

## 3-MCPD and glycidol in infant formula

*SpeedExtractor E-916, Multivapor™ P-6: Extraction of 3-MCPD and glycidyl-esters from infant formula.*

Esters of 2- and 3-MCPD (monochloropropanediol) are formed during the refining process of vegetable oils. Therefore, any food that contains vegetable oils can potentially contain 2- or 3-MCPD esters. 3-MCPD has been classified as potentially carcinogenic to humans, whereas glycidol is carcinogenic and genotoxic [1]. The EFSA (European Food Safety Authority) defined a tolerable daily intake (TDI) of 0.8 µg/kg body weight.

For glycidol and glycidyl esters there is no tolerable daily intake value available, but the presence should be avoided according to the ALARA principle (As Low As Reasonable Achievable).

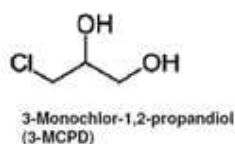


Figure 1: 3-MCPD [1].

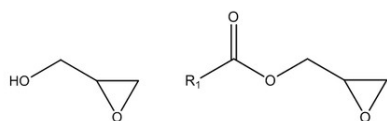


Figure 2: Glycidol and glycidol esters (R1 = fatty acid)

Among all foods, infant formula is the most critical one because infant formula is the only food that is consumed by infants that are not breastfed, and the body weight is very low.

### 1. Introduction

The objective of this Application Note was to determine 3-MCPD and glycidol in infant formula.

There is no official standard method for extraction prior to the analysis of 3-MCPD and glycidol available yet. The German Federal Institute for Risk Assessment (BfR) Method 22 includes pressurized solvent extraction. This method has been validated in a ring test with different food matrices [2]. The BfR method 22 had been adapted for infant formula and was published by Wöhrlin et al. [3].

### 2. Experimental

Two infant formula samples were extracted: sample A stage "PRE", sample B stage 2.

- Extraction using the SpeedExtractor E-916
- Evaporation to dryness for fat determination using the Multivapor™ P-6
- Determination of 3-MCPD and glycidol using DGF method C-IV 18

2 g infant formula, 4.6 g diatomaceous earth and 0.8 mL water were mixed and loaded into an extraction cell. The samples were extracted as native and as spiked samples (Stearate-esters of 3-MCPD resp. glycidol). The extraction was carried out on a SpeedExtractor E-916 using the parameters shown in Table 1.

Table 1: Parameters for extraction using the SpeedExtractor E-916.

Parameter	Value
Temperature	100 °C
Pressure	100 bar
Solvent	80 % Acetone 20 % Isohexane
Cell	40 mL
Vial	240 mL
Cycles	3
Heat up	1 min / 1 min / 1 min
Hold	10 min / 10 min / 10 min
Discharge	3 min / 3 min / 3 min
Flush with solvent	2 min
Flush with gas	3 min
Total extraction time	1 h 10 min

### 3. Results

In infant formula A and B the contents of fat, 3-MCPD and glycidol were determined. The results are shown in Table 2.

Table 2: Results of infant formula determination (n= 3).

Sample	Fat	3-MCPD	Glycidol	3-MCPD	Glycidol
	Extracted [%] (rsd [%])	Native sample [µg/kg fat]		Spiked sample [µg/kg fat] (recovery [%])	
A	25.00 (2.64)	0.52	0.11	2.17 (106.8)	1.53 (95.3)
B	18.87 (4.29)	0.36	0.32	2.90 (110.9)	2.69 (101.6)

### 4. Conclusion

Pressurized Solvent Extraction using the SpeedExtractor E-916 is a fast, reliable method for the determination of 3-MCPD and glycidol in infant formula.

### 5. Acknowledgement

We sincerely thank Mr. Pascal Stingl from Labor Veritas for the analysis of the samples and the support in developing this Application Note.

### 6. References

- [1] BfR Opinion No. 047/2007, 11 December 2007; Infant formula and follow-up formula may contain harmful 3-MCPD fatty acid esters.
- [2] Fry, H. et al. Collaborative Study for the Determination of 3-MCPD- and 2-MCPD Fatty Acid Esters in Fat Containing Foods, Federal Institute for Risk Assessment (BfR), 2012.
- [3] Wöhrlin, F. et al. Occurrence of fatty esters of 3-MCPD, 2-MCPD and glycidol in infant formula., Food Additives & Contaminants: Part A, 2015, Vol. 32, No. 11, 1810-1822.

For more detailed information and safety considerations please refer to the Application Note No. 301/2017.