ISO 9001 CERTIFIED
BROOKFIELD AMETEK

TEXTURE ANALYSIS APPLICATION NOTE:
Almonds

TEST PRINCIPLE
Evaluation of the hardness of almonds using a craft knife blade.

BACKGROUND
The quality of a product and its appearance are important factors to a consumer. Quality and appearance can be described by color, flavor, and taste in addition to physical attributes such as size, shape and texture.

Using the CT3 Texture Analyzer, almond hardness and work done to shear/bite the almond, as well as brittleness, can be determined. The test is carried out using a replaceable craft knife blade attached to the instrument and used to shear the almond at a given speed. The sharpness of the blade means that hard samples can be sheared with great precision without compressing the sample. Almond hardness is determined by the maximum force on the graph. This value correlates with the force required to shear the almond between the molars. The area under the graph is a measure of work done that correlates with the energy required to overcome the strength of the internal bonds within the almonds. The brittleness of the almonds can also be determined from the fracturability values. Almond crunchiness is determined from the measurement of the quantity of fractures generated during the test. Using these textural measurements, the quality of almonds can be assessed to meet customer satisfaction.

METHOD

EQUIPMENT:
- CT3 with 4.5 g load cell
- Craft Knife Blade (TA-CKB)
- Fixture Base Table (TA-BT-KIT)
- TexturePro CT Software

SETTINGS:

Test Type:	Compression
Pre-Test Speed:	1.5 mm/s
Test Speed:	2.0 mm/s
Post-Test Speed:	10.0 mm/s
Target Type:	Distance
Target Value:	5 mm
Trigger Force:	5.0 g

PROCEDURE
1. Attach the craft knife blade to the instrument.
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 base plate to the fixture base table and tighten into position using the side screws.
4. Position the fixture base table under the probe and then tighten the thumb screws to prevent further movement.
5. Remove the sample from the place of storage and place it on the fixture base plate.
6. Lower the arm of the instrument so that the probe is a few millimeters above the sample.
7. Position the sample centrally under the craft knife. To enable reliable and reproducible results, the sample orientation when presenting the sample to the instrument must be kept consistent throughout all tests performed.
8. Once alignment is complete, commence the test.

Note: Each sample should only be sheared once.

The razor blades are easily replaceable if blunting is a problem between tests.

The hardest sample is best tested first in order to predict the maximum testing range for subsequent samples to be tested.

RESULTS

The graphs show the hardness of almonds using a craft knife blade.

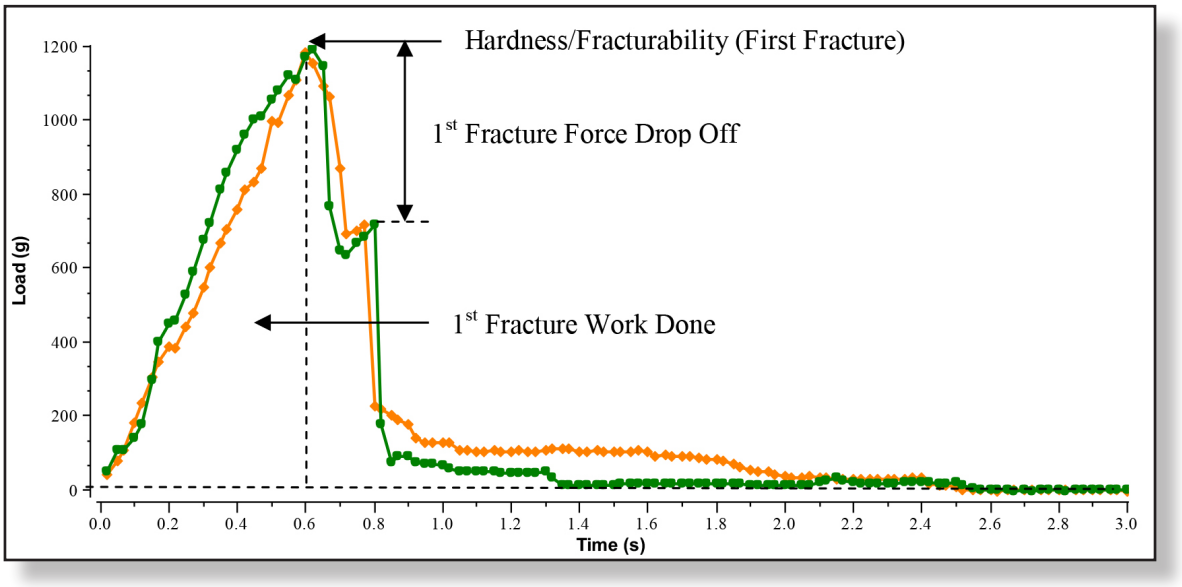

Figure I

Figure I shows the hardness of two almond samples from the same batch tested at a similar orientation and 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.

