Production: ALMONDS

Objective: Exterior and interior hardness of almonds using a craft knife

Type of action: Cutting test

Test mode settings:

Speed	Test mode	Trigger	Target	Hold
1 mm/s	Distance (c)	15 gf	4 mm	0 sec

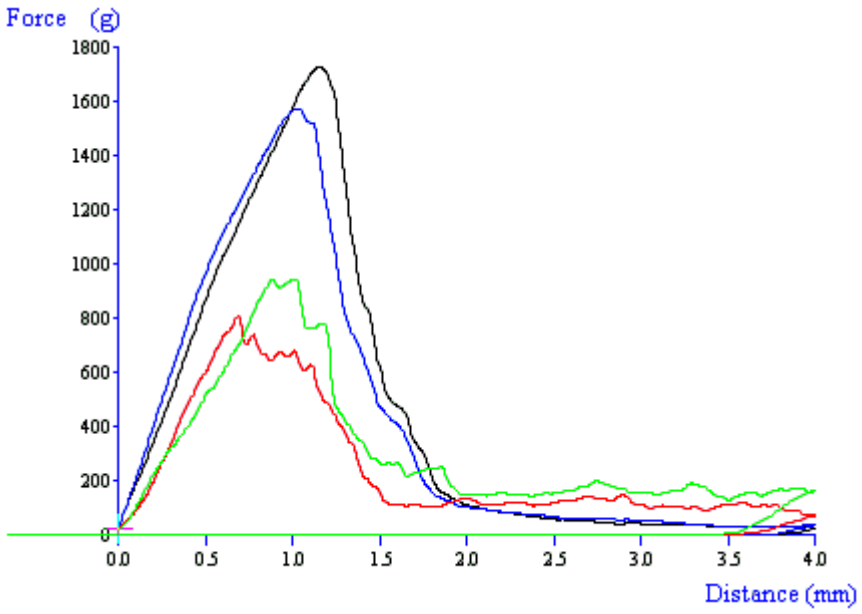
Accessory:
Sharpness knife rig, Platform

Remark:
The knife's replaceable razor blades are sharp enough to cut easily into and through a shelled almond without crushing or shattering it and are easily replaceable between tests if blunting is a problem.

Test Set-Up:
Insert the cutting block into the Heavy Duty Platform and position it onto the machine base. Attach the knife blade to the load cell carrier and lower it towards the cutting block until it comes close to contact. Calibrate the blade to acknowledge the block as a zero distance by clicking on:
Calibrate Height: **10mm** (selected blade return distance)

Place the sample centrally on the cutting block with the blade perpendicular to the nut length and commence the test around the mid region of the sample.

Typical plots:



The above curves were produced from testing two brands of whole almonds nuts (A and B) of their smoked and natural varieties.

Observations:
Once a trigger force of 15g has been achieved the blade proceeds to move down onto the nuts' surface and an initial rapid rise in force is observed. This stage ends abruptly when the blade cuts through the exterior of the nut and begins to cut into the sample interior. The maximum force and the area of work (to 2mm) measures the nuts' exterior hardness. These parameters probably correlate with consumer perceptions of 'first bite' hardness, a high profile textural characteristic of almonds. The 'smoked' almonds are shown to be more brittle than the 'natural' almonds since they crack at approximately one-half the deformation and force of the 'natural' almond.

The 'smoked' almonds are also softer as measured by the peak force and area of work. The 'smoked' almond interior, however, is much more firm, indicating that although it is softer to break into, the 'smoked' product requires more energy to break up. This element of the increased work may be related to the energy required to break up the almond in the mouth until it is palatable to be swallowed. The jaggedness of the 'smoked' almonds' curve through the middle indicates that its interior is drier and crunchier than the 'natural' almond.

Data Analysis:

Max Force (from 0 to 2 second)

Peak Distance

Area (+) (from 0 to 2 second)

Results

Sample	Mean Force of 1st Peak 'Hardness of Exterior' (+/- S.D.) (g)	Mean Dist. of 1st Peak 'Fracturability' (+/- S.D.) (mm)	Mean Area to 2mm 'Work to Shear Interior' (+/- S.D.) (g s)	Mean Area 2mm to 4mm 'Work to Shear Interior' (+/- S.D.) (g s)
Nature A	1855.4 +/- 225.7	1.27 +/- 0.15	1687.8 +/- 294.5	104.7 +/- 88.5
Nature B	1717.8 +/- 195.9	1.15 +/- 0.17	1505.3 +/- 267.4	108.9 +/- 79.5
Smoked A	898.2 +/- 480.7	0.69 +/- 0.28	784.6 +/- 216.6	283.6 +/- 273.5
Smoked B	529.4 +/- 426.0	0.4 +/- 0.3	919.6 +/- 298.7	369.5 +/- 279.5

Notes:

- The jaggedness can be analyzed in one of two ways; counting the number of peaks or calculating the linear distance. Insert a command to count force +ve peaks or linear distance between anchors 1 and 3 or perhaps just during the cutting of the nut interior (i.e. between anchors 2 and 3). The more brittle the sample is, the more fractures will be detected resulting in a higher number of peaks and a greater linear distance.

- When attempting to optimize test settings it is suggested that the first tests are performed on the hardest samples to anticipate the maximum testing range required and ensure that the force capacity allows testing of all future samples.

- The method and results for this application study have been kindly provided by Texture Technologies Corp., USA.