Determination of oil content in seed samples

Comparison of different extraction methods: Pressurized Solvent Extraction (PSE) using SpeedExtractor E-916 versus Weibull Stoldt method using Hydrolysis Unit E-416 and Extraction Unit E-816 SOX

Bioactive oils are commonly used in food, pharmaceutical and cosmetic applications [1]. Those oils are usually rich in unsaturated and polyinsaturated fatty acids. The majority of fatty acids can be produced by the human body. However, omega-3 and omega-6, essential in human nutrition, cannot be synthesized and must be provided by food [1]. Therefore, oils rich in unsaturatted fatty acids are widely used in food preparations or for direct consumption.

In this study, hemp, chia and linseed samples were chosen due to their high linoleic and linolenic acid contents. The declared oil contents were 31-33 %, but in natural products, the real oil value can differ from theoretical value.

1.

2. Introduction

The objective of this work was to extract and to quantify the oil content from these seeds with a Pressurized Solvent Extraction (PSE) method using the SpeedExtractor E-916 and to compare the results with classical extraction methods. Therefore, the samples were extracted with a Soxhlet extraction method using the Extraction Unit E-816 SOX for the determination of crude fat and according to Weibull Stoldt using a Hydrolysis Unit E-416 followed by a Soxhlet extraction method using the Extraction Unit E-816 SOX for the determination of total fat. The fat content was determined gravimetrically after the extract has been dried to a constant weight. The samples were extracted in duplicates.

3. Experimental

1 g of seed sample was extracted using a SpeedExtractor E-916 and the extract was evaporated in parallel to dryness using a Multivapor™ P-6. The parameters are shown in Tables 1-2. For comparison, 1 g of sample was extracted using the Extraction Unit E-816 SOX with and without hydrolysis prior to extraction using Hydrolysis Unit E-416. The parameters for the Soxhlet extractions are shown in Table 3.

Table 1: Parameters for extraction using the SpeedExtractor E-916.

Parameter	Value
Temperature	100 °C
Pressure	100 bar
Solvent	100 % n-Hexane
Cell	20 mL
Vial	240 mL
Cycles	
Heat up	1 min / 1 min
Hold	5 min / 5 min
Discharge	3 min / 3 min
Flush with solvent	2 min
Flush with gas	3 min
Total extraction time	35 min

Table 2: Evaporation method using the Multivapor™ P-6.

Bath temperature		50 °C
Rotation speed		5
Initial pressure	**Final pressure**	**Time**
Atmospheric pressure	350 mbar	2 min
350 mbar	350 mbar	1 min
350 mbar	250 mbar	3 min
250 mbar	250 mbar	2 min
250 mbar	180 mbar	3 min
180 mbar	180 mbar	15 min
180 mbar	120 mbar	1 min
120 mbar	120 mbar	5 min

Table 3: Method parameters for the Soxhlet extraction using the Extraction Unit E-816 SOX.

Solvent	n-Hexane
Extraction step	120 min / 20 cycles (Heater 100 %)
Rinsing step	5 min (Heater 100 %)
Drying step	25 min (Heater 100 %)
Solvent volume	120 mL

4. Results

The mean values of the obtained fat contents are shown in Figure 1.

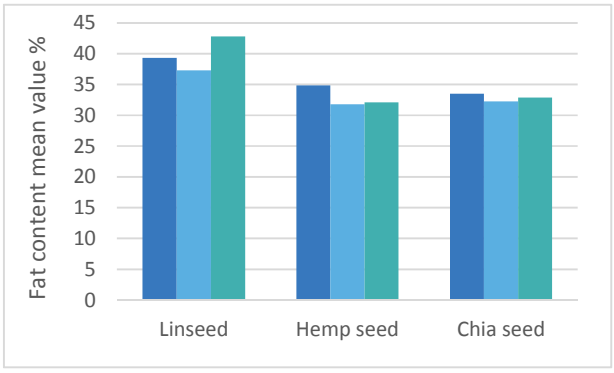

Figure 1: dark blue: E-916; pale blue: E-816 SOX; pale green: E-416 and E-816 SOX. n= 2.

5. Conclusion

The fat contents of linseed, chia seeds and hemp seeds were determined successfully using the three methods described above.

6. References

[1] Rodríguez, J.; Martín, M. J.; Ruiz, M. A.; Clares, B. Current Encapsulation Strategies for Bioactive Oils: From Alimentary to Pharmaceutical Perspectives. Food Res. Int. 2016, 83, 41–59.

For more detailed information and safety conside-rations please refer to the Application Note No. 308/2017.