FOOD ANALYSIS

HIGH THROUGHPUT ANALYSIS OF MOSH AND MOAH IN FOOD AND PACKAGING

Fully automated Agilent LC-GC solution with intelligent CHRONECT®LC-GC coupling

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ABSTRACT

The determination of mineral oil contaminants in foodstuffs and packaging becomes increasingly important as components of mineral oil are suspected of causing cancer. In contrast to conventional GC methods, the Agilent online LC-GC solution allows for the separation and quantitation of both MOSH and MOAH fractions within one chromatographic run of 30 minutes.

INTRODUCTION

This innovative solution is the result of a successful collaboration between SIM Scientific Instruments Manufacturer GmbH and Axel Semrau®, who optimized the original LC-GC method[1] by developing the module CHRONECT®LC-GC. By combining LC and GC separation with a special valve set up, it is possible to determine the MOSH and MOAH fractions within one single analysis.

SIM Scientific Instruments Manufacturer GmbH

Agilent Technologies
Premier Solution Partner

SIM GmbH can now offer this MOSH/MOAH Analyzer as a complete solution with proven Agilent LC and GC instrumentation and software. This combination delivers the foundation for a reliable and robust solution for the determination of mineral oil fractions in routine analysis. The key component of the system is the CHRONECT®LC-GC coupling developed by Axel Semrau®.

It consists of an intelligent valve setup with retention gap technique and solvent vapor exit to transfer both fractions of interest (450 µL each) from the LC to the GC system without any sample discrimination. This enables low limits of quantitation (LOQ) to be achieved e. g. for rice and noodles 0.5 mg/kg for MOSH and MOAH each. In order to double the sample throughput and to cut the solvent consumption in half, two FID channels in the GC are used in parallel. This significantly reduces the cost per sample.

Advantages of the online LC-GC System for MOSH and MOAH analysis:

- High sample throughput
- High degree of automation
- No risk of contamination
- Excellent reproducibility
- Optimum sensitivity
- 24/7 routine analysis
- Expandable to further applications (sterols, PAHs)

[1] Biedermann, M., Fiselier, K., and Grob, K., J. Agric. Food Chem. 2009, 57, 8711-8721

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MOSH/MOAH Contamination of Foodstuff

Contamination of food with mineral oils may occur by contamination of the raw materials, during the food manufacturing process or by the migration of mineral oil components from packaging materials (recycled cardboard) into the food. Mineral oil fractions of concern are mainly low molecular weight compounds (C16-C24), with the major portion being Mineral Oil Saturated Hydrocarbons (MOSH). About 15-20 % of the mineral oil fraction can be composed on Mineral Oil Aromatic Hydrocarbons (MOAH). According to the German Federal Institute for Risk Assessment (Bundesinstitut für Risikobewertung – BfR) the intake of MOSH should be reduced to a minimum and the intake of MOAH should entirely be avoided since it cannot be ruled out that this fraction does not contain carcinogenic compounds.

Application

Sample preparation is performed as described in the relevant literature. The essential step is the extraction of the sample with hexane. Depending on the sample matrix, desired sensitivity and moisture or fat content, the extraction has to be modified to eliminate biogenic hydrocarbons and the food's own olefins (for complex matrices like tea, chocolate, vegetable oils this can be done by pre-separation using activated alumina or epoxidation).

The original method requires two separate injections of the same sample in order to determine MOSH in the first run and MOAH in the second run. In the online LC-GC method, the normal phase liquid chromatography works as a sample preparation step to separate the MOSH and MOAH fractions as well as the interfering lipid and matrix components. Subsequently, the separated MOSH and MOAH fractions are transferred to the GC. By means of a valve setup with intelligent software and valve control, both fractions are determined by parallel detection using two FIDs with subsequent data analysis.

