Rapid Separation of trans/cis Fatty Acid Methyl Esters with Agilent DB-FastFAME GC Column

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RAFA 2019

POSTER # C13

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Introduction

- The **analysis of oils, fat, and fat-containing food** is a common task in governmental, quality control (QC), or contract research organizations (CRO) laboratories.
- The GC analysis of fatty acids as their FAME derivatives is an important tool in the characterization of fats in the **determination of total fat and *trans*-fat content** in food.
- Many regulatory methods for testing foods such as edible oils require separation of **specific *cis/trans* fatty acid isomers** using a capillary column coated with a cyanopropyl stationary phase when determining fatty acid composition.
- **Traditionally, long GC columns (100 m) and long analysis times (more than 75 min),** are required to achieve good FAME separations.
- However, **this leads to high analysis costs and low productivity**.

- The **new Agilent J&W DB-FastFAME GC columns** with a specially engineered high-content cyanopropyl phase was designed for the fast separation of FAME mixtures, including *cis/trans* isomer separations, to meet the requirements of regulatory methods.
- This research work demonstrates **rapid analysis of FAME mixture using several DB-FastFAME** column configurations.

Experimental

Chemicals and Standards

- The **37-FAME mix** was purchased from a local supplier.
- Additional individual FAME standards were purchased individually and added to the 37-FAME mix to obtain the **57 FAME mixture**

Instrumentation

- The analyses were performed using an **Agilent 7890 GC** equipped with a flame ionization detector (FID).
- Sample introduction was done using an Agilent **7693A automatic liquid sampler** with 5 µL syringe.

GC Conditions

Method 1

Column	DB-FastFAME, **30 m** x 0.25 mm x 0.25 µm (p/n G3903-63011)
Carrier	Helium, 13.8 psi, constant pressure mode
Oven	50 °C (1 min), 25 °C/min to 175 °C, 4 °C/min to 230 °C (5 min)
Inlet	Split/Splitless, 250 °C, split ratio 50:1
FID	260 °C, H_2: 40 mL/min, Air: 400 mL/min
Injection	1 µL

Method 2

Column	DB-FastFAME, **60 m** x 0.25 mm x 0.25 µm (p/n G3903-63012)
Carrier	Helium, constant pressure, 35 psi
Oven	80 °C (1.5 min), 45 °C/min to 205 °C (11 min); 12 °C/min to 235 °C (10 min)
Inlet	260 °C, split/splitless mode split ratio: 15:1
FID	260 °C, H_2: 40 mL/min, Air: 400 mL/min
Injection	1 µL

Method 3

Column	DB-FastFAME, **90 m** x 0.25 mm x 0.25 µm (p/n G3903-63013)
Carrier	Helium, constant pressure, 40 psi
Oven	75 °C (1.5 min), 30 °C/min to 200 °C (5 min); 2.5 °C/min to 206 °C (1.5 min), 12 °C /min to 230 °C (30 min)
Inlet	260 °C, split/splitless mode split ratio: 15:1
FID	260 °C, H_2: 40 mL/min, Air: 400 mL/min
Injection	1 µL

Results

- **Figure 1** shows the separation of a traditional **37-FAME mix** using a **30-m** DB-FastFAME in **under 22 min**. This column is useful for **most nutritional FAME analysis, including cis/trans isomers**.
- **Figure 2** shows the separation of the same mix, plus additional conjugated Linoleic Acid (CLA, C18:2 c9, t11, and C18:2 t10,c12) with a **60m** DB-FastFAME **under 25 minutes**. This column is ideal for separation of **cis/trans isomers in the C18:2 and C18:3 region, including CLA isomers**.
- **Finally, figure 3** shows the separation of a **57-FAME mix**, including **positional cis/trans isomers in the C18:1, C18:2 and C18:3** region with a **90-m** DB-FastFAME GC column.

  This high-resolution column provides an **Rs value of 1.4 for the challenging C18:1 trans 11 and C18:1 cis 6 pair**, make it ideal for the **proper quantification of *trans* fat in food samples**.

