



# MOSH/MOAH – QUESTIONS AND ANSWERS

## WHAT IS MOSH/MOAH?

MOSH/MOAH is the umbrella term describing mineral oil hydrocarbons that can migrate from packaging materials into foodstuffs during transportation and production. MOSH and MOAH are acronyms specifying complex mixtures consisting of a variety of chemical components:

■ **MOSH:**  
Mineral oil saturated hydrocarbons

■ **MOAH:**  
Mineral oil aromatic hydrocarbons

MOSH represents the general category of saturated aliphatic and cyclic hydrocarbons. There are two specific groups of saturated hydrocarbons under MOSH known as POSH (polyolefin oligomeric

saturated hydrocarbons) and PAO (poly alpha olefins). POSH, which are oligomers from polyolefins, can migrate. PAO, as isoparaffins, have found widespread application in products such as adhesives (e.g. hot melts) and as lubricants in the food industry or in synthetic engine lubricating oils. The MOAH fraction consists primarily of alkylated aromatic hydrocarbons.

## WHAT ARE THE KNOWN SOURCES OF CONTAMINANTS?

The input pathways of mineral oils are varied and extend across all stages of food production (raw materials, storage and transportation, production and packaging materials). The primary sources of MOSH/MOAH contamination are adhesives, printer inks and packaging

materials – particularly those made of recycled materials. Other sources include machine and hydraulic oils used to produce and package food. The use of corrugated cardboard-lined transport containers or jute or sisal bags impregnated with oil containing mineral oil

(batching oil) can also contribute to contamination. Mineral oils are used in production processes as lubricants and release agents. The substances of the MOSH/MOAH fraction can however also enter foodstuffs via the exhaust gases from harvesting machinery.

## WHICH FOODS ARE AFFECTED?

Based on today's information, the foods affected include dry foods with large surface areas such as flour, grit, rice, coffee, cocoa powder, milk powder, spices, bread crumbs and breakfast cereals. Oils and fats such as palm oil, olive oil, sunflower oil, rapeseed oil and cocoa butter, as well as coconut milk, chocolate, fatty sweets, butter and

vegetable fats, are also susceptible to contamination with MOSH/MOAH due to their lipophilic properties. The Commission Recommendation (EU) 2017/84 of January 2017 laid the foundation for the monitoring of mineral oil hydrocarbons in Europe. In 2017 and 2018, various foods "throughout the shopping cart" will be monitored for the presence of mineral oil

hydrocarbons. The data collected will be used by the EFSA (European Food Safety Authority) as the basis for assessing exposure and risk. The European Reference Laboratory (EU-RL) is developing specific guidelines for sampling, analysis and evaluation explicitly for this purpose.

## HOW DO MOSH/MOAH ENTER FOOD PRODUCTS?

The answer is through direct and indirect contact as well as through the gas phase. The risk of contamination

depends on several factors, including food properties, the concentration of MOSH/MOAH in the contamination

source, the type, intensity and duration of the contact and the temperature.

## WHAT HEALTH RISKS DO MOSH/MOAH POSE?

Some short-chain saturated hydrocarbons of the MOSH fraction are known to accumulate in different organs of the body. There is evidence from animal tests of damage to the liver and lymph

nodes. A number of alkylated aromatic hydrocarbons of the MOAH fraction are carcinogenic, including, for example, several representatives of polycyclic aromatic hydrocarbons (PAHs). The

complexity of carbon blends and the lack of scientific data make it difficult to reach a conclusive toxicological assessment of MOSH and MOAH.

## WHICH LIMIT VALUES APPLY TO MOSH/MOAH?

The overall objective is to minimise or even completely eliminate food contamination with MOSH/MOAH. In Germany, a third draft regulation published in July 2014, which amended the "German Bedarfsgegenständeverordnung"

proposed a maximum level for MOSH C16-35 of 24 mg/kg and for MOAH C16-35 of 6 mg/kg in paper and cardboard. For packaging materials that exceed these maximum levels, less than 2 mg/kg of MOSH C20-35 and

0.5 mg/kg of MOAH C16-35 should migrate into food. A revised draft followed in March 2017, which only limits the migration of MOAH from food contact materials made of recycled paper. No other limits were proposed.

## HOW IS MOSH/MOAH ANALYSED?

Using state-of-the-art technology, the material to be examined (food or packaging) is crushed and homogenised, and the components to be examined are extracted. Depending on the sample matrix, this can be followed by a purification process (e.g. with activated aluminium oxide, epoxidation). The MOSH and MOAH fractions are separated by means of chromatographic solid

phase extraction. The quantitative analysis method used is GC-FID (gas chromatography-flame ionisation detection) with large volume on-column injection. It is not possible to analyse individual components using GC-FID due to the enormous number of chemical substances in both fractions. Two-dimensional GCxGC separation with TOF mass spectrometer (GCxGC-TOFMS) can be

used to determine any potential mineral oil contamination and to characterise substance classes. This method offers the opportunity to distinguish MOSH from POSH, to capture fingerprints of typical mineral oils and to identify natural hydrocarbons of biogenic origin, such as terpenes. SGS established this modern analysis method and offers it now.