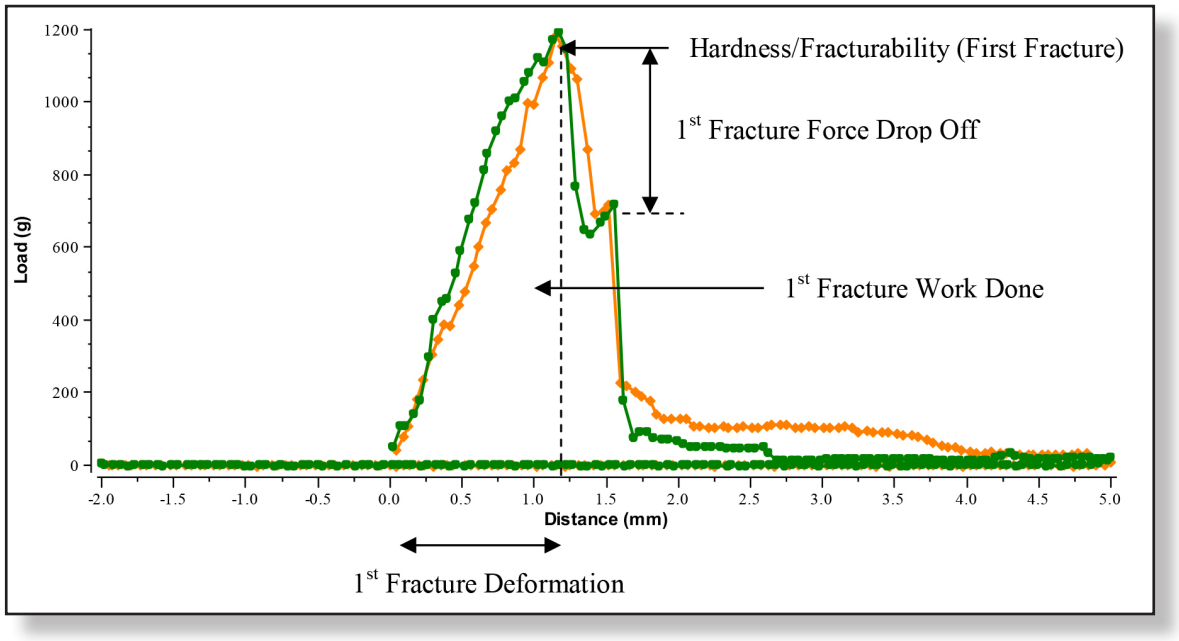

Figure II

Figure II shows force versus distance for the hardness of two almond samples 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 distance point (5 mm) is a measure of work done. The distance values at zero load are the points when the knife blade withdraws and separates from the sample. The negative distance values are the points when the knife blade is returning to its starting position (a few millimeters from the sample surface).

OBSERVATIONS

When a trigger load of 5 g has been detected at the sample surface, the probe (craft blade) proceeds to shear the sample at a test speed of 2 mm/s over a specified distance of 5 mm. A rise in force is seen as the craft knife shears though the exterior layer of the almond. As the blade penetrates inside the sample, the force decreases due to the exterior of the sample being firmer than its interior. The maximum force value over the specified distance is a measure of sample hardness, simulating the maximum force that will be required to crush the sample between the molars; the higher the value, the harder the sample. The hardness work done is the area under the graph from the start of the test to the maximum force (Figure I) or target distance point (Figure II). The larger the value, the more work required to break down the sample. This simulates the shearing energy required by the molars to break through the almond on the first bite. The fracturability value is an indication of sample brittleness; the higher the value, the less brittle the sample. The measured quantity of fractures generated during the shearing process gives an indication of the crunchiness of the sample.

The table below summarizes the results for tests run on 7 samples altogether from the same batch. The hardness and fracturability values show a high level of repeatability.

Sample	Hardness (g)	Work Done (mJ)	Fracturability (g)	Quantity of Fractures
Almonds	1276 ± 80	15.5 ± 4.5	1276 ± 94	6 ± 3