Production: BREAKFAST CEREALS

Objective: Comparison of 'bowl life' as indicated by the hardness and crispness of 3 types of breakfast cereals after immersion in milk

Type of action: Extrusion test

Test setting:

Speed	Test mode	Trigger	Target	Hold
5 mm/s	Distance (c)	0 gf	50 mm	0 sec

Accessory:

Ottawa Cell, Platform

Sample Preparation:

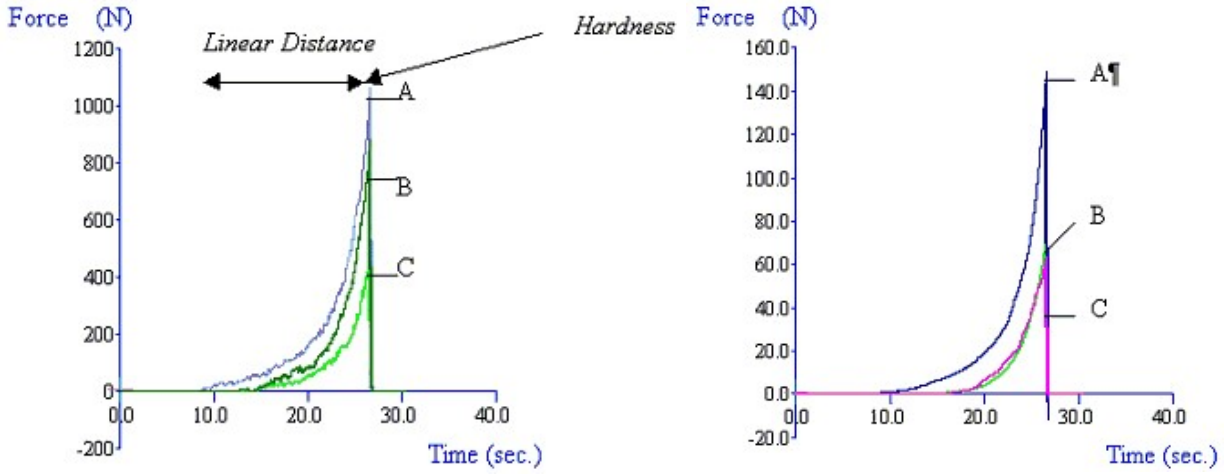
The cereal samples are removed from place of storage just prior to testing and weighed into equal portions. It is important that this weighed amount is enough to approximately fill the Ottawa cell by 50% of its capacity e.g. 30g.

Test Set-Up:

Place the Liquid Catchment Tray on the machine base over the screw holes and then position the empty Ottawa Cell on top of the tray. Loosely fix the Ottawa Cell using thumb screws threw the tray into the machine base. Insert the blank base plate into the Ottawa Cell and turn the screw attached under the plate as far as it can go to create a water tight seal (for calibration and testing). Attach the plunger to the load cell carrier and lower it slowly into the Ottawa Cell. Next manoever the Ottawa Cell until clearance is visible between the plunger and all sides of the cell. Raise the plunger above the cell to allow for placement of the test sample. Finally place a suitably sized vessel under the drainage hole in the corner of the liquid catchment tray.

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. Specify the distance that you want the plunger to start from for each test - e.g. **60mm** 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. Simultaneously commence the test and pour 100ml of milk into the cell. After 180 seconds delay, the watertight screw is turned backwards, releasing the milk, and the plunger then proceeds to compress the 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.



Observations:
Once the plunger has reached the sample (from a starting position of 60mm from the base), 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 fracture. As compression proceeds fracturing can be observed as a series of force peaks. The maximum force value was considered to be an indication of the overall 'hardness' of the sample and the linear distance was considered as an indication of 'crispness'. The greater the linear distance, the crisper is the product. The results show a trend; the longer the immersion time, the softer and less crispy the sample becomes. Out of the three types of cereal, type A retained its 'hardness' and 'crispness' the most followed by type B and finally type C.

Data Analysis:

☒Max Force

☒Linear Distance From 10 to 25 second

Results

Sample	Immersion Time In Milk (5C) (s)	Mean Maximum Force 'Hardness' (+/- S.D.) (N)	Mean Linear Distance 'Crispness' (+/- S.D.) (N s)
A	0	1088 +/- 1702	2347 +/- 175.6
A	40	348 +/- 24.0	554 +/- 72.6
A	180	148 +/- 9.9	364 +/- 22.1

Notes:

- The hardness and crunchiness values are taken as measures when the sample is compressed to 10mm 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 milk, and immersion period is kept constant and stated in reports.
- The sample to be compressed is often of variable configuration or structure. The result is an average of the forces required to compress the sample of variable geometry.
- The extent of compression and extrusion has been based on the use of an Ottawa cell with a 100kg load cell. A greater degree of compression and extrusion would therefore require a 250kg load cell.
- 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.