



Institut luxembourgeois de la normalisation  
de l'accréditation, de la sécurité et qualité  
des produits et services

## ILNAS-EN 14105:2020

### **Fat and oil derivatives - Fatty Acid Methyl Esters (FAME) - Determination of free and total glycerol and mono-, di-, triglyceride contents**

Produits dérivés des corps gras - Esters  
méthyliques d'acides gras (EMAG) -  
Détermination de la teneur en glycérols  
libre et total et en mono-, di- et

Erzeugnisse aus pflanzlichen und  
tierischen Fetten und Ölen - Fettsäure-  
Methylester (FAME) - Bestimmung des  
Gehaltes an freiem und Gesamtglycerin

12/2020



## National Foreword

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**Fat and oil derivatives - Fatty Acid Methyl Esters (FAME) -  
Determination of free and total glycerol and mono-, di-,  
triglyceride contents**

Produits dérivés des corps gras - Esters méthyliques  
d'acides gras (EMAG) - Détermination de la teneur en  
glycérols libre et total et en mono-, di- et triglycérides

Erzeugnisse aus pflanzlichen und tierischen Fetten und  
Ölen - Fettsäure-Methylester (FAME) - Bestimmung  
des Gehaltes an freiem und Gesamtglycerin und Mono-,  
Di- und Triglyceriden

This European Standard was approved by CEN on 2 November 2020.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

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## European foreword

This document (EN 14105:2020) has been prepared by Technical Committee CEN/TC 307 “Oilseeds, vegetable and animal fats and oils and their by-products - Methods of sampling and analysis”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2021, and conflicting national standards shall be withdrawn at the latest by June 2021.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 14105:2011.

In comparison with the previous edition, the following technical modifications have been made:

- document revised editorially;
- improvement of the quality of the figures;
- addition of figures in Annex A for clarification.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## 1 Scope

This document specifies a method to determine the free glycerol and residual mono-, di- and triglyceride contents in fatty acid methyl esters (FAME). The total glycerol content is then calculated from the obtained results.

Under the conditions described, the quantification limits are 0,001 % (*m/m*) for free glycerol, 0,10 % (*m/m*) for all glycerides (mono-, di- and tri-). This method is suitable for FAME prepared from rapeseed, sunflower, soybean, palm, animal oils and fats and mixture of them. It is not suitable for FAME produced from or containing coconut and palm kernel oils derivatives because of overlapping of different glyceride peaks.

NOTE 1 For the purposes of this document, the term “% (*m/m*)” is used to represent the mass fraction.

NOTE 2 Under the common EN 14105 GC conditions squalene can coelute with alpha glycerol monostearate. If the presence of squalene is suspected, EN 17057 can be used to discriminate between squalene and glycerol monostearate.

WARNING — The use of this document can involve hazardous materials, operations and equipment. This document does not purport to address all of the safety problems associated with its use. It is the responsibility of users of this document to take appropriate measures to ensure the safety and health of personnel prior to application of the standard, and fulfil statutory and regulatory requirements for this purpose.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN ISO 5555, *Animal and vegetable fats and oils — Sampling (ISO 5555)*

EN ISO 3170, *Petroleum liquids — Manual sampling (ISO 3170)*

## 3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

## 4 Principle

The glycerol and the mono- and diglycerides are transformed into more volatile and stable silyl derivatives in presence of pyridine and of N-methyl-N-trimethylsilyltrifluoroacetamide (MSTFA).

The sample after silylation is analysed by gas chromatography on a short capillary column with thin film thickness, with an on-column injector or equivalent device, and flame ionization detection.

After a calibration procedure, the quantification of glycerol is carried out in presence of the internal standard 1,2,4-butanetriol.

Mono-, di- and triglycerides are directly evaluated in presence of an internal standard for each glyceride category:

- glyceryl monononadecanoate (Mono C19) for monoglycerides;
- glyceryl dinonadecanoate (Di C38) for diglycerides;
- glyceryl trionadecanoate (Tri C57) for triglycerides.

## 5 Chemicals

Use only chemicals of recognized analytical grade, unless otherwise specified.

