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FAST-GC solutions

improve Your FAST-GC analysis

since 1980

MEGA S.r.l. - Capillary Columns Laboratory - Via Plinio, 29 - 20025 Legnano (MI) - Italy - tel./fax: +39 0331.54.79.24 - info@mega.mi.it

What is FAST-GC

What is FAST-GC.

FAST-GC is a technique that allows you to reduce the analysis time while keeping an adequate resolution power, thus increasing your throughput.

FAST-GC can be applied to medium-to-high complexity mixtures analysis and provides 3-10x faster analysis compared to conventional GC.

What you need to make FAST-GC.

To accomplish the FAST-GC you will simply need:

- a shorter column with a smaller internal diameter (so-called "narrow-bore" columns). Typically a 100µm ID x 5 or 10m length columns are used.
- an high temperature rate (usually more than 15°C/min) and a fast acquisition frequency on your detector (see Figure 1 to see how the acquisition frequency does affect the peak shape in FAST-GC).

Just contact us at info@mega.mi.it to have more information.

Some fundamental theoretical notion to better understand FAST-GC.

The parameter that best describes the theoretical separation power of a gas-chromatographic capillary column is the **number of the theoretical plates (N)**.

N is calculated as:

$$N = \frac{L}{H}; \qquad (H \sim ID)$$

where L is the column length and H is the height of the theoretical plates that can be approximated very well with the column's internal diameter (ID).

Is then easy to calculate that a conventional column 0.25mm ID x 25m has 100000 theoretical plates (N). But reducing the internal diameter of the column, we can keep constant the value of N reducing the length of the column. In fact a 100µm ID x 10m has as well 100000 theoretical plates that is the same separation power provided by a conventional GC column.

Narrow bore short columns consent to use high temperature rates and high linear velocities maintaining optimal conditions during the practical usage. That is why, to reduce columns sizes allows to speed up your analysis while retaining a proper separation level.

The importance of the selectivity of the stationary phase in FAST-GC.

The selectivity of the stationary phase is a **key parameter** in gas-chromatography. It takes an even more important role in FAST-GC, where it helps to compensate a natural compression of the peaks, in particular of critical pairs of peaks, in the very short "fast" analysis time.
Have the right selectivity gives the way to solve even very difficult analytical problems but keeping all the advantages of the FAST-GC technique.
In the following pages you will find some application notes where the selectivity of the stationary phase has been investigated and where is role is emphasized.

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Principal Parameters Comparison

Conventional GC	**FAST-GC**
Column: *usually columns 0.25mm/0.32mm I.D. x 25m, 30m or 50m length.*	**Column:** usually columns 0.05mm/0.10mm I.D. x 2.5m, 5m or 10m length.
Temperature Rates: *1 - 15°C/min.*	**Temperature Rates:** 15 - 60°C/min.
Injection: *using standard injection techniques, is possible to inject quite large quantities (typically 1 - 2µL of a diluted solution with a split ratio of 1:20).*	**Injection:** the injected quantity has to be at least 10x less than conventional GC. Usually split ratio of 1:100 or higher are used with diluted solutions (< 100ppm).
Carrier Gas: *typical flows are not less than 0.8mL/min with head pressures of 40 - 130kPa depending on column dimensions and carrier gas type (visit the "support-download" page on www.mega.mi.it to see and download the table with the recommended pressures and flows).*	**Carrier Gas:** typical flows do not exceed 0.9 - 1mL/min with higher head pressures (until 200-250kPa for 0.10mm I.D. columns, and until 300kPa or more for 0.05mm I.D. columns) anyway depending on column dimensions and carrier gas type (visit the "support-download" page on www.mega.mi.it to see and download the table with the recommended pressures and flows).
Peak Width: *2 - 5 seconds.*	**Peak Width:** 0.5 - 2 seconds.
Detector: *any type of detector for GC can be used.*	**Detector:** any type of detector for GC can be used. It is only necessary that the acquisition frequency is at least 50Hz (see page 4, Figure 1).
Analysis Time: *20 - 60 min.*	**Analysis Time:** 1 - 10 min.

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Acquisition Frequency in FAST-GC

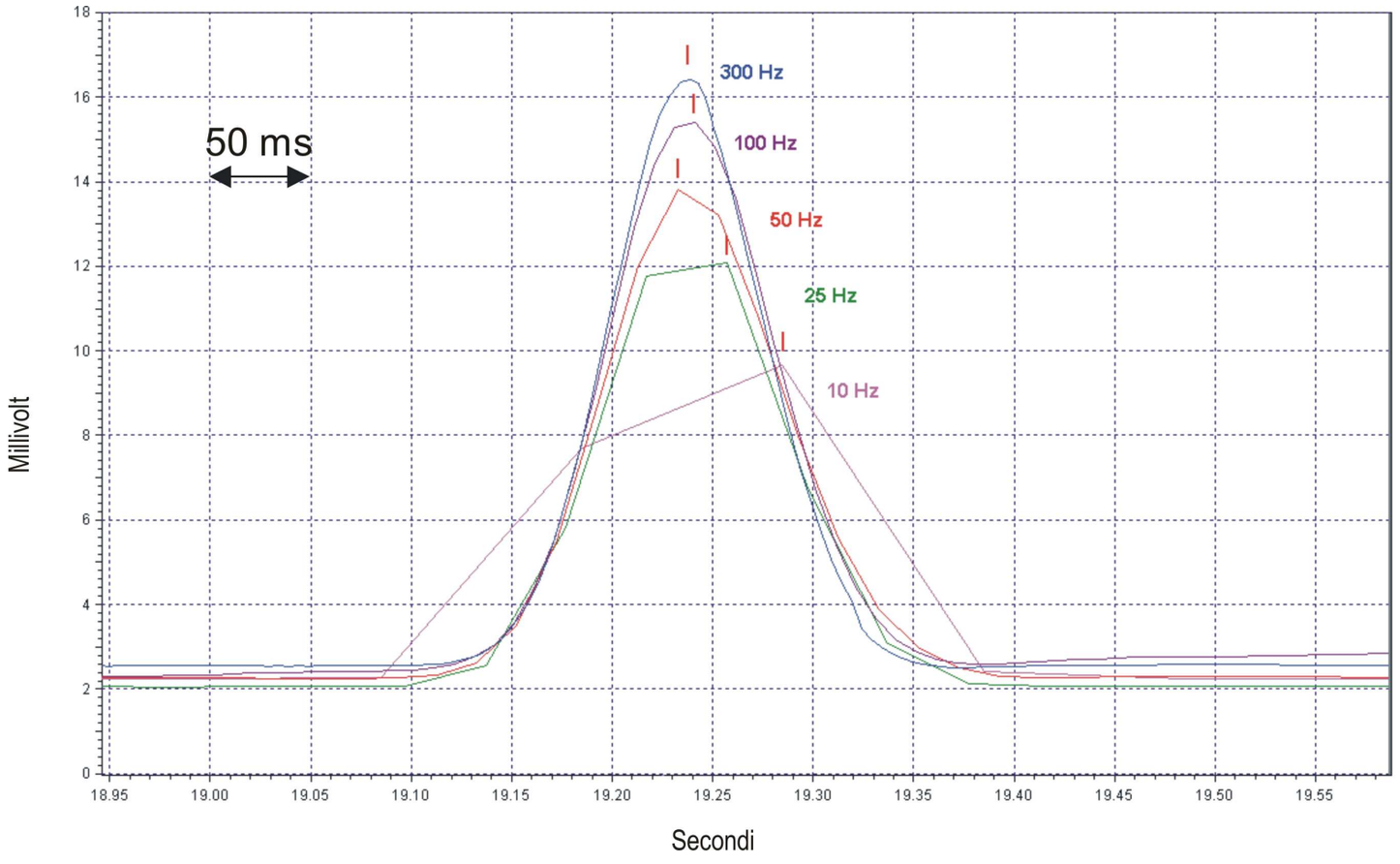

Figure 1 - Effect of the acquisition frequency on the peak shape. In FAST-GC, peaks could have very narrow width (even less than 500ms). For this reason is important to have an "high-speed" detector able to collect at least 10 points for every peak, thus to correctly describe the peak itself. In this way the peak can be properly integrated and quantified. **In FAST-GC an acquisition rate of at least 50Hz is recommended.**

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Typical FAST-GC columns dimensions

Internal Diameter	Length	Film Thickness	Theoretical Plates (N)
50µm	2.5m	0.05µm, 0.10µm	50000
	5m		100000
100µm	5m	0.10µm, 0.20µm	50000
	10m		100000

Ask us for completely custom sizes and products. From over 40 years we offer ad-hoc personalized solutions for your particular GC analytical problem.
Just contact us!

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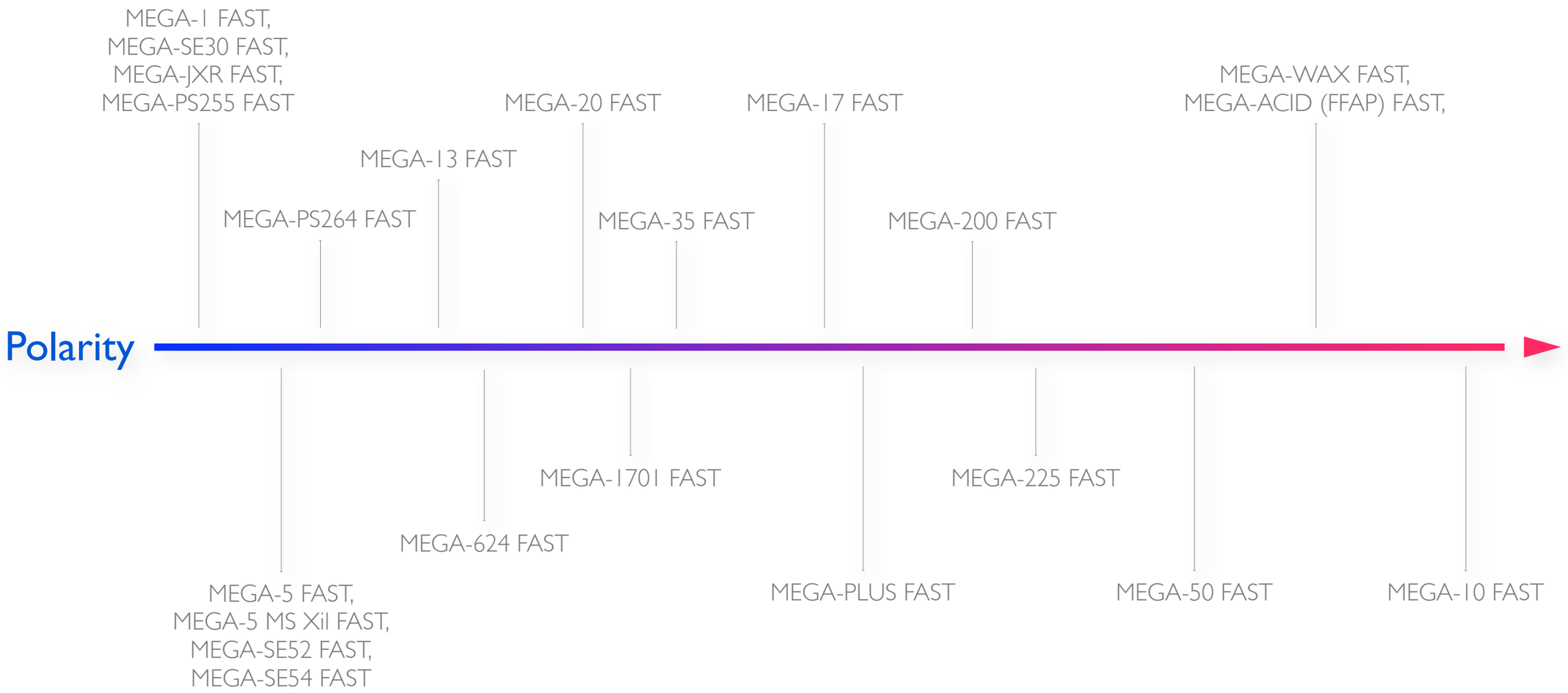
FAST-GC available stationary phases from MEGA



And even more...our MEGA-VOC 1 & 2 FAST , MEGA-POF 1 & 2 FAST unique stationary phases, MEGA-TNT 8095 FAST and our exclusive MEGA-DEX chiral columns FAST line.
Visit our website to find all our stationary phases and you can also ask us for custom solutions.

