:	120 m x 0.25 mm I.D.
Initial Temp.:	130 °C
Rate:	1 °C/min

Final Temp.:	220 °C
Carrier Gas:	He, 60 psi
Detector:	FID 280 °C
Gas velocity:	20 cm/sec at 130 °C



PEAK No.	FAME	ECL # 1
1	C18:0	18.00
2	C18:1n12t	18.19
3	C18:1n11t	18.20
4	C18:1n9t	18.22
5	C18:1n7t	18.28
6	C18:1n12c	18.31
7	C18:1n6t	18.32
8	C18:1n11c	18.33
9	C18:1n5t	18.36
10	C18:1n9c	18.37
11	C18:1n7c	18.47
12	C18:1n6c	18.52
13	C18:1n5c	18.60



For full product listing, specifications and ordering information visit www.sge.com/gc or look in SGE's Product Selection Guide



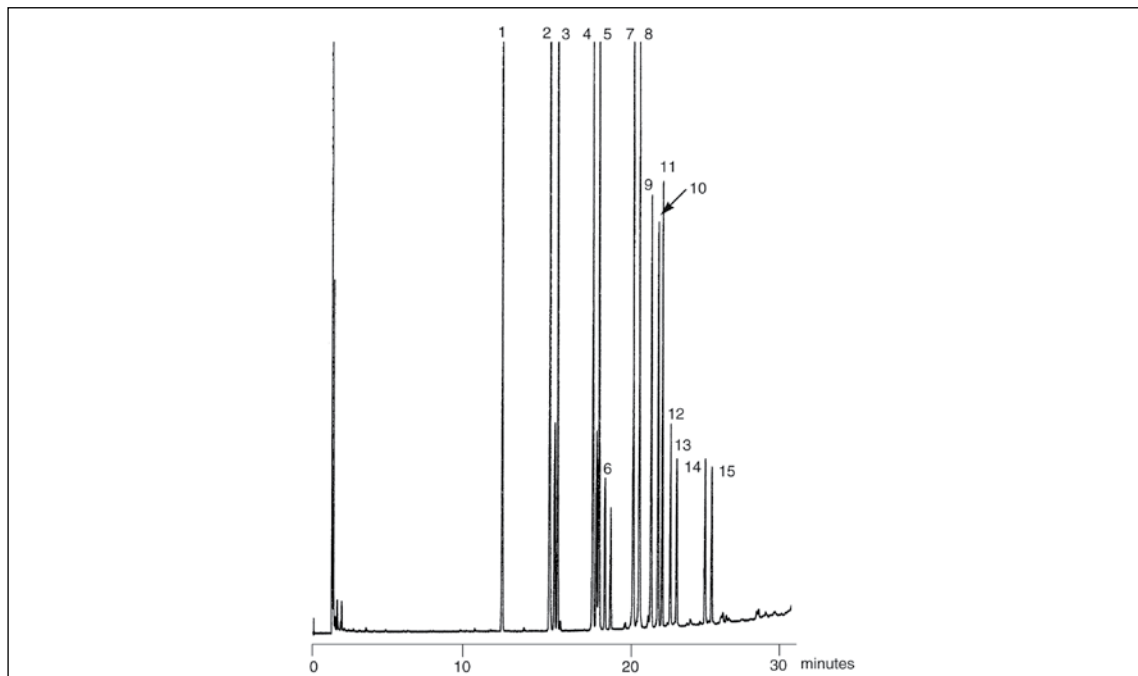
A Range of FAME Isomers on BPX70

Column Part No.: 054610

Phase:	BPX70, 0.5 µm film
Column:	25 m x 0.53 mm I.D.
Initial Temp.:	80 °C, 0 min
Program Rate:	5 °C/min
Final Temp.:	250 °C, 0 min

Carrier Gas:	He, 2 psi
Detector:	FID
Sensitivity:	32 x 10 ⁻¹² AFS
Injection Mode:	Split, 50:1

Notes: Even a 0.53 mm ID BPX70 provides adequate separation of FAMES by degree of unsaturation



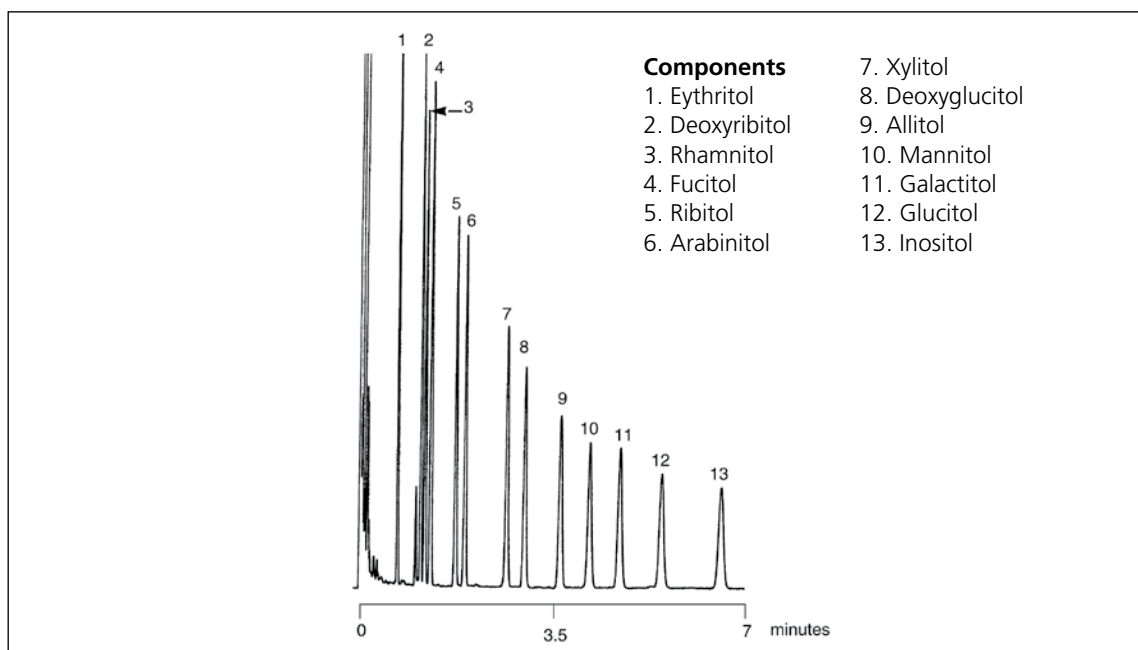
Analysis of Sugar Alditol Acetates on BPX70

Column Part No.: 054605

Phase:	BPX70, 0.25 µm film
Column:	12 m x 0.32 mm I.D.
Temp.:	Isothermal at 210 °C
Carrier Gas:	H ₂ , 3.3 psi

Detector:	FID
Sensitivity:	16 x 10 ⁻¹² AFS
Injection Mode:	Split, 50:1

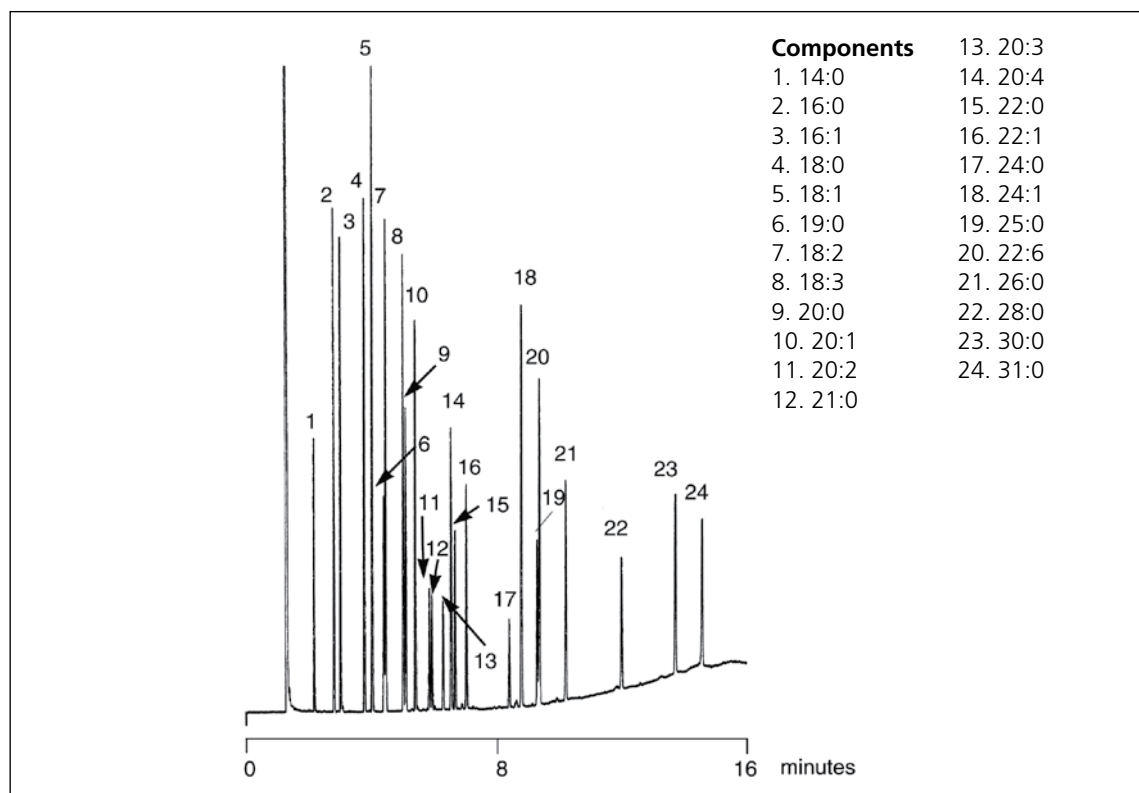
Notes: BPX70 polarity allows rapid analysis of alditol acetates.



