Extraction of Oil Content from Oilseeds by Accelerated Solvent Extraction

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Introduction

Oils for foods and cooking are derived from oilseeds like canola, soybeans, corn, flax, cotton, etc. The production of oil from oilseeds is an important business, and agronomists are continuing to investigate ways to improve the oil output of the seeds as well as ways to control the composition of the oil itself.

A common method used to remove the oil from the oilseeds is solvent extraction. Existing solvent extraction methods use large-volumes of solvent (typically several hundred milliliters) and long extraction times (8–16 h) to remove the oil from the seeds. Once the oil is removed, the weight percent of oil in the seeds can be determined, and the composition of the oils can be studied. Accelerated solvent extraction is an automated extraction technique that uses elevated temperature and pressure to expedite the removal of analytes from various matrices.

Accelerated solvent extraction is a technique that significantly streamlines sample preparation. A commonly used solvent is pumped into an extraction cell containing the sample, which is then brought to an elevated temperature and pressure. Minutes later, the extract is transferred from the heated cell to a standard collection vial for cleanup or analysis. The entire extraction process is fully automated and performed in minutes for fast and easy extraction with low solvent consumption.

The procedure described in this Application Note is an update to the work that was performed for Thermo Scientific Application Note 325 (AN 325). This update makes use of the Thermo Scientific™ Dionex™ ASE™ 350 Accelerated Solvent Extractor system and Thermo Scientific™ Rocket™ Evaporator to provide an automated workflow for oil determination in canola seeds. The original extraction procedure can be found in AN 325.

Equipment

- Dionex ASE 350 Accelerated Solvent Extractor system (P/N 083114, 120 V or 083146, 240 V)
- 10 mL Stainless Steel Extraction Cells (P/N 068087)
- Collection Vials, 60 mL (P/N 048784)
- Cellulose Filters (P/N 068093)
- Analytical Balance (to read to the nearest 0.0001 g or better)
- Mortar and pestle (Fisher Scientific)
- Rocket Evaporator (P/N 075904, 120 V or 082766, 240 V)
- Julabo® Recirculating Chiller, Model FL 601 (P/N 075905 (120 V) or 076364 (240 V)
- Thermo Scientific Dionex ASE Pucks (P/N 075910)

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Drying Agents and Dispersants

- Thermo Scientific Dionex ASE Prep DE (diatomaceous earth) Dispersant (P/N 062819)
- Ottawa Sand (Fisher Scientific)

Solvent

Petroleum Ether (pesticide grade or equivalent; Fisher Scientific)

Extraction Conditions*	
Solvent:	Petroleum ether 100%
Oven Temperature:	105 °C
Static Time:	10 min
Static Cycles:	3
Flush Volume:	100%
Purge Time:	60 sec

*Pressure is fixed at 1500 psi and does not need to be programmed in the method.

Samples

Dwarf Essex Rape (canola) seeds were obtained online from Wammock Farm Service.

Extraction Procedure

The rape seeds were ground using a commercial coffee grinder and then further crushed with a mortar and pestle (the particle diameter should be less than 3 mm when finished). Place a cellulose filter at the outlet end of the extraction cell. Weigh out 3 to 10 g of sample in a beaker and mix with Dionex ASE Prep DE if the sample is wet (1:1 w/w). If not, mix with Ottawa sand (approximately 1:1 w/w) and load into the extraction cell. Fill any void volume with clean Ottawa sand. Weigh and label the appropriate number of collection vials and place in the Dionex ASE 350 system vial carousel. Place the loaded cells in the cell carousel. Set up the method described in the “Extraction Conditions” section and begin the extraction. When the extractions are complete, remove the collection vials and place into Dionex ASE Pucks (Figures 1 and 2). Load the Dionex ASE Pucks into the Rocket Evaporator (Figure 3 and 4) and run the appropriate preprogrammed evaporation method. When using petroleum ether, use Evaporation Method 1 for very low boiling point solvents. Note that samples can be removed from the Dionex ASE 350 system and added directly to the Rocket Evaporator. The Rocket Evaporator will evaporate the solvent to dryness and will stop automatically when all solvent is evaporated.

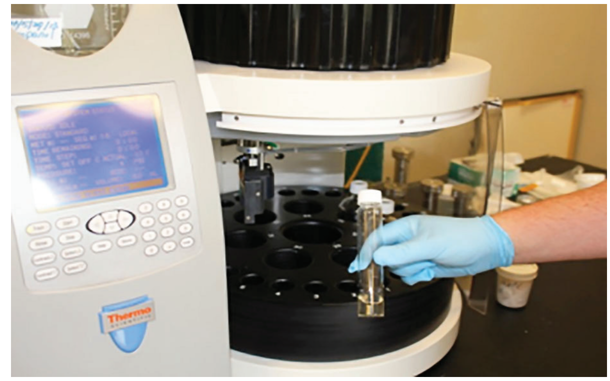

Figure 1. 60 mL vial containing extracts.

Figure 2. Dionex ASE Puck for three 60 mL collection vials.

Figure 3. Extracts are loaded into the Dionex ASE Puck.

Figure 4. Dionex ASE Pucks are loaded into the Rocket Evaporator.

Results and Discussion

Application Note 325 demonstrated the extraction efficiency of the Dionex ASE 200 system versus established method (AOCS AM 2-93). This update demonstrates that the Dionex ASE 350 system yields comparable performance to the Dionex ASE 200 system and that the Rocket Evaporator, streamlines the sample preparation workflow by eliminating the need for cumbersome nitrogen stream evaporation. The example used here is with rape seeds that contain approximately 47 wt percent oil. The results from the extraction of six samples are shown in Table 1 below.

Table 1. Percent oil* recovery from seeds.

Average (n = 6)	Standard Deviation	%RSD
48.2%	1.10	2.3%

*% oil = (residue/sample weight) × 100%

Conclusion

The use of the Dionex ASE 350 system with the Rocket Evaporator automates the extraction of oil from oil seeds. The use of Dionex ASE Pucks and Rocket Evaporator eliminates the need for manual sample transfer and nitrogen stream evaporation. By using the Dionex ASE 350 system and Rocket Evaporator together, the sample preparation workflow for oil extraction from oil seeds can be automated for increased productivity and throughput.

References

1. Thermo Scientific Application Note 325. *Extraction of Oils from Oilseeds by Accelerated Solvent Extraction.* **2004.**

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