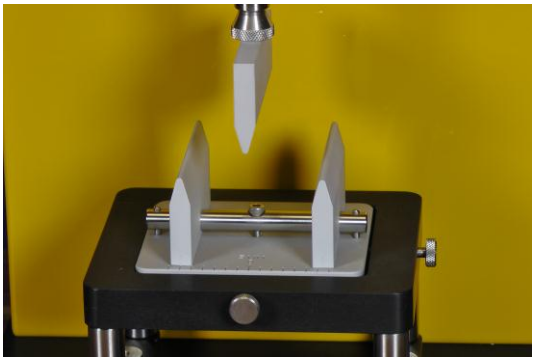
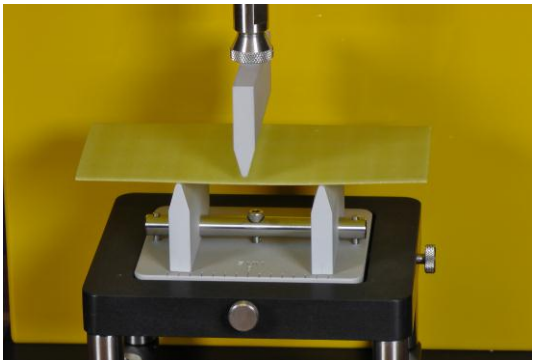
Product: DRY LASAGNE

Objective: **Evaluating the breaking strength of dry lasagne using a three-point bend test.**

The snap characteristics of dry lasagne can be determined using the three-point bend assembly.



The sample is supported at two points by the adjustable supports that are equidistant form each other at a distance that will support the sample.



The upper blade (flexure probe) is connected to the probe shaft of the instrument. As the probe travels down at a given test speed a force is applied at the sample surface until the sample snaps along its width creating a single fracture at the point of contact with the probe.

The three point bend test can be used to improve production consistency in order to maintain an "ideal" texture. Parameters of interest are hardness, fracturability or brittleness, and first fracture deformation. The *fracturability* is the force required to generate the first fracture, and the *first fracture deformation* the distance to snapping point that gives an indication of the flexibility of the sample.

The brittleness (fracturability) measurements from the test reflect on the breaking characteristics of the sample and can be used to optimise product formulation (e.g., moisture content, mixing time, temperature, gluten strength), and handling during manufacture.

The hardness measurements from the test can be used for shelf-life studies to assess the effectiveness of packaging in terms of preventing moisture penetration from the surroundings.

The quantity of fractures measurement from the test can be used to establish a sensory preference for the product during product development.

CT3 Settings:

Test Type:	*Compression*
Pre-Test Speed:	*2.0 mm/s*
Test Speed:	*3.0 mm/s*
Post-Test Speed:	*Return at test speed*
Trigger Force:	*15 g*
Distance	*5 mm*

Equipment:

4.5 kg Instrument
Fixture Base Table (TA-BT-KIT)
3-Point Bend Assembly (TA-TPB)

METHOD

Test Procedure:

1. Attach the flexure probe to the probe shaft of the instrument

2. Place the fixture base table to the base of the instrument and loosely tighten the thumb screws to enable some degree of mobility

3. Insert the 3 point bend assembly onto the fixture base table and tighten into position using the side screws

4. Using the scaled markings on the support, adjust the two adjustable supports such that they are of equal lengths apart. The selected distance should be able to support the sample.

5. Lower the arm of the instrument to a few millimetres above the base of the supports and centrally align the two supports to the flexure probe above by re-positioning the fixture base table until the flexure probe is equidistant to the two supports.

6. Once alignment is complete, tighten the thumb screws of the fixture base table to prevent further movement and raise the instrument arm to provide room to place the sample.

7. Remove the sample from storage and place it centrally over the supports.

8. The arm of the instrument can be lowered again at this point if a closer proximity to the sample surface is preferred before testing. The flexure probe however should not touch the sample surface.

