2-MCPD, 3-MCPD and Glycidyl fatty acid Esters

Most frenquently asked questions during the webinar

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TOP 10 of the most frequently asked questions during the webinar: **2-MCPD, 3-MCPD and Glycidyl fatty acid Esters: determine their presence in food products and manage the risk**

The esters of 3-Monochloro-1,2-propanediol (3-MCPD), its isomer 2-Monochloro-1,3-propanediol (2-MCPD) and Glycidol belong to the group of process contaminants. While the problem of free 3-MCPDs in (e.g. smoked) foods has been known much earlier, the esters of 3-MCPD were detected 15 years ago in refined edible oils and fatty foods. Later it was shown that the levels of Glycidyl and 3-MCPD esters in finished products from refined fats and oils corresponded to the level of contamination in the fat and oil used. Abraham et al. confirmed 2012 the assumption that the esterified form becomes bioavailable in the body. As published in 2011 by Kuhlmann et al. and Weißhaar et al. Glycidyl and 3-MCPD esters are produced at temperatures > 200 °C during raffination of vegetable oils. They are formed via different mechanisms and different strategies are needed to minimize them. For palm oil higher concentrations of these esters were reported in comparison to other refined oils but different mitigation measures have been taken by the palm oil producers since 2011.

A deodorization step below 230°C can avoid formation of Glycidyl esters from diacylglycerols. For the formation of 2-MCPD and 3-MCPD esters chlorinated compounds play an important role. Chloride can react with the glycerol backbone of lipids to form 2-MCPD and 3-MCPD esters. Therefore, some of the mitigation strategies focus on minimization of the chlorinated precursors and diacylglycerols. Since it proved not always feasible to work below the 3-MCPD ester formation temperatures measures were taken along the whole production chain (including cultivation, harvesting and storage as well as milling and refining). Further guidance for mitigation steps can be found from the Food Federation Germany and FEDIOL (European Union Vegetable Oil and Proteinmeal Industry).

Besides in refined fats and oils, 3-MCPD is also detected in food contact materials (FCM) containing epichlorohydrin-based wet-strength resins. From these FCM (tea bags, casings or baking dishes) 3-MCPD might migrate into tea, sausages or muffins. To mitigate free 3-MCPD epichlorohydrin containing FCM should not be used.

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1. What is the current regulation in chocolate confectionery and near future regulation - and why UE collects information about 3-MCPD in chocolate confectionery.

There are no special legal requirements for chocolate confectionery.
But our experiences showed that we find 3-MCPD in Chocolate confectionery because of the fats and oils besides cocoa butter used for the manufacturing. In view of the TDI of 2 µg/kg body weight, the analysis of this product group should not be ignored and should be taken under control.
And to the second part of the question:
The european commission and the member states are currently discussing maximum levels for different food groups. For example fine baked goods and potato products are included in the discussion but nothing is planned especially for chocolate. But it is possible that there will be maximum levels in the future.

2. What is the procedure for sampling and sending? What should be the sample size?

It depends on what kind of food it is. In the case of fats and oils it is only necessary that the sample container is clean and that the sample is representative and without particles.
The requirements for food depends on different things. I have already mentioned that a completely homogeneous sample is of great importance in order to extract the fat from all components of the sample.
So a representative amount for each sample should be sent to us. It is particularly useful with ready-to-eat food to send a larger sample quantity of e.g. 200g in order to ensure that all ingredients are included in the same ratio as given in the original product. Further homogenisation is then carried out at our institute to allow the sampling of an aliquot.
The sample size depends on the type of food and the fat content. For samples with less than 5 % fat we also need sample material of at least 200g. For fats and oils, a smaller amount of 10 g to 20 g is sufficient.

3. Can samples be stored in the Fridge?

Samples that are analysed for 3-MCPD should not be refrigerated beforehand. Studies have shown that glycidol degrades at temperatures around 10 degrees. Among other things, 3-MCPD is formed from this. Of course, this also depends on the storage time. The samples should either be stored at room temperature for as long as the foodstuff allows or deep-frozen so as not to change the specific content.

4. Why are there many different methods? Are there differences in the results?

There are different methods for different samples and expectations of the result. For example, if a quick result is needed, the ISO 18363-1 method would be the right one. The content can be determined in a timely manner due to the short reaction time and automated processing. However, the glycidyl ester content is only determined by calculation. For a direct determination of the glycidyl ester results a different method has to be chosen.
These methods have the advantage that direct quantification takes place via the appropriate internal standard, so that the results have a lower measurement uncertainty. Since these analyses need longer reaction times than the ISO 18363-1, the sample processing time is longer as a result.
When choosing between alkaline or acidic ester cleavage, the composition of the sample is of course of great importance. In the case of acidic ester cleavage, the emulsifiers contained can lead to an over-quantification of glycidol. However, in the case of alkaline ester cleavage, the undesired conversion of glycidol to 3-MCPD must be determined and corrected. The effect is taken into account in different ways in the determination of glycidol depending on the method used. By compensating for the undesired conversion depending on the method, the generated results are largely comparable with each other, but in some cases are subject to a higher degree of measurement uncertainty.

