

Trans Fatty Acids in fat and oil products – supelco solution and beyond



Nutrition Facts

Serving Size Entire Recipe 187g (187 g)

Amount Per Serving

Calories _____ Calories from Fat 31

% Daily Value*

Total Fat

Saturated Fat

Trans Fat

Cholesterol 0mg

8mg

20%

Supelco®

Analytical Products



One measure of the nutritional and health value of a food is its fat content. It is not only total fat, but also the type of fat that must be considered. Some 'good fats' are required for biochemical processes or necessary for dissolving fat-soluble vitamins. Other 'bad fats' interfere with biochemical processes or accumulate in the cardiovascular system, potentially leading to health problems. Currently, there is an increase in research into the safety and health effects of fatty acids and toward understanding their fundamental biochemistry.

Determining the fatty acid composition of a product may be difficult because foods can contain a complex mixture of saturated, monounsaturated and polyunsaturated fatty acids, each with a variety of carbon chain lengths.

In December 2020, FSSAI issued the restriction for trans fatty acid in fat and oil products. The actions to limit trans fatty acid (TFA) in foods to not more than 2% is in line with the WHO recommended practices in achieving a world free of industrially produced TFA by 2023.

Trans Fat Analysis

Because of the adverse health effects of trans fats, the United States Food and Drug Administration (FDA) requires that food manufacturers list trans fat content on the food's Nutrition Facts panel. These labeling requirements have placed added pressure on food analysts to process more samples, which in turn creates the need for a rapid analytical method.

SP-2560: The Best GC Phase Available for Detailed cis/trans FAME Analyses

Cis/trans selectivity increases with increasing column polarity (% of biscyanopropyl). The 100 m x 0.25 mm internal diameter (I.D.), 0.20 µm SP-2560 column is the longest, most polar column currently available. By combining both selectivity of the phase and column efficiency (by virtue of long column length), highly polar 100% biscyanopropyl SP-2560 capillary GC columns provide high resolution cis/trans FAME isomer separation. The SP-2560 column is specified in the Association of Official Analytical Chemists (AOAC) cis/trans FAME method as well as method IS 10633 : 2017 of Bureau of Indian Standards (BIS)

Analytical Challenge: Improved Throughput of Detailed cis/trans FAME Analyses

To increase throughput of the detailed cis/trans FAME analysis, Fast GC principles were applied by reducing column length, column I.D., film thickness, and carrier gas viscosity. The result is a significant reduction in analysis time compared to the 100 m column method: 30% reduction of the 37-component FAME sample (Figures 1 and 2), and nearly 50% reduction of the detailed analysis of the C18 isomer mix (Figures 3 and 4). Note that in both cases, peak shape and resolution does not suffer, even with the shorter analysis times.

FAME standard Mix composition (CRM47885)

Butyric Acid Methyl Ester (C4:0) at 4 wt %
Caproic Acid Methyl Ester (C6:0) at 4 wt %
Caprylic Acid Methyl Ester (C8:0) at 4 wt %
Capric Acid Methyl Ester (C10:0) at 4 wt %
Undecanoic Acid Methyl Ester (C11:0) at 2 wt %
Lauric Acid Methyl Ester (C12:0) at 4 wt %
Tridecanoic Acid Methyl Ester (C13:0) at 2 wt %
Myristic Acid Methyl Ester (C14:0) at 4 wt %
Myristoleic Acid Methyl Ester (C14:1) at 2 wt %
Pentadecanoic Acid Methyl Ester (C15:0) at 2 wt %
cis-10-Pentadecenoic Acid Methyl Ester (C15:1) at 2 wt %
Palmitic Acid Methyl Ester (C16:0) at 6 wt %
Palmitoleic Acid Methyl Ester (C16:1) at 2 wt %
Heptadecanoic Acid Methyl Ester (C17:0) at 2 wt %
cis-10-Heptadecenoic Acid Methyl Ester (C17:1) at 2 wt %
Stearic Acid Methyl Ester (C18:0) at 4 wt %

FAME standard Mix composition (CRM47885)

