Product: CHEWY SWEETS (CANDY)

Objective: **Evaluation of the firmness and fracturability of boiled sweets by penetration using a 2 mm cylinder probe.**

Background:
Sweets (candy) are made by dissolving sugar in water or milk and boiling the syrup until it reaches the desired concentration (thickness or consistency) or starts to caramelize. There are different kinds of candy depending on the ingredients used and the length of time the syrup is boiled. The final texture of a candy will depend upon the sugar concentration which depends on the boiling temperature. Higher boiling temperatures result in higher sugar concentrations as more of the water evaporates from the mixture producing hard, brittle candies; lower boiling temperatures on the other hand produces softer candies. Candy therefore comes in a variety of textures from soft and chewy to hard and brittle e.g., jelly beans, fudge, toffee, candy canes, lollipops and hard candy amongst others.

Other than the boiling temperature, a change in formulation for instance will affect the texture of the end product. Carrying out routine tests on the texture of the sweet product is necessary to ensure consistency from sample to sample. Texture analysis using the CT3 Texture Analyser with a cylinder probe enables one to measure the firmness and fracturability of boiled sweets. Tests can be performed directly from the production line.

METHOD

Equipment:
4.5 kg Instrument
Fixture base table (TA-BT-KIT)
2 mm Cylinder Probe (TA-39)

Sample preparation:
Remove the samples from storage and allow the samples to equilibrate to the testing temperature (room temperature in this case).

Test Procedure:

1. Attach the 2 mm cylindrical probe onto the instrument

2. Place the fixture base table onto the base of the instrument and loosely tighten with the thumb screws to enable some degree of mobility

3. Place the confectionary jig onto the fixture base tablet and tighten into position using the side screws.

4. Put the sample into the confectionary jig such that it is centrally aligned to the aperture of the fixture then tighten into position using the four screws. Tightening should be to the point of first resistance from the sample. Any further tightening will compress the sample

5. Lower the probe to about 5 mm above the confectionary jig

6. Align the aperture of the confectionary jig to the probe above and ensure that the probe can penetrate the aperture of the confectionary jig without friction effects with the sides of the jig.

7. Start the penetration test

8. After each test, clean the cylinder probe before proceeding to the next test

Note:
Samples should be represented to the instrument in the same orientation.

The sample in the confectionary jig must be placed centrally under the probe.

The firmest sample is better tested first in order to anticipate the maximum testing range required for subsequent samples. This will ensure that the force capacity covers the range for other future samples.

RESULTS

CT3 Settings:

Test type:	*Compression*
Pre-Test Speed:	*1.0 mm/s*
Test Speed:	*1.0 mm/s*
Return at Test Speed:	*1.0 mm/s*
Target Type:	*Distance*
Target value:	*6 mm*
Trigger Load:	*5.0 g*

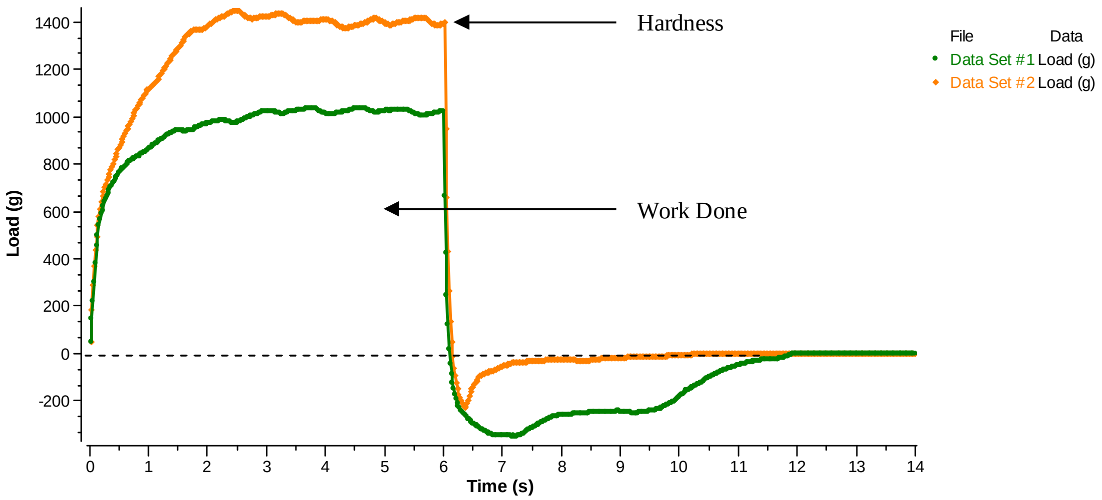

Figure 1. A graph to show the firmness of two cherry flavour chewy sweets/candy of different brands.
The maximum force value is a measure of the amount of force required to initiate penetrating the sample. This is followed by a plateau as the probe continues to penetrate the sample over a specified distance. The area under the graph is a measure of work done.
Data Set #1: Bonbons Tendres aux Fruits
Data Set #2: Frucht-Kaubonbons