Considering the importance of the selectivity in FAST-GC, MEGA can offer more than 30 different stationary phases for your FAST-GC analysis. We are also able to tune the selectivity for your specific analytical needs with our MEGA-2D technology and using our experience in the mixed phases works [1], [2].

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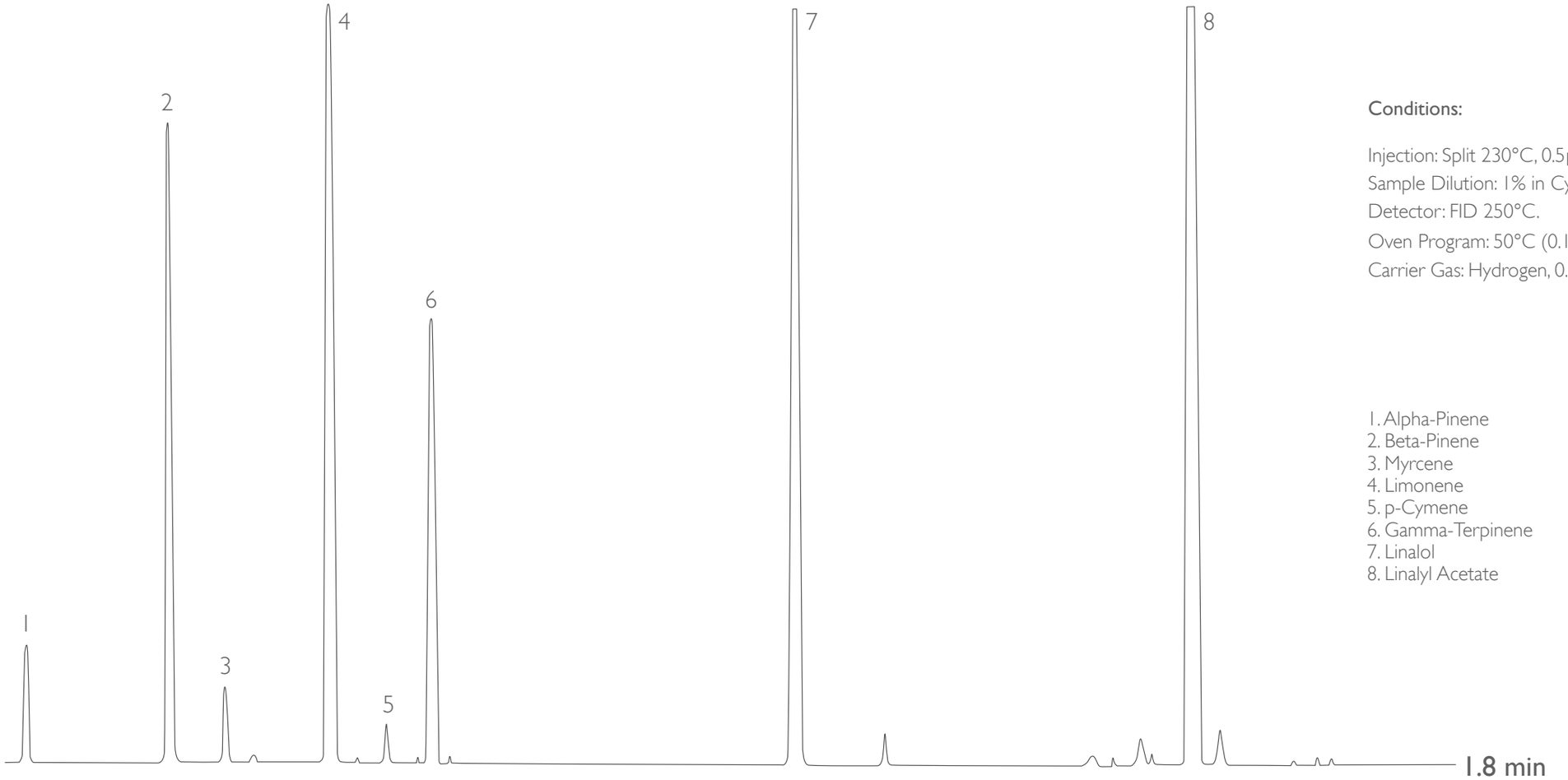
Bergamot Essential Oil

Column: **MEGA-1701 FAST - 0.10mm, 0.10µm, 5m**
Catalog Code: F-1701-010-010-5



1. Alpha-Pinene
2. Beta-Pinene
3. Myrcene
4. Limonene
5. p-Cymene
6. Gamma-Terpinene
7. Linalol
8. Linalyl Acetate

Conditions:

Injection: Split 230°C, 0.5µL, 1:250 Split Ratio.
Sample Dilution: 1% in Cyclohexane.
Detector: FID 250°C.
Oven Program: 50°C (0.1min), 50°C/min, 250°C.
Carrier Gas: Hydrogen, 0.5mL/min.

Acknowledgement: **Prof. C. Bicchi, C.Brunelli et al.**, Università di Torino, Dipartimento di Scienza e Tecnologia del Farmaco, Via Pietro Giuria, 9 - Torino - Italy.

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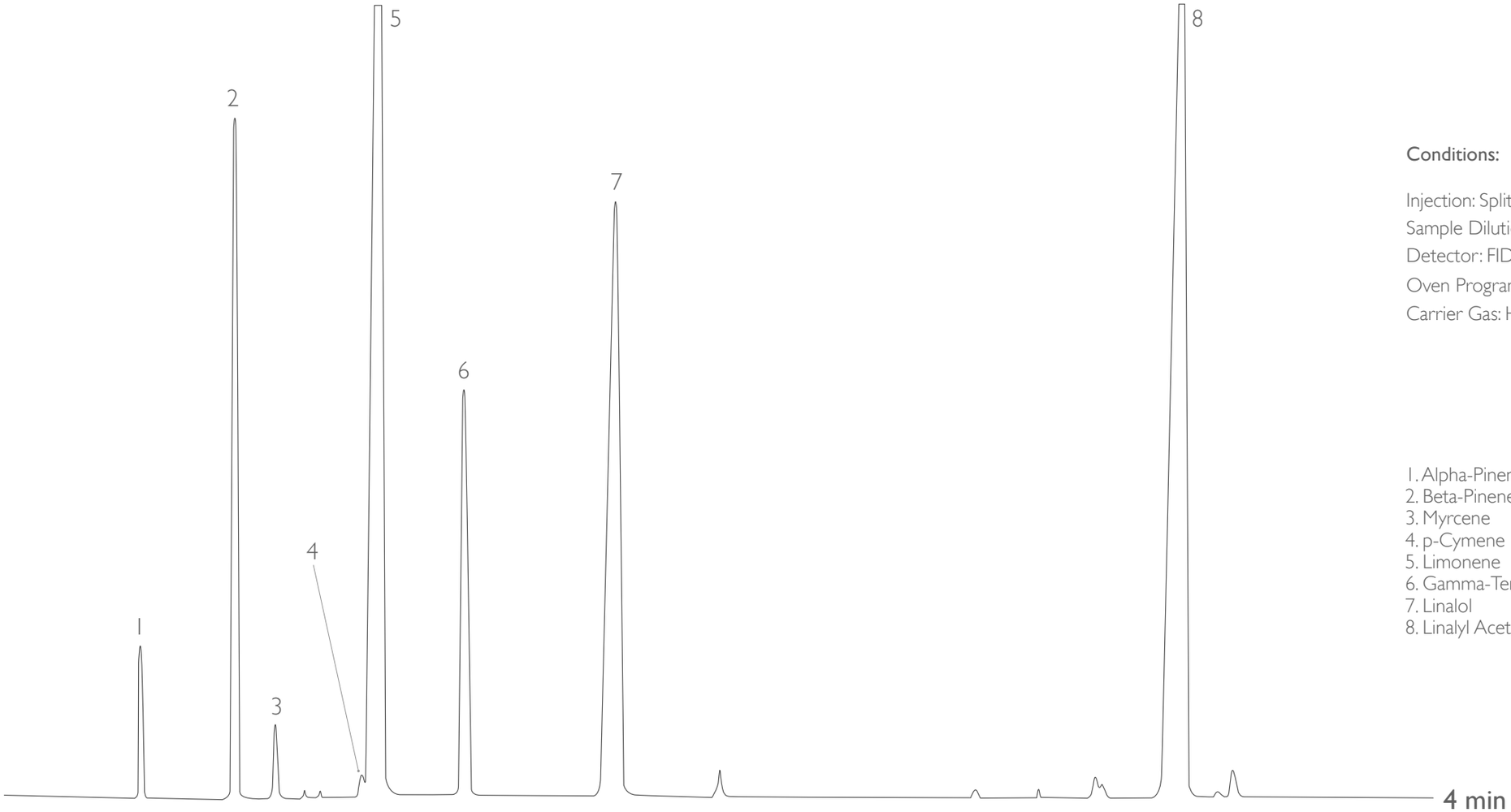
Bergamot Essential Oil

Column: **MEGA-SE54 FAST - 0.10mm, 0.10µm, 5m**
Catalog Code: F-SE54-010-010-5



Conditions:

Injection: Split 230°C, 0.5µL, 1:250 Split Ratio.
Sample Dilution: 1% in Cyclohexane.
Detector: FID 250°C.
Oven Program: 50°C (0.1min), 30°C/min, 250°C.
Carrier Gas: Hydrogen, 0.5mL/min.

1. Alpha-Pinene
2. Beta-Pinene
3. Myrcene
4. p-Cymene
5. Limonene
6. Gamma-Terpinene
7. Linalol
8. Linalyl Acetate

Acknowledgement: **Prof. C. Bicchi, C.Brunelli et al.**, Università di Torino, Dipartimento di Scienza e Tecnologia del Farmaco, Via Pietro Giuria, 9 - Torino - Italy.

