Application manual No. 101

Production: STRAWBERRIES

Objective: Comparison of firmness and total extrusion force of fresh and tinned strawberries by bulk compression

Type of action: Extrusion test

Test mode settings:

Speed	Test mode	Trigger	Target	Hold
1.5 mm/s	Distance (c)	0 gf	69 mm	0 sec

Accessory:
Ottawa Cell, Platform

Sample Preparation:
Remove the strawberries from place of storage just prior to testing. Samples should be weighed into equal portions. It is important that this weighed amount is enough to approximately fill the Ottawa Cell by 50% of its capacity e.g. 120g.

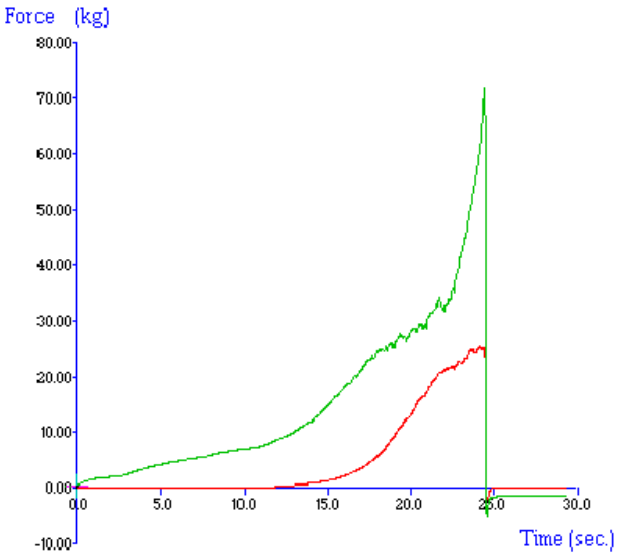
Test Set-Up:
The empty Ottawa Cell is loosely fixed onto the machine base. The plunger is attached to the load cell carrier and is lowered slowly into the Ottawa Cell. The Ottawa Cell is then manoeuvred until clearance is visible between the plunger and the sides of the cell. The Product Catchment Drawer is positioned under the Ottawa Cell, to catch the extruded sample. The plunger is then raised above the cell to allow for placement of the test sample.

Before carrying out the test using a 'Zero' trigger one must calibrate the plunger to acknowledge the bottom of the cell as a zero position. To do this, lower the plunger, so that it is close to the bottom of the cell. Click on **CALIBRATE Height**. Specify the distance that you want the plunger to start from for each test - e.g. **70mm** is suggested.

The plunger will move down and touch the holed plate and then move up to the specified start distance. For the comparison of results it is crucial that the test always begins at the same distance from the bottom of the cell, this distance can be programmed into the **CONTROL PROBE** feature.

Prior to each test ensure that there is good clearance around the plunger to avoid frictional effects. This can be checked by running a 'blank' test i.e. one without any sample in the cell, to ensure that the plunger is not touching the sides. The plunger is then raised above the cell to allow for placement of the test sample. Place the sample into the cell, distribute pieces evenly and run the test. In between tests clean the plunger, extrusion plate, and the inside of the cell to remove any remaining sample, as this will cause variable results.

Typical plots:



The above curves were produced from 120g samples of Tinned and Fresh Strawberries, tested at 20C.

Observations:
Once the plunger has reached the sample, force is seen to increase at a steady rate. As the plunger moves down further onto the sample the force begins to increase rapidly as the sample begins to deform and rupture. After rupturing has occurred the subsequent increase in force is as a result of the force required to push and extrude the sample through the holes in the base plate. The maximum force ('Firmness') and total area under the extrusion curve ('Work of Extrusion') is obtained and used as an index of textural quality.

Data Analysis:

☒Max Force

☒Area (+)

Results

Sample	Maximum Force 'Firmness' (+/- S.D.) (kg)	Mean Area 'Work of Extrusion' (+/- S.D.) (kg·s)
Tinned	33.9 +/- 3.8	172.2 +/- 16.3
Fresh	54.7 +/- 5.5	322.3 +/- 24.3

Notes:

- The sample to be compressed and extruded is often of variable configuration or structure. The result is an average of the forces required to compress and extrude the sample of variable geometry.
- If the sample is more firm, a 500kg load cell would be recommended for a higher force range.
- 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.