Analysis of Fatty Acid Methyl Ester (FAME) Mixture on BPX70

Column Part No.: 054602

Phase:	BPX70, 0.25 µm film	Final Temp.:	250 °C, 2 min
Column:	25 m x 0.22 mm I.D.	Detector:	FID
Initial Temp.:	180 °C, 1 min	Sensitivity:	32 x 10 ⁻¹² AFS
Program Rate:	5 °C/min	Injection Mode:	Split, 50:1

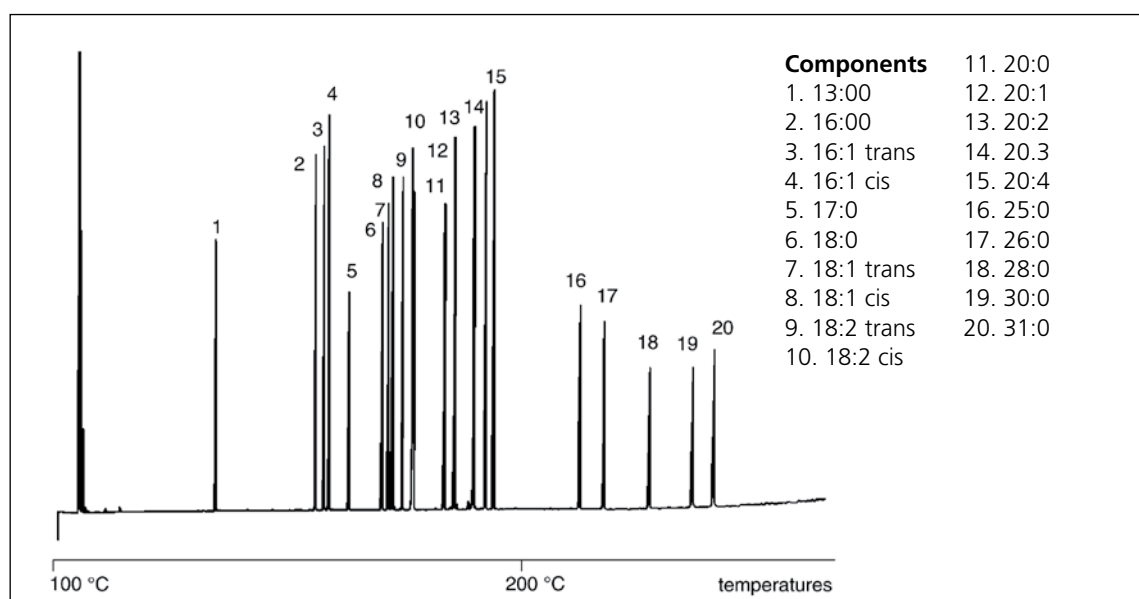


Analysis of Fatty Acid Methyl Esters (FAMES) on BPX70

Column Part No.: 054602

Phase:	BPX70, 0.25 µm	Final Temp:	260 °C, 5min
Column:	25 m x 0.22 mm ID	Detector:	FID
Initial Temp.:	100 °C, 0 min	Sensitivity:	128 x 10 ⁻¹² AFS
Rate:	4 °C/min	Injection Mode:	Split, 50:1

Notes: BPX70 column can be used to analyse high molecular weight fatty acids



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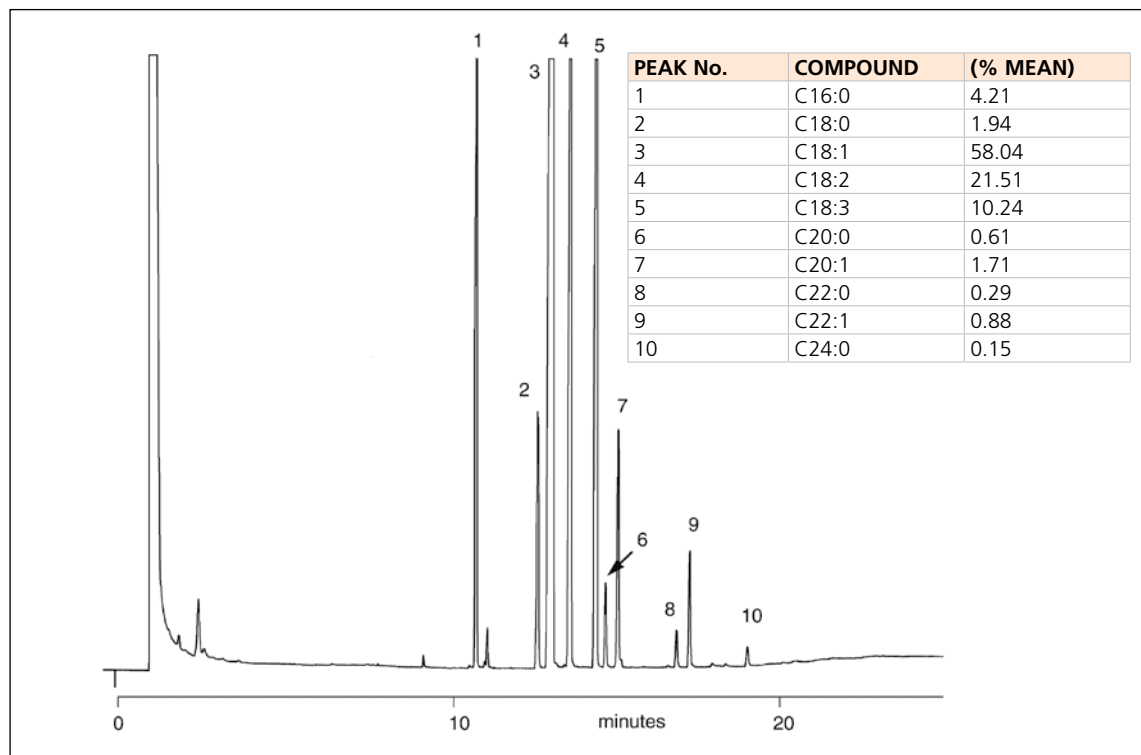
Composition of Fatty Acids in Canola Oil on BPX70

Column Part No.: 054610

Phase:	BPX70, 0.5 µm
Column:	25 m x 0.53 mm I.D.
Initial Temp:	60 °C, 1.5 min.
Rate 1:	10 °C/min.
Temp:	150 °C

Rate 2:	5 °C
Final Temp:	230 °C, 5 min.
Carrier Gas:	Helium, 4 psi
Injection Mode:	On-column 0.5 µL

Notes: A 0.53 mm ID BPX70 column provides both quantitative and qualitative analysis.

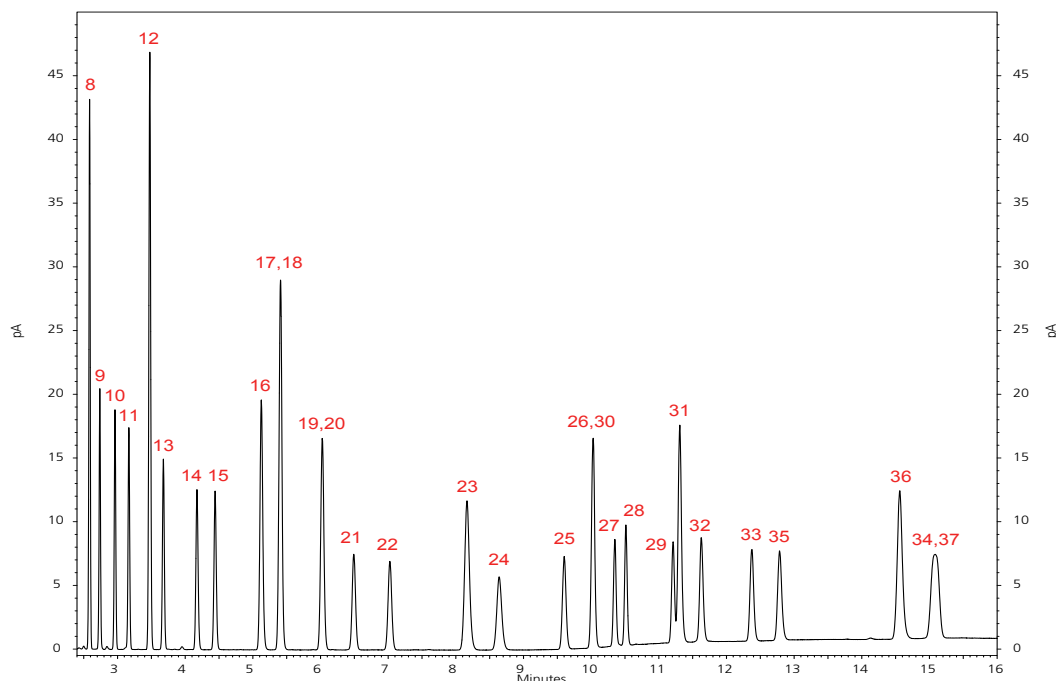


EN14103 Determination of Ester and Linolenic Acid Methyl Ester Contents

37 FAME Reference Standard

Column Part No: 0544331

Column:	BPX-BIOD20 – 30M X 0.32mm ID X 0.25 µm film:	Detector Temp:	280 °C
Inlet Liner:	FocusLiner Split	GC Conditions:	
Septum:	HT	Carrier Gas:	He
Condition column at 260 °C for 1.5 hours		Constant flow:	on
Ferrule:	SilTite™ Ferrule Kit	Column Flow:	1.5 ml/min
Autosampler Syringe:	10 µL	Oven:	210 °C for 9 minutes to 240 °C at 20 °C/min hold 6 minutes (16.5 minutes)
Injection type:	split 50:1	Injection volume:	1 µL via Autosampler
Injector Temp:	250 °C		



RT	#	Component	Wt%	RT	#	Component	Wt%
2.58	8	C14:0 (Myristic)	4	8.16	23	C20:0 (Arachidic)	4
2.74	9	C14:1 (Myristoleic)	2	8.64	24	C20:1n9 (cis-11-Eicosenoic)	2
2.96	10	C15:0 (Pentadecanoic)	2	9.60	25	C20:2 (cis-11,14-Eicosadienoic)	2
3.17	11	C15:1 (cis-10-Pentadecenoic)	2	10.03	26	C20:3n6 (cis-8,11,14-Eicosatrienoic)	2
3.48	12	C16:0 (Palmitic)	6	10.03	30	C21:0 (Henicosenoic)	2
3.68	13	C16:1 (Palmitoleic)	2	10.35	27	C20:3n3 (cis-11,14,17-Eicosatrienoic)	2
4.17	14	C17:0 (Heptadecanoic)	2	10.51	28	C20:4n6 (Arachidonic)	2
4.44	15	C17:1 (cis-10-Heptadecenoic)	2	11.21	29	C20:5n3 (cis-5,8,11,14,17-Eicosapentaenoic)	2
5.12	16	C18:0 (Stearic)	4	11.31	31	C22:0 (Behenic)	4
5.41	17	C18:1n9c (Oleic)	4	11.63	32	C22:1n9 (Erucic)	2
5.41	18	C18:1n9t (Elaidic)	2	12.38	33	C22:2 (cis-13,16-Docosadienoic)	2
6.02	19	C18:2n6c (Linoleic)	2	12.78	35	C23:0 (Tricosanoic)	2
6.02	20	C18:2n6t (Linolelaidic)	2	14.56	36	C24:0 (Lignoceric)	4
6.49	21	C18:3n6 (γ-Linolenic)	2	15.08	34	C22:6n3 (cis-4,7,10,13,16,19-Docosahexaenoic)	2
7.02	22	C18:3n3 (α-Linolenic)	2	15.08	37	C24:1n9 (Nervonic)	2

For full product listing, specifications and ordering information visit www.sge.com/gc or look in SGE's Product Selection Guide

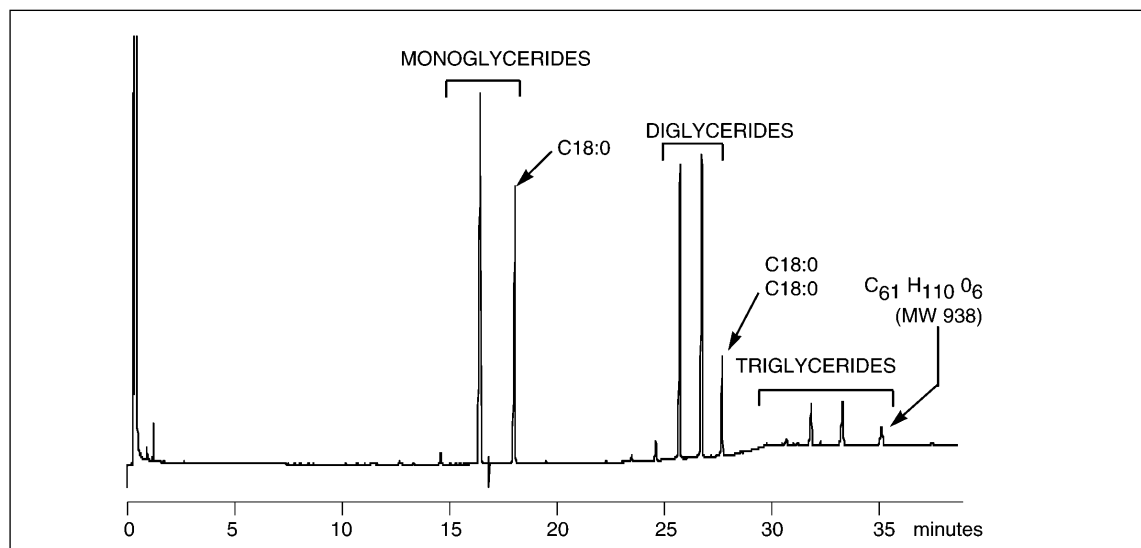


Mono, Di, & TriGlycerides on BPX5

Column Part No.: 054118

Phase:	BPX5, 0.25 µm	Final Temp.:	365 °C, 10 min
Column:	12 m x 0.32 mm I.D.	Detector:	FID
Initial Temp.:	80 °C, 1 min	Injector Mode:	On-Column (SGE OCI-5)
Rate:	10 °C/min	Carrier:	He, 10 psi

Notes: BPX5 column allows this analysis to be performed on a routine basis. On-column injection is recommended to ensure no loss of high MW fraction.



