

ANALYSIS OF OMEGA-3 FATTY ACIDS USING A HIGHLY SELECTIVE GC CAPILLARY COLUMN

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Introduction

Fats are contained in a large number of foods that are consumed in the diets of many people. While certain fats are contributors to heart disease, not all fats are detrimental. Omega 3 fatty acids are part of a class of unsaturated fatty acids and are a healthy dietary supplement. Fish is regarded as healthy due to the recognised beneficial attributes of fish oils. These fish oils provide many nutritionally important classes of fatty acids, including Omega 3 fatty acids, which have an important role in retarding heart disease. Omega 3 fatty acids have been found to lower cholesterol in the blood and therefore help lower the risk of heart disease. For this reason, Omega-3 fatty acids are used in enriched foods and health food supplements. An important requirement is to be able to analyse the content of these products for consumer safety and information.

Analysis

The analysis of fatty acids in food is typically as Fatty Acid Methyl Ester (FAME). The free fatty acids are difficult to analyse by gas chromatography (GC) because of their poor peak shape and quantitation. This poor peak shape is due mainly to the acid functionality of the long chain fatty acid and the interaction with the capillary column phase. Esterification of the fatty acid prior to analysis avoids these problems as the esterified compound gives better peak shape, neutral pH, more reproducible quantitation and improved separation of the large number of cis/trans and structural isomers. Figure 1 shows the structure of one of the major Omega-3 fatty acids: alpha-linolenic acid (LNA), and the esterification of the Omega-3 fatty acid to the methyl ester.