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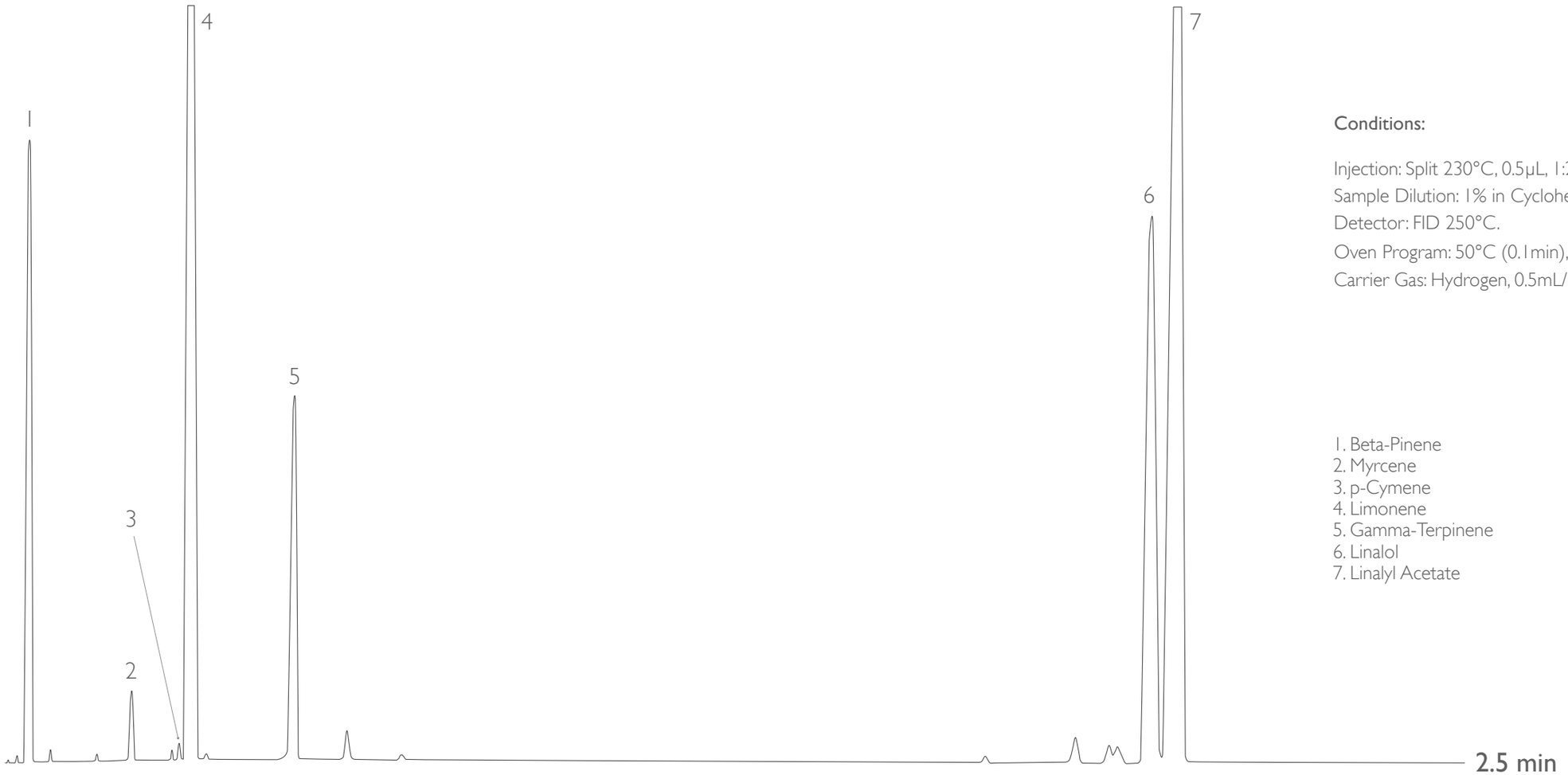
Bergamot Essential Oil

Column: **MEGA-WAX FAST - 0.10mm, 0.10µm, 5m**
Catalog Code: F-WAX-010-010-5



Conditions:

Injection: Split 230°C, 0.5µL, 1:250 Split Ratio.
Sample Dilution: 1% in Cyclohexane.
Detector: FID 250°C.
Oven Program: 50°C (0.1min), 30°C/min, 250°C.
Carrier Gas: Hydrogen, 0.5mL/min.

1. Beta-Pinene
2. Myrcene
3. p-Cymene
4. Limonene
5. Gamma-Terpinene
6. Linalol
7. Linalyl Acetate

Acknowledgement: **Prof. C. Bicchi, C.Brunelli et al.**, Università di Torino, Dipartimento di Scienza e Tecnologia del Farmaco, Via Pietro Giuria, 9 - Torino - Italy.

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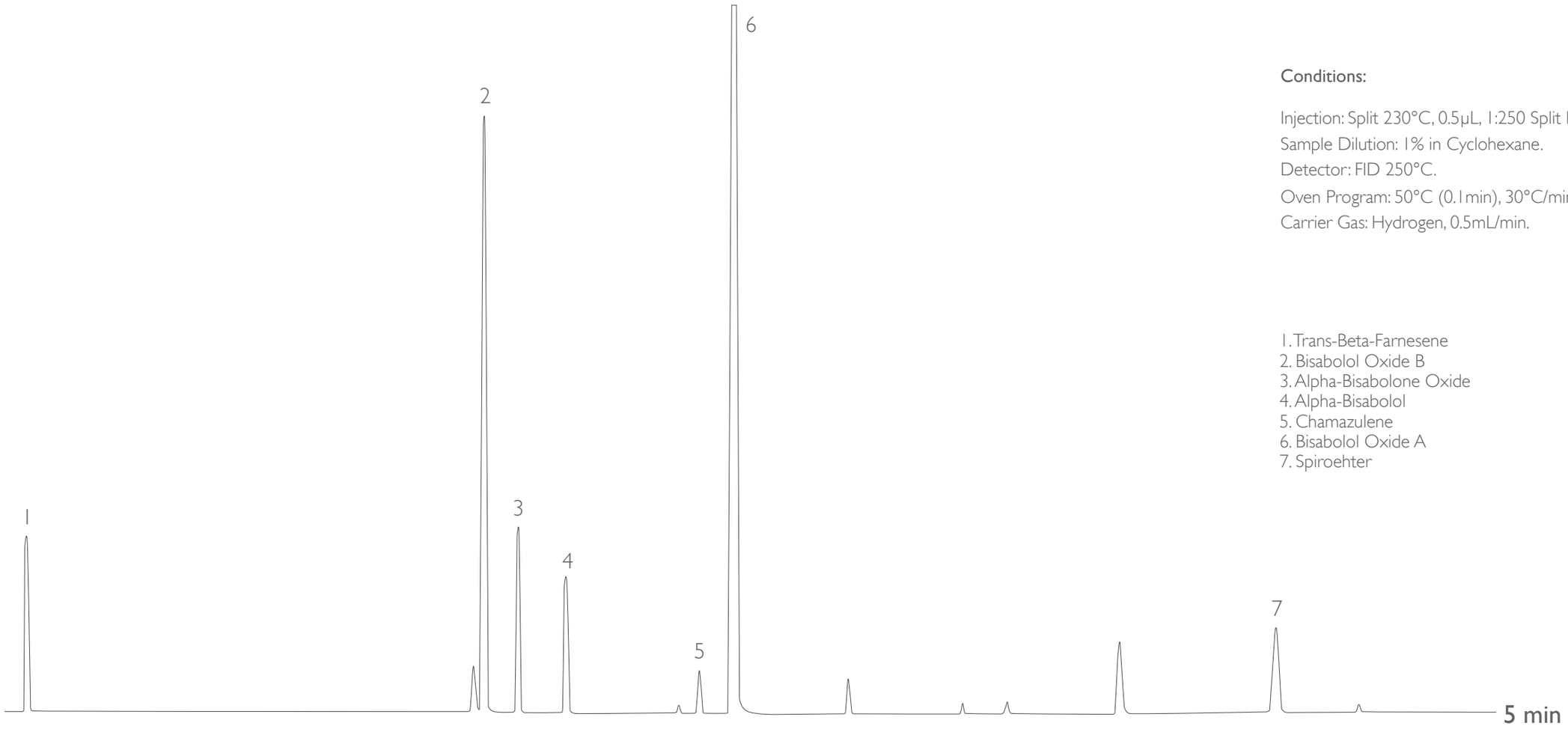
Chamomile Essential Oil

Column: **MEGA-WAX FAST - 0.10mm, 0.10µm, 5m**
Catalog Code: F-WAX-010-010-5



Conditions:

Injection: Split 230°C, 0.5µL, 1:250 Split Ratio.
Sample Dilution: 1% in Cyclohexane.
Detector: FID 250°C.
Oven Program: 50°C (0.1min), 30°C/min, 250°C.
Carrier Gas: Hydrogen, 0.5mL/min.

1. Trans-Beta-Farnesene
2. Bisabolol Oxide B
3. Alpha-Bisabolone Oxide
4. Alpha-Bisabolol
5. Chamazulene
6. Bisabolol Oxide A
7. Spiroehter

Acknowledgement: **Prof. C. Bicchi, C.Brunelli et al.**, Università di Torino, Dipartimento di Scienza e Tecnologia del Farmaco, Via Pietro Giuria, 9 - Torino - Italy.

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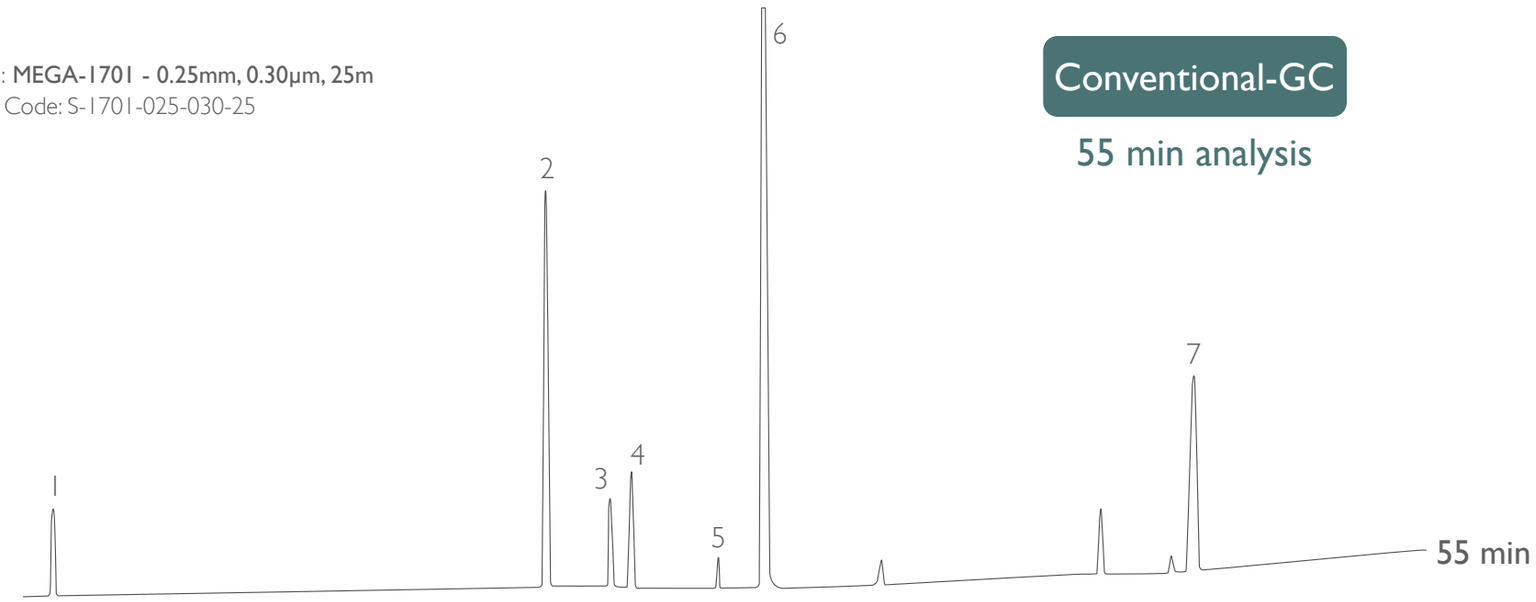
Chamomile Essential Oil