5. Can we use microwave extraction systems for fat extraction?

Microwave extraction for fat extraction can be used. However, the number of samples that can be extracted is limited by the capacity of the microwave. In addition, the sample weight is limited by the special extraction container. In the case of low-fat samples, this would lead to multiple extraction, while in the case of manual fat extraction, the amount of sample used can be adjusted to the fat content of the sample.

6. What is the most recommended method for the analysis of 3-MCPD in a cocoa biscuit food matrix?

This matrix does not require any special treatment and can be processed with our routine method. This is the 18363-01

method, which is also automated and gives fast results.

7. Which method would you recommend for fatty foodstuff (raw materials)?

This matrix does not require any special treatment and can be processed with our routine method. This is the ISO Norm 18363-01, which is also automated and gives fast results.

8. Can the conversion of GE back to 3-MCPD also happen during alkaline cleavage?

The conversion of 3-mcpd to glycidol is an equilibrium reaction. Under the conditions during the alkaline hydrolysis, the equilibrium of the reaction is on the part of 3-MCPD. This means that a reverse reaction from 3-MCPD to glycidol takes place, but to a much lesser dimension than the reaction from glycidyl to 3-MCPD. Therefore, the conversion of GE back to 3-MCPD can be neglected.

9. A 3-MCPD analysis carried out in your laboratory indicates the ASU L 08.00-6 method:. 1980 mod, what was the method you talked about?

This is actually not possible, because the ASU L08.00-6 method :. 1980 is not used at our institute for the analysis of 3-MCPD. In this analysis, the total fat is determined according to the Weibull-Stoldt method. The fat obtained therefrom cannot be used for the analysis of 3-MCPD due to the acidic hydrolysis during the analysis. By adding HCl for hydrolysis according to ASU L 08.00-6 method:. 1980 the added chloride can react with the glycidyl ester to form 3-MCPD. This results in an over-quantification of 3-MCPD and an under-quantification of glycidyl ester.

10. If 2-MCPD can be converted to 3-MCPD, why are 2-MCPD and 2-MCPD esters not taken into account by the regulatory limits?

The conversion of 2-MCPD into 3-MCPD only happening to a negligible extent. According to the literature, it only takes place under certain conditions, which, however, have not been researched in detail. It is to be expected that high temperatures play a decisive role in the conversion. Furthermore, not enough toxicological data were available for a risk assessment, so that no risk assessment could be carried out by EFSA. As a result, this analyte has not yet been considered in the regulatory assessment. Reference substances for 2-MCPD have been commercially available since 2010 and therefore a toxicological evaluation of 2-MCPD might follow, if further studies will be available to EFSA.

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Want to discuss a specific need?
Get in touch with our teams!

Konstantin Hogh - Customer and Project Management

konstantin.hogh@mxns.com

+49 30 457 98 93-119

Katrin Schneemann - Customer and Project Management

katrin.schneemann@mxns.com

+49 30 457 98 93-135

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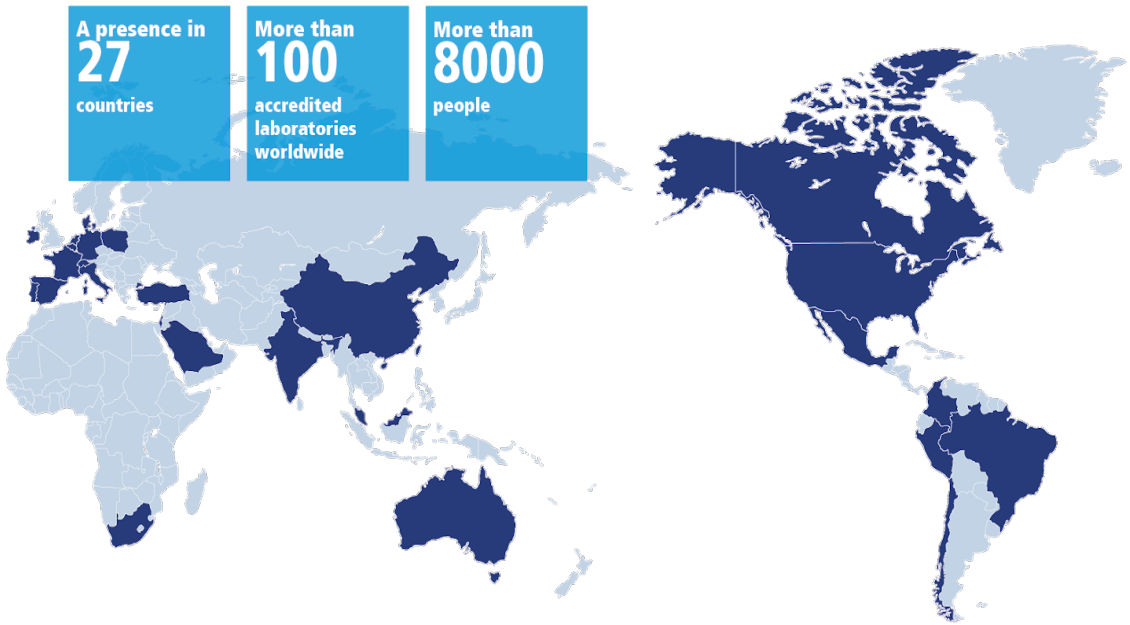

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