neotron
Part of the Cotecna Group

Mineral Oil Hydrocarbons (MOH) in Food

The **Mineral Oil Hydrocarbons (MOH) definition includes a large group of mixtures of hydrocarbons** containing thousands of chemical compounds of different structures and size, derived mainly from crude oil but also produced synthetically from coal, natural gas and biomass.

There are **several possible sources of MOH contamination into food**: mainly food packaging materials, food additives, processing aids and environmental contaminants such as lubricants. The contamination can occur both from raw materials and at various stages of food production, including transportation and storage.

MOSH Mineral Oil Saturated Hydrocarbons

MOSH include open chain and commonly branched hydrocarbons (e.g. alkanes) and naphthene-like cyclic hydrocarbons (cycloalkanes)

MOAH Mineral Oil Aromatic Hydrocarbons

MOAH are highly alkylated mono- and/or poly-aromatic rings

The MOSH results may include several compounds so-called **MOSH analogues** cannot be separated analytically:

- **POSH** = Polymer Olimeric Saturated Hydrocarbons, chemically similar to MOSH from polyolephynes (PE,PP)
- **PAO** = Polyalphaolefins: components in synthetic lubricants and hot melt adhesives
- **MORE** = Mineral Oil Refined Products such us paraffin-like waxes

Reference News

In April 2022 the EU Standing Committee on Plants, Animals, Food and Feed (SC PAFF), published the draft harmonised approach for handling findings of aromatic mineral oil hydrocarbons (MOAH) in food. An update version was published in October 2022.

In order to ensure a uniform enforcement approach throughout the EU, the Member States agreed to withdraw and, if necessary, to recall products from the market, when the sum of the concentrations of MOAH in food are at or above the following maximum LOQs:

- *0.5 mg/kg for dry foods with a low fat/oil content (≤ 4% fat/oil)*
- *1 mg/kg for foods with a higher fat/oil content (> 4% fat/oil, ≤ 50 % fat/oil)*
- *2 mg/kg fats/oils and foods with > 50% fat/oil*

In February 2019, the EU Commission's Joint Research Centre (JRC) published a "Guidance on sampling, analysis and data reporting for the monitoring of mineral oil hydrocarbons in food and food contact materials". The second edition of the guideline was published in 2023.

In March 2023 the EFSA's Unit on Feed and Contaminants has launched a public consultation on the draft scientific opinion on the update of the risk assessment of mineral oil hydrocarbons in food.

Quantitative Analysis of MOSH & MOAH in Food

The determination of MOH is carried out by online LC-GC-FID. The sample to be examined, added with Internal Standards (IS), is extracted with n-hexane and, depending on the matrix, different pre-treatments and purification steps can be applied before the instrumental analysis.

Considering fatty foods or vegetable oils and fats, an hot saponification before the extraction and an epoxidation with m-CPBA after the extraction are applied to minimize the possible interferences due to fatty matters and natural compounds. For the same purpose, also additional clean-up with activated silica or aluminium oxide are applied.

The MOSH and MOAH quantified fractions are detected as request by JRC guidance 2019 with different limit of quantification on the basis to the different matrices:

Cereals: *LQ = 0.5 mg/kg (for each fraction)*
Oil and fat: *LQ = 1 – 2 mg/kg (for each fraction)*
Other food: *LQ = 0.5 - 1 mg/kg (for each fraction)*
Paper & cardboard: *LQ = 5.0 mg/kg (for each fraction)*

MOSH as CyCy	MOAH as 1MN or TBB
MOSH C10-C16	MOAH C10-C16
MOSH C16-C25	MOSH C16-C25
MOSH C25-C35	MOSH C25-C35
MOSH C35-C40	MOSH C35-C40
MOSH C40-C50	
MOSH C10-C50 *total integration*	MOSH C10-C50 *total integration*

Sampling

To prevent contamination of the samples during sampling and protect them during transport, we suggest the use of glass or PET containers and the application of aluminium foil.

Reliability and Innovation

Neotron collaborated at European work tables for the optimization of methods for the analysis of MOH in different applications: MOAH in Infant Formula organized by JRC and MOH in vegetables oils for the revision of method EN 16995- 2017 organized by ITERG and Max Rubner-Institut.

We participate annually in Proficiency tests organized by DRRR (German Reference Office for Proficiency testing & Reference materials), DGF-German Society for Fat Science, COI and JRC.

Accredia Accreditation by **ISO 17025** ensures reliability and accuracy in analytical results.

MOSH/MOAH Characterization: GCxGC-TOFMS

Since FID is not a selective detector, as reported in EFSA Opinion of 2012 and in JRC guidance, additional techniques have to be applied for the verification in case of suspected interferences. Considering GCxGC one of the most effective way to distinguish the different MOH subclasses, we developed an application in two-dimensional separation coupled with TOF mass spectrometry (GCxGC-TOFMS) as confirmatory technique for MOSH&MOAH qualitative characterization to identify typical markers (e.g. DIPNs, hopanes, steranes) and avoid false positive results.

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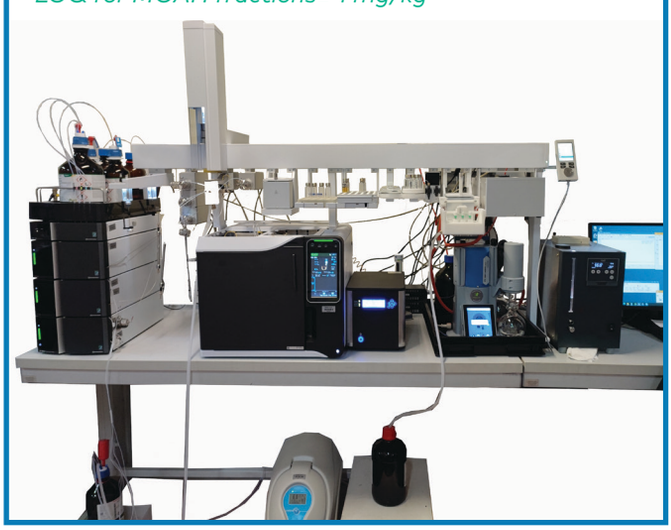
New equipment for MOSH/MOAH analysis by LC-GC-FID with automated workflow for sample preparation, utilizing saponification and new performic acid epoxidation to increase the sensitivity and reducing the time of analysis for vegetable oil.
LOQ for MOAH fractions= 1 mg/kg



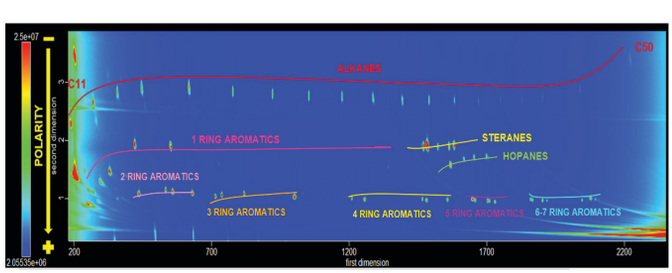


Fig.1: GCxGC-TOFMS chromatogram, where the contour plots of various classes of characteristic markers are highlighted.

Find more information or contact us at
www.neotron.it

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