Column: **MEGA-1701 - 0.25mm, 0.30µm, 25m**
Catalog Code: S-1701-025-030-25



Conventional-GC

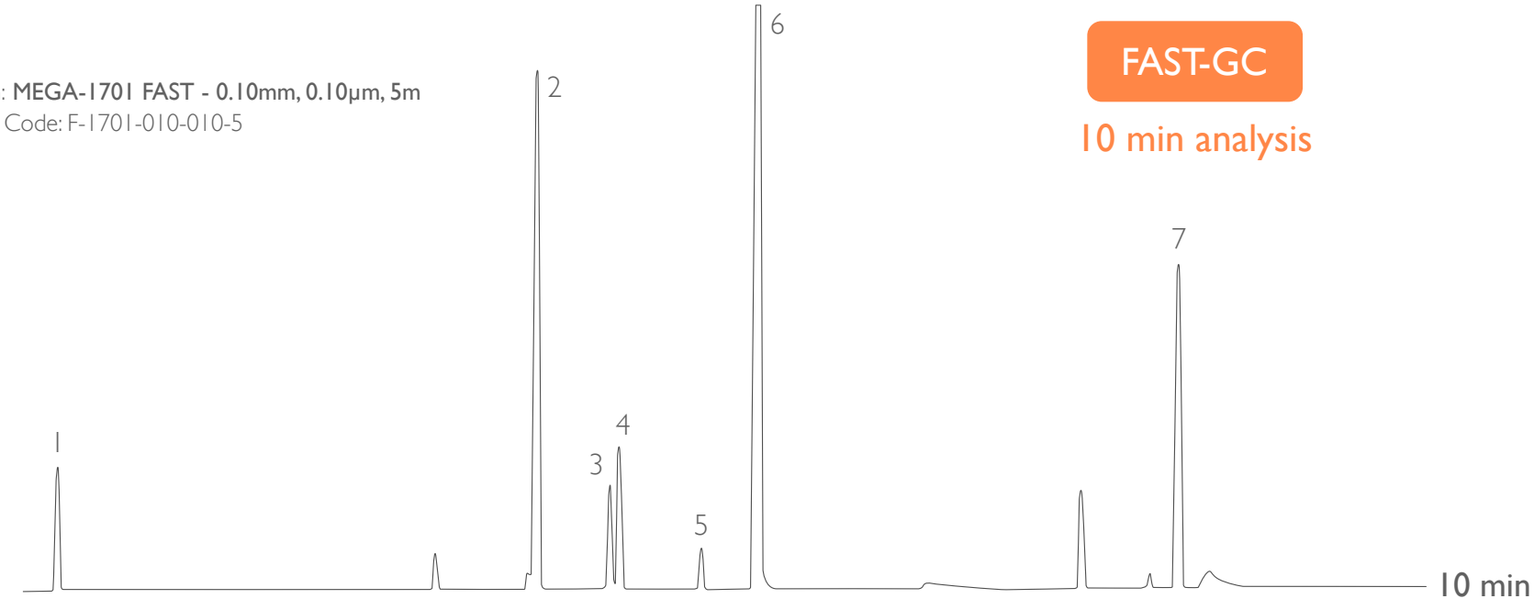
55 min analysis

Conventional-GC Conditions:

Injection: Split 230°C, 1µL, 1:50 Split Ratio.
Sample Dilution: 1% in Cyclohexane.
Detector: FID 250°C.
Oven Program: 50°C (0.1min), 3°C/min, 250°C (5min).
Carrier Gas: Hydrogen, 1.5mL/min.

1. Trans-Beta-Farnesene
2. Bisabolol Oxide B
3. Alpha-Bisabolol
4. Alpha-Bisabolone Oxide
5. Chamazulene
6. Bisabolol Oxide A
7. Spiroether

Column: **MEGA-1701 FAST - 0.10mm, 0.10µm, 5m**
Catalog Code: F-1701-010-010-5



FAST-GC

10 min analysis

FAST-GC Conditions:

Injection: Split 230°C, 0.5µL, 1:250 Split Ratio.
Sample Dilution: 1% in Cyclohexane.
Detector: FID 250°C.
Oven Program: 50°C (0.1min), 50°C/min, 250°C (5min).
Carrier Gas: Hydrogen, 0.5mL/min.

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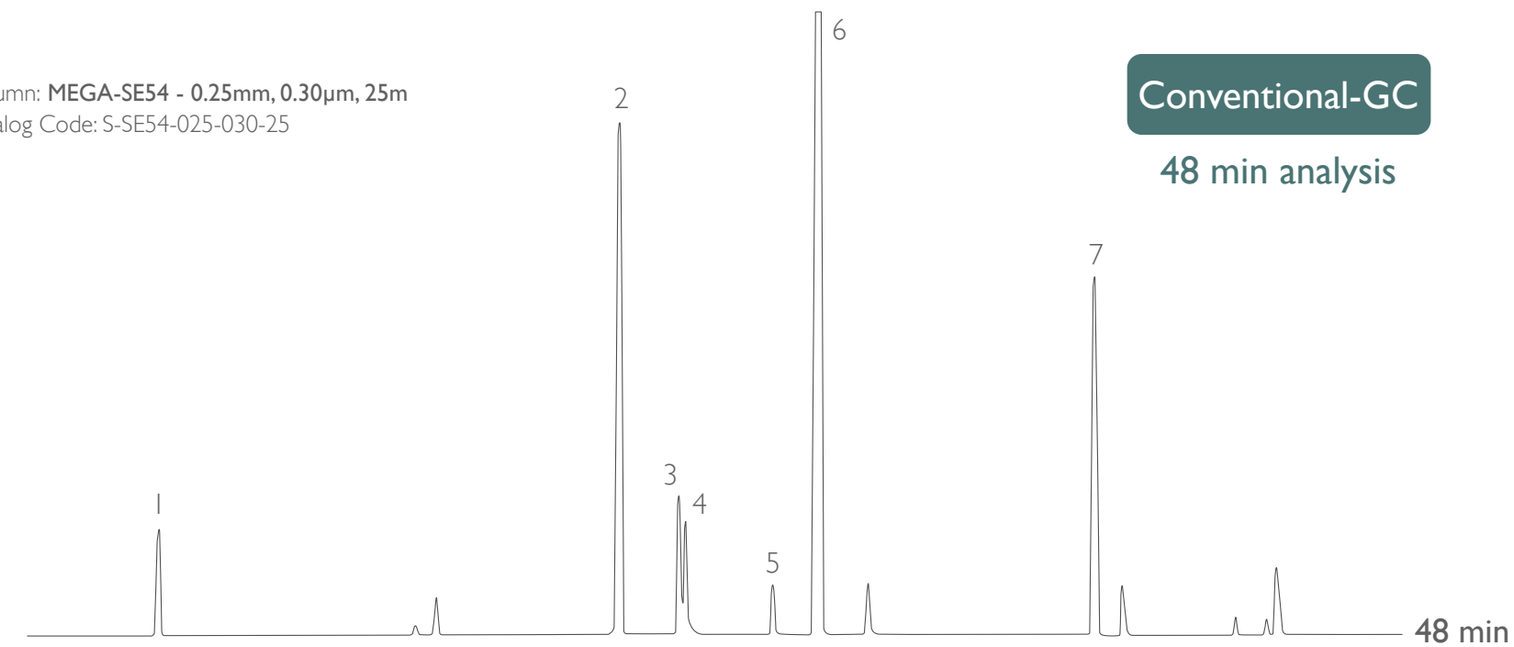
Chamomile Essential Oil

Column: **MEGA-SE54 - 0.25mm, 0.30µm, 25m**
Catalog Code: S-SE54-025-030-25



Conventional-GC

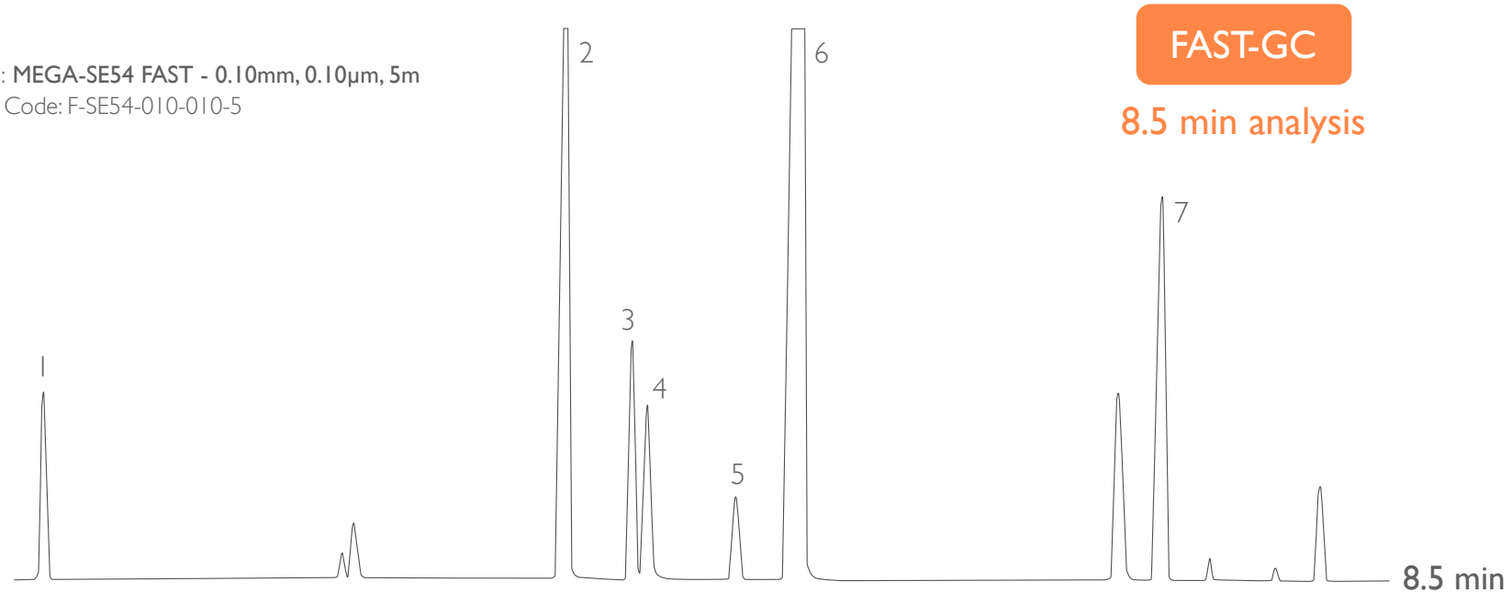
48 min analysis

Conventional-GC Conditions:

Injection: Split 230°C, 1µL, 1:50 Split Ratio.
Sample Dilution: 1% in Cyclohexane.
Detector: FID 250°C.
Oven Program: 50°C (0.1min), 3°C/min, 250°C (5min).
Carrier Gas: Hydrogen, 1.5mL/min.

1. Trans-Beta-Farnesene
2. Bisabolol Oxide B
3. Alpha-Bisabolone Oxide
4. Alpha-Bisabolol
5. Chamazulene
6. Bisabolol Oxide A
7. Spiroether

Column: **MEGA-SE54 FAST - 0.10mm, 0.10µm, 5m**
Catalog Code: F-SE54-010-010-5



FAST-GC

8.5 min analysis

FAST-GC Conditions:

Injection: Split 230°C, 0.5µL, 1:250 Split Ratio.
Sample Dilution: 1% in Cyclohexane.
Detector: FID 250°C.
Oven Program: 50°C (0.1min), 50°C/min, 250°C (5min).
Carrier Gas: Hydrogen, 0.5mL/min.

