(800) 628-8139 or (508) 946-6200
brookfieldengineering.com

Breakfast Cereals

The appeal of breakfast cereals lies in their crunchiness and crispiness, which are highly favored, whereas soggy textures are not. The texture of these products is influenced by their mechanical properties during the initial bites and the physicochemical changes that occur during mastication and hydration by saliva.

Determination of the hardness, crunchiness, and crispiness of breakfast cereals using Ottawa cell– TA-OC-002 having a capacity of 447 cc and a CTX Texture Analyzer. A CTX Texture Analyzer with a 100 kg load cell was used for this test. The Ottawa cell fixture (447 cc; TA-OC-002) was attached to the load cell to compress the probe into the sample to a set distance.

The word “Breakfast” in English refers to breaking the fasting period of the previous night. The meal consists of typical or traditional food items and varies depending upon the regions and traditions worldwide. Cereals are a great source of protein and fiber and provide enough energy to get you through the day, which make them a popular breakfast option**.** Choose from a wide variety of cholesterol-free cereals and make your life healthier. Made using ragi, wheat flour, and natural sugars, these products are suitable for all ages.

To measure these parameters, a CTX texture analyzer with a 100 kg load cell and fixture TA-OC is used. The results obtained provide textural parameters which correlate with sensory evaluation parameters.

METHOD

Equipment:
CTX Texture Analyzer with 100 kg of Load Cell (CTX)
Fixture Base Table (TA-BT-KIT)
Fixture: Ottawa Cell (TA-OC)
TexturePro Software (SWL-02-111)

Parameters Set:

Parameter	Value set
Test type	Compression
Target type	Distance
Target Value	12 mm
Test speed	1.00 (mm/s)
Trigger Load	100.0 g
Distance	2.50 mm

(800) 628-8139 or (508) 946-6200
brookfieldengineering.com

SAMPLE PREPARATION

The sample was weighed in the tared Ottawa Cell sample holder to occupy more than 3/4th of the container height. The Froot Loops weighed about 50 gm, and the Wheat Flakes weighed about 74 gm. Analysis was carried out in triplicate for both variants and the mean results are reported.

PROCEDURE

1. Attach the plate of the Ottawa Cell for testing cereal samples to the analyzer.
2. Fix 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 Ottawa Cell sample holder into the fixture base table and tighten it into position using the side screws.
4. Position the fixture base table centrally under the probe, and then tighten the thumbscrews to prevent further movement.
5. Weigh the sample in a tared Ottawa Cell, tap the cell gently to avoid as many air gaps as possible, and place it on the fixture base table.
6. Position the plate in the sample holder, to enable free movement of the probe in the cell.
7. Lower the arm of the instrument so that the plate probe is a few millimeters above the sample.
8. Once alignment is complete, commence the test.
9. Ensure that the sample does not stick to the probe on the return stroke.
10. Each sample should only be tested once.

OBSERVATION

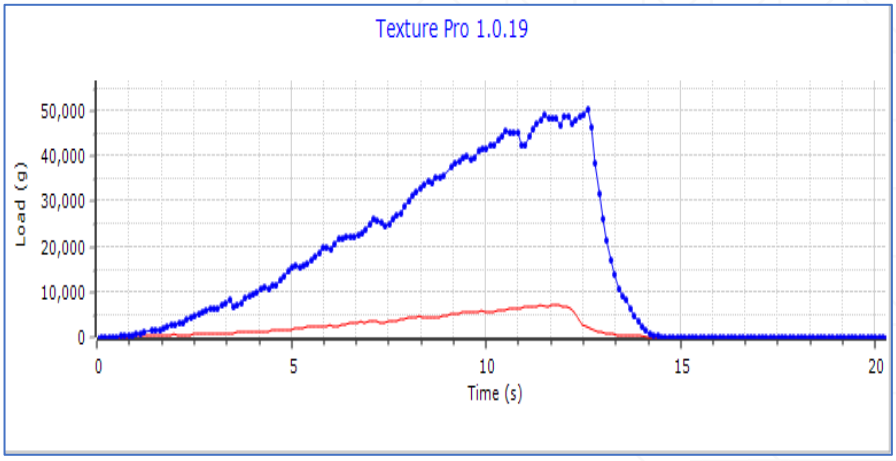
When a trigger force of 100 gm has been detected at the sample surface, the probe proceeds into the sample at a test speed of 1.0 mm/s and compresses it to a 12 mm distance. Once the target distance is met, the probe returns to the starting position.

