Questions and answers on mineral oil components in food

Updated BfR FAQ of 12 December 2017

In light of the knowledge that mineral oil components may be found in foods, the German Federal Institute for Risk Assessment (BfR) has conducted an assessment to determine whether mineral oil components in foods can pose a health risk.

For a number of years now, the Institute has been pointing out that the transfer of mineral oil components from recycled cartons into foods is possible and is to be expected, as one of the materials used to produce these cartons is printed recovered paper that may contain mineral oil components from newspaper printing ink. To date, the transfer of these substances has above all been observed in dry foods with a large surface area such as rice or semolina.

The contamination of foods with mineral oil components from food packagings is undesirable.

Below, the BfR has put together frequently asked questions and answers regarding mineral oil components that can transfer from packagings into foods:

How can mineral oil components find their way into foods?

The recovered paper used to make cardboard also includes printed newspaper, and most conventionally used newspaper printing inks contain mineral oils. Up to now, it has not been possible to adequately remove these inks during the recycling process, with the result that they can find their way into the food packagings made from recycled cardboard. Other potential sources of transfer into foods include lubricants from food processing machines, exhaust gases from harvesting machines, or mineral oils used as lubricants or release agents in production and packaging processes.

What is meant by the term "mineral oil" in connection with foods?

The detected mineral oil mixtures consist of saturated hydrocarbons as well as aromatic hydrocarbons.

In chemical terms, saturated hydrocarbons are open-chain and cyclic hydrocarbons (MOSH). The abbreviation MOSH stands for “mineral oil saturated hydrocarbons”. Aromatic hydrocarbons are referred to as MOAH – “mineral oil aromatic hydrocarbons”. The MOAH transferring from packagings into food consist of a complex mixture of predominantly alkylated aromatic hydrocarbons.

Into which foods can mineral oil components from packagings transfer?

The BfR assumes that transfer of mineral oils from the packaging into foods is above all to be expected with dry foods with large surface area, such as flour, semolina, rice, breadcrumbs or breakfast cereals.

When did the BfR draw attention to the problem of mineral oil components from packagings transferring into food?

In the light of findings of the Zurich Cantonal Laboratory in Switzerland, the BfR drew attention to the problem of mineral oil components transferring into food in 2009.

The laboratory detected a mineral oil mixture in rice that was stored in a cardboard box for eight months. It can be reasonably assumed that the detected transfer is largely the result of the outgassing of mineral oils from the cardboard.

What are the known health risks of mineral oil?
Saturated hydrocarbons (MOSH) of a certain chain length range are absorbed by the human body and can also be detected in some human organs. Animal studies have shown that mineral oil mixtures containing these kinds of compounds can lead to deposits and inflammatory effects in the liver of a certain rat strain. The relevance of this finding for humans has not yet been clarified, however.

The aromatic hydrocarbon compounds (MOAH) detected in foods can come from various sources. Usually they are a complex mixture of predominantly alkylated polycyclic aromatic hydrocarbons that may also include carcinogenic substances. Due to insufficient data, a health assessment is not possible.

This kind of contamination of foods is generally unwanted, and this is why the BfR believes that the transfer of mineral oils from recycled paper and cardboard into foods as well as from other sources should be minimised.

Are MOSH and MOAH the only mineral oil hydrocarbons that might be found in foods?
In addition to MOSH and MOAH, foods can also contain so-called POSH ("polyolefin oligomeric saturated hydrocarbons") if the foods are stored in containers made of certain plastics or are packaged using certain types of plastic film.

What are POSH?
Polyolefin oligomeric saturated hydrocarbons (POSH) are saturated hydrocarbons that occur as oligomers in certain plastics known as polyolefins (e.g. polyethylene, polypropylene). If materials of this kind are used as packaging or for the storage of foods, POSH can migrate into these foods in small amounts.

What health risk is posed by POSH in foods?
As the BfR does not possess any toxicological data on POSH, it has to date not been possible to conduct a health assessment of these substances.

What quantity of mineral oil components from packagings do consumers ingest via foods?
In 2012, the European Food Safety Authority (EFSA) estimated that adults ingest between 0.03 and 0.3 mg of saturated hydrocarbons (MOSH) per kilogram bodyweight daily via food and that intake levels may also be higher in children. Based on the EFSA estimates, the intake of aromatic hydrocarbons (MOAH) is at a level of around 20% of that observed for MOSH – in other words, between 0.006 and 0.06 mg per kilogram bodyweight and day. In the case of a child weighing 10 kg, this corresponds to a daily intake of up to 0.6 mg.