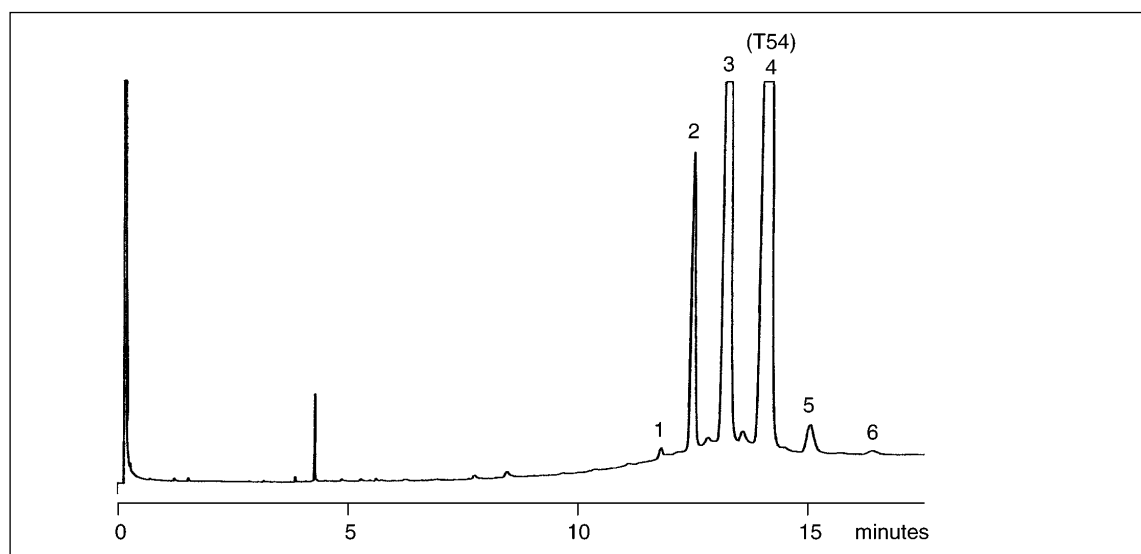
Triglyceride Distribution in Olive Oil on BPX5

Column Part No.: 054133

Phase:	BPX5, 0.25 µm	Final Temp.:	360 °C, 5 min
Column:	12 m x 0.53 mm I.D.	Detector:	FID
Initial Temp.:	100 °C, 0.5 min	Injector Mode:	On-Column (SGE OCI-5)
Rate 1:	50 °C/min	Carrier:	He, 6 psi
Temp:	280 °C	Injection	Volume: 1 µL
Rate 2:	10 °C/min		

Notes: Recommended Operating Conditions
Carrier Gas Velocity (Helium): 100-150 cm/sec approx.,
Pressure: 5-7 psi Sample Concentration

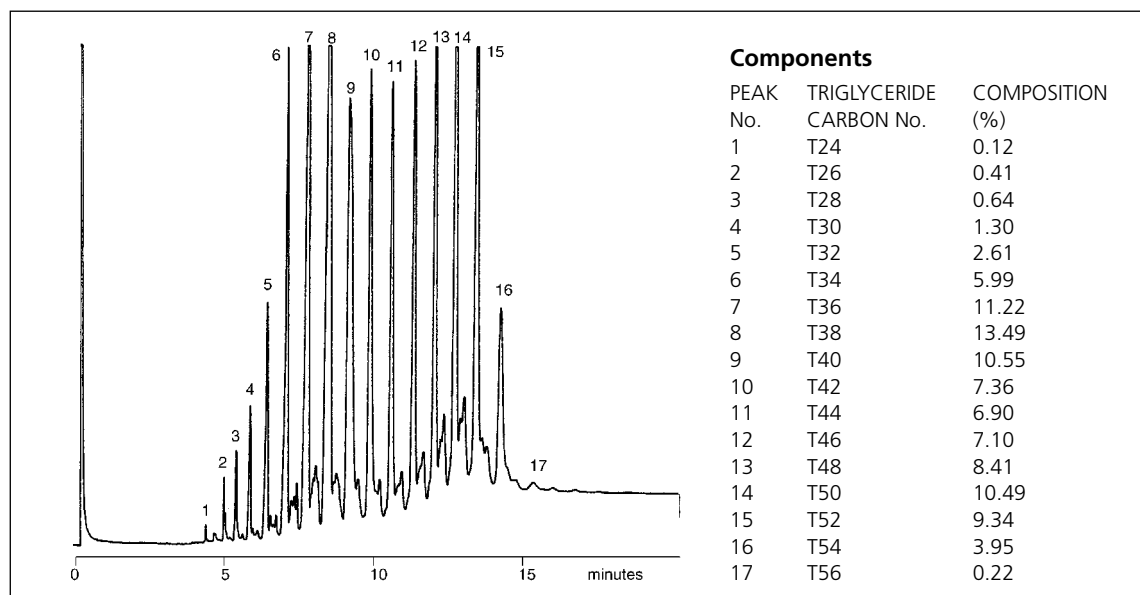
On-column: - Olive oil : 0.5-1.0 mg/ml (0.05 - 0.1 % solution)
Injection Temp.: 100 °C, solution dissolved in iso-octane



Triglyceride distribution in Milk Fat on BPX5

Column Part No.: 054133

Phase:	BPX5, 0.25 µm	Rate 2:	10 °C/min.
Column:	12 m x 0.53 mm I.D.	Final Temp:	360 °C, 5 min.
Initial Temp.:	100 °C, 0.5 min.	Carrier Gas:	He, 6 psi
Rate 1:	50 °C/min.	Injection Mode:	On-column (OCI-5)
Temp.:	280 °C	Injection Volume:	1 µL



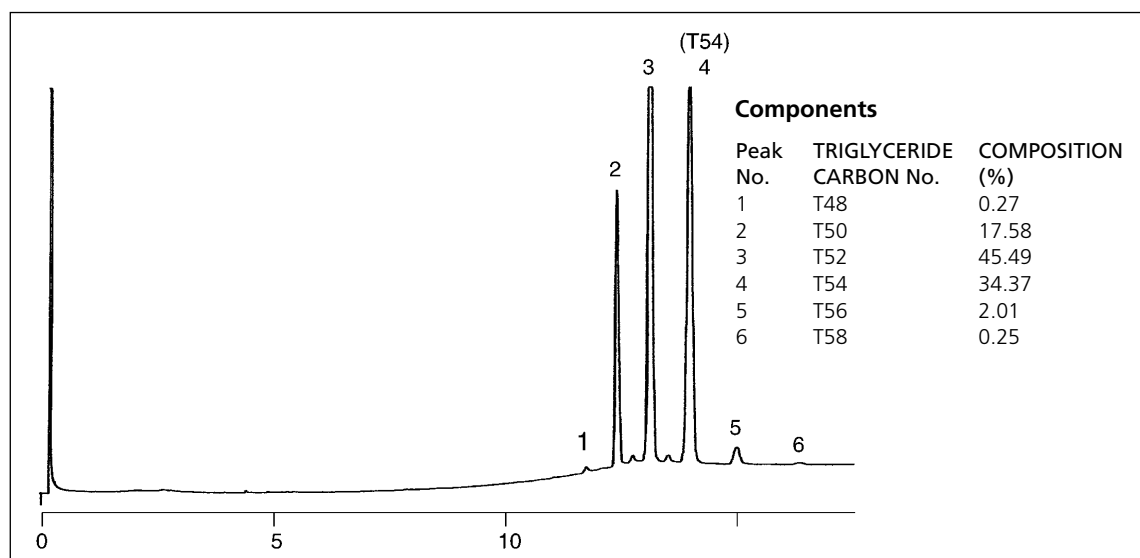
Triglyceride Distribution in Cocoa Butter on BPX5

Column Part No.: 054133

Phase:	BPX5, 0.25 µm	Final Temp.:	360 °C, 5 min
Column:	12 m x 0.53 mm I.D.	Detector:	FID
Initial Temp.:	100 °C, 0.5 min	Injector Mode:	On-Column (SGE OCI-5)
Rate 1:	50 °C/min	Carrier:	He, 6 psi
Temp:	280 °C	Injection Volume:	1 µL
Rate 2:	10 °C/min		

Notes: Recommended Operating Conditions
Carrier Gas Velocity (Helium): 100-150 cm/sec approx.,
Pressure: 5-7 psi Sample Concentration

On-column: - cocoa butter: 0.5 - 1.0 mg/ml
(0.05 - 0.1 % solution)
Injection Temp.: 100 °C, solution dissolved in iso-octane



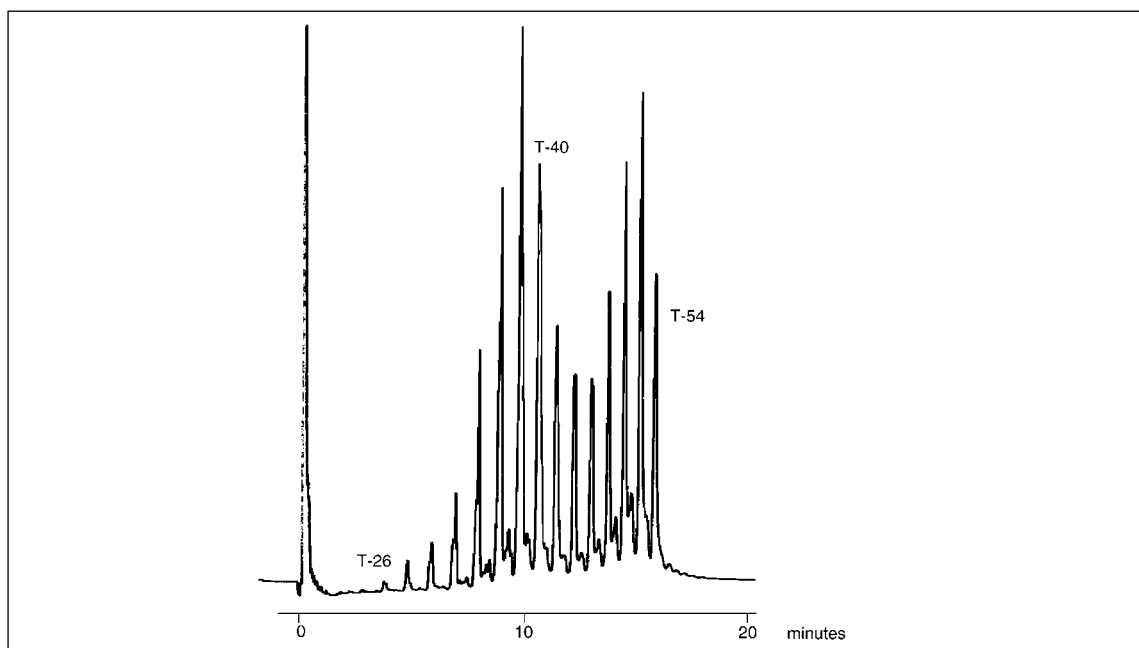
For full product listing, specifications and ordering information visit www.sge.com/gc or look in SGE's Product Selection Guide



