ISO 9001 CERTIFIED
BROOKFIELD AMETEK

TEXTURE ANALYSIS APPLICATION NOTE:

Butter & Margarine

Cutting Force

TEST PRINCIPLE

Evaluation of the cutting force of butter and margarine using a wire cutter.

BACKGROUND

The textural properties of butter and margarine, such as hardness, spreadability, graininess, brittleness, oiliness and stickiness, can be determined using the CT3 Texture Analyzer. The texture of butter and margarine can vary depending on temperature, origin of the milk or oil, and fat content.

Temperature changes can vary the texture by affecting the consistency of butter or margarine. They alter the state of the fat contents, thereby varying the distribution of solid and liquid glycerides and size of fat crystals. In general, larger fat crystals (>5µm) and a high solids content make a harder, grainy and more brittle product.

The origin of butter or margarine also affects texture by determining the type of fats and predominating fats (saturated or unsaturated) that are present. A high fat content generally gives a product higher hardness values and low spreadability values. Such products also tend to be more adhesive and less cohesive.

This application compares the cutting force between butter and margarine using the CT3 Texture Analyzer fitted with a wire cutter on a 4.5 kg load cell. When the wire blade cuts through the sample, a measurement of the cutting strength or force and work done (area under the positive curve) can be made. These measurements are an indication of sample quality and texture.

METHOD

EQUIPMENT:
- CT3 with 4.5 kg load cell
- Wire Shear Plate (TA-WSP)
- Fixture Base Table (TA-BT-KIT)
- TexturePro CT Software

SETTINGS:

Test Type:	Compression
Pre-Test Speed:	1.0 mm/s
Test Speed:	0.5 mm/s
Post-Test Speed:	0.5 mm/s
Target Type:	Distance
Target Value:	35 mm
Trigger Force:	30 g

SAMPLE PREPARATION

Cut the sample into equal rectangles or squares and return to storage so that the samples can stabilize to the same temperature. The width of the sample should be less than the width of the wire cutter. Samples should only be removed

from the place of storage at the point of testing.

Note: For comparison purposes, the samples should be of equal length and at the same test temperature.

PROCEDURE

1. Attach the wire cutter probe to the instrument.
2. Place the fixture base table to the base of the instrument and loosely tighten the thumb screws to enable some degree of mobility.
3. Insert the wire cutter base plate to the fixture base table and tighten into position using the side screws.
4. Align the slot of the wire cutter base plate with the wire cutter probe such that the probe can penetrate right through the slot without coming into contact with the plate.
5. Once the alignment is complete, tighten the thumb screws of the fixture base table to prevent further movement.
6. Remove the sample from the place of storage (refrigerator) and place it on the fixture base table.
7. Lower the arm of the instrument and centrally align the sample under the wire cutter.
8. Position the wire cutter a few millimeters from the sample.
9. Commence the test.

Note: When optimizing test settings, the hardest sample should be tested first in order to anticipate the maximum testing range required. This will ensure that the force capacity covers the range for other future samples.

RESULTS

The graphs show the cutting force required to slice through butter and margarine using a wire cutter.

