ISO 9001 CERTIFIED

TEXTURE ANALYSIS APPLICATION NOTE: Cheese Puffs

TEST PRINCIPLE

Evaluation of the hardness of cheese puffs by bulk compression using an Ottawa Cell.

BACKGROUND

Puffed corn snacks are very popular with many interesting variations and improvements made over the years. Companies are constantly seeking new flavors to spray onto the extruded cornmeal. Other than flavor, color and texture are also important factors influencing consumer preference and brand loyalty.

In Quality Control, the selection of the type of cornmeal and the moisture content dictate the texture of the finished product. A gritty cornmeal, for instance, will produce an undesirable mouth feel as the finished product is consumed, while excessive moisture content will have a tendency to form small, heavy, and hard puffs. Excessively dry cornmeal will tend to produce light, long, and straight puffs. Furthermore, puffs that are too dry are prone to burn in the dryer.

The texture of cheese puffs should be crunchy, with a satisfying snap. Using the CT3 Texture Analyzer with the Ottawa Cell fixture, the hardness and crunchiness of cheese puffs can be determined. Results are displayed in a graphical format with the maximum force value depicting sample hardness. This value correlates with the force required to crush the sample between the molars. The area under the graph from the start of the test to the maximum force value gives a measure of work done. This value correlates with the energy required to overcome the strength of the internal bonds within the sample. Using these textural measurements, the quality of cheese puffs can be assessed to meet customer satisfaction.

METHOD

EQUIPMENT:	CT3 with 50 kg load cell	
	Ottawa Cell (TA-OC)	
	Fixture Base Table (TA-BT-KIT)	
	Plunger	
	TexturePro CT Software	
SETTINGS:	Test Type:	Compression
	Pre-Test Speed:	1.0 mm/s
	Test Speed:	2.0 mm/s
	Post-Test Speed:	10.0 mm/s
	Target Type:	Distance
	Target Value:	30 mm
	Trigger Force:	30 g

SAMPLE PREPARATION

Remove the sample from the place of storage prior to testing. Weigh the sample into equal portions to enable comparison between tests. Ensure the weighed amount fills the Ottawa Cell by 60 - 90%.

PROCEDURE

1. Attach the plunger 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. Place the Ottawa Cell to the fixture base table with the Perspex side facing the front and tighten into position using the side screws.
4. Slowly lower the instrument plunger to the Ottawa cell and reposition the fixture base table so that the plunger can clearly penetrate the Ottawa Cell without any friction caused by the plunger touching the side walls of the cell.
5. Once the alignment is complete, tighten the thumb screws of the fixture base table to prevent further movement.
6. Raise the plunger above the cell to allow the sample to be placed into the Ottawa Cell. Ensure that the sample is evenly distributed within the cell.
7. Move the plunger down to the chosen starting position (ideally a few millimeters above the sample surface).
8. Commence the test.
9. After each test, clean the Ottawa Cell to remove all traces of previous samples to avoid variability in the results.

Note: When testing different sample types, the hardest sample is best 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.

For comparison purposes, the weight of the samples to be tested should be the same from sample to sample.