Analysis of Butter Fat on HT5

Column Part No.: 054661

Phase:	HT5, 0.1 µm	Final Temp.:	370 °C, 5 min
Column:	6 m x 0.53 mm I.D. (Aluminum Clad)	Carrier Gas:	H ₂ , 2 psi
Initial Temp.:	200 °C, 0 min	Detector:	FID
Program Rate:	10 °C/min	Sensitivity:	32 x 10 ⁻¹² AFS
		Injection Mode:	On-column



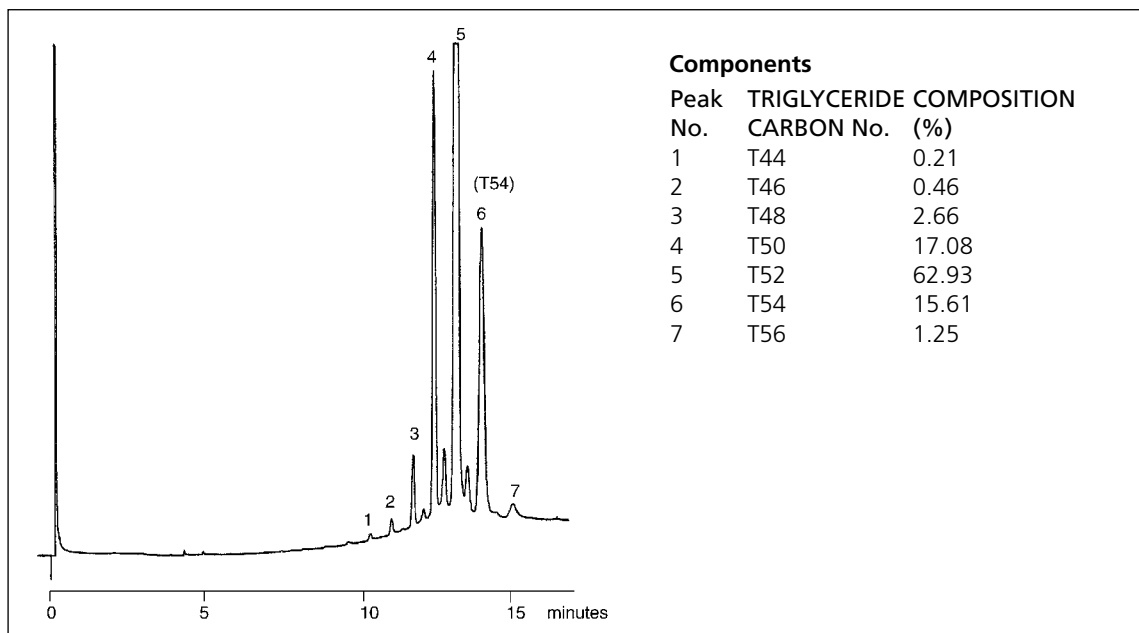
Analysis of Triglyceride Distribution in Lard on BPX5

Column Part No.: 054133

Phase:	BPX5, 0.25 µm	Rate 2:	10 °C/min.
Column:	12 m x 0.53 mm I.D.	Final Temp.:	360 °C, 5 min.
Initial Temp.:	100 °C, 0.5 min.	Carrier Gas:	He, 6 psi
Rate 1:	50 °C/min.	Injection Mode:	On-column (OCI-5)
Temp.:	280 °C	Injection Volume:	1 µL

Notes: Recommended Operating Conditions
Carrier Gas Velocity (Helium): 100-150 cm/sec approx.,
Pressure: 5-7 psi Sample Concentration

On-column: - Olive oil, lard and cocoa butter : 0.5-1.0 mg/ml
(0.05 - 0.1 % solution)
Injection Temp.: 100 °C, solution dissolved in iso-octane

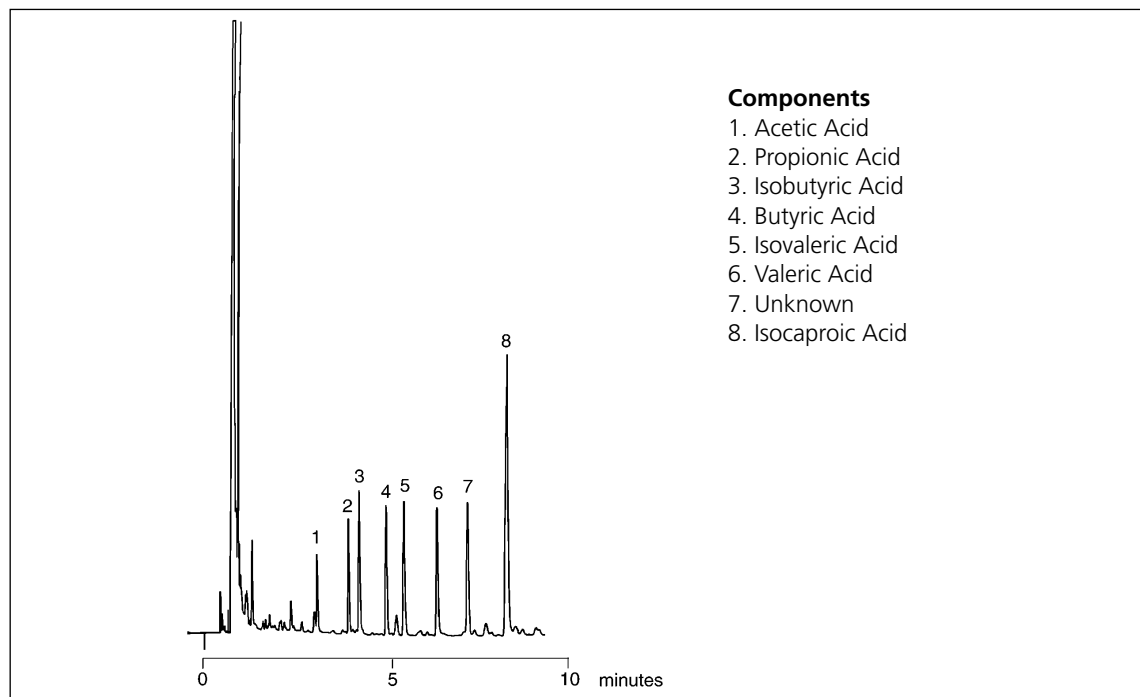


Free Fatty Acid Analysis on BP21

Column Part No.: 054474

Phase: BP21, 0.5 µm Film
Column: 25 m x 0.53 mm ID
Initial Temp.: 90 °C, 1min
Rate 1: 8 °C/min
Final Temp.: 160 °C

Detector: FID, 300 °C
Injector Mode: Split, 100:1
Carrier Gas: He, 5 ml/min
Injection Volume: 1 µL

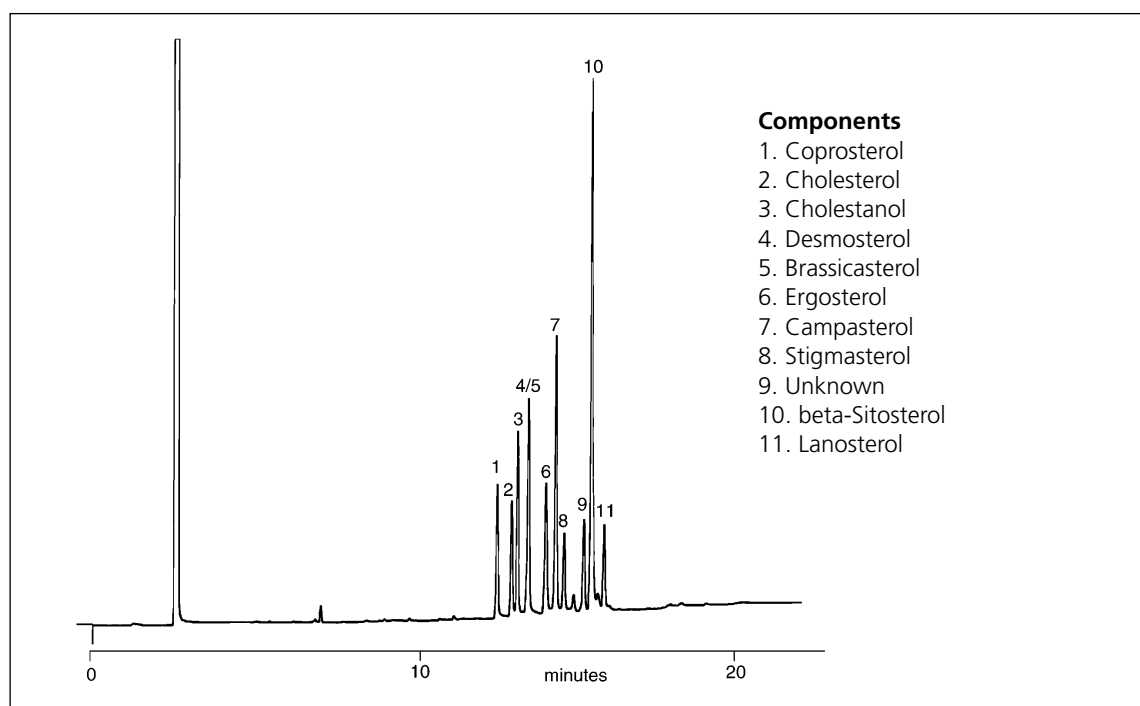


Plant Sterols with Temperature Program on BPX5

Column Part No.: 054142

Phase: BPX5, 0.25 µm
Column: 30 m x 0.22 mm ID
Initial Temp.: 280 °C, 1min
Rate 1: 4 °C/min
Final Temp.: 350 °C, 5min

Detector: FID, 360 °C
Injector Mode: Split 100:1
Carrier Gas: He, 20 psi
Injection Volume: 1 µL