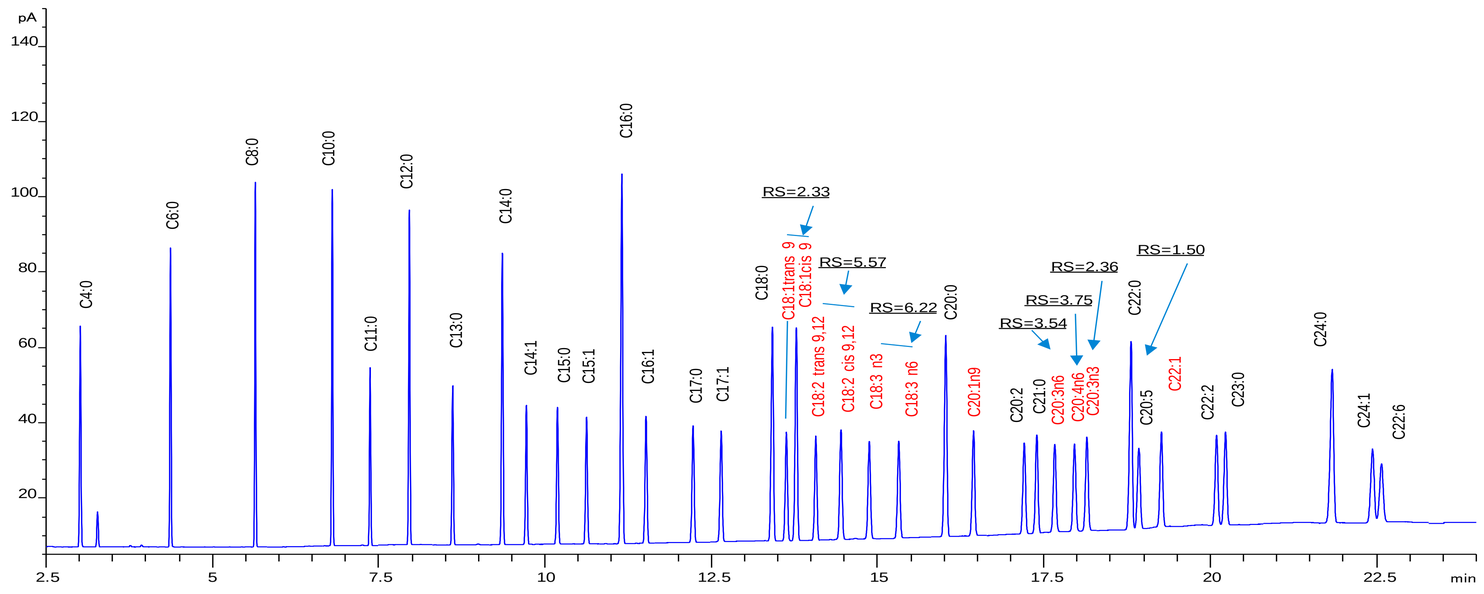

Figure 1. GC/FID chromatogram of 37-component FAME standard mixture on a 30m x 0.25mm i.d. x 25 m Agilent J&W DB-FastFAME using Method 1

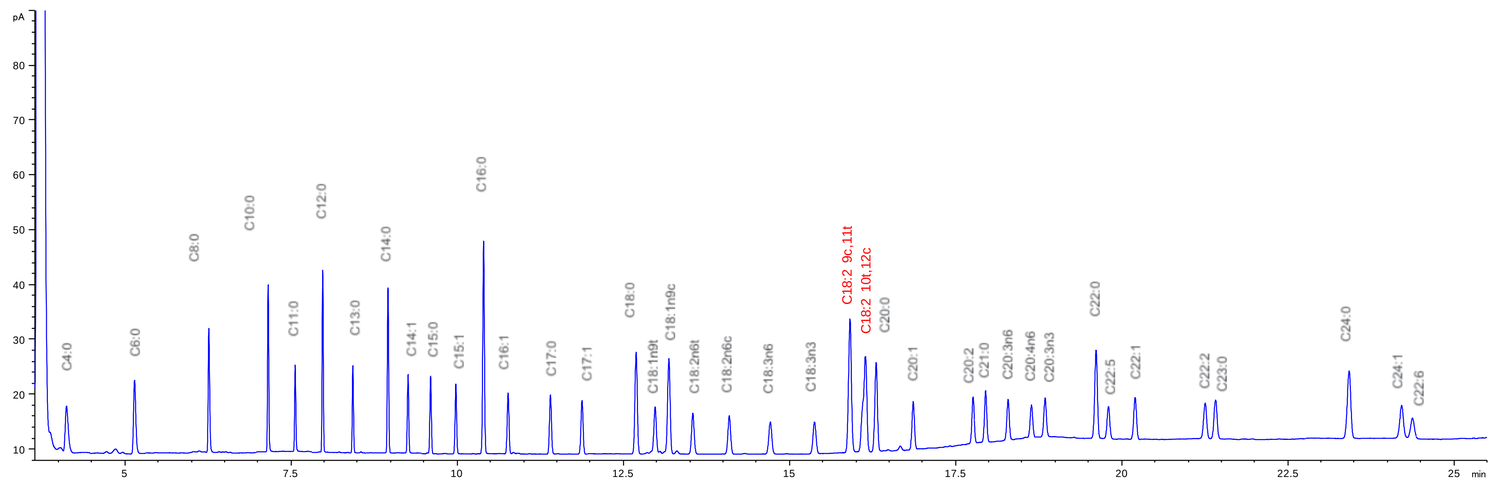

Figure 2. GC/FID chromatogram of 39-component FAME standard mixture on a 60m x 0.25mm i.d. x 25 m Agilent J&W DB-FastFAME using Method 2

