Determination of total fat content in different food samples using the UniversalExtractor E-800
HydrolEx H-506, UniversalExtractor E-800: Total fat determination in food samples according to Weibull-Stoldt by use of Soxhlet, Hot and Twisselmann Extraction

A simple and reliable procedure for determination of fat content in different food samples according to Weibull-Stoldt, Hot Extraction and Twisselmann Extraction is introduced. The samples are hydrolyzed using the HydrolEx H-506. The extraction is performed with the UniversalExtractor E-800. Gravimetric determination of the total fat content follows the drying of the extract to a constant weight. This application complies with official methods (AOAC 963.15, ISO 22630:2015, AOAC 991.36). The combination of the HydrolEx H-506 and the UniversalExtractor E-800 increases the sample throughput.

1. Introduction

Fat determination is one of the key analysis performed in the food industry. The samples require a hydrolysis step with hydrochloric acid to break the chemically bound and naturally encased fat from the matrix. Afterwards, the fat is extracted with a suitable solvent according to Soxhlet, Hot Extraction or Twisselmann extraction. After the extract has been dried to a constant weight the total fat content is determined gravimetrically.

2. Experimental

Equipment: HydrolEx H-506 with long glass sample tubes and long aspiration tubes for Soxhlet and Hot Extraction, with standard glass sample tubes and aspiration tubes for Twisselmann Extraction, UniversalExtractor E-800

Samples: Shortbread LVU No. 17-11 with a certified fat content of 27.47 g/100 g (+/- 0.311 g/100 g); Milk powder, Muva MP-0215 with a certified fat content of 26.79 g/100g (0.25 g/100g); Boiled sausage, declared fat content 20 g/100g, purchased at a local supermarket; Chocolate coated breakfast cereals, declared fat content 3.5 g/100g, purchased at a local supermarket.

Determination: 20 g of quartz sand was added to a glass sample tube and 2 g Celite® 545 was placed on top. The samples were weighed into a hydrolysis vessel containing 2 g of Celite®. After adding 2 x 50 mL hydrochloric acid (4 M) into each vessel the samples were hydrolyzed for 30 min using the H-506. The hydrolyzate was transferred and the vessels washed with warm (50 °C) deionized water, until a neutral pH was obtained. The glass sample tubes were dried in a vacuum oven, drying oven or microwave oven. After cooling down in a desiccator another layer of quartz sand (20 g) was added to the sample tube. The extraction was performed using the E-800 (Figure 1) applying the parameters specified in Table 1.

Figure 1: UniversalExtractor E-800

Table 1: Parameters for the extraction with the UniversalExtractor E-800

Extraction method	Soxhlet	Hot Extraction	Twisselmann
Solvent		Petroleum ether	
Extraction step Heating level	20 cycles 7	30 min 7 3 chamber	60 min 7 beaker 7 chamber
Rinse step Heating level	5 min 7	10 min 7	10 min 7
Drying 1 Heating level Drying 2 Heating level	☑ AP 0 min 7 ☐ AP 2 min 4	☑ AP 0 min 7 ☐ AP 2 min 4	☑ AP 0 min 7 ☐ AP 2 min 4
Solvent volume	100 mL	100 mL	100 mL

The samples were extracted in triplicate. The extracts were dried to a constant weight in a drying oven at 102 °C and the total fat content was calculated.

3. Results

The determined fat contents are presented in Table 2. The results correspond to the certified values of the reference materials. The determinations show low relative standard deviations.

Table 2: Determined total fat content of different food samples, fat in g/100 g (relative standard deviation in brackets), n=3

Extraction method	Soxhlet	Hot	Twisselmann
Shortbread 27.47 +/- 0.311	**27.49** (0.26)	**27.51** (0.26)	**27.44** (0.24)
Milk powder 26.79 +/- 0.25	**26.67** (0.42)	**26.85** (0.84)	**26.65** (0.49)
Cervelat sausage 20	**18.44** (0.18)	**18.51** (0.14)	**18.54** (0.23)
Breakfast cereals 3.5	**3.39** (1.50)	**3.42** (1.97)	**3.55** (1.12)

4. Conclusion

The determination of total fat in different food samples using the HydrolEx H-506 and the UniversalExtractor E-800 provides reliable and reproducible results. These results independent of the extraction method correspond well to the certified and labelled values, with low relative standard deviations (rsd).

5. References

[1] AOAC 963.15 Fat in Cacao Products
[2] ISO 22630:2015 Oilseed meals – Rapid extraction method
[3] AOAC 991.36 Fat (crude) in meat and meat products

For more detailed information and safety considerations please refer to the Application Note No. 386/2019.