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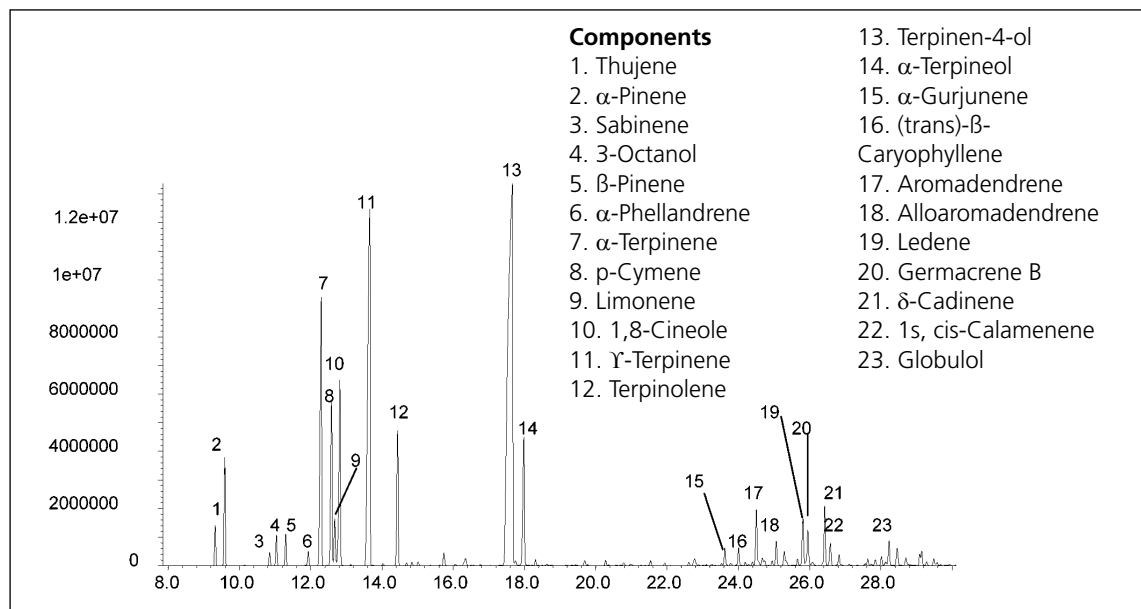


Analysis of Teatree Oil on BPX5

Column Part No.: 054101

Phase:	BPX5, 0.25 µm film
Column:	30 m x 0.25 mm ID
Initial Temp.:	40 °C, 1 min.
Rate 1:	5 °C/min to 200 °C,
Final Temp:	200 °C
Detector Type:	Mass Spectrometer
Carrier Gas:	He, 7.0 psi
Carrier Gas Flow:	1.0 mL/min.
Constant Flow:	On
Average Linear Velocity:	36 cm/sec at 40 °C

Injection Mode:	Split
Split Ratio:	200:1
Purge on (Split)	
Vent Flow:	200 mL/min.
Injection Volume:	0.2 µL
Injection Temp.:	250 °C
Liner Type:	4 mm ID Double Taper Liner
Liner Part Number:	092018

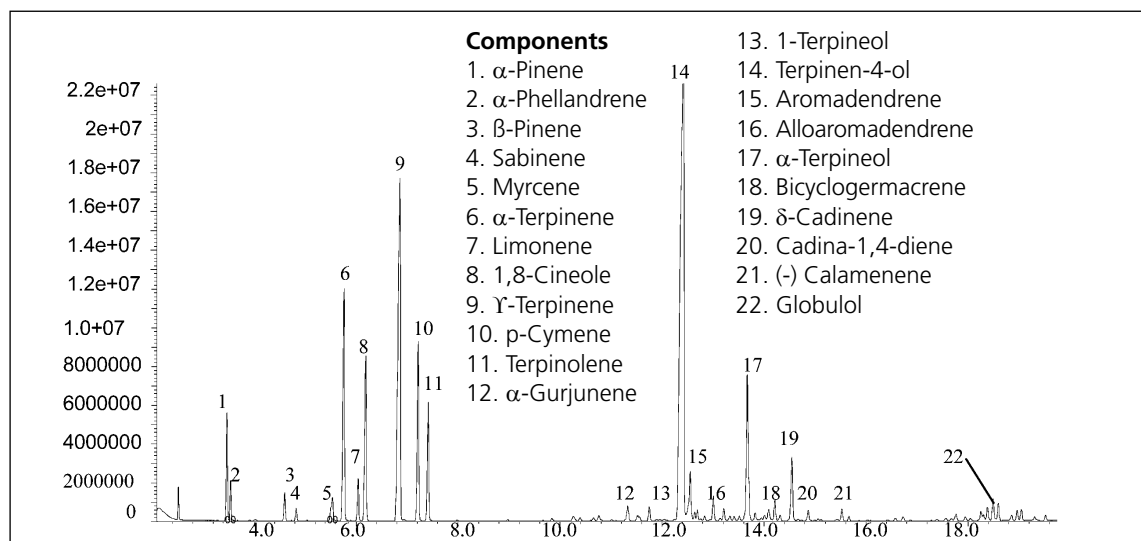


Analysis of Teatree Oil on SolGel-WAX™

Column Part No.: 054796

Phase:	SolGel-WAX™, 0.25 µm film
Sample:	10 ppm in methanol
Column:	30 m x 0.25 mm ID
Initial Temp.:	40 °C, 1 min.
Rate 1:	8 °C/min to 220 °C,
Final Temp:	220 °C, 5 min.
Detector Type:	Mass Spectrometer
Carrier Gas:	He, 25.7 psi
Carrier Gas Flow:	1.8 mL/min.
Constant Flow:	On

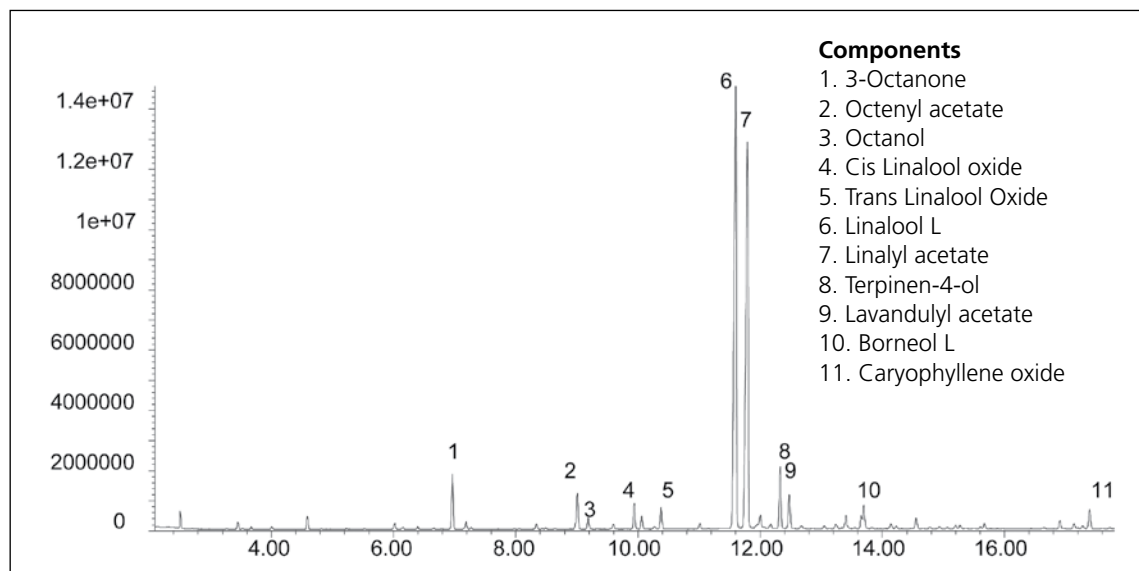
Average Linear Velocity:	35 cm/sec at 40 °C
Injection Mode:	Split
Split Ratio:	100:1
Injection Volume:	0.2 µL
Injection Temp.:	250 °C
Liner Type:	4 mm ID Single Taper Liner
Liner Part Number:	092017
Full Scan / SIM:	Full scan 45-450



Column Part No.: 054796

Phase:	SolGel-WAX™, 0.25 µm film
Sample:	neat
Column:	30 m x 0.25 mm ID
Initial Temp.:	40 °C, 1 min.
Rate 1:	8 °C/min to 220 °C,
Final Temp:	220 °C, 5 min.
Detector Type:	Mass Spectrometer
Carrier Gas:	He, 25.7 psi
Carrier Gas Flow:	1.8 mL/min.
Constant Flow:	On

Average Linear Velocity:	35 cm/sec at 40 °C
Injection Mode:	Split
Split Ratio:	100:1
Injection Volume:	0.2 µL
Injection Temp.:	250 °C
Liner Type:	4 mm ID Single Taper Liner
Liner Part Number:	092017
Full Scan / SIM:	Full scan 45-450

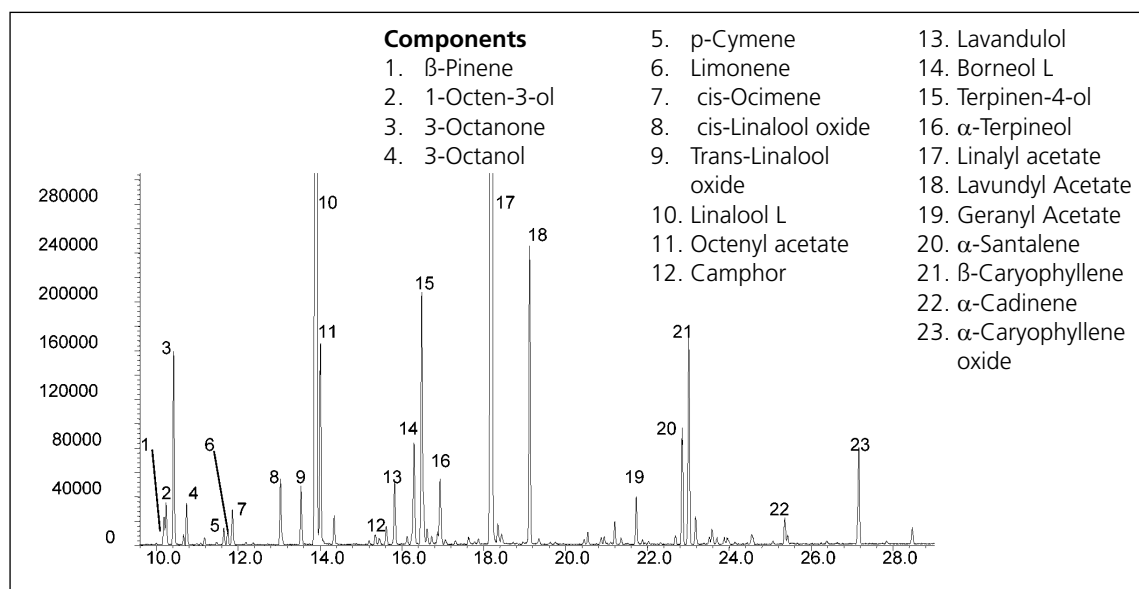


Analysis of Lavender Oil on BPX5

Column Part No.: 054101

Phase:	BPX5, 0.2 5 µm film
Column:	30 m x 0.25 mm ID
Initial Temp.:	40 °C, 1 min.
Rate 1:	5 °C/min to 260 °C,
Final Temp:	260 °C
Detector Type:	Mass Spectrometer
Carrier Gas:	He, 7.0 psi
Carrier Gas Flow:	1.0 mL/min.
Constant Flow:	On
Average Linear Velocity:	36 cm/sec at 40 °C