## WHICH ANALYTICAL METHODS ARE USED AT SGS?

SGS uses a modified method by the BfR. The analytical method is accredited. After sample preparation, the analysis is conducted by means of an automated, on-line coupled liquid chromatography-gas chromatography (LC-GC) and connected flame ionisation detection

(FID). The LC acts as a preparative step by purifying the extracts and fractionates these extracts into the MOSH or MOAH fraction. Since mid-2017, SGS is offering a modified method of CEN (DIN EN 16995) as an extension to the MOSH and MOAH analysis in vegetable fats, oils and fatty

foods. With the CEN method, samples are subjected to saponification, go through a purification step and are then analysed using automated, online-coupled LC-GC and connected flame ionisation detection (FID).

## WHAT ARE THE LIMITATIONS OF THE SGS METHOD?

The SGS method determines the presence of MOSH and MOAH simultaneously in levels of up to 0.5 mg/kg. It can be used to examine all food items, several types of packaging materials such as plastic wrap, paper, cardboard,

jute and sisal bags, as well as cosmetics and their raw materials. Due to certain sample properties, special processing methods are sometimes necessary. It is not always possible to reach a limit of quantification (LOQ) of 0.5 mg/kg due to

matrix effects LOQ. For vegetable oils, the LOQ for MOAH can be specified at 1.0-2.0 mg/kg. Herbs and spices also often require a higher LOQ.

## WHERE CAN I FIND ADDITIONAL ADVICE AND INFORMATION?

Due to the continued relevance of this topic in almost all food sectors, in December 2017, the German Federation of Food Law and Food Science (BLL) published the "BLL Toolbox for Preventing

the Transfer of Undesired Mineral Oil Hydrocarbons into Food" → <https://www.bll.de/de/lebensmittel/verpackung/mineraloeluebergaenge/toolbox-vermeidung-mosh-moah>

This publicly available document provides background information and decision-making tools for interested parties.

## HOW CAN I ORDER MOSH/MOAH ANALYSES?

If you are interested or have further questions, please send your enquiry to

→ [de.food.berlin@sgs.com](mailto:de.food.berlin@sgs.com)

or contact your customer service consultant. A brochure of the analyses offered in the field of MOSH/MOAH is available as a download at → [www.sgs.com](http://www.sgs.com).

## WHAT SAMPLE VOLUMES ARE REQUIRED?

■ **FOODSTUFF:**  
Minimum 50 g

■ **PACKAGING MATERIAL:**  
Minimum 10 g

Please be sure that the samples are representative. Samples of packaging materials should be taken from areas free from adhesives.

## HOW SHOULD THE SAMPLES BE PACKAGED?

When packaging the samples, ensure that the packaging materials do not contain or transfer the substances to be analysed. Suitable packaging includes

PET, glass and metal containers. If containers with screw caps are used, then place aluminium foil between the food and the plastic lid as a barrier. Other

containers may be used if they have an airtight aluminium coating. Aluminium foil is also a suitable packaging material.

## WHERE SHOULD THE SAMPLES BE SENT?

**PLEASE SEND THE SAMPLES TO THE FOLLOWING ADDRESS IN COORDINATION WITH YOUR CUSTOMER SERVICE CONSULTANT:**

SGS INSTITUT FRESENIUS GmbH  
Bldg. B5.2, Ground Floor  
(Sample receipt)  
Tegeler Weg 33  
10589 Berlin, Germany  
t +49 (0)30 34607 - 700

## MOSH/MOAH: AT A GLANCE

<b>MOSH</b>	Mineral oil saturated hydrocarbons
<b>POSH</b>	Polyolefin oligomeric saturated hydrocarbons
<b>PAO</b>	Poly alpha olefine
<b>MOAH</b>	Mineral oil aromatic hydrocarbons
<b>PROBLEM</b>	A variety of chemical substances per fraction with different toxicological potential
<b>FOODS AFFECTED</b>	Flour, grit, rice, coffee, cocoa powder, cocoa butter, milk powder, spices, bread crumbs, breakfast cereals, palm oil, coconut milk, olive oil, sunflower oil, rapeseed oil, chocolate, confectionery, butter, vegetable fats, meat products
<b>CONTAMINANT SOURCES</b>	Packaging material (cardboard, paper, jute, etc.), adhesives (hot melt), printer inks, hydraulic and machine oils, corrugated cardboard lined containers, batching oil, separating and lubricating agents in food production and packaging plants, exhaust gases from harvesting vehicles
<b>CONTAMINATION</b>	Direct and indirect contact, gas phase
<b>HEALTH RISK</b>	Accumulation in the body, partially carcinogenic; toxicological studies insufficient
<b>STATUTORY LIMITS</b>	None <i>(In Germany, the fourth draft regulation amending the German Bedarfsgegenständeverordnung only proposed limits on the migration of MOAH from food contact materials made of recycled paper to food commodities.)</i>
<b>ANALYTICAL METHOD</b>	Sample preparation/extraction, cleaning, MOSH/MOAH separation, LC-GC-FID as well as GCxGC-TOFMS analyses starting in 2018
<b>DETECTION LIMIT</b>	2.0 mg/kg to 0.5 mg/kg, depending on the matrix
<b>SAMPLE VOLUME REQUIRED</b>	Foodstuff: 50 g Packaging material: 10 g
<b>SAMPLING</b>	Representative, without glue residue, packaged in glass or PET containers, aluminium foil
<b>SAMPLE SHIPMENT ADDRESS</b>	SGS INSTITUT FRESENIUS GmbH Bldg. B5.2, Ground Floor (Sample receipt) Tegeler Weg 33 10589 Berlin, Germany
<b>CONTACT FOR QUESTIONS</b>	t +49 (0)30 34607 - 700 → <a href="mailto:de.food.berlin@sgs.com">de.food.berlin@sgs.com</a>

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