9. Commence the test.

RESULTS

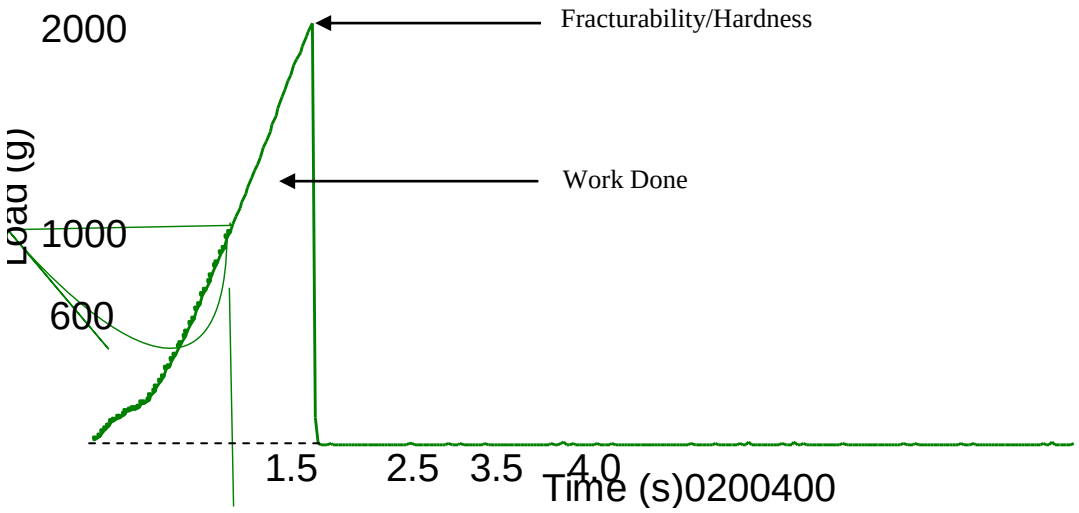


Figure 1. A graph to show the breaking strength of dry lasagne using a three point bend accessory. The maximum force value is a measure of sample hardness. The fracturability of the sample is measured at the force that generates the first fracture. The fracturability value for this sample is similar to its hardness value indicating that the sample immediately snaps once its resistance to the compressive force has been exceeded. The area under the graph is the work done to break the sample. This is the energy required to overcome the strength of the internal bonds within the sample. The gradient of the graph can also be measured to give sample stiffness.

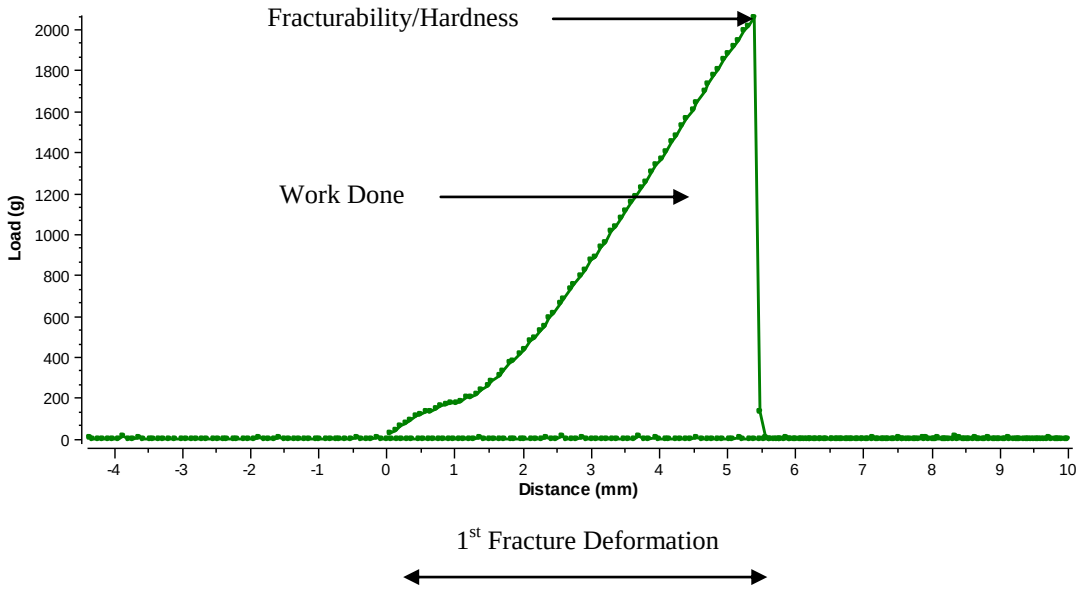


Figure 1. A graph to show the breaking strength of dry lasagne using a three point bend accessory. This is an alternative option for displaying the results. The graph shows similar information to the load/time graph with one additional measurement. It is from the load/distance graph alone that the flexibility of the sample can be measured. The distance to the first fracture deformation is an indication of sample flexibility such that the longer the distance, the more flexible the sample.

Observations:
When a trigger force of 15 g has been attained at the sample surface, the probe proceeds to compress the sample at a test speed of 3 mm/s over a distance of 5 mm. During this time, the force is seen to rapidly increase. When the applied force exceeds the force of resistance by the sample, the sample reaches its breaking point and snaps seen by the sudden drop in force to zero. The maximum force value is a measure of sample breaking strength. The area under the graph from the start of the test to the maximum force value (Figure 1) or target distance point (Figure 2) is a measure of work done. The gradient of the graph can also be measured to give an indication of sample stiffness; the steeper the gradient, the stiffer the sample. From the load/distance graph, the distance to breaking point (in this case first fracture generation) gives an indication of sample brittleness. This is an indication of how far a sample can be deformed before fracture.

The table below summarises the average results of four samples as obtained from the Texture Pro CT Software:

Sample	Hardness (g)	Work Done (mJ)	Fracturability (g)	Quantity of Fractures	1st Fracture Deformation (mm)
Dry Lasagne	2114 ± 61	47.9 ± 2.9	2114 ± 61	1	5.41 ± 0.12

Technical Assistance:

At Brookfield we pride ourselves on the availability and quality of our technical support. Our Texture departments are staffed with experienced Texture Specialists with extensive practical and theoretical expertise in sample preparation, presentation and analysis. If you have any questions or experience any difficulties regarding Texture Analysis methodology or software in general, please do not hesitate to contact us.

Brookfield customers are a major source of information regarding the use of our products. We encourage you to contact us if you have any suggestions on product performance or new applications or technologies.

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