

Production: TOMATO KETCHUP

Objective: Comparison of the consistencies of two brands of tomato ketchup by back extrusion

Type of action: Extrusion test

Test mode settings:

Speed	Test mode	Trigger	Target	Hold
1 mm/s	Distance (c)	5 gf	30 mm	0 sec

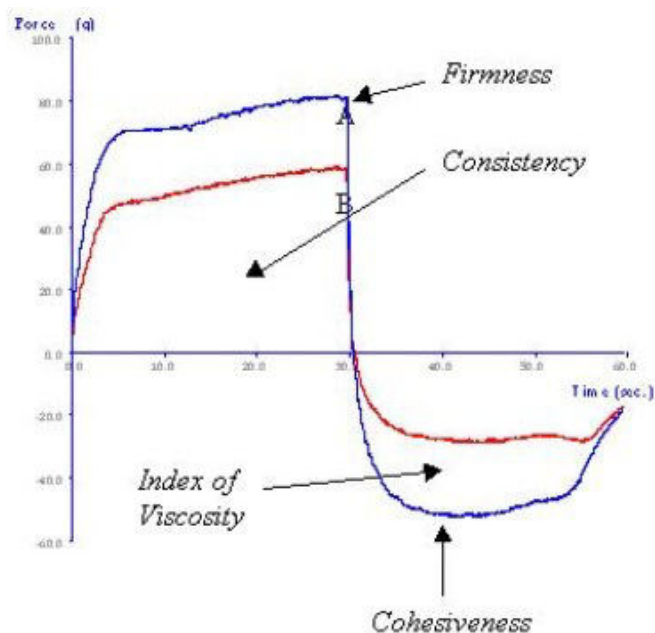
Accessory:

Back extrusion rig

Test Set-Up:

Tests are carried out in a standard size back extrusion container (50mm diameter) approximately 75% full immediately after removal from storage at a specific temperature e.g. 5C. The extrusion disc should be positioned centrally over the sample container. For comparison of cohesiveness and 'work of cohesion' the probe must return to the same position above the samples after each test. To do this it is necessary to calibrate the probe to a distance that is a starting distance of e.g. 30mm, above the top of the container or the sample surface. When the probe is returning to the start (i.e. pulling out of the sample) it is recommended that the container is held to prevent it from lifting.

Typical plots:



The above curves were produced from tests of two types of ketchup, carried out in a 75% full standard sized back extrusion container, which had been stored at 5C.

Observations:

When a 5g surface trigger is attained (i.e. the point at which the disc's lower surface is in full contact with the product) the disc proceeds to penetrate to a depth of 30mm (*or other specified distance). At this point (most likely to be the maximum force), the probe returns to its original position. The 'peak' or maximum force is taken as a measurement of firmness - the higher the value the firmer is the sample. The area of the curve up to this point is taken as a measurement of consistency - the higher the value the thicker the consistency of the sample. The negative region of the graph, produced on probe return, is as a result of the weight of sample which is lifted primarily on the upper surface of the disc on return, i.e. due to back extrusion and hence gives again an indication of consistency/resistance to flow off the disc. The maximum -ve force is taken as an indication of the cohesiveness of the sample - the more negative the value the more 'cohesive' is the sample. The area of the negative region of the curve may be referred to as the 'work of cohesion' - the higher the value the more resistant to withdrawal the sample is which is an indication of the cohesiveness and also consistency/viscosity of the sample. Quite clearly one can see that tomato ketchup A is firmer, more cohesive and viscous than tomato ketchup B.

Data Analysis:☒ Max Force☒ Area (+)☒ Min Force**Results**

Ketchup	Mean Max. +ve Force 'Firmness' (+/- S.D.) (g)	Mean +ve Area 'Consistency' (+/- S.D.) (g s)	Mean Max.-ve Force 'Cohesiveness' (+/- S.D.) (g)	Mean -ve Area 'Index of Viscosity' (+/- S.D.) (g s)
A	81.1 +/- 2.5	2153.6 +/- 29.8	52.2 +/- 1.3	908.2 +/- 14.0
B	59.0 +/- 0.6	1517.1 +/- 5.9	30.1 +/- 0.9	739.4 +/- 17.7

Notes:

- Depending upon the regularity of the surface (i.e. the contents of the container may not have settled as a flat surface), it may be necessary to increase the trigger force value slightly. When the test begins to plot data the extrusion disc should be in such a position so as to be in full contact with the product surface but should not have not started penetrating to any considerable depth.
- The product may be tested directly from the container in which it was originally dispensed. However, when comparing different samples try to ensure that the temperature, container size and the volume of product dispensed are the same (and should always be specified) when reporting results.
- The distance of extrusion to be set in the test mode Settings will depend upon the depth of the sample within the container, the depth of the container, and whether the chosen container is tapered towards the base or not. The chosen depth should not be greater than 75% of the depth of the sample, so as to avoid the disc coming into contact with the base of the container during testing which could produce an erroneous result.
- During penetration of the disc, a large blip in the otherwise smooth curve may be observed. This is due to the compression of an air pocket within the product close to the disc, so it is important to minimize the presence of air pockets when filling the extrusion container.
- The terms consistency, cohesiveness etc. relate to the sensory properties of the samples used in this case. Although the measurement points of the curve are likely to be useful in each case, the terms relating to sensory analysis may however need to be renamed.
- 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.