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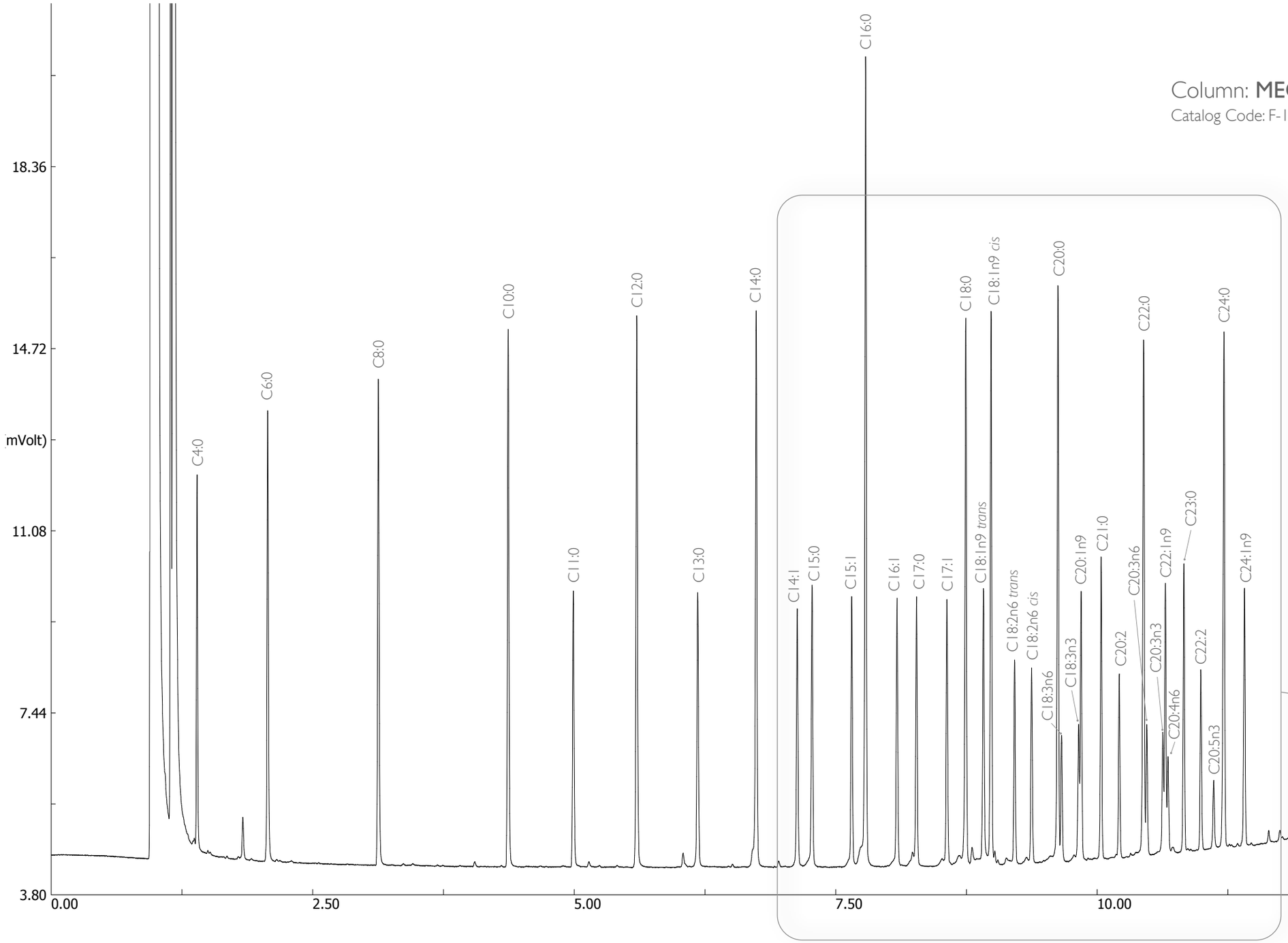
FAMEs *cis-trans* isomers



Column: **MEGA-10 FAST - 0.20mm, 0.20µm, 30m**

Catalog Code: F-10-020-020-30

Conditions:

Injection: Split 250°C, 0.5µL, 1:250 Split Ratio.
Sample: 37 FAMEs Mix (Supelco cat. #: 47885-U).
Detector: FID 255°C.
Oven Program: 60°C, 15°C/min, 250°C.*
Carrier Gas: Hydrogen, 150 kPa.*

(* best conditions with Helium Carrier Gas:

Temperature Rate: 10 - 12°C/min.
Carrier Gas: Helium, 180 - 200 kPa.)

Click here to see this zoomed portion of the chromatogram

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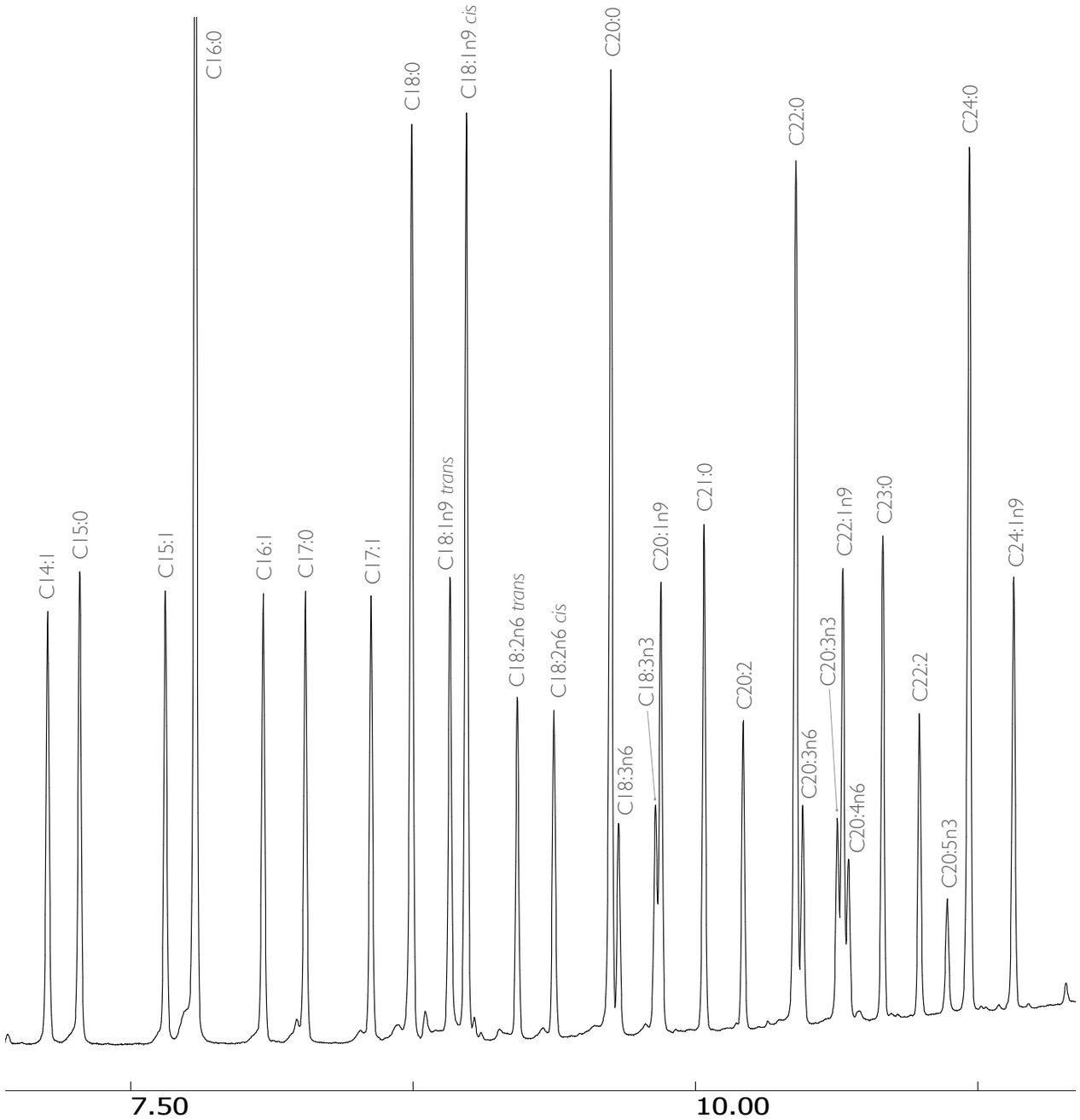
FAMEs *cis-trans* isomers detail



Column: **MEGA-10 FAST - 0.20mm, 0.20µm, 30m**
Catalog Code: F-10-020-020-30

Conditions:

Injection: Split 250°C, 0.5µL, 1:250 Split Ratio.
Sample: 37 FAMEs Mix (Supelco cat. #: 47885-U).
Detector: FID 255°C.
Oven Program: 60°C, 15°C/min, 250°C.*
Carrier Gas: Hydrogen, 150 kPa.*

(* best conditions with Helium Carrier Gas:

Temperature Rate: 10 - 12°C/min.
Carrier Gas: Helium, 180 - 200 kPa.)

Click here to go to the previous page and see the complete chromatogram

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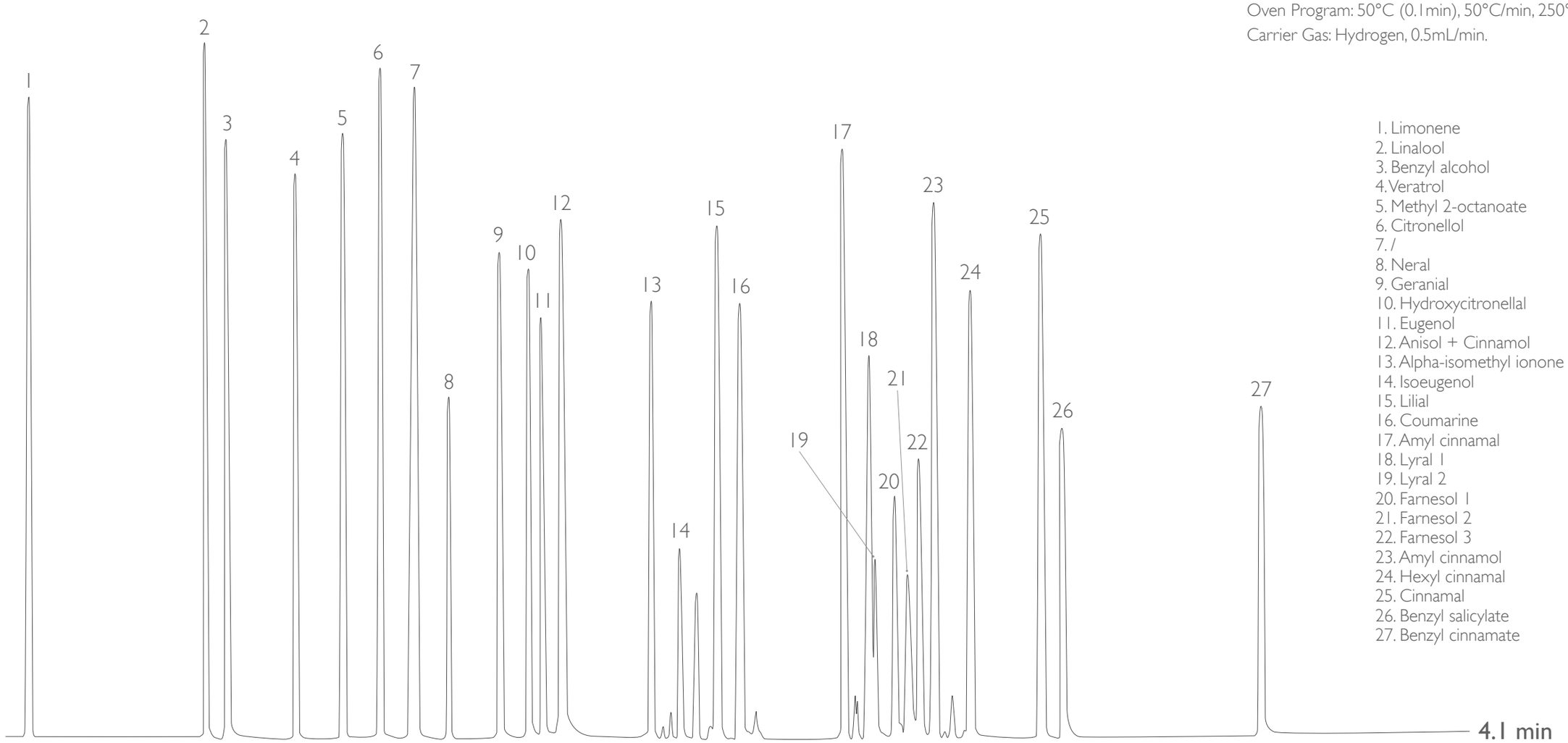
Fragrance Allergens

FAST-GC solutions

Column: **MEGA-1701 FAST - 0.10mm, 0.10µm, 5m**
Catalog Code: F-1701-010-010-5



Conditions:

Injection: Split 230°C, 0.5µL, 1:300 Split Ratio.
Sample Dilution: 1% in Cyclohexane.
Detector: FID 250°C.
Oven Program: 50°C (0.1min), 50°C/min, 250°C (5min).
Carrier Gas: Hydrogen, 0.5mL/min.

