onePSE APPLICATIONS #229

The Rapid Gravimetric Determination of Fat from Meat and Meat Products by the Weight Loss Method using the Pressurized Solvent Extraction (PSE) Technique

Introduction

Pressurized solvent extraction is a new technique that reduces both solvent consumption and sample preparation time. Solvent, pumped into an extraction vessel containing the sample, is heated and pressurized. The pressurized solvent at high temperature then accelerates the extraction process by increasing the solubility of the analyte in the solvent and also increasing the kinetic rate of desorption of the analyte from the sample matrix.

The determination of fat in food products is a quality control procedure performed routinely in the food industry. The analysis typically employs a solvent extraction. This method is slow, labor intensive, and requires the use of large quantities of hazardous solvents.

This application describes a rapid alternative procedure for the gravimetric determination of fat in meat and meat products using the pressurized solvent extraction technique. Fat is calculated by the weight loss method, eliminating the time required to evaporate the solvent extract in the standard gravimetric procedure.

The conditions for the extraction, including sample weight, extraction temperature, and extraction pressure, were optimized with standard samples. The optimization method was then applied to different meat samples, including ground beef and frankfurters.

Data is presented comparing the accuracy and precision of the pressurized solvent extraction of fat from meat products by the rapid weight loss procedure to the standard weight gain method. An analysis

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of the time savings achieved when compared to the traditional extraction method is also included.

Equipment

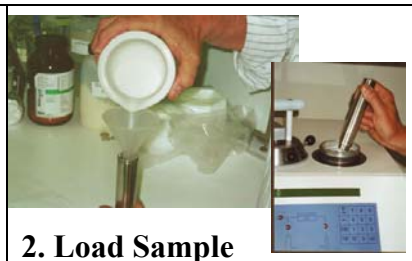
- ✓ Applied Separations' *one* PSE Pressurized Solvent Extractor
- ✓ 11mL or larger Extraction Vessels-Cat. #10625
- ✓ Microwave Oven – for sample drying
- ✓ Analytical Balance

Solvents and Materials

- ✓ Petroleum ether (b.p. 35 - 60ºC)
- ✓ Collection vials (60mL for extract collection)-Cat. #10650
- ✓ Cellulose Filter Disks-Cat. #10711
- ✓ S/S Vessel Frits (10 micron)-Cat. #10710
- ✓ Fiberglass Pads

Summary of Method

1. Prepare Sample



2. Load Sample

3. Run Sample

4. Collect Extract

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Procedure

Sample Preparation

Prepare the extraction vessel(s) for analysis by placing a filter disk in the bottom opening followed by a 10µ frit, and secure them in place with the retaining nut.

Accurately weigh a 2.5 gr. sample onto a tared fiberglass pads. Ensure that the meat product sample is homogeneous before proceeding with this method. Failure to prepare a totally uniform sample may result in inconsistent results. Spread the sample on the fiberglass pad.

Dry the sample by placing fiberglass pad in a microwave oven on a high setting for 1.5 minutes and record weight.

Load Sample

Roll fiberglass pad into a cylinder so that sample contents are trapped inside and place the rolled fiberglass pad into extraction vessel.

Run Sample

Select the appropriate extraction program and start.

Extraction Conditions

Program the following extraction parameters on the one PSE

Program A Mode – 11mL vessel

Oven temperature:	125ºC
Pressure:	100 bar
Static time:	1 minute
Refills:	7/2
Solvent:	Petroleum Ether
Purge:	N=2
Flush program:	Solvent/gas/repeat flush:20sec/2min/0

Collect Extract

At the end of the extraction sequence, remove fiberglass pad from the vessel and dry pad in microwave in order to evaporate solvent. When it is dry, reweigh fiberglass pad on a balance to determine the amount of fat in the sample.

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Analysis

Frankfurter

% Fat

	Ave.	S.D.	N
PSE	24.27	0.25	3
Soxhlet	24.72	0.12	3

Ground Beef 1

% Fat

	Ave.	S.D.	N
PSE	15.47	0.35	6
Soxhlet	15.43	0.19	3

Ground Beef 2

% Fat

	Ave.	S.D.	N
PSE	4.14	0.07	3
Soxhlet	4.18	0.07	3

Results

Comparison of Methods

	PSE	Soxhlet
Sample Dry Time (min)	1.5	60
Extraction Time (min)	9	240
Solvent Evaporation Time (min	0.5	30
Total Time (min)	11	330
Solvent Consumption	22mL	150mL

Conclusion

Pressurized solvent extraction provides accurate and precise results comparable to traditional methods of extraction. In addition, PSE allows for faster sample preparation at significantly reduced solvent consumption.

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References

Kaziunas,A.; Maxwell, R.; and Pearl, K. “The Rapid Gravimetric Determination of Fat from Meat and Meat Products by the Weight Loss Method using the Pressurized Solvent Extraction Technique.” *Pittcon 2003*.

Safety

The use of organic solvents, elevated temperatures, and high pressures present potential safety concerns in the laboratory. Common sense laboratory practices can be employed to minimize these concerns.

Extraction vessels in the *one* PSE oven are hot enough upon removal to burn unprotected skin. Allow the vessels to cool before removing them from the oven or use appropriate protective equipment (e.g., insulated gloves or tongs), as recommended by the manufacturer.

During the gas purge step, some solvent vapors may exit through a vent port in the instrument. Connect this port to a fume hood or other means to prevent release of solvent vapors to the laboratory atmosphere. This precaution also applies to the removal of post extraction solvent from the collected extract.

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