How does the BfR view the health risk of mineral oil components in chocolate from Advent calendars?
Based on the data provided by the Stiftung Warentest in 2015, the BfR has conducted a preliminary assessment of the health risk posed by mineral oil components in chocolate. Assuming the worst-case by using the maximum level of approx. 7 milligrams per kilogram of chocolate, the concentration of aromatic hydrocarbons in the individual chocolate pieces from the calendars, was calculated to 0.022 milligrams. Based on the assumption that a person eats one chocolate piece per day, this translates into only a very small additional intake

on top of the daily intake of aromatic mineral oil hydrocarbons via foods estimated by the European Food Safety Authority (EFSA 2012). This additional amount is only small but aromatic hydrocarbons are nevertheless undesirable in foods, as currently the possibility that these substances possess a carcinogenic potential cannot be ruled out.

Can mineral oil components also transfer from cardboard packagings into frozen foods?
The BfR currently has very limited data concerning the transfer of mineral oil components into frozen foods. However, migration is unlikely at freezing temperatures, as mineral oil components do not outgas under these conditions.

Are there limit values for the transfer of mineral oil components into foods?
There are currently no legal stipulations in place governing the levels of mineral oil components in foods. The Federal Ministry of Food and Agriculture (BMEL) is in the process of drawing up an ordinance to regulate the transfer of these substances from recycled cardboard into foods.

What limit values does the BfR recommend for the transfer of aromatic hydrocarbons (MOAH) and saturated hydrocarbons (MOSH) from packagings into foods?
No toxicological data is available that would permit the assessment of and the derivation of limit values for MOAH. The opinion of the BfR that a possible carcinogenic potential of the aromatic hydrocarbons transferring from recycled cartons cannot be ruled out was confirmed by an expert opinion published by the European Food Safety Authority in 2012 (EFSA 2012). This is why there should be no detectable transfer of MOAH from packagings into food.

No adequate data is available for the assessment of MOSH in the molecular weight range transferring from recycled cardboard. In 2012, the joint FAO/WHO Committee on Food Additives (JEFCA) withdrew the temporary ADI value for low-viscosity white oils (JECFA 2012). ADI stands for "acceptable daily intake" and is a measure of the amount of a specific substance that can be ingested (orally) on a daily basis over a lifetime without an appreciable health risk.

The BfR has derived reference values of 12 mg/kg or 4 mg/kg for the transfer into foods of solvents that contain MOSH with hydrocarbon chain lengths of C10 to C16 and C16 to C20, respectively.

Based on current knowledge, the MOSH fraction that leads to deposits and inflammatory reactions in the liver of a certain rat strain is decisive for the health assessment of MOSH. EFSA supported a research project on the assessment of the MOSH detected in foods that possess a spectrum of hydrocarbons deviating from approved types (EFSA Supporting publication 2017:EN-1090). The conclusions of EFSA from the findings of the study are not yet available. The data show that there is structure- and organ-specific accumulation of MOSH in the aforementioned rat strain. However, these findings do not currently permit any statements on the toxicity and relevance of this data for humans.

As it is currently not possible to definitively assess the health impact of MOSH in the molecular weight range transferring from recycled cardboard, and as it is also not possible to clearly determine the concrete cause of the inflammatory processes observed in the liver of the specific rat strain, the additional entry and transfer of these substances from packagings should be minimised as far as is technically possible.

What are the recommendations of the BfR to minimise the transfer of mineral oil components from cardboard packagings into foods?

The transfer of mineral oil components is influenced not only by their concentration in the packaging material but also by the storage conditions and the type of food. It can be prevented by using virgin fibre-based cardboard and mineral oil-free printing inks as well as by incorporating functional barriers in the design of the packaging. In this respect, it is not only the direct food packaging that must be taken into consideration but also the possibility of transfer from the outer packaging.

About the BfR

The German Federal Institute for Risk Assessment (BfR) is a scientifically independent institution within the portfolio of the Federal Ministry of Food and Agriculture (BMEL) in Germany. It advises the Federal Government and Federal Laender on questions of food, chemical and product safety. The BfR conducts its own research on topics that are closely linked to its assessment tasks.

This text version is a translation of the original German text which is the only legally binding version.