1. Limonene
2. Linalool
3. Benzyl alcohol
4. Veratrol
5. Methyl 2-octanoate
6. Citronellol
7. /
8. Neral
9. Geranial
10. Hydroxycitronellal
11. Eugenol
12. Anisol + Cinnamol
13. Alpha-isomethyl ionone
14. Isoeugenol
15. Lilial
16. Coumarine
17. Amyl cinnamal
18. Lyral 1
19. Lyral 2
20. Farnesol 1
21. Farnesol 2
22. Farnesol 3
23. Amyl cinnamol
24. Hexyl cinnamal
25. Cinnamal
26. Benzyl salicylate
27. Benzyl cinnamate

Acknowledgement: **Prof. C. Bicchi, C.Brunelli et al.**, Università di Torino, Dipartimento di Scienza e Tecnologia del Farmaco, Via Pietro Giuria, 9 - Torino - Italy.

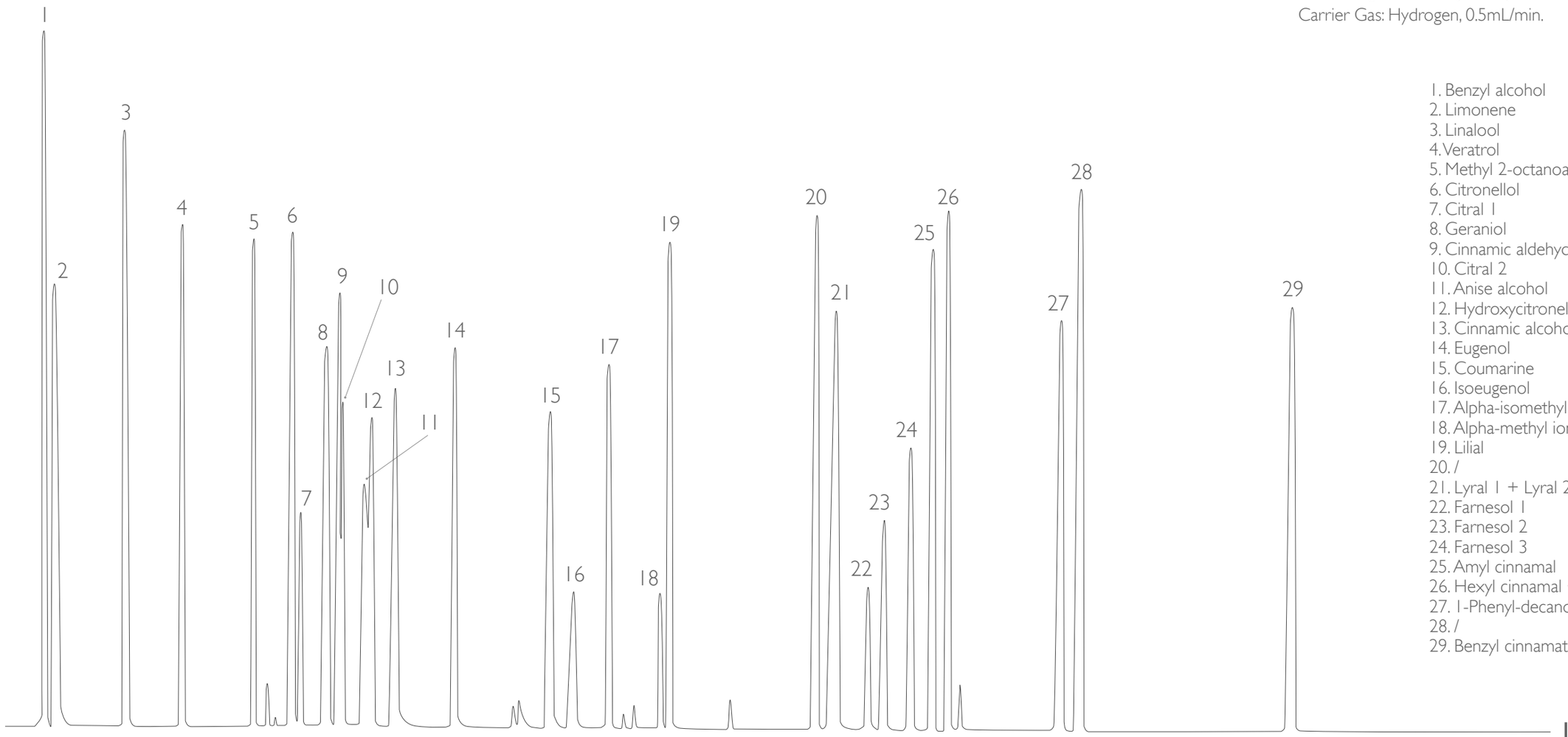
Fragrance Allergens

FAST-GC solutions

Column: **MEGA-SE54 FAST - 0.10mm, 0.10µm, 5m**
Catalog Code: F-SE54-010-010-5

Conditions:

Injection: Split 230°C, 0.5µL, 1:300 Split Ratio.
Sample Dilution: 1% in Cyclohexane.
Detector: FID 250°C.
Oven Program: 50°C (0.1min), 50°C/min, 250°C (5min).
Carrier Gas: Hydrogen, 0.5mL/min.



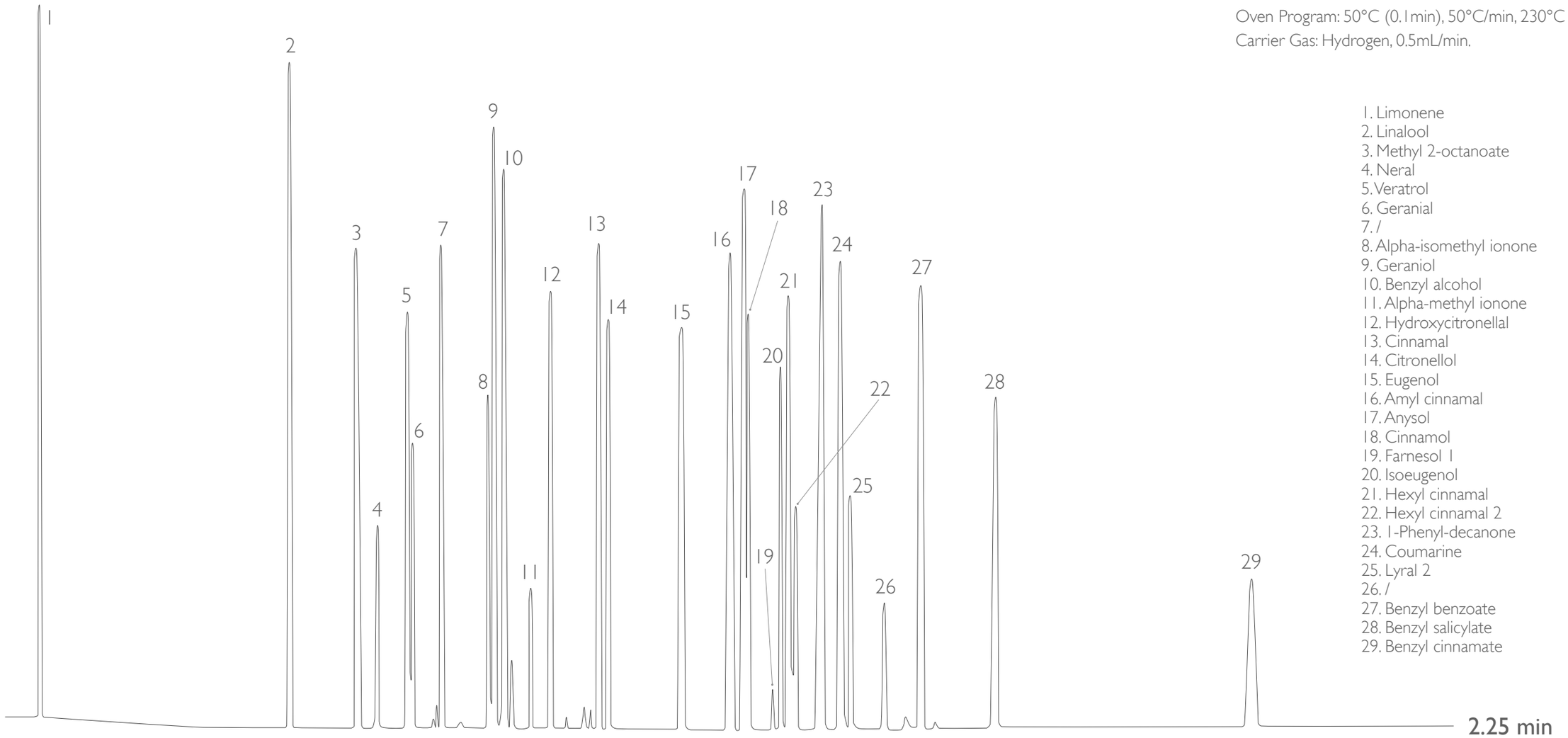
1. Benzyl alcohol
2. Limonene
3. Linalool
4. Veratrol
5. Methyl 2-octanoate
6. Citronellol
7. Citral 1
8. Geraniol
9. Cinnamic aldehyde
10. Citral 2
11. Anise alcohol
12. Hydroxycitronellal
13. Cinnamic alcohol
14. Eugenol
15. Coumarine
16. Isoeugenol
17. Alpha-isomethyl ionone
18. Alpha-methyl ionone
19. Lilial
20. /
21. Lyral 1 + Lyral 2
22. Farnesol 1
23. Farnesol 2
24. Farnesol 3
25. Amyl cinnamal
26. Hexyl cinnamal + Benzyl salicylate
27. 1-Phenyl-decanone
28. /
29. Benzyl cinnamate

Acknowledgement: **Prof. C. Bicchi, C.Brunelli et al.**, Università di Torino, Dipartimento di Scienza e Tecnologia del Farmaco, Via Pietro Giuria, 9 - Torino - Italy.

Fragrance Allergens

FAST-GC solutions

Column: **MEGA-WAX FAST - 0.10mm, 0.10µm, 5m**
Catalog Code: F-WAX-010-010-5



Conditions:

Injection: Split 230°C, 0.5µL, 1:300 Split Ratio.
Sample Dilution: 1% in Cyclohexane.
Detector: FID 250°C.
Oven Program: 50°C (0.1min), 50°C/min, 230°C (2min).
Carrier Gas: Hydrogen, 0.5mL/min.

1. Limonene
2. Linalool
3. Methyl 2-octanoate
4. Neral
5. Veratrol
6. Geranial
7. /
8. Alpha-isomethyl ionone
9. Geraniol
10. Benzyl alcohol
11. Alpha-methyl ionone
12. Hydroxycitronellal
13. Cinnamal
14. Citronellol
15. Eugenol
16. Amyl cinnamal
17. Anysol
18. Cinnamol
19. Farnesol 1
20. Isoeugenol
21. Hexyl cinnamal
22. Hexyl cinnamal 2
23. 1-Phenyl-decanone
24. Coumarine
25. Lyral 2
26. /
27. Benzyl benzoate
28. Benzyl salicylate
29. Benzyl cinnamate

Acknowledgement: **Prof. C. Bicchi, C.Brunelli et al.**, Università di Torino, Dipartimento di Scienza e Tecnologia del Farmaco, Via Pietro Giuria, 9 - Torino - Italy.