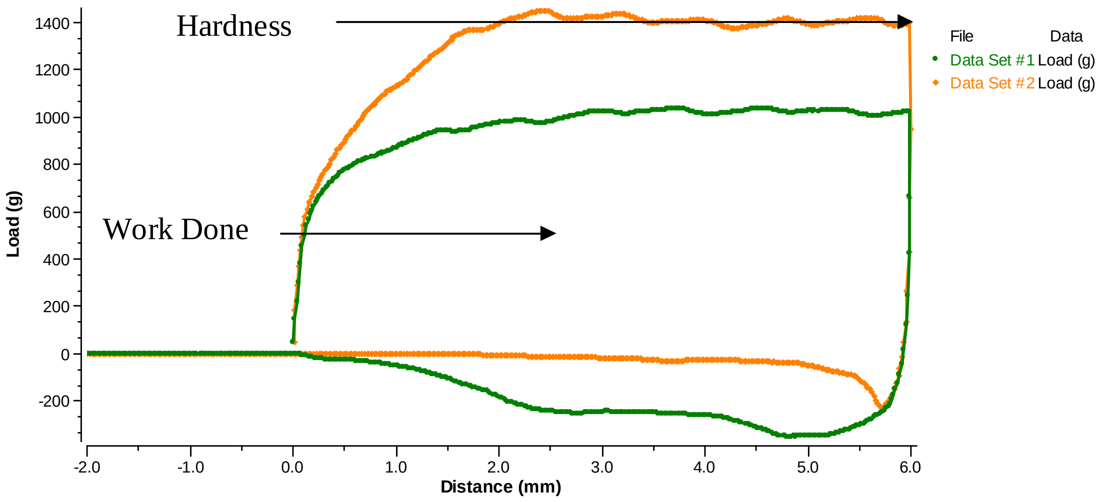

Figure 2. The load verses distance for the firmness of two chewy cherry brands of sweets using a cylinder probe
This is an alternative option for displaying the results and shows the distance of travel by the probe. The maximum force value on the graph is a measure of sample hardness. This is the force required to initiate penetrating the sample. This is followed by a plateau as the probe continues to penetrate the sample over a distance of 6 mm. The area under the graph from the start of the test to the target distance point (6 mm) is a measure of work done.
Data Set #1: Bonbons Tendres aux Fruits
Data Set #2: Frucht-Kaubonbons

Observations:
When a trigger force of 5 g has been attained at the sample surface, the probe proceeds to penetrate the sample over a specified distance of 6 mm at a test speed of 1 mm/s. The force is seen to increase rapidly until the surface of the candy is ruptured before reaching a plateau when. The force required to penetrate the sample is the force required to bite the sample and is a measure of sample hardness. This simulates the force that would be required by a consumer to break into and chew the sample with the teeth. The higher the hardness value the firmer the sample. The area under the graph from the start of the test to the target distance point (6 mm) is a measure of work done. This is the energy required to break down the strength of the internal bonds within the sample.

As the probe withdraws from the sample the negative part of the graph is produced. The maximum negative value is a measure of the adhesive force (the force necessary to overcome the attractive forces between the sample and the probe with which the sample comes into contact). This also the force required to separate the teeth from the sample during chewing. The area above the negative part of the graph is a measure of adhesiveness (the energy required for the probe to pull away from the sample). These measurements can be correlated to the stickiness of the sample to the mouth, teeth, and palate and can be obtained automatically from the TexturePro CT Software.

Table 1 below summarises the hardness and work done results as calculated from the TexturePro CT software for all five sweet flavours from the two brands:

Table 1

Flavour	Sweet Brand	Hardness (g)	Work done (mJ)
Cherry	Bonbons Tendres Aux Fruits	1036.5	55.79
	Frucht-Kaubonbons	1446.5	76.21
Lemon	Bonbons Tendres Aux Fruits	1052	58.07
	Frucht-Kaubonbons	1821	92.71
Orange	Bonbons Tendres Aux Fruits	1137.5	57.66
	Frucht-Kaubonbons	2071.5	106.49
Rasberry	Bonbons Tendres Aux Fruits	1306.5	64.12
	Frucht-Kaubonbons	1730.5	84.13
Strawberry	Bonbons Tendres Aux Fruits	820.5	42.9
	Frucht-Kaubonbons	1800.5	89.25

Table 1 shows the hardness and work done values for each individual flavour type for each brand. From Table 1, the sweets from the Frucht-Kaubonbons brand are firmer compared to those from the Bonbons Tendres aux Fruits for all flavours. This means that the former sweet brand will require more energy to break down than the Bonbons Tendres aux Fruits brand.

Table 2 below shows the average hardness and work done values for all five flavours put together for each brand.

Table 2

Sweer Brand	Hardness (g)	Work done (mJ)
Bonbons Tendres Aux Fruits	1070 ± 176.2	55.71 ± 7.81
Frucht-Kaubonbons	1774.0 ± 223.9	89.76 ± 11.23

Technical Assistance:

At Brookfield we pride ourselves on the availability and quality of our technical support. Our Texture departments are staffed with experienced Texture Specialists with extensive practical and theoretical expertise in sample preparation, presentation and analysis. If you have any questions or experience any difficulties regarding Texture Analysis methodology or software in general, please do not hesitate to contact us.

Brookfield customers are a major source of information regarding the use of our products. We encourage you to contact us if you have any suggestions on product performance or new applications or technologies.

For technical assistance and more information, please contact:
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