Production: CROUTONS

Objective: Assessment of crunchiness of croutons after holding in boiling water for 3 minutes

Type of action: Extrusion

Test setting:

Speed	Test mode	Trigger	Target	Hold
1 mm/s	Distance (c)	0 gf	8.5mm	0 sec

Accessory:
Ottawa Cell, Platform

Sample Preparation:
Remove samples from place of storage just prior to testing. Weigh out enough sample to form a monolayer on the watertight base plate e.g. 10g.

Test Set-Up:
The empty Ottawa Cell is loosely fixed onto the machine base. The blank base plate is inserted into the Ottawa Cell and the levers positioned upwards (for calibration and testing). 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 plunger is then raised above the cell to allow for placement of the test sample.

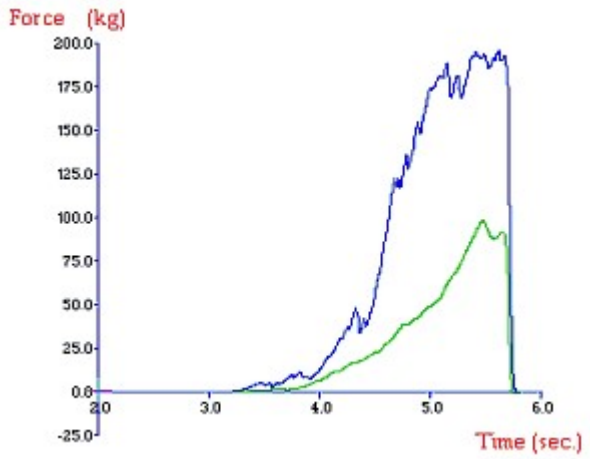
Before carrying out the test using a 'Button' trigger one must calibrate the plunger to acknowledge the bottom of the cell (i.e. the plate surface) as a zero position. To do this, lower the plunger, so that it is close to the bottom of the cell. Click on **T.A.** (in the menu bar) then **CALIBRATE PROBE**. Specify the distance that you want the plunger to start from for each test - e.g. **12mm** is suggested.

The plunger will move down and touch the watertight base 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 and distribute pieces evenly. Pour 100ml of boiling water into the cell (making sure that the watertight levers are down) and commence the test. After 180 seconds delay the watertight levers are pulled upwards, releasing the boiling water, and the probe then proceeds to compress the test sample.

In between tests clean the plunger, watertight base 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 10g of croutons 6 x 6 x 6mm tested dry and wet (3mins)

Observations:
As compression proceeds fracture can be observed as a series of force peaks. The maximum force value is considered to be an indication of the overall 'hardness' of the crouton sample and the total work of compression (i.e. area under the curve) is considered as an indication of 'crunchiness'. The results show sample C to be the hardest and crunchiest of all the samples, followed by B and then A, which had a considerably lower cruchiness retention.

Data Analysis:

☒Max Force

☒Area (+)

Results

Sample	Mean Maximum Force 'Hardness' (+/- S.D.) (kg)	Mean Area 'Crunchiness' (+/- S.D.) (kg s)
Dry	195.8 +/- 7.4	209.4 +/- 11.8
Wet	92.8 +/- 3.5	83.5 +/- 4.0
Crunchiness retention:		39.9%

Assessment of 'Crunchiness' retention:
Dry sample value x 100%
Wet sample value

Notes:

- The hardness and crunchiness values are taken as measures when the sample is compressed to 3.5mm above the cell base. Adjustment of this distance would cause the values to change. These values are therefore only relevant to the parameters of the chosen protocol.
- In order for test results to be comparable it is important that the temperature of the water, and immersion period is kept constant and stated in reports.
- Compression of the sample to a greater extent may be required - if this is the case a 500kg load cell would be recommended for higher force range.
- 'Linear Distance' may also be added into the macro. This function calculates the length of an imaginary line joining all points in the selected region. A jagged curve would consequently produce a much larger linear distance when compared to a smooth (soft texture) curve. The answer has no defined units.
- When attempting to optimise 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.