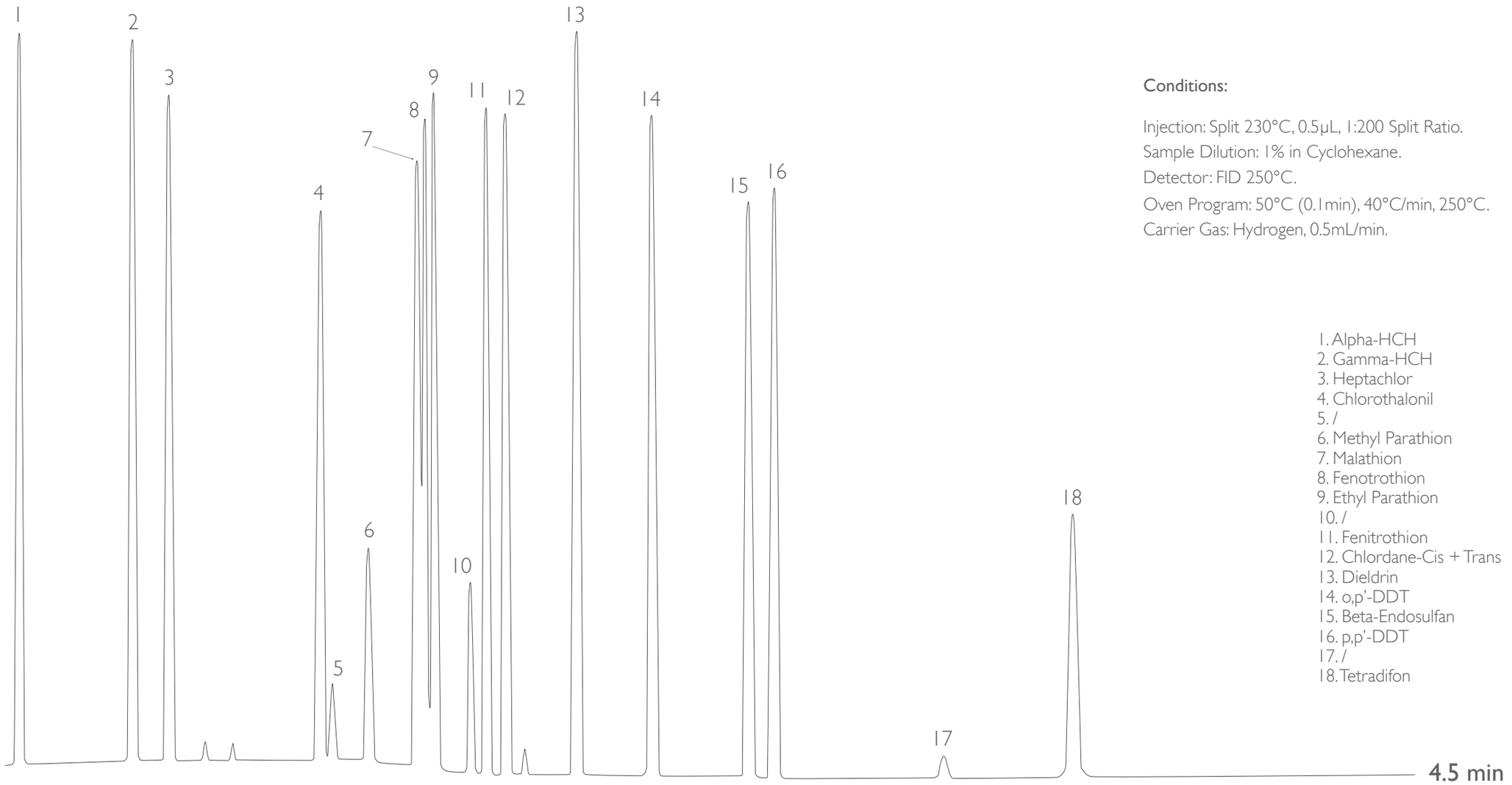
Pesticides

FAST-GC solutions

Column: **MEGA-1701 FAST - 0.10mm, 0.10µm, 5m**
Catalog Code: F-1701-010-010-5

Conditions:

Injection: Split 230°C, 0.5µL, 1:200 Split Ratio.
Sample Dilution: 1% in Cyclohexane.
Detector: FID 250°C.
Oven Program: 50°C (0.1min), 40°C/min, 250°C.
Carrier Gas: Hydrogen, 0.5mL/min.



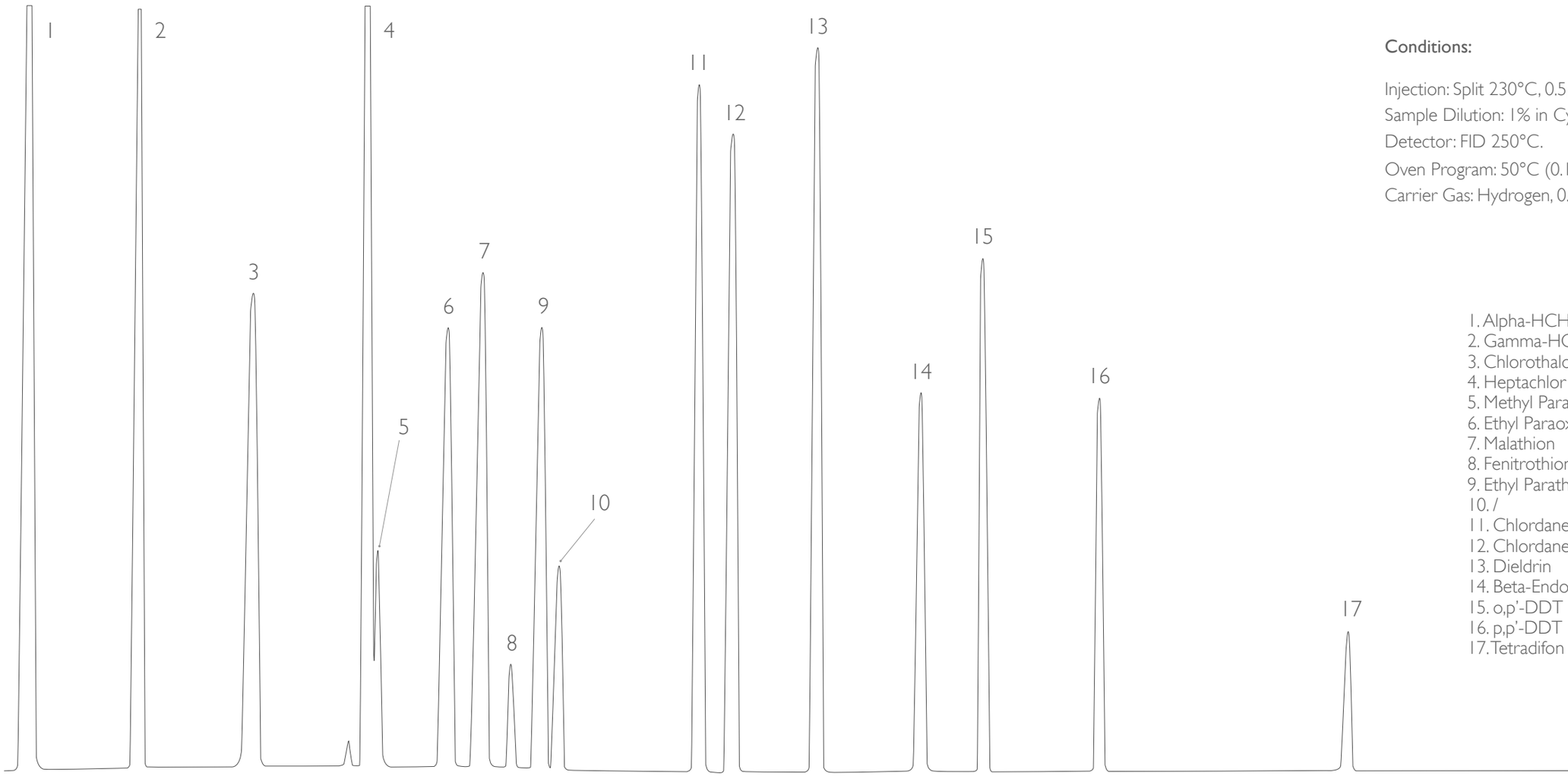
1. Alpha-HCH
2. Gamma-HCH
3. Heptachlor
4. Chlorothalonil
5. /
6. Methyl Parathion
7. Malathion
8. Fenotrothion
9. Ethyl Parathion
10. /
11. Fenitrothion
12. Chlordane-Cis + Trans
13. Dieldrin
14. o,p'-DDT
15. Beta-Endosulfan
16. p,p'-DDT
17. /
18. Tetradifon

Acknowledgement: **Prof. C. Bicchi, C.Brunelli et al.**, Università di Torino, Dipartimento di Scienza e Tecnologia del Farmaco, Via Pietro Giuria, 9 - Torino - Italy.

Pesticides

FAST-GC solutions

Column: **MEGA-SE54 FAST - 0.10mm, 0.10µm, 5m**
Catalog Code: F-SE54-010-010-5



Conditions:

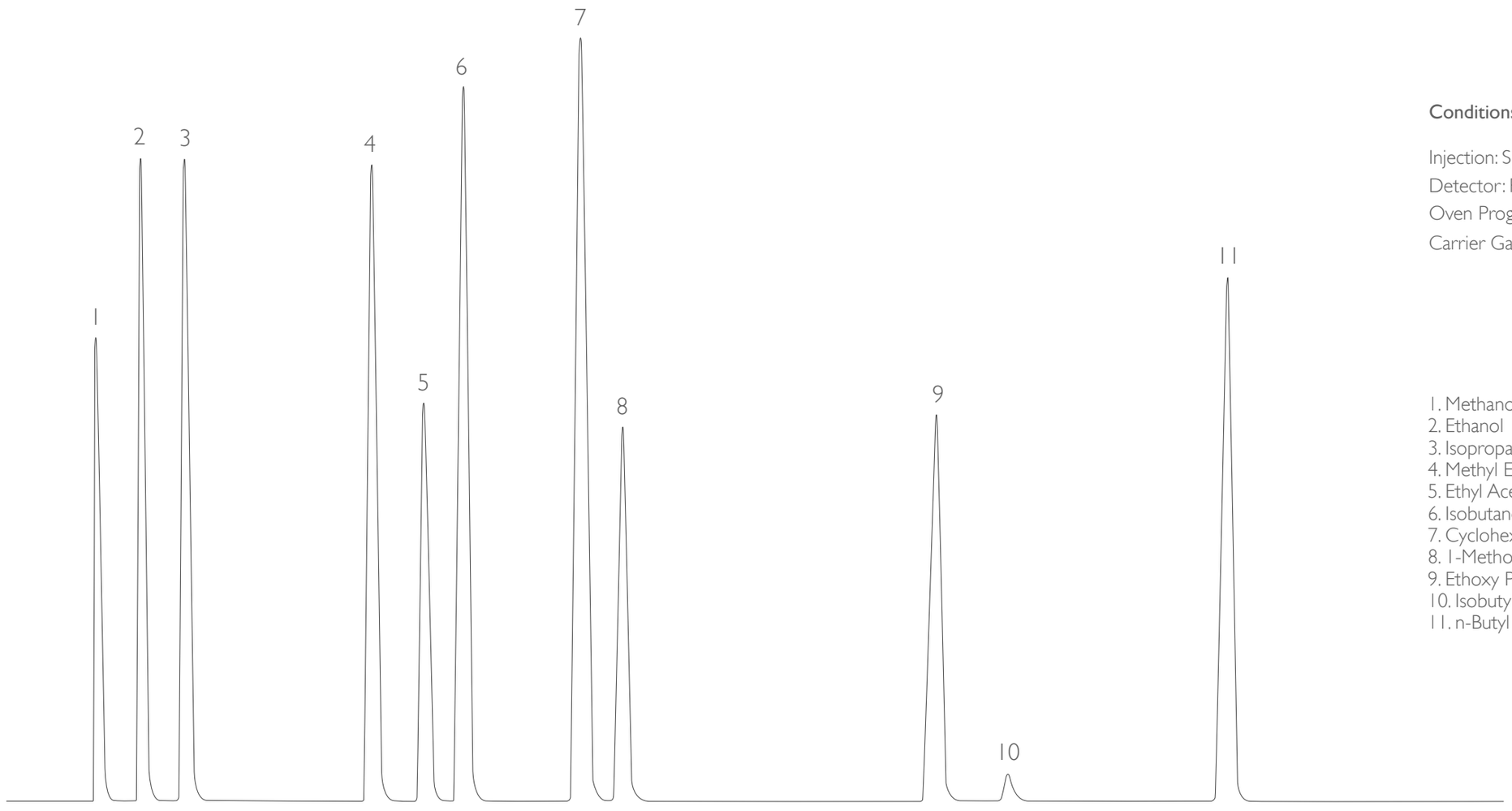
Injection: Split 230°C, 0.5µL, 1:200 Split Ratio.
Sample Dilution: 1% in Cyclohexane.
Detector: FID 250°C.
Oven Program: 50°C (0.1min), 40°C/min, 250°C.
Carrier Gas: Hydrogen, 0.5mL/min.

