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Challenges in mineral oil analysis

October 2023

Introduction

Mineral oil hydrocarbons (MOH) are a complex mixture of hydrocarbons, which are chemical compounds of different sizes and structures. MOH are mainly derived from crude oil. The group of MOH comprises both 'aromatic' hydrocarbons (MOAH) and 'saturated' hydrocarbons (MOSH).

For more background information about the regulation and analysis of MOH, have a look at our previous paper: "Harmonised action limits for MOAH in food".

The analysis of mineral oil is known to be precarious on food samples containing oils and fats. This can be due to the interaction of these fats with the chromatography columns.

In addition, some samples may contain biogenic alkanes and/or biogenic olefin structures. These structures co-elute with respectively MOSH or MOAH, leading to peak interferences that can be misinterpreted as MOSH or MOAH during the interpretation of the results.

In order to improve the analysis of mineral oil on difficult matrices, various additional steps can be applied during the sample preparation. The above mentioned difficulties can be tackled by using a saponification step or different purification steps.

Saponification

The addition of a saponification step in the sample preparation can improve the analysis of samples containing high amounts of oils and fats. The used chromatography columns have a limit on the amount of fat that can be loaded. During the saponification step fat is removed from the sample, leading to a reduction of interferences with these chromatography columns. The reduction of the fat content from the sample also allows to use a higher amount of sample during the consequent analysis, resulting in more sensitive and more reliable results.

Besides, tropical oils, such as palm oil, can contain β-carotene which interferes with the MOAH chromatogram. The addition of a saponification step on such types of matrices will consequently result in a more efficient purification and more clear chromatograms.

Lastly, the use of a saponification step has been included in the European guidelines regarding the analysis of mineral oil ("Guidance on sampling, analysis and data reporting for the monitoring of mineral oil hydrocarbons in food and food contact materials").

Purification steps

A second action that will lead to the improvement of mineral oil analyses is the application of purification steps, which are possible for both MOSH and MOAH.

Epoxidation – MOAH

An epoxidation step will remove the interference of co-eluted biogenic olefin structures. However, the risk of such an epoxidation step is to also decrease the MOAH that could be present in the sample. This is especially the case when an epoxidation is performed with mCPBA. Result variants have unfortunately been observed due to incomplete derivatizations.

In order to improve this purification step, the epoxidation is performed with performic acid. By doing so only the interfering components will be disrupted and not the MOAH, leading to clear MOAH humps for result interpretations. This will allow a better and more correct determination of the MOAH presence in the analysed food samples. Figure 1 shows a reduced MOAH hump after an expoxidation step using mCPBA (left) in comparison with the MOAH hump after an epoxidation using performic acid (right) due to the elimination of the MOAH destruction.

Purification with aluminium oxide – MOSH

Some samples may contain biogenic alkanes, which can interfere with the result analysis of the MOSH fraction. By performing a purification step using aluminium oxide, these interferences can be reduced.

This purification step is automated in our laboratory, allowing a faster analysis time.

Conclusion

Due to the challenging nature of mineral oil analysis, it is advised to performe the necessary checks and purifications to ensure the exclusion of false negative or positive results on your sample.

At our laboratory these necessary purifications are performed.

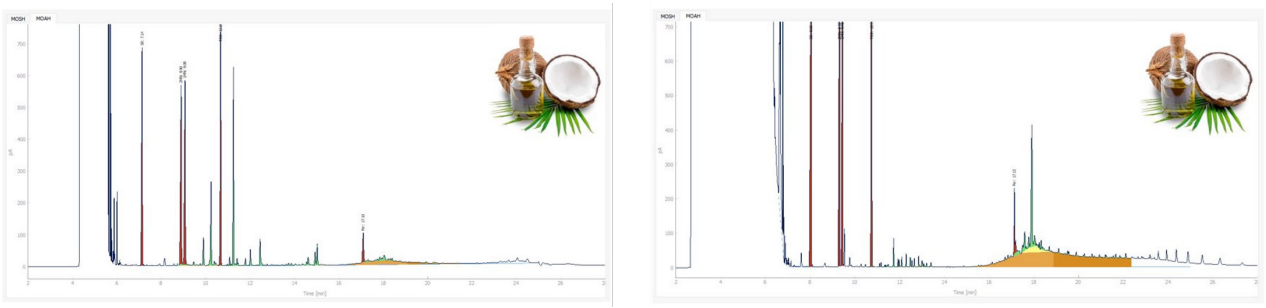

Figure 1: Comparison of a MOAH hump after an epoxidation step using mCPBA (left image) and an epoxidation step using performic acid (right image)

You can rely on us

In case you would like more information on the analysis of mineral oil on your samples, please contact our customer care service:

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Quality and reliability of our analyses is key to us, which is why our in-house R&D team is continuously working to improve our existing methods as well as developing new relevant methods based on market trends. Furthermore, our pesticide analyses are **BELAC** accredited conform the requirements of the EN **ISO/IEC 17025:2017** standard. In addition, we have **various recognitions** to further ensure the quality and relevance of our analysis scope. Below just a selection of our current recognitions.

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