

## Fat Determination in cacao products according to Weibull-Stoldt – from the bean to the chocolate bar

*FatExtractor E-500: Soxhlet Extraction after hydrolysis with the HydrolEx H-506*

A simple and reliable procedure for fat determination of cacao products according to Weibull-Stoldt is introduced. In this application note, the samples are hydrolyzed with the HydrolEx H-506. The Soxhlet extraction is performed with the FatExtractor E-500. Calculation of total fat content follows gravimetrically after the extract has been dried to a constant weight.

### 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. After the extract has been dried to a constant weight the total fat content is determined gravimetrically.

### 2. Experimental

Equipment: HydrolEx H-506, FatExtractor E-500 Soxhlet

Samples: Cacao nibs, Cacao extract powder low fat, Cacao extract powder high fat, Cacao powder, Chocolate dark DRRR with a certified fat content of 39.93 g/100 g (+/- 0.15 g/100 g).

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 2x50 mL hydrochloric acid (4 M), the samples were hydrolyzed for 30 min using the H-506. The hydrolyzate was transferred and the vessels washed with warm (50 °C) deionised water, until a neutral pH was obtained. The glass sample tubes were dried in a drying 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 FatExtractor E-500, applying the parameters specified in Table 1.

*Table 1: Parameters for the extraction with the FatExtractor E-500 Soxhlet*

Method parameters	
Solvent	Petroleum ether
Extraction step	20 cycles (heating level 6)
Rinse step	5 min (heating level 6)
SmartDrying	on
Solvent volume	100 mL

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

### 3. Results

All the cacao products are analysed in duplicates and triplicates. The determined fat content corresponds well with the expected and certified values with low relative standard deviations (rsd). The results are shown in Table 2.

*Table 2: Determined fat content in cacao products and chocolate, fat in g/100 g (rsd: relative standard deviation), n=2,3*

Sample	Fat content	Mean value	rsd
Cacao nibs	52.64	<b>52.91%</b>	<b>0.61%</b>
	52.83		
	53.27		
Cacao extract powder low fat	7.14	<b>7.21%</b>	<b>1.38%</b>
	7.28		
Cacao extract powder high fat	16.60	<b>16.50%</b>	<b>0.51%</b>
	16.45		
	16.46		
Cacao powder	24.91	<b>25.16%</b>	<b>0.88%</b>
	25.29		
	25.29		
Chocolate DRRR	39.99	<b>40.00%</b>	<b>0.50%</b>
	39.82		
	40.21		

### 4. Conclusion

The determination of fat in different cacao products using the HydrolEx H-506 and the FatExtractor E-500 provides reliable and reproducible results. These results correspond well to the expected and certified values, with low relative standard deviations (rsd).

### 5. Acknowledgements

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### 6. References

[1] AOAC 963.15 Fat in Cacao Products

For more detailed information and safety considerations please refer to the Application Note No. 769/2021.