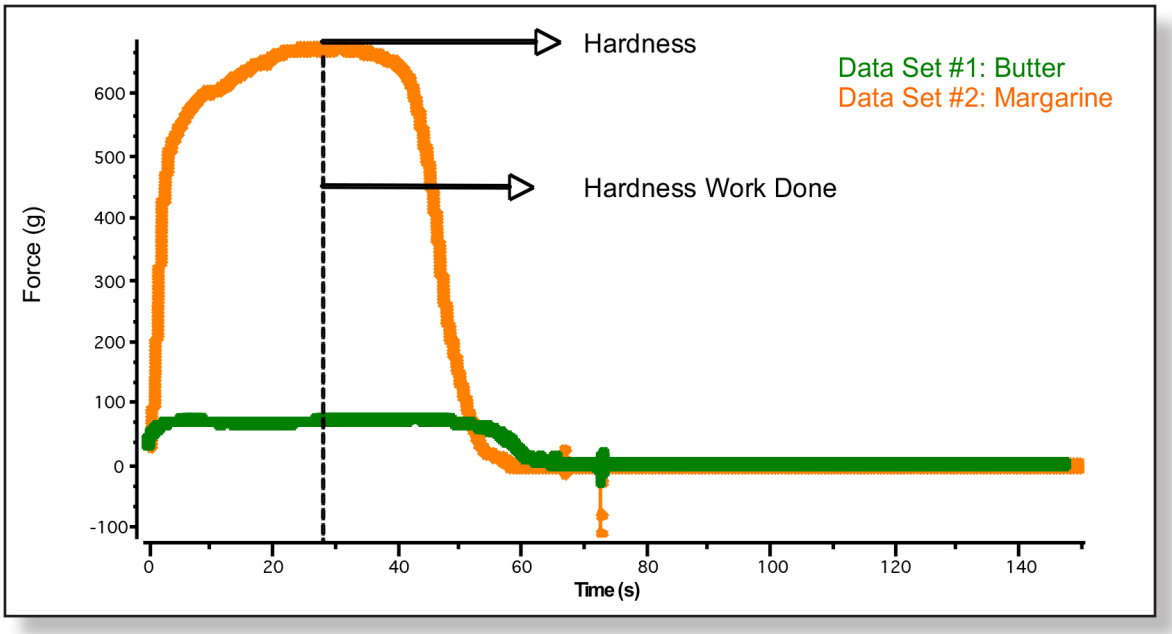

Figure I

Figure I shows the cutting force of a 5 cm x 3 cm block of butter and margarine tested at room temperature. The maximum peak on the graph is a measure of sample hardness. The area under the load vs. time graph from the start of the test to the maximum point is a measure of hardness work done.

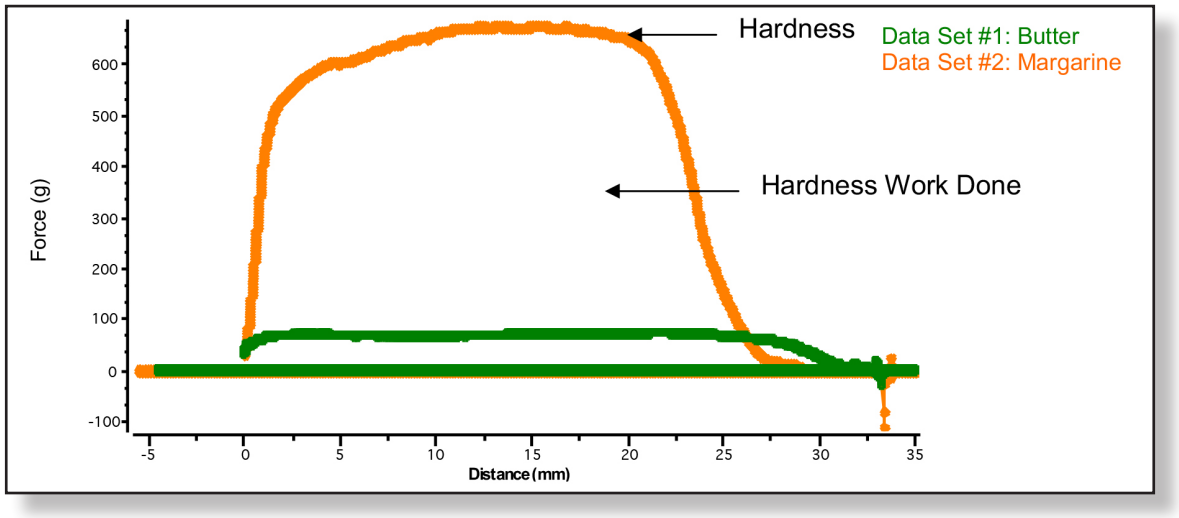

Figure II

Figure II shows force versus distance for the cutting force of a 5 cm x 3 cm block of butter and margarine tested at room temperature.

DISCUSSION

When a trigger force of 30 g has been attained at the sample surface, the wire cutter proceeds to penetrate the sample over the specified distance of 35 mm. The slope of the graph is seen to increase as the wire travels through the sample until a plateau is reached. This is the maximum force required to shear through the sample. Once the wire blade has cut through the sample, the blade continues to travel until the specified distance has been reached. The probe then returns to its staring position above the sample. The higher the plateau value, the firmer the sample and therefore the higher the cutting force. It is clear that butter is firmer than margarine.

Mean hardness and hardness work done for the cutting force of butter and margarine are shown below:

Cutting Force	Hardness (g)	Work Done (mJ)
Butter	679.5	145.27
Margarine	73	19.46