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Analysis of Cis and Trans Fatty Acid Methyl Esters from Margarine by Capillary Gas Chromatography

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There is speculation that consumption of trans fatty acids increases LDL ("bad") cholesterol and decreases HDL ("good") cholesterol. Partially hydrogenated oils used in foods contain trans fats. The FDA mandated the labeling of trans fat content in all processed foods sold beginning in January 2006. This application note will demonstrate the separation of cis and trans isomers of unsaturated FAMES from margarine on a 100% cyanopropyl-substituted sili-cone stationary phase column.

The analysis of triglycerides from edible fats and oils is typically accomplished by gas chromatography after derivatization of the triglycerides into fatty acid methyl esters (FAMES). There are many published methods for this derivatization, for example AOCS Official Method Ce 2-66. One step transesterification reagents, such as Meth-Prep™ 2, may also be used to convert triglycerides to FAMES. Partially hydrogenated vegetable oils, such as those used to make margarine, may contain trans fatty acids. The cis fatty acids are naturally occurring in edible oils used in food. Separation of cis and trans isomers by gas chromatography is best accomplished with a highly polar stationary phase with a high cyanopropyl content, as the cis-isomer has a stronger affinity for the cyano dipole than the trans-isomer, which causes the trans-isomer to elute before the cis-isomer.

Experimental Conditions

GC Column: Alltech® Heliflex® AT™ Silar™ 100, 100 m × 0.25 mm × 0.20 μm (Part No. 12643)
Oven Temp: 180 °C, Carrier: Helium at 1 mL/min (20 cm/s),
Detector: FID at 250°C, Sample: Margarine-Converted to FAMES via Meth-Prep™ 2 Reagent (Part No. 18007).

Results and Conclusion

The separation of FAMES from margarine per conditions described in AOCS Official Method Ce 1h-05 is shown in Figure 1. This analysis has taken on increased importance since the FDA directive regarding labeling of trans fat in processed foods went into effect in January 2006. Capillary columns coated with a stationary phase containing a high cyanopropyl content are highly effective for the separation of saturated and various degrees of unsaturated FAMES.

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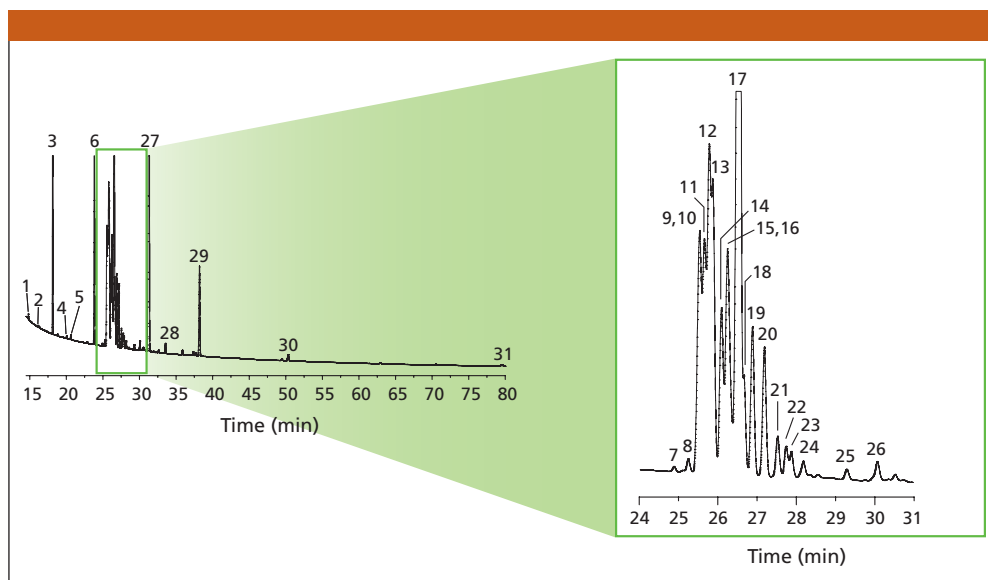


Figure 1: Margarine FAMES on 100 meter AT Silar 100 Column. 1. Me C14:0, 2. Me C15:0, 3. Me C16:0, 4. Me C16:1 (9 cis), 5. Me C17:0, 6. Me C18:0, 7. Me C18:1 (4 trans), 8. Me C18:1 (5 trans), 9. Me C18:1 (6 trans), 10. Me C18:1 (8 trans), 11. Me C18:1 (9 trans), 12. Me C18:1 (10 trans), 13. Me C18:1 (11 trans), 14. Me C18:1 (12 trans), 15. Me C18:1 (13 trans), 16. Me C18:1 (14 trans), 17. Me C18:1 (9 cis), 18. Me C18:1 (10 cis), 19. Me C18:1 (11 cis), 20. Me C18:1 (12 cis), 21. Me C18:1 (13 cis), 22. Me C18:1 (16 trans), 23. Me C18:1 (14 cis), 24. Me C18:1 (15 cis), 25. Me C18:2 (9 cis, 13 trans), 26. Me C18:2 (9 cis, 12 trans), 27. Me C18:2 (9 cis, 12 cis), 28. Me C20:0, 29. Me C18:3 (9 cis, 12 cis, 15 cis), 30. Me C22:0, 31. Me C24:0

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