Oleic Acid Methyl Ester (C18:1n9c) at 4 wt %
Elaidic Acid Methyl Ester (C18:1n9t) at 2 wt %
Linoleic Acid Methyl Ester (C18:2n6c) at 2 wt %
Linolelaidic Acid Methyl Ester (C18:2n6t) at 2 wt %
Linolenic Acid Methyl Ester (C18:3n6) at 2 wt %
Linolenic Acid Methyl Ester (C18:3n3) at 2 wt %
Arachidic Acid Methyl Ester (C20:0) at 4 wt %
cis-11-Eicosenoic Acid Methyl Ester (C20:1n9) at 2 wt %
cis-11,14-Eicosadienoic Acid Methyl Ester (C20:2) at 2 wt %
cis-8,11,14-Eicosatrienoic Acid Methyl Ester (C20:3n6) at 2 wt %
cis-11,14,17-Eicosatrienoic Acid Methyl Ester (C20:3n3) at 2 wt %
Arachidonic Acid Methyl Ester (C20:4n6) at 2 wt %
cis-5,8,11,14,17-Eicosapentaenoic Acid Methyl Ester (C20:5n3) at 2 wt %
Heneicosanoic Acid Methyl Ester (C21:0) at 2 wt %
Behenic Acid Methyl Ester (C22:0) at 4 wt %
Erucic Acid Methyl Ester (C22:1n9) at 2 wt %
cis-13,16-Docosadienoic Acid Methyl Ester (C22:2) at 2 wt %
cis-4,7,10,13,16,19-Docosahexaenoic Acid Methyl Ester (C22:6n3) at 2 wt %
Tricosanoic Acid Methyl Ester (C23:0) at 2 wt %
Lignoceric Acid Methyl Ester (C24:0) at 4 wt %
Nervonic Acid Methyl Ester (C24:1n9) at 2 wt %

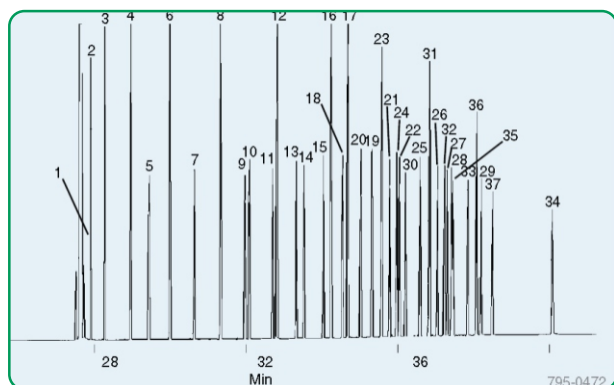


Fig.1 37-Component FAME Mix on the 100 m SP-2560 Column

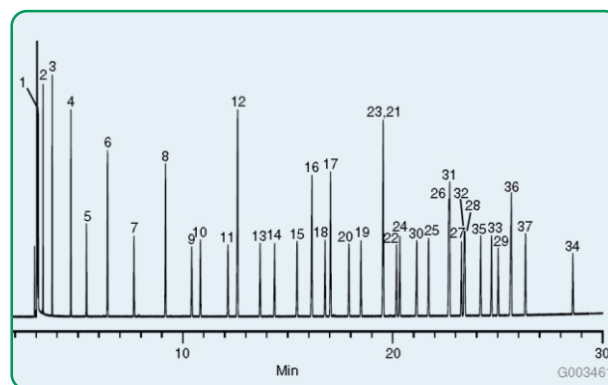


Fig.2 37-Component FAME Mix on the 75 m SP-2560 Column

column: SP-2560, 100m x 0.25mm I.D., 0.20 μ m (24056)

oven: 140 $^{\circ}$ C (5 min.), 4 $^{\circ}$ C/min. to 240 $^{\circ}$ C (15 min.)

inj.: 250 $^{\circ}$ C

det.: FID, 260 $^{\circ}$ C

carrier gas: helium, 20 cm/sec @ 175 $^{\circ}$ C

injection: 1 μ L, 100:1 split

sample: Supelco 37-Component FAME Mix (47885-U), analytes at concentrations indicated in methylene chloride

column: SP-2560, 75 m x 0.18 mm I.D., 0.14 μ m (23348)

oven: 140 $^{\circ}$ C (5 min.), 4 $^{\circ}$ C/min. to 240 $^{\circ}$ C (2 min.)

inj.: 250 $^{\circ}$ C

det.: FID, 250 $^{\circ}$ C

carrier gas: hydrogen, 40 cm/sec @ 175 $^{\circ}$ C

injection: 1 μ L, 100:1 split

liner: 4 mm I.D, split, cup design

sample: Supelco 37-Component FAME Mix (47885-U), analytes at concentrations indicated in methylene chloride

