

Production: Margarine

Objective: Comparison of spreadability / firmness of two margarine types by ability to extrude through a 3mm hole

Type of action: Extrusion

Test setting:

Speed	Test mode	Trigger	Target	Hold
1 mm/s	Distance (c)	50 gf	20 mm	0 sec

Accessory:

Forward extrusion rig, Platform

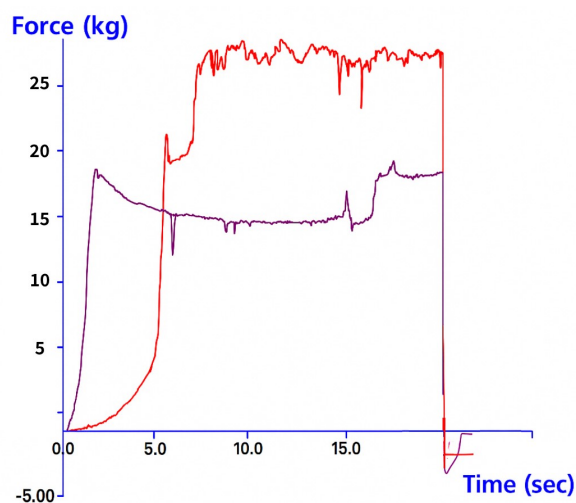
Sample Preparation:

Fill the forward extrusion containers by at least 50% (gently pushing the sample down to try and remove large air pockets). It is preferable to deposit the sample into the forward extrusion cell to set into shape rather than taking it from another container once set and trying to fill the forward extrusion cell. The latter sample preparation method is not recommended as it is almost impossible to avoid the presence of air pockets which will be clearly shown on the test curve. Equilibrate for at least 5 hours in a thermal chamber at a specified temperature.

Test Set-Up:

Remove the samples from the thermal chamber just prior to testing. Position a forward extrusion container centrally under the probe and commence the penetration test.

Typical plots:



The above curves were produced from 2 types of cooking margarine tested in 50% full forward extrusion containers at 20C.

Observations:

When a 50g surface trigger is attained the piston proceeds to push onto the sample. At this point the sample is being deformed and compressed to pack more and more tightly into the diminishing space available under the descending piston and the force is seen to increase gently. Soon afterwards when the sample becomes more packed, except for small amounts of entrapped air, the force is seen to increase steeply and the extrusion commences. Once the force increases to a maximum point a plateau is observed which shows the force required to continue extrusion. For some samples an increase in force is sometimes apparent which can be explained by the observation of a short blockage through the extrusion hole followed by the extrusion of a larger diameter of sample. This region is therefore discarded in data analysis.

Data Analysis:

1. AVE (+) from 10 to 20 sec

Results

Sample	Mean Extrusion force "Firmness" (+/- S.D) kg
A	19.5 +/- 3.2
B	28.6 +/- 3.8

Notes:

- A fluctuation in force produced on extrusion may be as a result of the release of previously trapped air pockets.
- In order to make comparisons between tests the amount of sample, test temperature and other test parameters must remain constant.
- When attempting to optimise test settings it is suggested that the first tests are performed on the hardest samples to anticipate the maximum testing range required and ensure that the force capacity allows testing of all future samples.
- Butter and margarine are predominantly fatty systems and the consistency at any temperature is determined primarily by the structure of the fatty phase, i.e. the proportions and distribution of solid and liquid glycerides and the size and nature of the fat crystals. Softness of comparative samples of butter and margarine is observed to approximately correlate with the total amount of fat in the sample and the percentage of saturation of this fat.
- Factors affecting the rheological properties of the fat-based spread -
 - A. Solid Fat Content (temperature dependent)
 - B. Type of fat present and predominant (saturated/unsaturated)
 - C. Dispersed particle volume fraction (especially in low-fat formulations)
 - D. Crystal modification (aggregated fat crystal network formation) - under standard test conditions results may indicate prior major temperature abuse and subsequent fat crystal modification.