Application manual No. 057

Production: MARMALADE

Objective: Measurement of gel strength, rupture force, brittleness/elasticity and adhesiveness of a marmalade formulation

Type of action: Penetration test

Test mode settings:

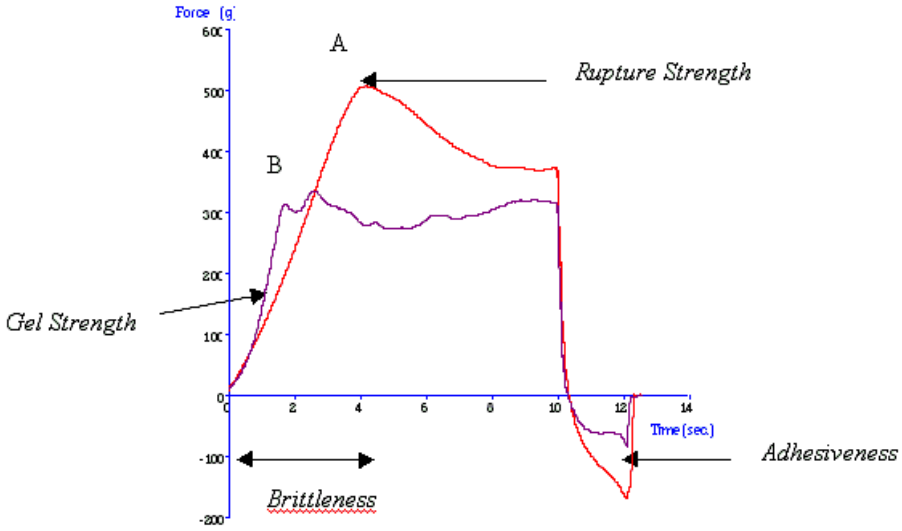
Speed	Test mode	Trigger	Target	Hold
2 mm/s	Distance (c)	20 gf	10 mm	0 sec

Accessory:
ϕ 25 mm cylinder probe, Platform

Sample Preparation:
Prepare the gels according to a standard or preferred procedure and condition for a specified time at a controlled temperature which should be adhered to for subsequent comparative gel testing.

Test Set-Up:
After conditioning, place the sample container centrally under the probe and commence the penetration test.

Typical plots:



The above curve was produced from two different brands of marmalade, tested at 20C.

Observations:
After a trigger force of 10g is attained the probe then proceeds to penetrate into the gel to a depth of 20mm. During penetration the force is shown to drop at the point where the gel breaks. After this, the resulting forces are due to continuing penetration up to the required depth. The maximum +ve force (i.e. the rupture point of the gel) is taken and recorded as 'rupture strength' (or 'rupture force'). The distance that the gel penetrates before this break occurs gives an indication of the gel's elasticity, i.e. a short distance of penetration before break indicates a brittle gel whereas a large distance of penetration before rupture indicates a more elastic gel. When the probe withdraws from the sample, the total force (area under the negative region of the curve) required to do this is measured and recorded as the 'adhesiveness'. A 'gel strength' measurement is taken at the initial stage of penetration, i.e. a point (in this case 3mm) in the penetration where little gel deformation has occurred. The results from this test show that at 3mm of penetration, gel B has greater gel strength than gel A. However, the rupture strength, brittleness and adhesiveness values of gel A are greater than those of gel B, indicating that it has a greater rupture strength, is more elastic and more adhesive than gel A. One can also see from the standard deviations that gel A is a much more reproducible gel than gel B.

Data Analysis:

☒Cursor Mark by user (Find the distance at 3mm)

☒Max Force

☒Peak Distance

☒Area (-)

Results

Sample	Force at 3mm 'Gel Strength' (+/- S.D.) (g)	Mean Max. Force 'Rupture Strength' (+/- S.D.) (g)	Mean Distance at Break 'Brittleness' (+/- S.D.) (mm)	Mean -ve Area 'Adhesiveness' (+/- S.D.) (g s)
A	145.3 +/- 13.7	500.9 +/- 38.3	8.8 +/- 0.7	-198.5 +/- 8.8
B	237.4 +/- 39.8	338.2 +/- 4.1	5.4 +/- 0.2	-92.4 +/- 12.3

Notes:

- The results for this type of test normally show very good reproducibility. However this is only true when the sample is set in a position which allows the formation of a flat surface. Failure to test on a flat surface causes differing test contact areas and hence produces erroneous results. Also presence of particulates contributes to the variation in the results. A probe with a large contact area (such as that used here) attempts to overcome this problem.

- 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.