The LC-GC-analysis of a single sample lasting 30 minutes is shown in 3 chromatograms:

- The HPLC UV detector signal (Figure 1)
- The FID signal of the MOSH fraction (green trace in Figure 2)
- The FID signal of the MOAH fraction (black trace in Figure 2)

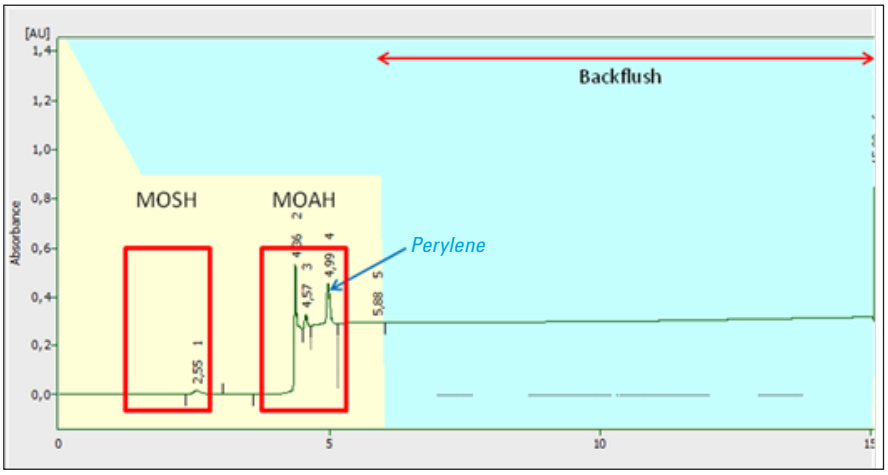

Figure 1: HPLC chromatogram with the marked MOSH and MOAH fractions which are transferred to the GC system

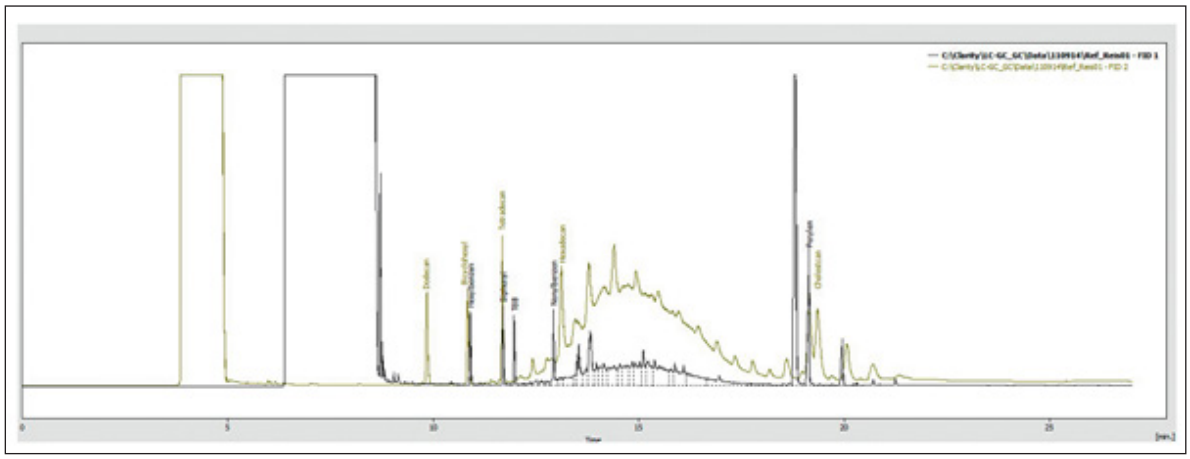

Figure 2: GC injection of a contaminated rice sample and the resulting signals from the MOSH (green) and MOAH (black) channel

Agilent LC-GC MOSH/MOAH Analyzer

The LC-GC analyzer consists of:

- Agilent 1260 Infinity LC with binary pump, UV detector and degasser
- CTC PAL autosampler
- Agilent 7890B GC with two FIDs for the simultaneous determination of the MOSH and MOAH fractions
- CHRONECT®LC-GC interface for the simultaneous coupling of two channels
- Chromatographic Data System with control and evaluation software (Chronos and OpenLAB CDS ChemStation)
- Accessories and consumables

The system is preassembled in the manufacturer's laboratory, configured with columns and analytical method, tested and delivered "ready to analyze". This reduces start-up time and verification of chromatographic performance at installation.

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