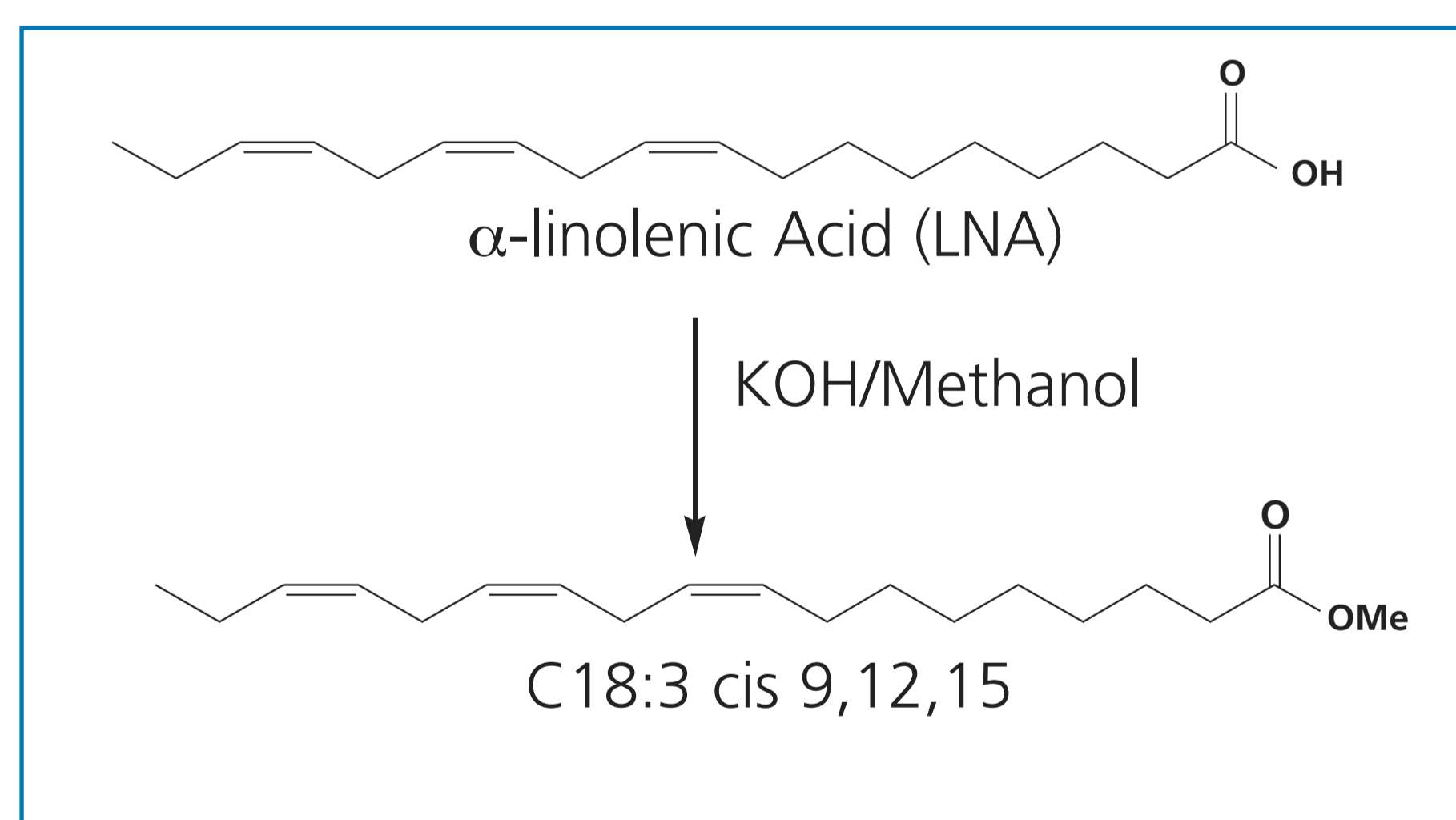


Figure 1. Structure of alpha linolenic acid, a major Omega-3 fatty acid, and its esterification to the methyl ester.

Analysis by GC requires an extremely polar phase capillary column to achieve the desired separation of the numerous isomers of FAME compounds. The SGE BPX70 column is a cyanopropyl phase that is specifically designed for the analysis of FAME compounds. Thermally stable to 260°C, the BPX70 can easily elute the high boiling FAME compounds without damage to the stationary phase.

FAME compounds are very sensitive to changes in column polarity resulting in coelutions or complete changes in elution order of some components.