RESULTS

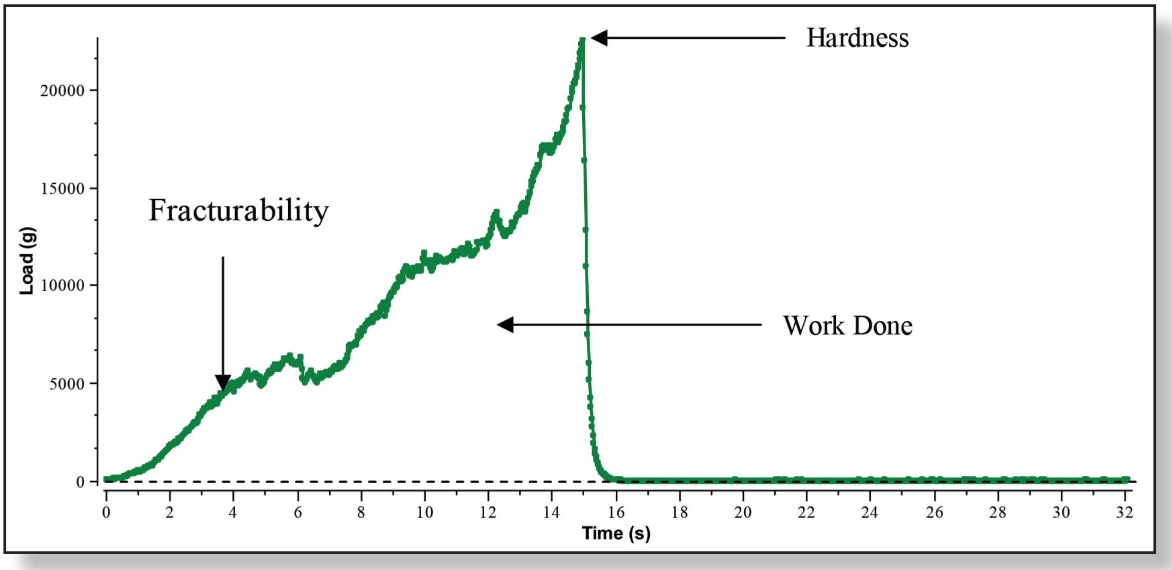

Figure I

Figure I shows shows bulk compression of 10g of cheese puffs tested at room temperature. The maximum force value is a measure of sample hardness. The area under the graph from the start of the test to the maximum force is a measure of work done.

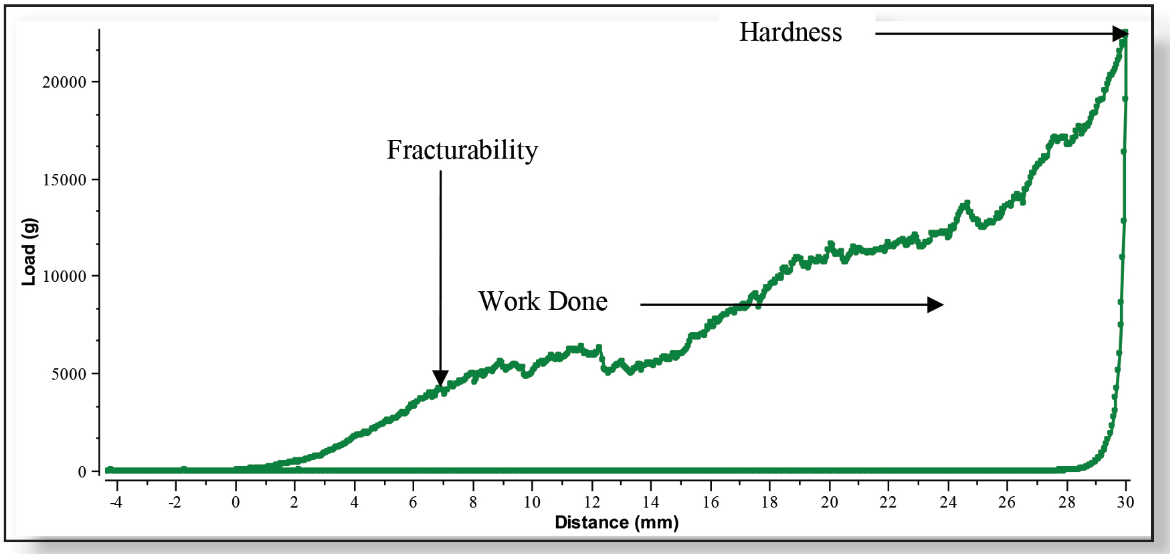

Figure II

Figure II shows shows force vs. distance for 10 g of cheese puffs tested at room temperature. This is an alternative option for displaying the results. The maximum force value is a measure of sample hardness. The area under the graph from the start of the test to the target distant point (30 mm) is a measure of work done. Once the plunger has reached the target distance, the plunger withdraws from the sample, as seen by the sudden drop in force to zero load. The distance value at zero load indicates the point when the plunger is no longer in contact with the sample. As the plunger returns to its starting position, the negative distance values show how much distance the plunger moved at the start of the test before making contact with the sample.

OBSERVATIONS

When a trigger force of 30 g has been attained at the sample surface, the plunger proceeds to compress the sample at a speed of 2 mm/s over a specified distance of 30 mm before withdrawing from the sample. The maximum force over the 30 mm is a measure of sample hardness (Figures I and II); the higher the value, the harder the sample. This value correlates with the force required to compress and crush the sample between the molars. The area under the graph from the start of the test to the maximum force (Figure I) or target distance of 30 mm (Figure II) is a measure of work done; the larger the area, the more work or energy required to chew the sample and overcome the strength of the internal bonds within the sample.

The table below summarizes the results:

Sample	Hardness (g)	Hardness Work Done (mJ)	Fracturability (g)	Quantity of Fractures
Cheese Puffs	22545	2346.5	4015	31

The table above shows the hardness and work done on 10 g of cheese puffs. For comparison purposes, it is important that the weight of the sample to be tested is the same for each test. The quantity of fractures is an indication of the cheese puffs crispiness/crunchiness. The fracturability value is the first fracture detected during the test and is an indication of cheese puff brittleness.

Using these textural measurements, the quality of cheese puffs can be assessed to meet customer satisfaction and improve the consistency of the product. The breaking and crunching characteristics of cheese puffs are very useful in the development process for optimizing product formulation, cook times, and moisture content of the raw product, as well as verifying the ideal sensory features of the product.