Injection Mode:	Split
Split Ratio:	200:1
Purge on (Split)	
Vent Flow:	200 mL/min.
Injection Volume:	0.2 µL
Injection Temp.:	250 °C
Liner Type:	4 mm ID Double Taper Liner
Liner Part Number:	092018



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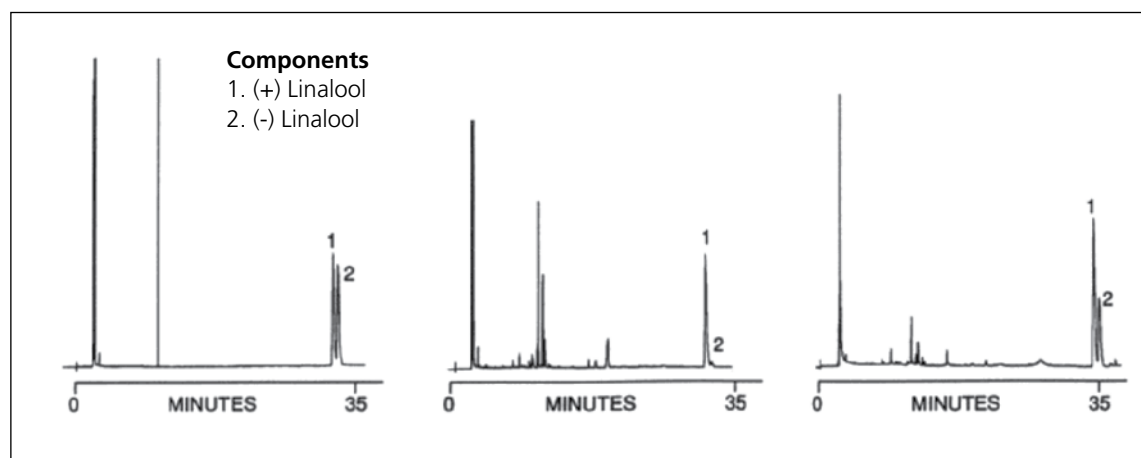


Analysis of Lavender Oil on CYBEX-B™

Column Part No.: 054901

Injection Mode:	Split	Initial Temp.:	Isothermal at 90 °C
Phase:	Cydex-B™ 0.25 µm film	Detector:	FID
Column:	50 m x 0.22 mm ID	Sensitivity:	32 x 10 ⁻¹² AFS

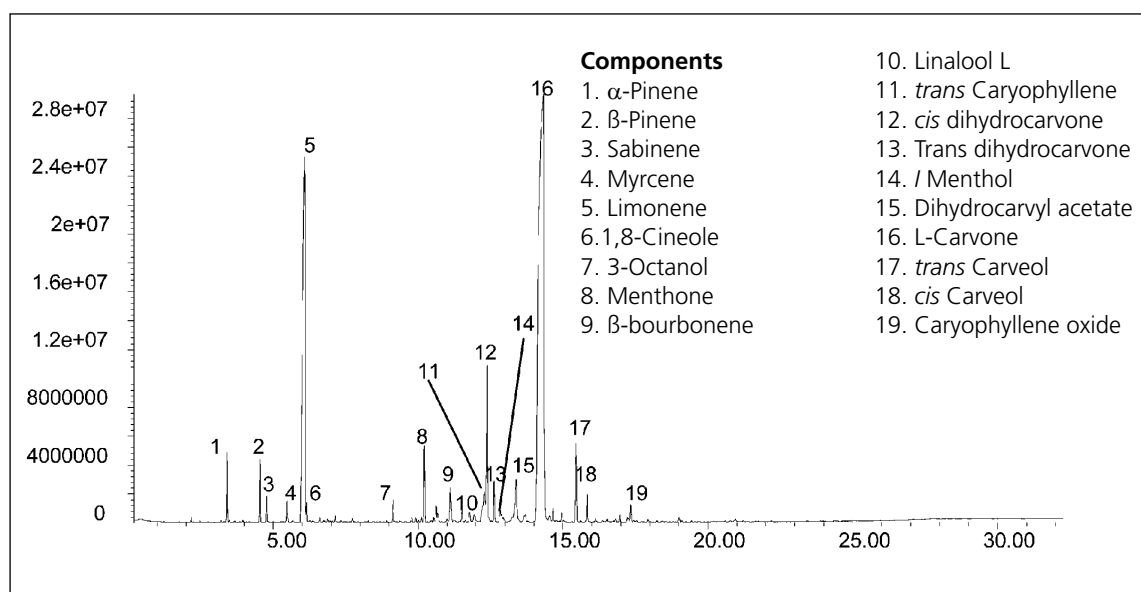
Notes: The Cydex - B™ column enables easy detection of adulteration of Lavender oils



Analysis of Spearmint Oil on SolGel-WAX™

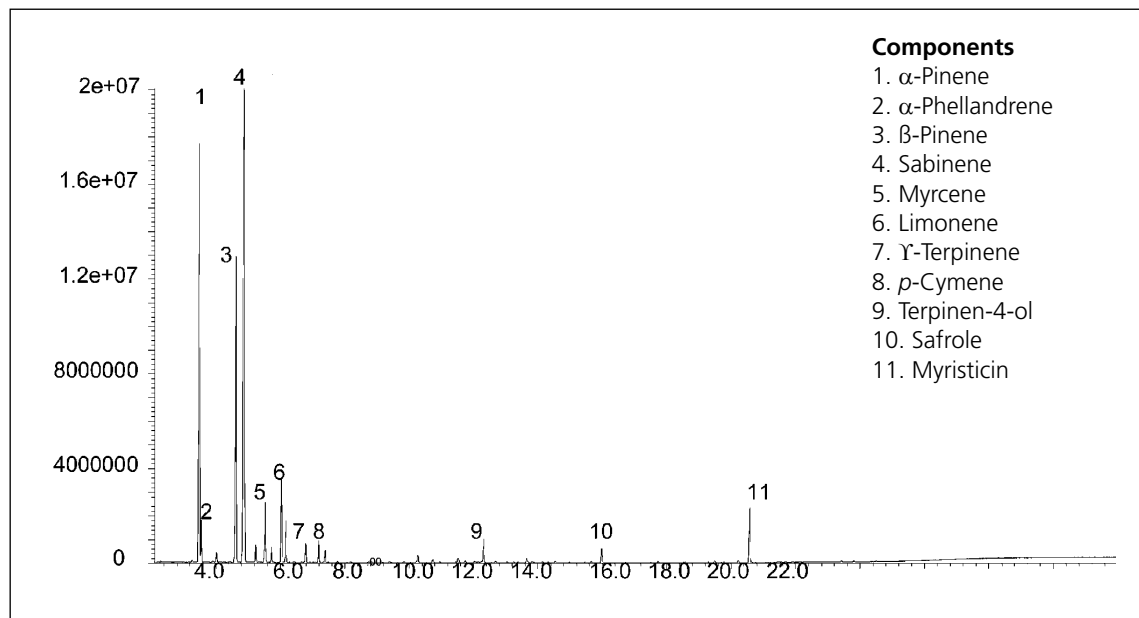
Column Part No.: 054796

Phase:	SolGel-WAX™, 0.25 µm film	Average Linear Velocity:	35 cm/sec at 40 °C
Sample:	Neat	Injection Mode:	Split
Column:	30 m x 0.25 mm ID	Split Ratio:	100:1
Initial Temp.:	40 °C, 1 min.	Injection Volume:	0.2 µL
Rate 1:	8 °C/min to 220 °C,	Injection Temp.:	250 °C
Final Temp:	220 °C, 5 min.	Liner Type:	4 mm ID
Detector Type:	Mass Spectrometer		Single Taper Liner
Carrier Gas:	He, 25.7 psi	Liner Part Number:	092017
Carrier Gas Flow:	1.8 mL/min.	Full Scan / SIM:	Full scan 45-450
Constant Flow:	On		



Column Part No.: 054796

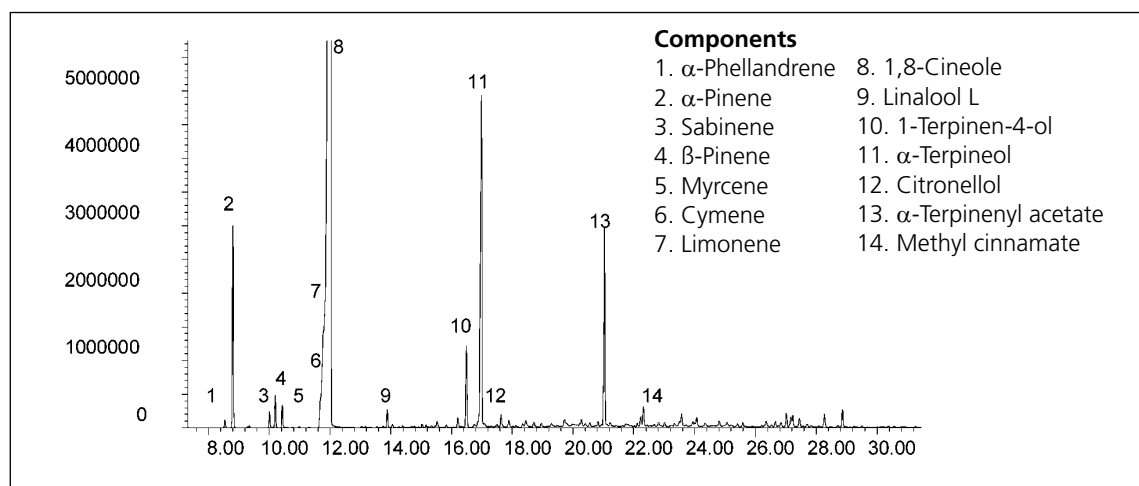
Phase:	SolGel-Wax™, 0.25 µm	Average Linear Velocity:	35 cm/sec at 40 °C
Sample:	2000-3000 ppm in ethanol	Injection Mode:	Split
Column:	30 m x 0.25 mm ID	Split Ratio:	100:1
Initial Temp.:	40 °C, 1 min.	Injection Volume:	0.2 µL
Rate 1:	8 °C/min to 220 °C,	Injection Temp.:	250 °C
Final Temp:	220 °C, 5 min.	Liner Type:	4 mm ID
Detector Type:	Mass Spectrometer		Single Taper Liner
Carrier Gas:	He, 25.7 psi	Liner Part Number:	092017
Carrier Gas Flow:	1.8 mL/min.	Full Scan / SIM:	Full scan 45-450
Constant Flow:	On		



Analysis of Eucalyptus Oil on BPX5

Column Part No.: 054101

Phase:	BPX5, 0.25 µm film	Injection Mode:	Split
Column:	30 m x 0.25 mm ID	Split Ratio:	200:1
Initial Temp.:	40 °C, 1 min.	Purge on (Split)	
Rate 1:	5 °C/min to 200 °C,	Vent Flow:	200 mL/min.
Final Temp:	260 °C	Injection Volume:	0.2 µL
Detector Type:	Mass Spectrometer	Injection Temp.:	250 °C
Carrier Gas:	He, 7.0 psi	Liner Type:	4 mm ID Double
Carrier Gas Flow:	1.0 mL/min.		Taper Liner
Constant Flow:	On	Liner Part Number:	092018
Average Linear Velocity:	36 cm/sec at 40 °C		