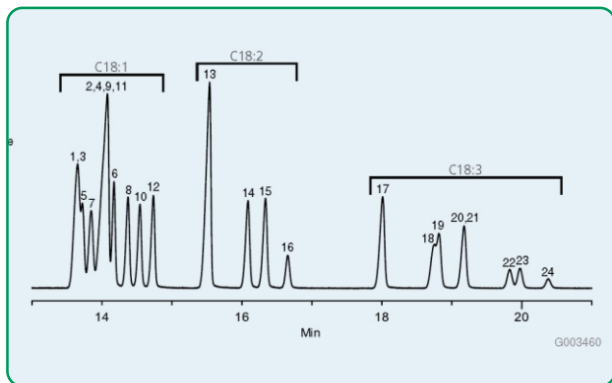


Fig 3 Detailed Analysis of C18 FAME Isomers on the 75 m SP-2560 Column

column: SP-2560, 75 m x 0.18 mm I.D., 0.14 μ m (24056)
 oven: 180 $^{\circ}$ C
 inj.: 220 $^{\circ}$ C
 det.: FID, 220 $^{\circ}$ C
 carrier gas: hydrogen, 25 cm/sec @ 180 $^{\circ}$ C
 injection: 0.5 μ L, 100 : 1 split
 Liner: 4 mm I.D., split, cup design
 sample: Mixture of C18 : 1, C18 : 2, and C18:3 FAMES in methylene chloride

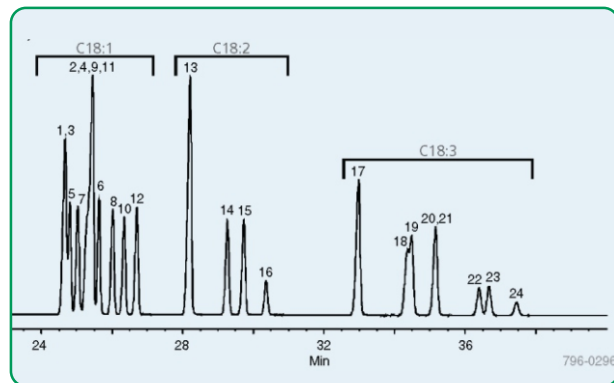


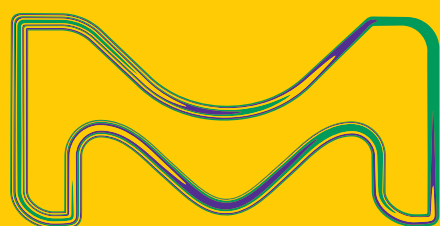
Fig 4 Detailed Analysis of C18 FAME Isomers on the 100 m SP-2560 Column

column: SP-2560, 100 m x 0.25 mm I.D., 0.20 μ m (24056)
 oven: 175 $^{\circ}$ C
 inj.: 210 $^{\circ}$ C
 det.: FID, 250 $^{\circ}$ C
 carrier gas: helium, 20 cm/sec @ 175 $^{\circ}$ C
 injection: 1.0 μ L, 100:1 split
 sample: Mixture of C18:1, C18:2, and C18:3 FAMES in methylene chloride

In both examples shown here, the loss of total theoretical plates by reducing the column length from 100 m to 75 m is offset by the narrower column I.D. (0.18 vs. 0.25 mm), thinner film (0.14 vs. 0.20 μ m) and the higher diffusivity, lower viscosity carrier gas (hydrogen vs. helium). Simply put, the 75 m x 0.18 mm I.D. SP-2560 column does what the 100 m x 0.25 mm I.D. column does, but in a much shorter time. The 0.18 mm I.D. column is compatible with both conventional and Fast GC instruments.

Conclusion

Supelco offers food analysts performing detailed cis/ trans FAME analyses solutions in terms of both resolving power and speed. The 100 m SP-2560 column provides excellent resolution and is a workhorse column for detailed cis/trans FAME analyses. Now, for analysts interested in improving throughput, a Fast GC version SP-2560 column in 75 m x 0.18 mm, 0.14 μ m dimensions, offered exclusively by Supelco, provides both the high resolution and high speed needed to achieve high throughput with detailed cis/trans FAME analyses.



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