Highlighting Automated Sample Preparation Solutions for MCPD and GE in Food.

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Executive summary

Various methodologies exist to measure residual monochloropropanediol- (MCPD) and glycidyl-esters (GE) in oils at trace and ultra-trace levels. Each solution is characterized by its own particularities, giving the end-user a lot of flexibility in method choice and preference. In this technical note we provide an overview of the turnkey automated solutions that SampleQ offers for this challenging analysis.

Introduction

MCPD and glycidol are the central point of attention of the food industry. Various studies revealed that these components are toxic for both humans and animals. As a result, the European Union imposed stringent regulations on MCPD and glycidol content in food products, oils, etc.
MCPD and glycidol are unwanted by-products of oil refinery, and predominately occur in palm oil, because it requires processing at much higher temperatures compared to other edible oils. Nonetheless, any oil can contain MCPD and glycidol when it is not processed with the utmost care. In the oil matrix they occur as esters but their analysis required transesterification and derivatization.

We are able to fully automate three methods that are commonly applied:

	AOCS Cd29a-13/ ISO18363-3	**AOCS Cd29c-13/ ISO18363-1**	**Zwagerman method / ISO 18363-4 (under validation)**
Reaction Time	16 hours	5,5 min	12 min
Reaction conditions	Acidic, above RT	Alkaline, RT	Alkaline, below RT
Components	3-MCPDe, 2-MCPDe and GE	3-MCPDe and GE (calculated)	3-MCPDe, 2-MCPDe and GE
Analysis	GC-MS	GC-MS	GC-MS/MS

Depending on your current needs and future wishes we are able to offer the methodology that suits you best. In the following sections we highlight some considerations of each methodology.

Automated method AOCS Cd29a-13

AOCS Cd29a-13 setup

Method AOCS Cd29a-13 is often depicted as the **Unilever method.** It is particularly well-suited for laboratories that need to adhere to prevailing AOCs guidelines. However, the extremely long reaction time is a huge bottleneck for QC laboratories that need to process large amount of samples in the shortest amount of time and at an acceptable cost.

Disadvantages
Reaction time is long
Requires a set up with evaporation, centrifuge and heated trays

Benefits
Manual labor is limited to weighing the sample
The method adheres to current AOCs guidelines
Full scope of the MCPD and GE in a single injection

Automated method AOCS Cd29c-13

This method is also known as the **DGF method**. It performs well in laboratories that need to fulfil AOCS requirements but for which the Unilever method is far too tedious and time-consuming. Unfortunately, this comes at a price, i.e. each sample needs to be prepared in duplicate to measure and calculate MCPD and GE separately without covering possible 2-MCPD conversion to glyicidol.

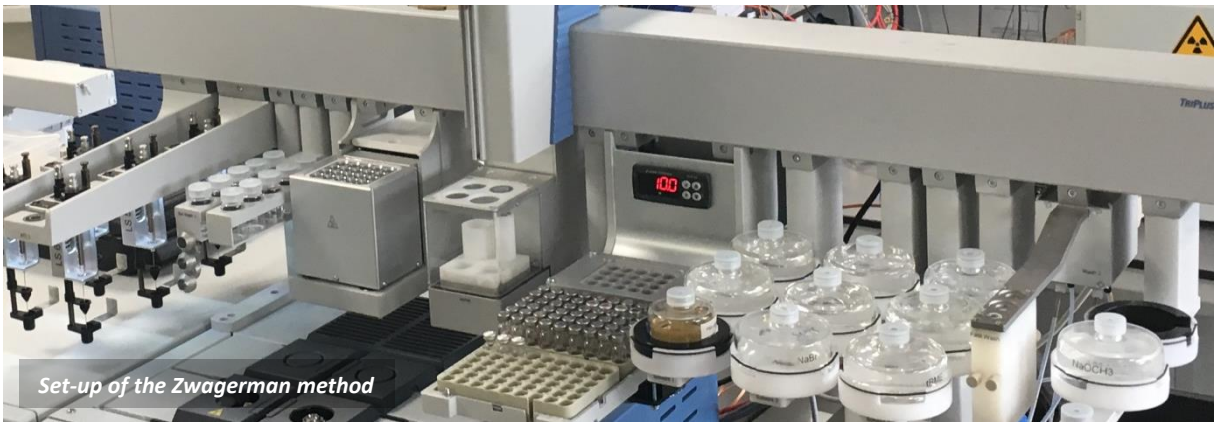
Disadvantages
Two aliquots required
More complicated hardware requirements, e.g. evaporation unit
2-MCPD is not measured
GE is not measured directly, but only calculated
Possible conversion of 2-MCPD to glycidol is not covered

Benefits
Fast reaction time
Adhering to AOCs guidelines
Manual labor is limited to weighing in two samples

Please note that the instrumental set-up is similar to the set-up described in the “Zwagerman” method.

Automated Zwagerman method (modified AOCs Cd29c)

The **Zwagerman method** is the most appropriate approach to determine MCPD and GE in oil in a fully automated fashion. It does not require any evaporation nor centrifugation step, which significantly improves sample throughput. It is a perfect fit for ambitious laboratories with high throughput requirements. This method was developed as a partnership between **Bunge Loders Croklaan and SampleQ.**



Set-up of the Zwagerman method

Disadvantages
The method requires a GC-QQQ instead of a GC-SingleQuad

Benefits
Manual labor is limited to weighing in the sample
The method is fully validated (see publications)
Full scope of the MCPDe and GE in one single injection
Short reaction time without evaporation
Short analysis time
GE, 2-MCPDe and 3-MCPDe are measured

Additional advantages:

- Smart sample prep: 40 real samples per 24 hrs from prep-to-rep
- Smart sample prep: 80 samples per 24 hrs in off-line mode
- Smart QC: automated calibration curves and addition of internal standards
- Smart software: automated calculation, data evaluation and LIMS export

Conclusions

Automated solutions approach for three methodologies to measure MCPDe and GE were developed by the SampleQ team throughout the last couple of years. Our solutions are based on standard procedures, robust and reliable but remain inherently flexible as to accommodate any particular attribute you would like to include and to make the device truly fit-for-your-purpose.

References

AOCS Official Method Cd 29a-13
Revised 2017
2- and 3-MCPD Fatty Acid Esters and Glycidol Fatty Acid Esters in Edible Oils and Fats by Acid Transesterification and GC/MS
https://www.aocs.org/attain-lab-services/methods/methods/method-detail?productId=118272

AOCS Official Method Cd 29c-13
Revised 2017
2- and 3-MCPD Fatty Acid Esters and Glycidol Fatty Acid Esters in Edible Oils and Fats by GC/MS
https://www.aocs.org/attain-lab-services/methods/methods/method-detail?productId=118275

Bunge Loders Croklaan Publication 1
A novel method for the automatic sample preparation and analysis of 3-MCPD-, 2-MCPD-, and glycidylesters in edible oils and fats, Zwagerman & Overman; 2015
https://onlinelibrary.wiley.com/doi/pdf/10.1002/ejlt.201500358

Bunge Loders Croklaan Publication 2
Optimized Analysis of MCPD- and Glycidyl Esters in Edible Oils and Fats Using Fast Alkaline Transesterification and ^{13}C-Correction for Glycidol Overestimation: Validation Including Interlaboratory Comparison, Zwagerman & Overman; 2018
https://onlinelibrary.wiley.com/doi/full/10.1002/ejlt.201800395

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