



## MCPD and glycidyl fatty acid esters

### Process contaminants in fats and fatty foods

3-Monochloropropanediol (3-MCPD), 2-monochloropropanediol (2-MCPD), their fatty acid esters and glycidyl fatty acid esters are process-related contaminants which can arise during heating of fatty foods in the presence of salt. Free 3-MCPD has been known since 1978 as a contaminant in different foods, especially in condiments such as soy sauce and dark-roasted bakery products. Bound fatty acid esters of 2-MCPD, 3-MCPD and glycidol arise especially during the refining of vegetable oils and edible fats, due to the strong heating of the triglycerides in the presence of compounds containing chlorine. They are formed mainly during the last step of refining comprising removal of odours and flavouring substances (deodorizing). The highest concentrations of these compounds have been found in refined palm oils and fats, followed by other refined vegetable oils and fats. All foods produced on the basis of refined, edible vegetable oils and fats (including margarine, bakery products, infant formula) can be contaminated too.<sup>1</sup> Even if proper raw materials are used, the contaminants can form during preparation of the food at a later stage, for example, due to strong heating.

#### Health risk

3-MCPD and glycidol exhibit significant toxic effects in animal tests. In the current monographs of the IARC («International Agency for Research on Cancer») 3-MCPD is classified as «possibly carcinogenic for humans (group 2B)» and glycidol is classified as «probably carcinogenic for humans (group 2A)».<sup>2</sup> Both compounds (especially glycidol) therefore need to be minimized in food (principle known as ALARA: As Low As Reasonably Achievable). Considered justifiable by the Federal Institute for Risk Assessment (BfR) as a basis for risk assessment is complete dissociation of fatty acids from the 3-MCPD fatty acid esters ingested via food.<sup>3</sup> The European Food Safety Authority (EFSA) has specified the tolerable daily intake (TDI) of 3-MCPD as being 2 µg/kg of body weight.<sup>4</sup> This limit can quickly be reached, especially in lightweight infants. Not surprising, therefore, is the present assumption of a health risk, especially for younger population groups.<sup>1</sup>

#### Statutory maximum levels

On 26<sup>th</sup> February 2018, the European Commission published regulation (EU) 2018/290 as an amendment to regulation (EC) 1881/2006 which specifies maximum levels for glycidyl fatty acid esters (glycidyl esters). The two maximum levels for free 3-MCPD in hydrolysed vegetable protein and soya sauce, also specified in Swiss legislation (contaminant regulation, SR 817.022.15), were established some time ago. Currently applicable maximum levels are listed in Table 1.



	<b>Maximum level (µg/kg)</b>
<b>3-Monochloropropanediol (3-MCPD)</b>	
Hydrolysed vegetable protein <sup>(1)</sup>	20
Soy sauce <sup>(1)</sup>	20
<b>Glycidyl fatty acid esters expressed as glycidol</b>	
Vegetable oils and fats placed on the market for the final consumer or for use as an ingredient in food	1000
Vegetable oils and fats destined for the production of baby food and processed cereal-based food for infants and young children <sup>(2)</sup>	500
Infant formula, follow-on formula and foods for special medical purposes for infants and young children (powder) <sup>(2),(3)</sup>	75 until 30.6.2019 50 as from 1.7.2019
Infant formula, follow-on formula and foods for special medical purposes for infants and young children (liquid) <sup>(2),(3)</sup>	10,0 until 30.6.2019 6,0 as from 1.7.2019

<sup>(1)</sup> The maximum level relates to the liquid product with 40% dry mass

<sup>(2)</sup> Products as defined in the commission's directive 96/5/EC dated 16<sup>th</sup> February 1996 and concerning processed cereal-based foods and baby foods for infants and young children (OJ L 49 dated 28.2.1996, P. 17), last amended by directive 2003/13/EC (OJ L 41 dated 14.2.2003, P. 33)

<sup>(3)</sup> The maximum level refers to the commercially available product

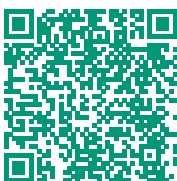
Table 1: Maximum levels specified by regulation (EU) 2018/290

### Analytical determination

Analyses of 2-/3-MCPD and glycidol are usually performed using fat or oil samples. If composite food is involved, the fat is first isolated from the sample; this can be achieved with the help of accelerated solvent extraction. To release the analytes, the fat must then be macerated. After transition to the form necessary for measurement (derivatization), the analytes are examined using gas-chromatographic mass spectrometry. The procedure used at Labor Veritas AG is based on DGF standard C-VI 18 (10), and has been continually developed in recent years. On request, however, analysis can also be performed on the basis of further testing standards. In the case of foods not containing fat, free 2- and 3-MCPD are obtained from an aqueous extract via adsorption on a substrate, and can be analyzed directly after derivatization. This procedure is used with malt samples, for example.

### Literatur, Quellen

- <sup>1</sup> 3-MCPD-, 2-MCPD-Glycidyl-Fettsäureester in Lebensmitteln: EFSA und BfR sehen Gesundheitsrisiko vor allem für jüngere Bevölkerungsgruppen, Mitteilung Nr. 020/2016 des BfR vom 07. Juli 2016
- <sup>2</sup> <https://monographs.iarc.fr/list-of-classifications-volumes/>
- <sup>3</sup> 3-MCPD-Fettsäureester in Lebensmitteln, Stellungnahme Nr. 006/2013 des BfR vom 3. April 2012
- <sup>4</sup> Update of the risk assessment on 3-monochloropropane diol and its fatty acid esters, Panel on Contaminants in the Food Chain (CONTAM), EFSA Journal 018;16(1):5083



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