The table below reports the data collected:

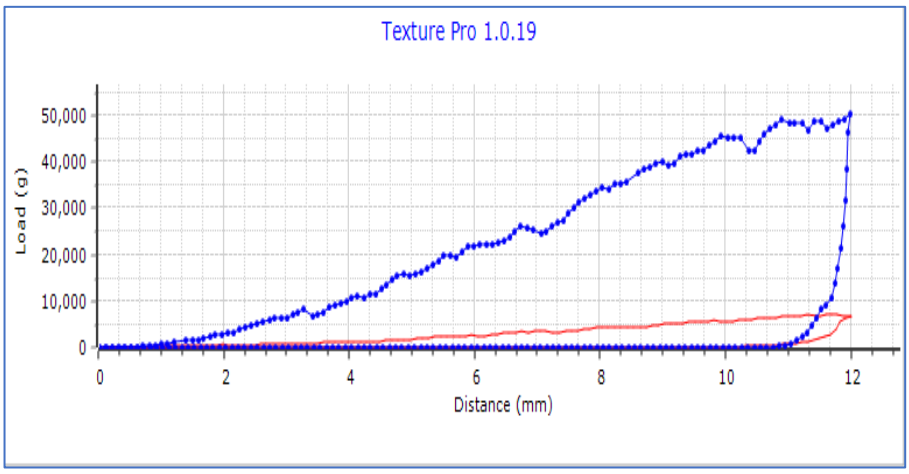
Sample	Froot Loops	Wheat Flakes
Hardness Cycle 1 (g)	52311	5862
Hardness Work Cycle 1 (mJ)	3193	264.4
Quantity of Fractures	6.00	9.00
Fracturability (g)	17469	354.5

(800) 628-8139 or (508) 946-6200
brookfieldengineering.com

The Load vs. Time Graph:



The Load vs. Distance Graph *displays the response of the sample to the application and removal of strain.*



DISCUSSION

The maximum force value is the peak load. It is a measure of sample firmness, the higher the value, the firmer the sample. The higher the peak load, the more work required to break down the sample. Peak load is represented by the positive maximum peak on the Load vs. Time graph.

The average peak force (maximum force) required to compress the Froot Loops in the Ottawa Cell (TA-OC) is 52,311 gm and the Wheat Flakes is 5,862 gm. The average work done (total area under the positive curve) is 3,193 mJ for Froot Loops and 354.5 mJ for Wheat Flakes.

A fracture occurs when there is a sharp decrease in load. The quantity of fractures provides a strong indication of sample crunchiness by measuring the number of fractures during the first compression stroke (only one compression stroke was used in this test). The quantity of fractures corresponds to the crunchiness of cereals by indicating their brittleness.

(800) 628-8139 or (508) 946-6200
brookfieldengineering.com

DATA REPORT

TexturePro Software is used to program and control the CTX during experimental tests. It automatically measures peak load values and calculates the hardness and other characteristic properties.

- **Hardness** is the force required to compress food between the molars.
- **Hardness work done** is the work necessary to overcome the internal strength of bonds within a food.
- The **quantity of fractures** gives a good indication of food crispiness and crunchiness.
- **Fracturability** indicates the brittleness of the food.

CONCLUSION

The test results can be used to determine the hardness, crispiness, crunchiness, and brittleness of cereals.

The test procedure, sample preparation, and equipment setup must be adhered to for reproducible test results.

For repeatability and reproducibility of results, the following must be considered:

1. Physical parameters of the sample.
2. Position of placing the samples such that a minimum air gap is created in the sample holder.
3. Temperature and humidity-sensitive samples are to be conditioned and maintained at the required conditions.