### 5.1 N-methyl-N-trimethylsilyltrifluoroacetamide (MSTFA).

### 5.2 Pyridine, max. 0,1 % water, stored on molecular sieve.

Pyridine silyl grade (5.10) can also be used.

### 5.3 Tetrahydrofuran (THF).

### 5.4 n-Heptane.

### 5.5 Glycerol.

### 5.6 1,2,4-Butanetriol.

### 5.7 1-Glyceryl monononadecanoate (Mono C19).

### 5.8 1-3 Glyceryl dinonadecanoate (Di C38).

### 5.9 Glyceryl trionadecanoate (Tri C57).

### 5.10 Pyridine, silyl grade.

## 6 Apparatus

Usual laboratory apparatus and, in particular, the following.

**6.1 Gas chromatograph**, equipped with an on-column injector or equivalent device, a temperature-programmable oven and a flame ionization detector.

**6.2 Capillary column**, capable of being programmed up to 400 °C ("high temperature" type) for which the following characteristics are advised:

- 100 % dimethylpolysiloxane or 95 % dimethyl-5 % diphenylpolysiloxane stationary phase;
- length 15 m;
- internal diameter 0,32 mm;
- film thickness 0,1 µm.

### 6.3 Volumetric flask, 50 ml capacity, Grade A.

### 6.4 Volumetric flasks, 20 ml capacity, Grade A.

### 6.5 Volumetric flasks, 10 ml capacity, Grade A.

**6.6 Screw-cap vials with PTFE-faced septa**, 10 ml capacity.

**6.7 Precision pipette**, 1 ml capacity.

**6.8 Precision pipette or syringe**, 100 µl capacity.

**6.9 Precision pipette or syringe**, 500 µl capacity.

**6.10 Graduated cylinder**, 10 ml capacity.

**6.11 Analytical balance**, with a weighing accuracy of  $\pm 1$  mg or better and a readability of  $\pm 0,1$  mg or better.

**6.12 Carrier gas**, hydrogen or helium.

**6.13 Auxiliary gases**, such as air, hydrogen and nitrogen.

## **7 Preparation of solutions**

### **7.1 1,2,4-Butanetriol stock solution, 1 mg/ml**

Weigh  $(50,0 \pm 0,1)$  mg 1,2,4-butanetriol (5.6) in a 50 ml volumetric flask (6.3) and fill up to the mark with pyridine (5.2 or 5.10).

### **7.2 Glycerol stock solution, 0,5 mg/ml**

Weigh  $(50,0 \pm 0,1)$  mg glycerol (5.5) in a 10 ml volumetric flask (6.5) and fill up to the mark with pyridine (5.2 or 5.10). Transfer 1 ml of this solution into a 10 ml volumetric flask (6.5) using a pipette (6.7) and fill up to the mark with pyridine (5.2 or 5.10).

### **7.3 Standard glycerides stock solution, 2,5 mg/ml**

For each reference glyceride, monononadecanoate (5.7), dinonadecanoate (5.8) and trinonadecanoate (5.9), weigh  $(50,0 \pm 0,1)$  mg in a unique 20 ml volumetric flask (6.4) and fill up to the mark with tetrahydrofurane (5.3).

The solution shall be perfectly transparent at ambient temperature. After storage in a refrigerator at 4 °C the solution can show a precipitate that shall re-dissolve spontaneously when restored at ambient temperature, without any external heating.

NOTE If stored at 4 °C the solution is stable for almost 3 months.

### **7.4 Commercial mixture of monoglycerides**

Made up of mono-palmitoylglycerol (monopalmitin), mono-stearoylglycerol (monostearin) and of mono oleoylglycerol (monoolein), present in quantities having an identical mass.

Prepare a stock solution of this mixture by weighing approximately 100 mg in a 10 ml volumetric flask (6.5) and fill up to the mark with pyridine (5.2 or 5.10).

This solution may be used to locate the relevant peaks in GC paths.

### **7.5 Calibration solutions**

Prepare four calibration solutions by transferring the volumes given in Table 1 of the glycerol stock solutions (7.2) and of the 1,2,4-butanetriol (7.1) into a series of vials (6.6), using the 100 µl precision pipette (6.8). If using a syringe, make sure that the needle and the body of the syringe are free from air bubbles.