1. Alpha-HCH
2. Gamma-HCH
3. Chlorothalonil
4. Heptachlor
5. Methyl Parathion
6. Ethyl Paraoxon
7. Malathion
8. Fenitrothion
9. Ethyl Parathion
10. /
11. Chlordane-Trans
12. Chlordane-Cis + Alpha-Endrin
13. Dieldrin
14. Beta-Endosulfan
15. o,p'-DDT
16. p,p'-DDT
17. Tetradifon

Acknowledgement: **Prof. C. Bicchi, C.Brunelli et al.**, Università di Torino, Dipartimento di Scienza e Tecnologia del Farmaco, Via Pietro Giuria, 9 - Torino - Italy.

Food Packaging Residual Solvents

Column: **MEGA-VOC 2 FAST - 0.20mm, 1.00µm, 10m**
Catalog Code: F-VOC2-020-100-10



Conditions:

Injection: Split 250°C.
Detector: FID 250°C.
Oven Program: 35°C (0.5min), 15°C/min, 100°C.
Carrier Gas: Hydrogen, 50kPa.

1. Methanol
2. Ethanol
3. Isopropanol
4. Methyl Ethyl Ketone (MEK)
5. Ethyl Acetate
6. Isobutanol
7. Cyclohexane
8. 1-Methoxy-2-Propanol
9. Ethoxy Propanol
10. Isobutyl Acetate
11. n-Butyl Acetate

Analysis carried out with DANI Master GC.

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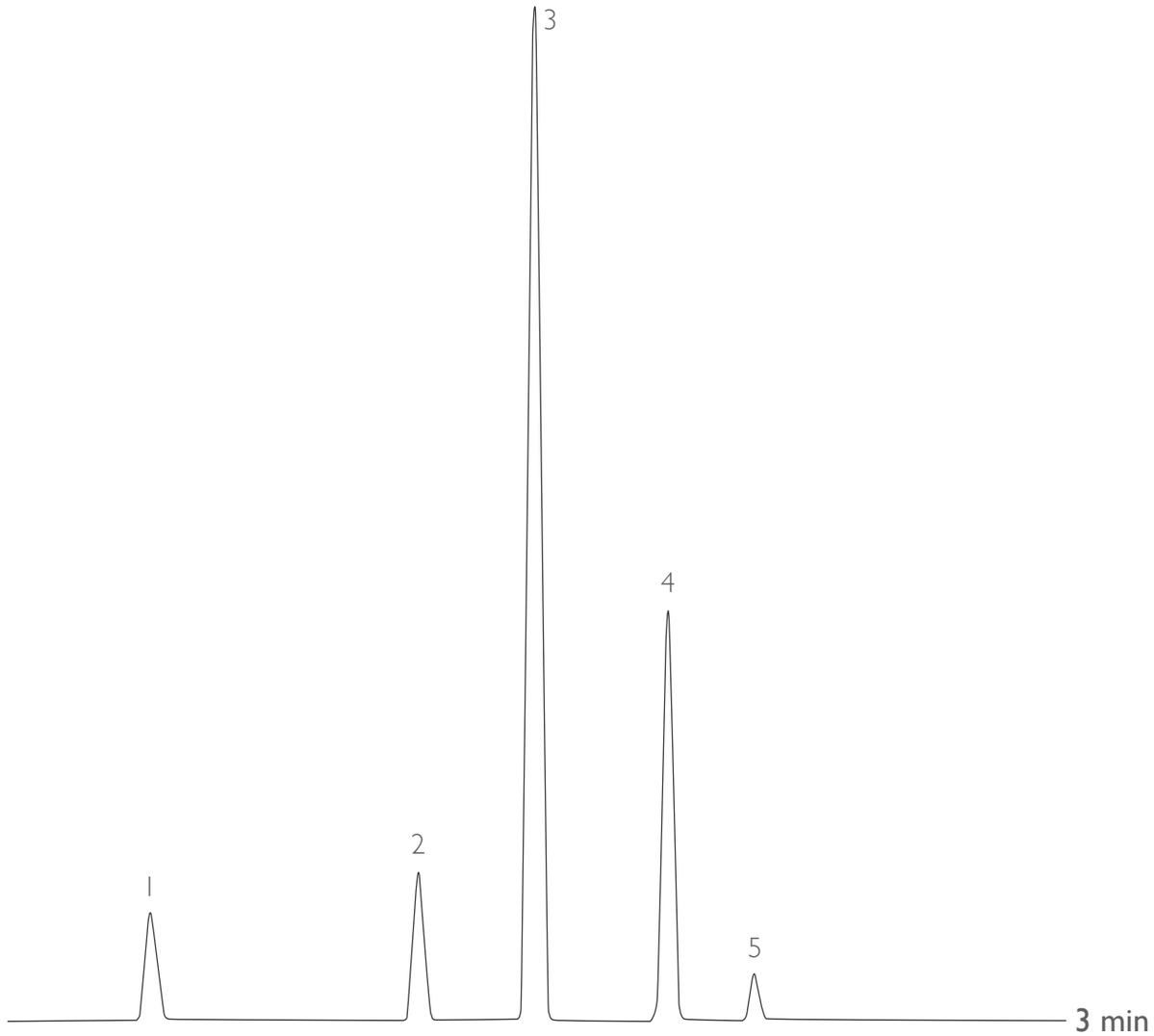
USP 467 Residual Solvents (OVIs) Headspace



Analysis carried out with DANI Master GC.

Column: **MEGA-624 FAST - 0.10mm, 0.45µm, 10m**
Catalog Code: F-624-010-045-10

(USP G43 phase)

Conditions:

Injection: Split 250°C, 0.5mL with Gas Syringe, 1:100 Split Ratio.
Sample: Headspace of Residual Solvents Mix, hold 45min @ 80°C.
Detector: FID 250°C.
Oven Program: 35°C, 15°C/min, 100°C.
Carrier Gas: Hydrogen, 0.4mL/min.

1. Methylene Chloride
2. Chloroform
3. Benzene
4. 1,1,1 - trichloroethylene
5. 1,4 - dioxane

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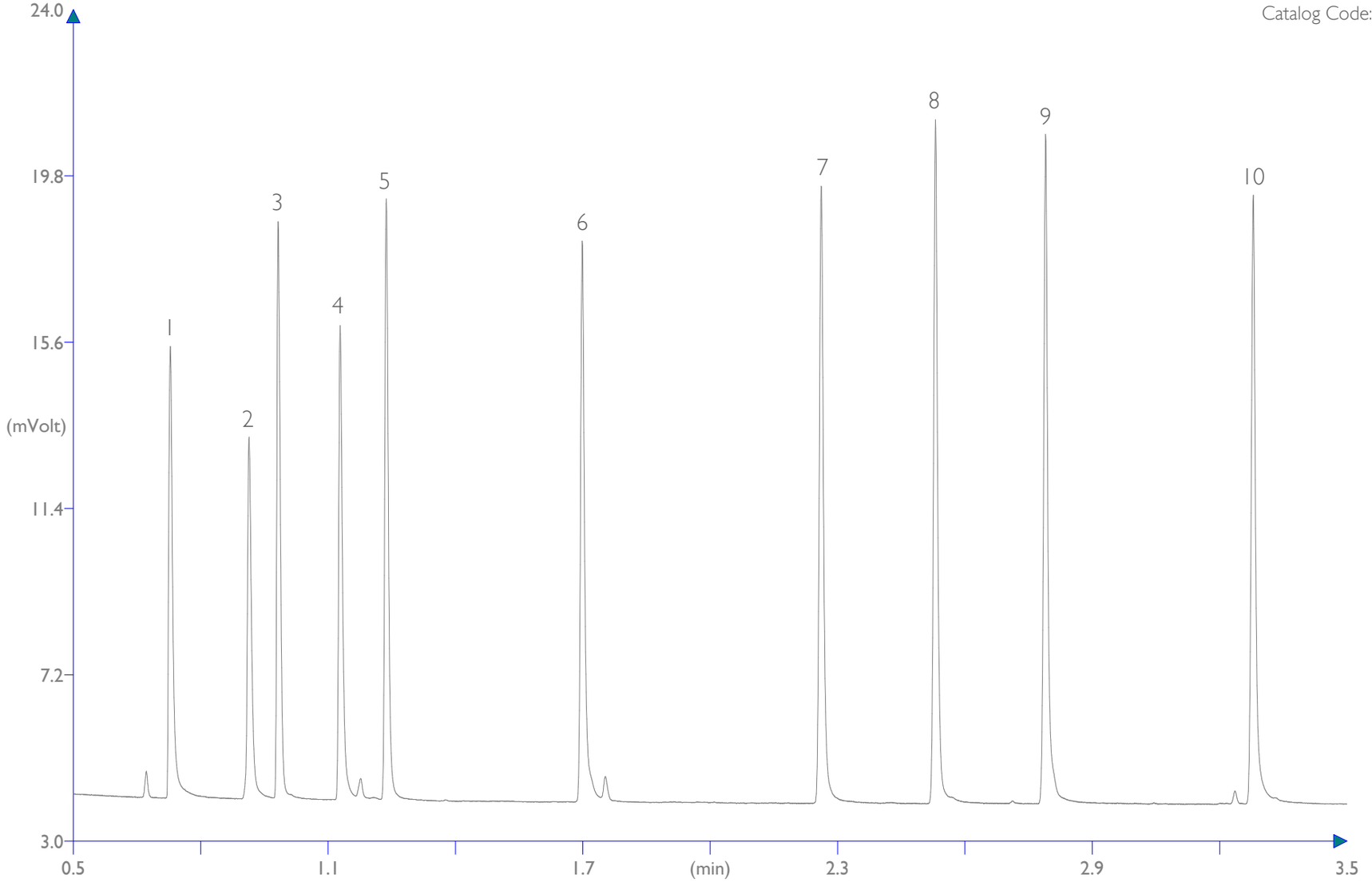
Free Fatty Acids

Column: **MEGA-ACID (FFAP) FAST - 0.10mm, 0.10µm, 5m**
Catalog Code: F-ACID-010-010-5



Conditions:

Injection: Split 250°C, 0.2µL, 80mL/min Split Flow.
Sample Dilution: from 28 to 46mg/100mL each component, sol. 50% Ethanol.
Detector: FID 250°C.
Oven Program: 80°C (0.1min), 40°C/min, 250°C.
Carrier Gas: Hydrogen, 130kPa.

1. Acetic Acid
2. Propionic Acid
3. Iso-Butyric Acid
4. Butyric Acid
5. Iso-Valeric Acid
6. Caproic Acid
7. Caprylic Acid
8. Nonanoic Acid
9. Decanoic Acid
10. Dodecanoic Acid

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Bibliography and acknowledgments

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