Crude Fat Determination in Butter and Margarine according to the Randall method

Reference **AOAC 938.06** Fat in butter.

Tested with **VELP Scientifica SER 158/6 Solvent AutoExtractor** (Code S303A0380)

Introduction

Butter and margarine are two fats commonly used in food preparation, from every day cooking methods like frying or roasting; to baking cakes, biscuits and other desserts; even ice cream.

Butter is a dairy product containing up to 80% butterfat (in commercial products) which is solid when chilled and at room temperature in some regions and liquid when warmed. It is made by churning fresh or fermented cream or milk, to separate the butterfat from the buttermilk.

Modern margarine is made mainly of refined vegetable oil and water, and may also contain milk. In some places in the United States it is colloquially referred to as "oleo", short for oleomargarine.

Margarine, like butter, consists of a water-in-fat emulsion, with tiny droplets of water dispersed uniformly throughout a fat phase in a stable crystalline form. In some jurisdictions margarine must have a minimum fat content of 80% to be labelled as such, the same as butter.

Fat Determination in Butter and Margarine

Hot solvent extraction process with SER 158 Series can be summed up in 5 steps, for a fully unattended operation:

| STEP 1 IMMERSION | → | STEP 2 REMOVING | → | STEP 3 WASHING | → | STEP 4 RECOVERY | → | STEP 5 COOLING |

During IMMERSION the sample is immersed in boiling solvent. Then the REMOVING step automatically lowers the level of the solvent to below the extraction thimble. During WASHING the condensed solvent flows over the sample and through the thimble to complete the extraction process. The fourth step involves solvent RECOVERY. Approximately 90% of the solvent used is collected in the internal recovery tank. The final step is the COOLING of the extraction cups containing the extracted matter. The cups are raised to prevent burning. The extraction cups containing the extract are placed in a drying oven, cooled in a desiccator and weighed for the extract percentage calculation.

Sample

Butter → Fat labeled value: 83%

Margarine → Fat labeled value: 80%

Chemicals and Equipment Required

- Analytical balance, 3 decimals
- Extraction thimbles (33x80 mm) (Code A00000295)
- Glass extraction cups
- Vaflon seals
- Diethyl ether as solvent
- Sodium sulphate anhydrous
- Defatted cotton

Sample Preparation

Fix the Extraction thimbles with the Extraction thimbles holders (Code A00000312). Then, add about 5 g of sodium sulphate anhydrous directly in the VELP extraction thimbles using the Thimble weighing cup (Code A00000310). Put 2 g of Sample* and mix thoroughly using a glass rod. Clean the glass rod using a piece of clean defatted cotton and place it into each thimble, over the sample.

(*) Use both samples at room temperature (around 20°C).

Glass Extraction Cups Preparation

- Position the empty extraction cups in a drying oven (105 °C) for 1 hour.
- Cool them in a desiccator until constant weight of the tare (*Tare*).
- Position the extraction thimbles in the extraction cups
- The extraction cups containing the extraction thimble can now be placed on the ultra-fast heating plate of SER158.

Extraction Procedure with SER 158

On the ControlPad select "*Analysis*", and then create a method in a customer panel including the following parameters:

- Immersion Time: 50 minutes
- Removing Time: 15 minutes
- Washing Time: 50 minutes

- Recovery Time: 20 minutes
- Cooling Time: 5 minutes
- Diethyl Ether: 110 ml

Close the safety guard and add the solvent using the automatic solvent dispensing system SolventXpress™ to minimize exposure to the solvent ensuring operator safety.

Press START to begin the extraction process. At the end of analysis position the extraction cups containing the extract in a drying oven (1 hour at 105 °C), cooled them in a desiccator to room temperature and record the accurate weight (*Total*).

Typical Results on Margarine and Butter

Analysis results are calculated automatically and stored in the ControlPad when entering the weights into the software (manually or automatically through the balance connection). The extract percentage calculation is performed by using the following formulas:

$$\text{Extract (g) = (Total - Tare)}$$
$$\text{Extract (\%) = Extract x 100 / (Sample)}$$

Where:

Sample= sample weight (g)

Tare= weight of the empty extraction cup (g)

Total= weight of the extraction cup + extract (g)

Results of Butter

Sample (g)	Extract (g)	Extract (%)
2,0253	1,6963	83,76%
2,0617	1,7314	83,98%
2,2170	1,8420	83,09%
2,0257	1,6910	83,48%
2,4417	2,0281	83,06%
2,5563	2,1374	83,61%
	Average ± SD%	**83.50 ± 0.36**
	RSD% *	**0.439**

Fat Labeled Value: 83 g / 100 g

* RSD% = (Standard Deviation x 100) / Average

Results of Margarine

Sample (g)	Extract (g)	Extract (%)
2,0267	1,6274	80,30%
2,3905	1,9472	81,46%
2,1868	1,7648	80,70%
2,2169	1,7925	80,86%
2,0467	1,6573	80,97%
2,5113	2,0421	81,32%
	Average ± SD%	**80.93 ± 0.42**
	RSD% *	**0.520**
Fat Labeled Value: 80 g / 100 g		

* RSD% = (Standard Deviation x 100) / Average

Conclusion

The results obtained for both of samples are reliable and reproducible in accordance with the expected values, with a low relative standard deviation, that means high repeatability of the results.

Therefore, SER 158 Solvent Extractor is the ideal solution for the fat content determination in butter and margarine.

Benefits of hot solvent extraction (Randall) by using the **SER 158 Automatic Solvent Extractor**:

- Load&Go operation minimize the operator requested labor time and makes analysis faster and safer

- up to 5 times faster than traditional Soxhlet (hot solvent vs. cold solvent);

- low solvent consumption (high solvent recovery, approximately 90%) - limited cost per analysis;

- no exposure to solvent thanks to **SolventXpress™**

- worldwide recognized official method;

- full traceability of data with automatic result calculation and storage on the on-board archive.