

## Determination of Oil in Soybeans according to Am 2-93

*FatExtractor E-500 ECE: Determination of oil content in a soybeans sample by continuous extraction according to AOCS Am 2-93 (equal to ISO 659 and FOSFA)*

A simple and reliable procedure for the oil determination in soybeans samples is introduced. This Short Note follows the standard method AOCS Am 2-93 [1]. The standard method Am 2-93 is equal to the ISO 659:2009 [2] and the FOSFA Oilseeds – Determination of oil content – solvent extraction (reference method) [3].

The standard method AOCS Am 2-93 requires an extraction with a Butt-type extraction apparatus. The Butt-type extraction is equal to the Twisselmann extraction method used in the FatExtractor E-500 ECE. Both, the Butt-type extractor as well as the Economic Continuous Extraction (ECE) are continuous extractions where the sample is constantly kept in hot solvent vapor whilst efficiently rinsed with freshly distilled solvent.

AOCS Am 2-93 describes a determination consisting of three extractions: the sample is first extracted for 4 h, then the sample is grinded, followed by a second extraction for 2 h, the sample is grinded again and extracted with a third extraction for 2 h.

The oil content is determined gravimetrically after the extract has been dried to a constant weight.

### 1. Introduction

This Short Note shows by means of a certified reference material sample that reliable and reproducible results will be received using the FatExtractor E-500 ECE.

### 2. Experimental

Equipment: FatExtractor E-500 Economic Continuous Extraction, Recirculating Chiller F-308.

Sample: Soybeans, AOCS reference material 10 Soybeans 2019-2020, sample 1, expected oil content: 20.19 % (limit of tolerance: 19.27 – 21.11 %)

Procedure: The soybeans sample was dried in a drying oven to determine the moisture content. The dried sample was homogenized. 10 g of the homogenous sample was weighed into a cellulose thimble. The sample was extracted three times using the E-500 ECE applying the parameters specified in Table 1. After the first and the second extraction the sample was transferred into a mortar and grinded with a pestle for 1 min.

Table 1: Parameters for E-500 ECE, following AOCS Am 2-93

Step	Value	Heating level
Solvent	Petroleum ether	
Extraction 1:	240 min	6
Extraction 2:	120 min	6
Extraction 3	120 min	6
SmartDrying	on <sup>1</sup>	-
Solvent volume [mL] for each extraction	70	

The extracts of the three extractions were dried to a constant weight in a drying oven at 102 °C, cooled down to ambient temperature in a desiccator, weighed and the oil content was calculated.

### 3. Results

The determined fat content is presented in Table 2.

Table 2: Sum of first, second and third extraction of oil content of a soybeans sample, determined with FatExtractor E-500; expected oil content: 20.19 % (limit of tolerance: 19.27 – 21.11 %).

	m <sub>sample</sub>	Oil%, total
Sample 1	10.0866	21.66
Sample 2	10.1351	21.41
Sample 3	10.1958	21.43
<b>Mean value [%]</b>		<b>21.50</b>
sd		0.14
<b>rsd [%]</b>		<b>0.64</b>

The determined fat content is higher than the expected fat content of the certified reference material: 20.19 % (limit of tolerance: 19.27 % – 21.11 %). The value for the fat content of the certified reference material is determined with an interlaboratory test following standard method AOCS Ac 3-44 [4]. The standard method Ac 3-44 requires a single extraction for 5 h without additionally homogenization during the extraction process. Therefore, the procedure of AOCS Am 2-93 with three extractions and grinding in between, yields in higher oil contents compared to the procedure of AOCS Ac 3-44. These findings are in accordance with literature [5, 6], whereas the AOCS Am 2-93 has found to give the highest oil recovery.

### 4. Conclusion

The determination of the oil content in a soybeans sample following AOCS Am 2-93 using the FatExtractor E-500 ECE provides reliable and reproducible results.

### 5. References

- [1] AOCS Official Method Am 2-93: Oil Content in Oilseeds, Revised 2017.
- [2] ISO 659:2009 Oilseeds – Determination of oil content (Reference method)
- [3] FOSFA International Official Method, Oilseeds - Determination of oil content – solvent extraction (reference method)
- [4] AOCS Official Method Ac 3-44: Oil in Soybeans, Reapproved 2017.
- [5] Taylor, S. et al. 1997. Food Research International, Vol. 30. No. 5, pp. 365-310
- [6] Barthelet, V. J. and Daun J. K. 2004. Oil Content Analysis: Myths and Reality, in Luthria, D.L. Oil Extraction and Analysis. AOAC Press

For more detailed information and safety considerations please refer to the Application Note No. 393/2020.

<sup>1</sup> Instead of using SmartDrying it is possible to use the following drying parameters. Then, SmartDrying is switched off: Petroleum ether: 12 min