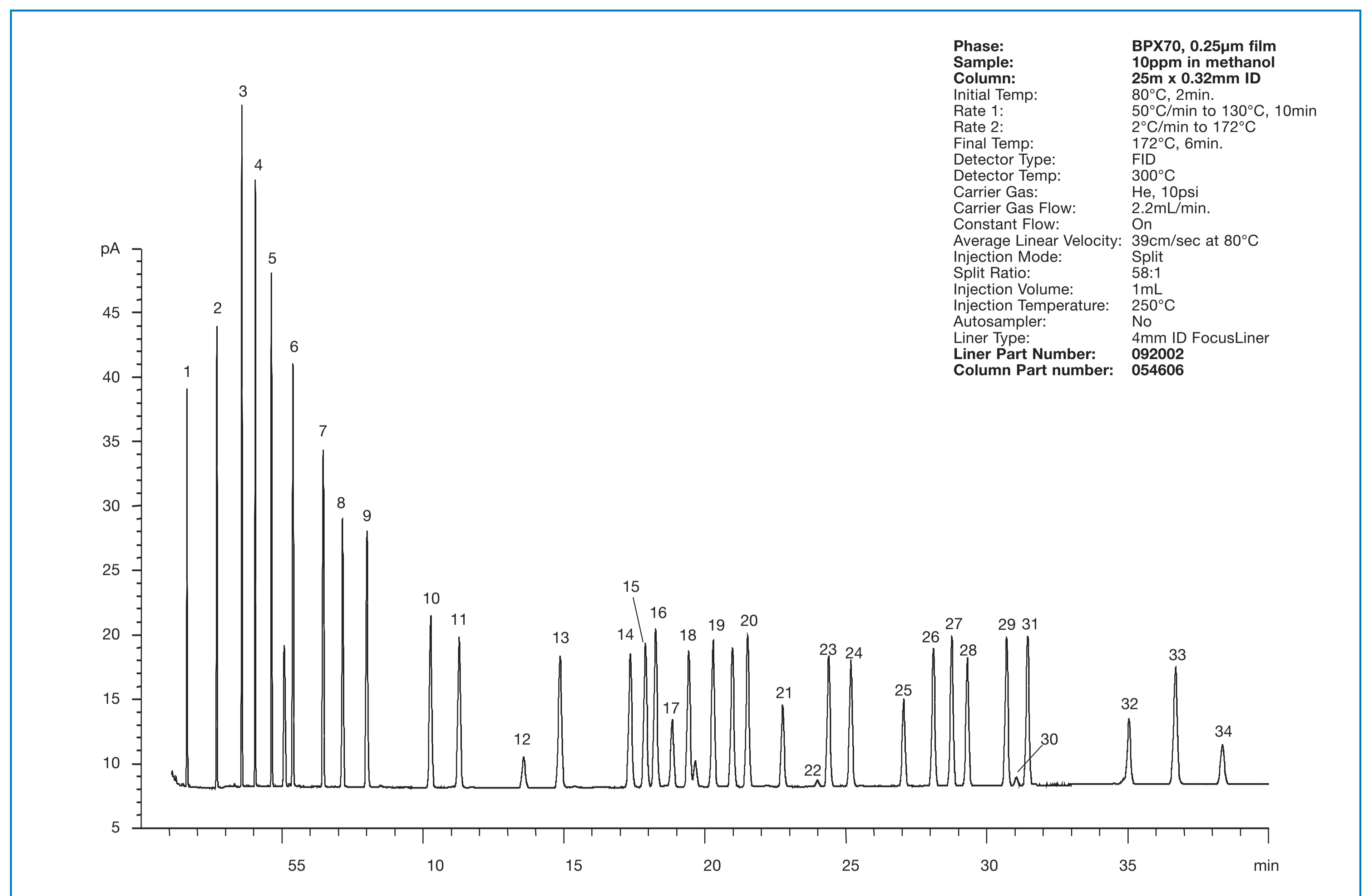


Figure 2. The chromatogram shows the excellent separation of a complex mixture of FAME compounds. Note the excellent peak shape and separation of the Omega-1,2 and 3 fatty acid isomers both structural and cis and trans.

Components	9. C15	18. C18:2 trans 9, 12	27. C20:4 cis 5, 8, 11, 14
1. C6	10. C16	19. C18:2 cis 9, 12	28. C20:3 cis 11, 14, 17
2. C8	11. C16:1 cis 9	20. C18:3 cis 6, 9, 12	29. C22
3. C10	12. C17	21. C18:3 cis 9, 12, 15	30. C20:5 cis 5, 8, 11, 14, 17
4. C11	13. C17:1 cis 10	22. C18:4 Cis 6, 9, 12, 15	31. C22:1 cis 13
5. C12	14. C18	23. C20	32. C22:4 cis 7, 10, 13, 16
6. C13	15. C18:1 trans 9	24. C21:1 cis 11	33. C24
7. C14	16. C18:1 cis 9	25. C20:2 cis 11,14	34. C22:6 cis 4,7,10,13,16,19
8. C14:1 cis 9	17. C18:1 cis 12	26. C20:3 cis 8, 11,14	

The BPX70 column gives a unique separation of the FAME compounds and can easily distinguish between the complex mixtures of Omega-3 fatty acids that are regularly screened in food laboratories.

Figure 2 shows a chromatogram of a complex mixture of 34 FAME compounds that are regularly screened in many food substances. Note the excellent peak shape and separation with no coelutions present in this complex mixture. All components are baseline resolved, in particular the C18:1cis/trans, C18:2, C18:3 and C20:3 structural isomers. Note also the excellent separation of C20:5 (peak 30) and C22:1 (31), two of the more difficult-to-resolve components. This chromatogram demonstrates the unique separation properties of the SGE BPX70 column for complex FAME compounds.

Summary

The BPX70 capillary column gives unparalleled separation of complex FAME compounds. Difficult-to-separate cis/trans and structural isomers are easily baseline resolved making quantitation easy and reproducible. Thermally stable, the BPX70 capillary column easily elutes high boiling FAME compounds making it the first choice column for FAME analyses.

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