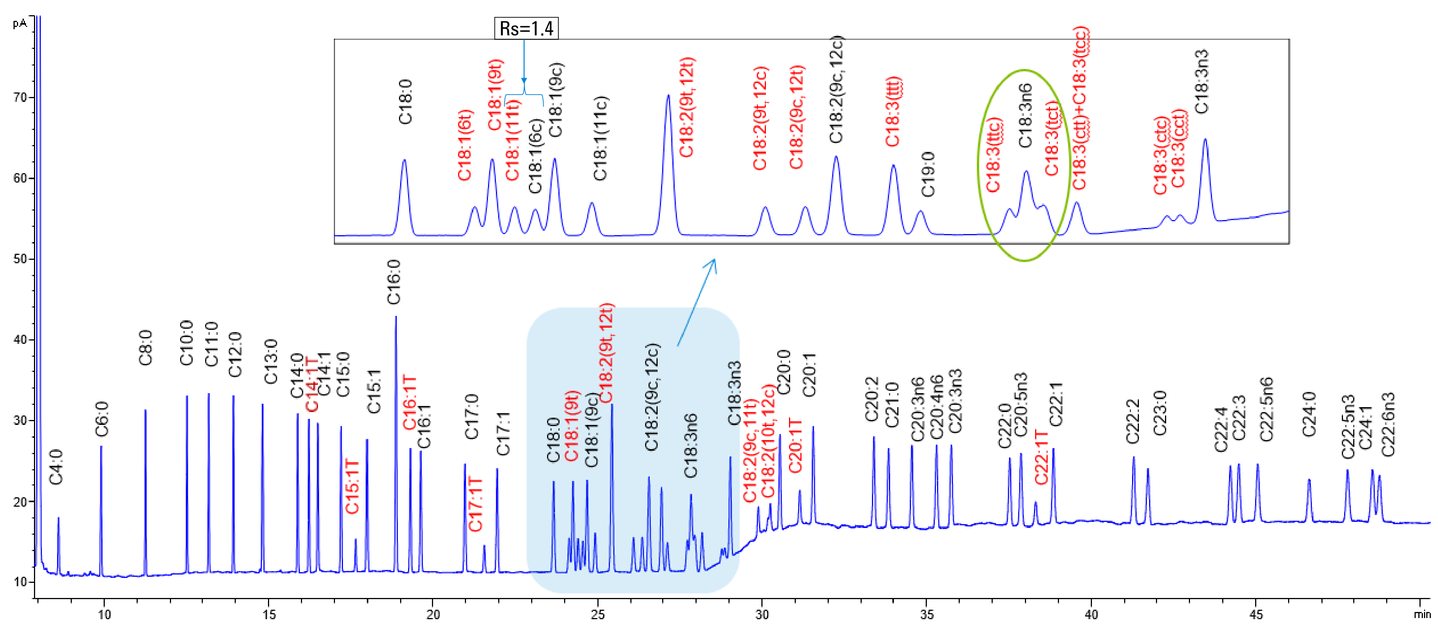

Figure 3. GC/FID chromatogram of 57-component FAME standard mixture on a 90m x 0.25mm i.d. x 25 m Agilent J&W DB-FastFAME using Method 3

Conclusions

- **DB-FastFAME GC columns** can provide rapid and **excellent separation of FAME mixtures**, with several dimensions available for specific applications.
  - The **30m DB-FastFAME** is ideal for **most nutritional FAME analysis**, including cis/trans separations in **22 min.**
- **The 60-m DB-FastFAME** is ideal for complex FAME analysis, including **CLA FAME isomers** in **under 25 min**,
- **and the 90-m DB-FastFAME** offers the highest resolution for **challenging positional cis/trans isomers** in **under 50 min**.

References

1. AOAC Official Methods for Analysis (2000), method Ce 2-66
2. IUPAC, Standard Methods for the Analysis of Oils, Fats and Derivatives, Blackwell Scientific Publications, IUPAC Method 2.301

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