3-MCPD and related compounds

Process contaminants as a result of high temperature treatment and/or refinement of vegetable fats and oils

Free 2- and 3-monochloropropanediol (MCPD) may occur if food, rich in fat and salt, is exposed to high temperatures, e.g. during the manufacturing of soy and seasoning sauces or hydrolysed vegetable protein, baking of pastries or during barbecuing and smoking of meat products. Further chloropropanols like 1,3- and 2,3-dichloropropanol (1,3-DCP, 2,3-DCP) evolve in small quantities as byproducts. Traces of 3-MCPD may also be formed during the manufacturing of glycerol.

2-MCPD-, 3-MCPD- und glycidyl esters (GE) may be formed during refinement of vegetable fats and oils. The contents of MCPD and glycidyl esters in oils and fats depend on the intensity of the industrial procedures. But even the raw material is of major importance. For example, palm oils contain high levels of diglycerides and are therefore especially bound to form 3-MCPD esters. Refined fats and oils are not only consumed directly, but are also commonly used in various areas of industrial food productions. Palm oil is often part of baby food and mayonnaise, bakery products, bread spreads, antipasti and pesto are yet other areas of usage.

Toxicology

3-MCPD is linked to nephron- and testicular toxicity. Therefore, EFSA decreased the Tolerable Daily Intake (TDI) level for 3-MCPD (incl. esters) to 0.8 µg/kg bodyweight (EFSA Journal 2016: 24(5): 4426).

3-MCPD is a potential marker substance for all other chloropropanols. 1,3-DCP, like glycidol, is classified as a genotoxic carcinogen. For glycidyl esters (GE) the EFSA concluded a particular health concern for certain population groups. Due to a lack of information, no risk characterisation was done for 2-MCPD. The EFSA recommends further studies. It is assumed that the esters (2-MCPD-, 3-MCPD- and GE) are transformed into their free forms within the human body. Thus they are considered to be equally toxic. Consequently, the German Federal Institute for Risk Assessment (BfR) recommends to minimise the contents of 3-MCPD esters in food as much as possible.

Food Law

The main sources for the diet-related intake of 3-MCPD are soy sauce and soy sauce based products. Maximum levels for 3-MCPD in hydrolysed vegetable proteins and soy sauce are established in Regulation (EC) No. 1881/2006 (see table 1).

For 1,3- und 2,3-DCP, there is no regulation on maximum levels so far.

A number of different foodstuffs consumed in high quantities like bread and pasta, may also add significantly to the intake of 3-MCPD. However, this is rather caused by the large quantities usually consumed than by their high content of 3-MCPD.

EU Regulation No. 231/2012 on specifications for food additives sets a maximum level for 3-MCPD in glycerol of no more than 0.1 mg/kg.

Analysis

The analysis of the various 2-MCPD-, 3-MCPD- and glycidyl esters in food is extremely complex with a couple of direct and indirect methods in existence. Eurofins´ most comprehensive portfolio on process contaminants comprises a set of direct and indirect methods for the analysis of 3-MCPD, its esters as well as glycidyl esters by gas chromatographic methods.

Direct methods are currently applied for the analysis of free 3-MCPD.

Indirect methods cover free 3-MCPD, after the cleavage of 3-MCPD esters without distinguishing between the individual esters. Depending on the sample preparation, it is possible to differentiate between 3-MCPD- and glycidyl esters.

The different analytical strategies for fats and oils are presented in table 1.

<table>
<tr><th>Parameters</th><th>Direct Methods</th><th colspan="2">Indirect Methods</th></tr>
<tr><td>Free 3-MCPD</td><td>GC-MS, Internal Method</td><td rowspan="2">GC-MS
DGF C-VI
18 (10) B</td><td rowspan="3">GC-MS
DGF C-VI
18 (10) A</td></tr>
<tr><td>3-MCPD esters</td><td>-</td></tr>
<tr><td>Glycidyl esters</td><td>-</td><td>-</td></tr>
<tr><td>2-MCPD esters</td><td>-</td><td>GC-MS,
DGF C-VI 18 (10) B</td><td>-</td></tr>
</table>

Tab.1: Analytical strategy for 2-MCPD-, 3-MCPD- and glycidyl esters in fats and oils

16GTTR06



Eurofins Food & Feed Testing Germany
service@eurofins.de – www.eurofins.de