Dried Fruit

How to test for texture

Increasingly popular as a nutritious snack food are dried fruit pieces. Each type of fruit will have its own unique texture, depending on how it's prepared. Banana chips, for example, are usually produced from under-ripe banana slices fried in oil. See Figure 1. Dry and crisp in texture, they can be salted, flavored with spices, or sugar coated to give consumers a choice of tastes that have general appeal. What type of test will confirm that the banana chips are cooked correctly and have the crispy crunchy texture that consumers crave?

Figure 1: Banana Chip Samples

Texture Analyzers are the preferred laboratory instrument when it comes to testing foods] for desired properties, such as hardness and crispiness. This device simulates the types of actions that our hands and mouth accomplish when holding, biting into, and chewing a food item. The Analyzer is equipped with specially designed probes that compress or penetrate the sample and measures the amount of force required to accomplish each action. Figure 2 shows the instrument and an accessory called the Three-Point-Bend fixture which can snap the chip in half. This basic test correlates with customer experience when either breaking the chip by hand or putting it into your mouth to take a bite. Figure 3 shows a Blade Probe breaking the chip during a test.

Figure 2: Test Equipment for Texure Analysis Test on Banana

Preparation for the test requires deciding how to store the banana chips after manufacture until time of test. Since chips may be packaged shortly after manufacture, but not consumed until several days later, it's appropriate to test the chips at various time intervals after they have been cooked. The objective is to verify that the chips will retain their textural quality for an appreciable length of time, thereby meeting customer expectation that the chips will have a crispy crunch when biting into and chewing each one.

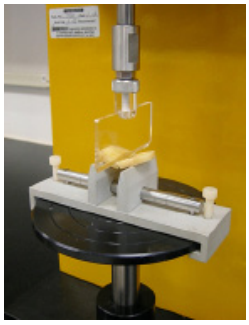

Figure 3: Blade Probe Snaps Banana Chip in Half

The actual test with the Texture Analyzer specifies the speed of penetration for the Blade Probe and the distance that it should move to snap the chip in half. Typical values might be 1 mm/sec and 3 to 4 mm respectively. Use of software during the test allows the user to record the measured load data as a real time graph. Figure 4 shows force vs. time while Figure 5 shows force vs. distance. The "peak load" is the maximum force that is measured before the chip snaps. "Fractures" are identified on the graph as sudden drops in load that may occur multiple times before the chip snaps. The "Work Done" that is required to snap the chip is shown as the area under the load curve in Figure 5.

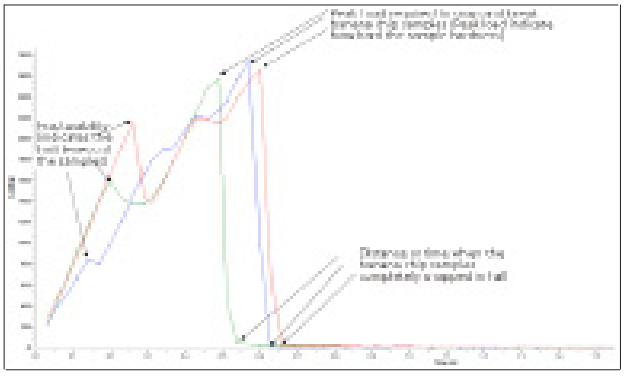

Figure 4: Force vs. Time Graph

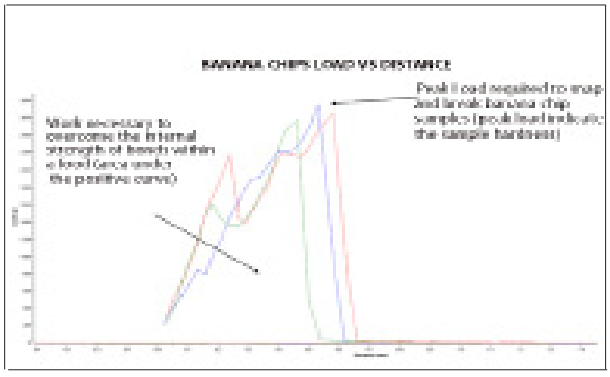

Figure 5: Force vs. Distance Graph

Use of software not only records data, but also performs analysis and calculations, such as quantity of "fractures" and "work done" (energy expended to bite and chew the chip). Multiple samples can be tested and calculated values for standard deviation for each parameter are reported. The following table shows the statistical results from three different tests.

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STATISTICAL REPORT

# Sample Description Product Name	Batch Name	Results Sample	Hardness Cycle 1 g	Quantity of Fractures	Fracturability g
1 Sample A	BananaChip /TPB	2	2648.00	3.00	2166.00
2 Sample B	BananaChip /TPB	3	2740.00	2.00	838.00
3 Sample C	BananaChip /TPB	4	2568.00	2.00	1600.00
Calculation Settings: Fracture Sensitivity: 1% of Load	**Minimum**		2568	2.00	838.0
	Maximum		2740	3.00	2166
	Average		2652	2.00	15235
	Standard Deviation		86.00	1.00	666.0

Statistical Report Table

In conclusion, Texture Analysis can verify the ideal hardness and crispiness values for banana chips. R&D will use this information to specify a range of acceptable values for QC testing. This results in the delivery of consistent product to the consumer market who base their purchasing decisions on predictable quality. Objective information from texture testing is clearly an intelligent approach compared to assuming banana chips must be "good" because the production process doesn't change.

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