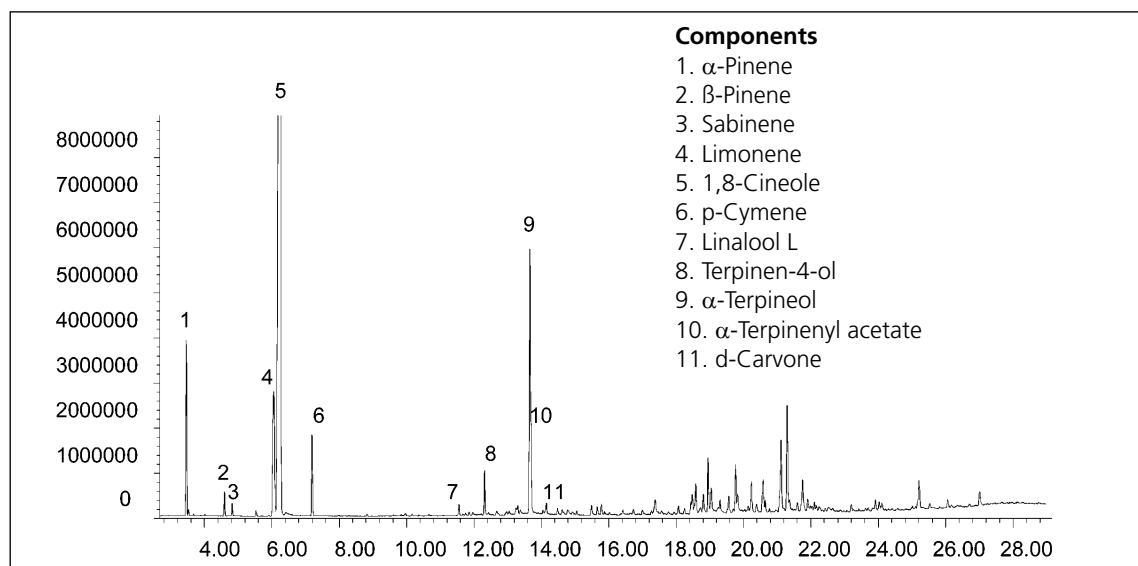
For full product listing, specifications and ordering information visit www.sge.com/gc or look in SGE's Product Selection Guide



Analysis of Eucalyptus Oil on SolGel-WAX™

Column Part No.: 054796

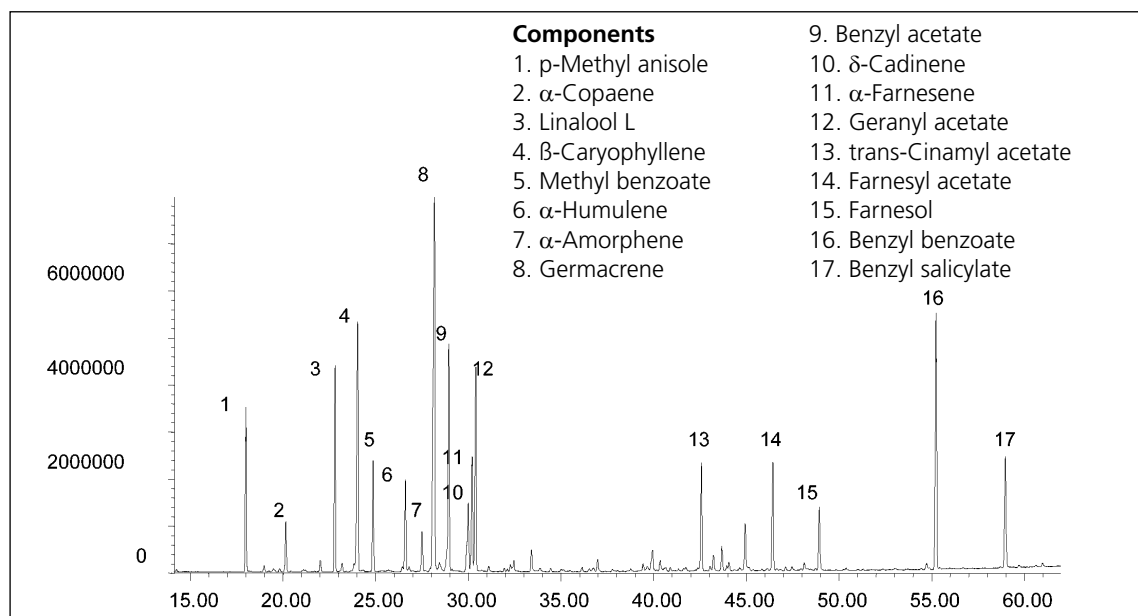
Phase:	SolGel-WAX™, 0.25 µm film	Constant Flow:	On
Sample:	Neat	Average Linear Velocity:	35 cm/sec at 40 °C
Column:	30 m x 0.25 mm ID	Injection Mode:	Split
Initial Temp.:	40 °C, 1 min.	Split Ratio:	100:1
Rate 1:	8 °C/min to 220 °C,	Injection Volume:	0.2 µL
Final Temp:	220 °C, 5 min.	Injection Temp.:	250 °C
Detector Type:	Mass Spectrometer	Liner Type:	4 mm ID Single Taper Liner
Carrier Gas:	He, 25.7 psi	Liner Part Number:	092017
Carrier Gas Flow:	1.8 mL/min.	Full Scan / SIM:	Full scan 45-450



Analysis of Ylang Ylang Oil on SolGel-WAX™

Column Part No.: 054796

Phase:	SolGel-WAX™, 0.25 µm	Average Linear Velocity:	35 cm/sec at 40 °C
Sample:	Ylang Ylang oil neat.	Injection Mode:	Split
Column:	30 m x 0.25 mm ID	Split Ratio:	120:1
Initial Temp.:	40 °C, 2 min.	Injection Volume:	0.1 µL
Rate 1:	3 °C/min to 250 °C,	Injection Temp.:	250 °C
Final Temp:	250 °C, 10 min.	Autosampler:	No
Detector Type:	Mass Spectrometer	Liner Type:	4 mm ID Double Taper Liner
Carrier Gas:	He, 25.7 psi	Liner Part Number:	092018
Carrier Gas Flow:	1.8 mL/min.	Full Scan / SIM:	Full scan 45-450
Constant Flow:	On		

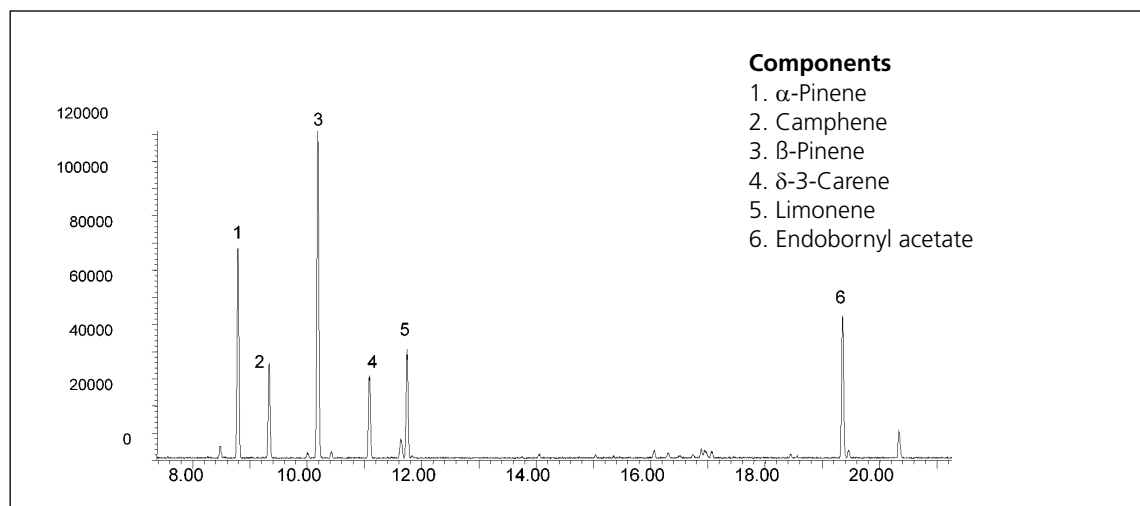


Analysis of Pine Oil on BPX5

Column Part No.: 054101

Phase:	BPX5, 0.25 µm film
Column:	30 m x 0.25 mm ID
Initial Temp.:	40 °C, 1 min.
Rate 1:	5 °C/min to 260 °C,
Final Temp:	260 °C
Detector Type:	Mass Spectrometer
Carrier Gas:	He, 7.0 psi
Carrier Gas Flow:	1.0 mL/min.
Constant Flow:	On
Average Linear Velocity:	36 cm/sec at 40 °C

Injection Mode:	Split
Split Ratio:	200:1
Purge on (Split)	
Vent Flow:	200 mL/min.
Injection Volume:	0.2 µL
Injection Temp.:	250 °C
Liner Type:	4 mm ID Double Taper Liner
Liner Part Number:	092018

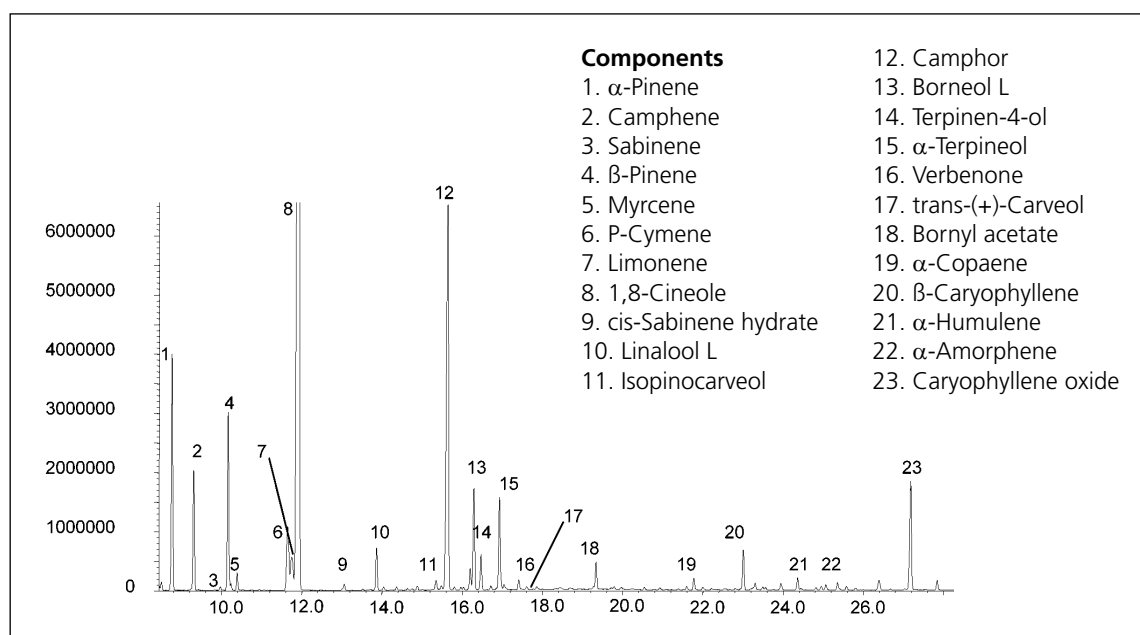


Analysis of Rosemary Oil on BPX5

Column Part No.: 054101

Phase:	BPX5, 0.25 µm film
Column:	30 m x 0.25 mm ID
Initial Temp.:	40 °C, 1 min.
Rate 1:	5 °C/min to 260 °C,
Final Temp:	260 °C
Detector Type:	Mass Spectrometer
Carrier Gas:	He, 7.0 psi
Carrier Gas Flow:	1.0 mL/min.
Constant Flow:	On
Average Linear Velocity:	36 cm/sec at 40 °C

Injection Mode:	Split
Split Ratio:	200:1
Purge on (Split)	
Vent Flow:	200 mL/min.
Injection Volume:	0.2 µL
Injection Temp.:	250 °C
Liner Type:	4 mm ID Double Taper Liner
Liner Part Number:	092018



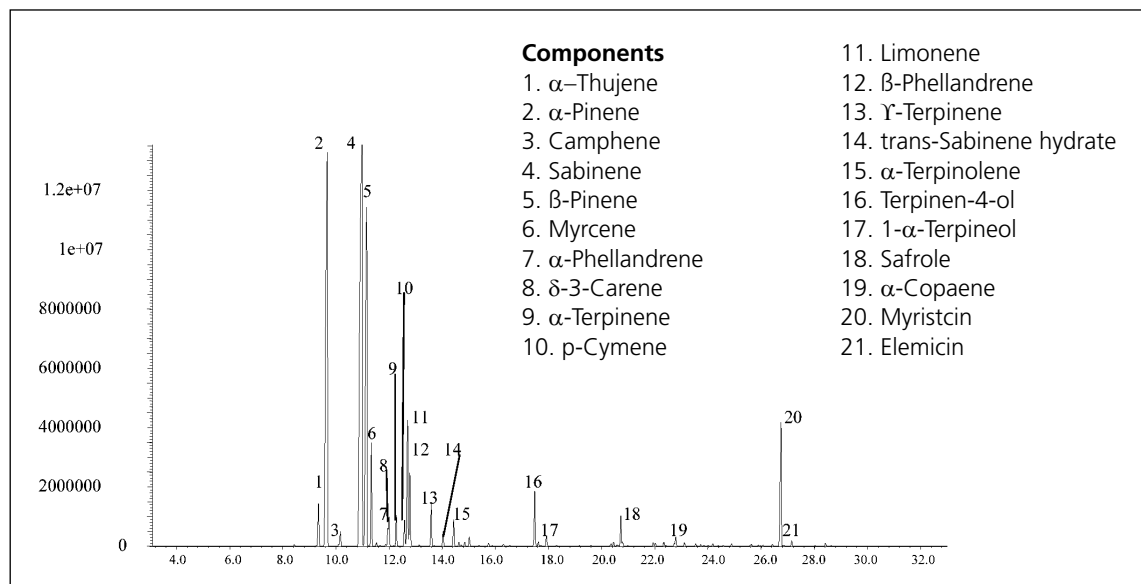
For full product listing, specifications and ordering information visit www.sge.com/gc or look in SGE's Product Selection Guide



Analysis of Nutmeg Oil on BPX5

Column Part No.: 054101

Phase:	BPX5, 0.25 µm film	Average Linear Velocity:	36 cm/sec at 40 °C
Column:	30 m x 0.25 mm ID	Injection Mode:	Split
Initial Temp.:	40 °C, 1 min.	Split Ratio:	200:1
Rate:	5 °C/min to 260 °C,	Purge on (Split) Vent Flow:	200 mL/min.
Final Temp:	260 °C	Injection Volume:	0.2 µL
Detector Type:	Mass Spectrometer	Injection Temp.:	250 °C
Carrier Gas:	He, 7.0 psi	Liner Type:	4 mm ID Double Taper Liner
Carrier Gas Flow:	1.0 mL/min.	Liner Part Number:	092018
Constant Flow:	On		

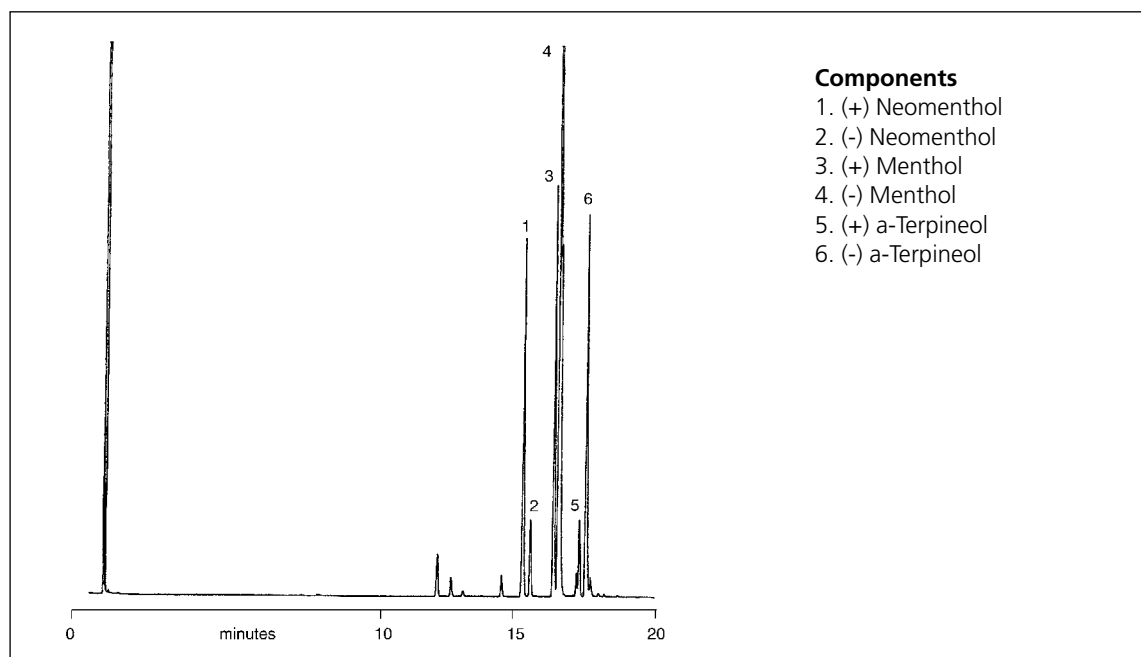


Analysis of Menthol Oil on CYDEX-B™

Column Part No.: 054901

Phase:	Cydex-B™, 0.25 µm film	Carrier Gas:	H ₂
Column:	50 m x 0.22 mm I.D.	Detector:	FID
Initial Temp.:	100 °C, 5 min	Sensitivity:	32 x 10 ⁻¹² AFS
Rate:	2 °C/min	Injection Mode:	Split
Final Temp.:	130 °C		

Notes: Cydex - B™ column enables the separation of three different enantiomer pairs in Menthol Oil.



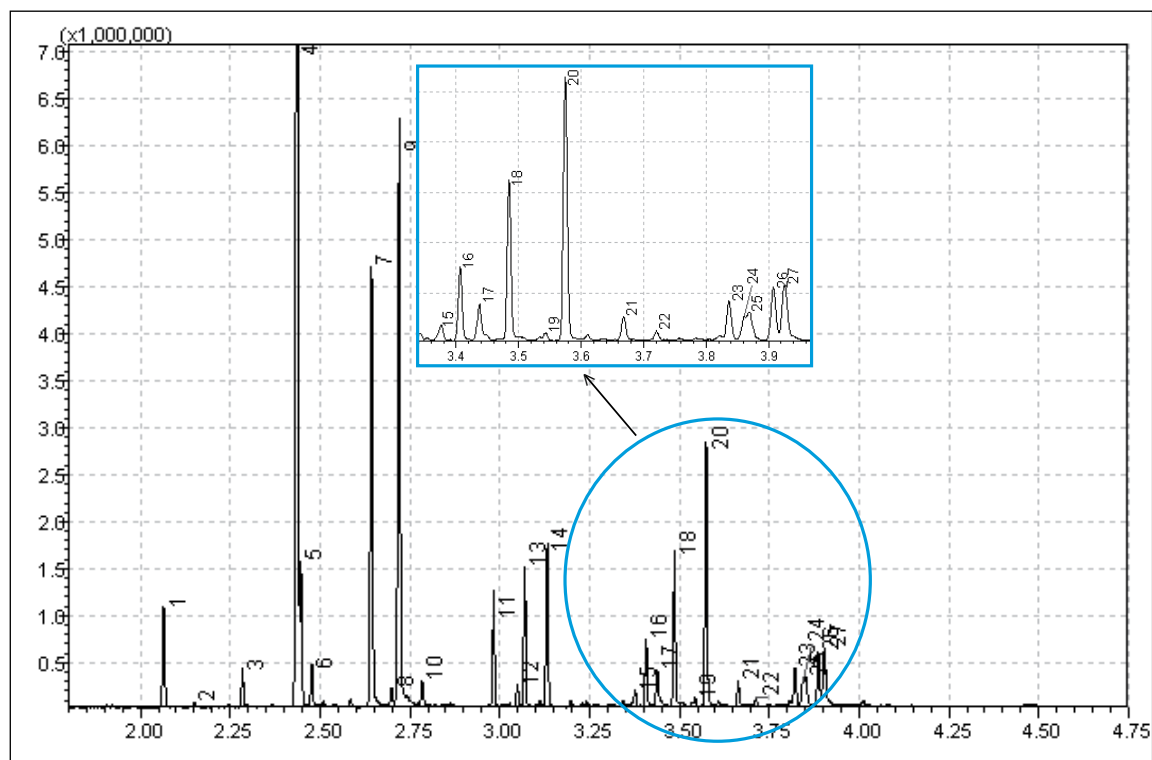
Analysis of Serai Essential Oil by Fast GCMS

Column Part No: 054099

Instrument Parameters (Fast GCMS):

Instrument: Shimadzu GCMS 2010 ULTRA
 Column: BPX5 10 m x 0.10 mm ID x 0.10 μ m
 Injection Mode: High Pressure injection (550 kPa,
 Time: 1.0 min) (Split 1:50)
 Flow Control Mode: Linear Velocity (50 cm/sec)
 Injection Temperature: 250 °C

Column Temperature: Temperature Gradient [Initial 50 °C
 (hold 1 min), 75 °C/min until 150 °C
 (hold 0.30 min),
 60 °C/min until 200 °C (hold 0.5 min),
 750 °C/min until 300 °C].
 Interface Temperature: 300 °C
 Ion Source Temperature: 200 °C
 Mass Range: 40 - 500.00 m/z.
 Scan Speed: 20,000 u/sec.



Components	
1	Limonene
2	Bergamal
3	Linalool
4	Citronellal
5	Isopulegol
6	Isoisopulegol
7	Citronellol
8	Neral
9	Geraniol
10	Geranial
11	Citronellyl acetate
12	Eugenol
13	Geranyl acetate
14	Beta-Elemene
15	Gamma-Muurolene
16	Gamma-Amorphene
17	Alpha-Muurolene
18	Delta-Cadinene
19	Alpha-Cadinene
20	Alpha-Elemol
21	Gleenol
22	Unknown
23	Gamma-Eudesmol
24	Alpha-Muurolol
25	Unknown
26	Cadin-4-en-10-ol
27	Beta-Eudesmol



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