Application manual No. 086

Production: JAM/FRUIT PRESERVE

Objective: Comparison of Firmness of Fruit Preserves/Jams using a Multiple Puncture Probe

Type of action: Penetration test

Test mode setting:

Speed	Test mode	Trigger	Target	Hold
2 mm/s	Distance (c)	30 gf	50 mm	0 sec

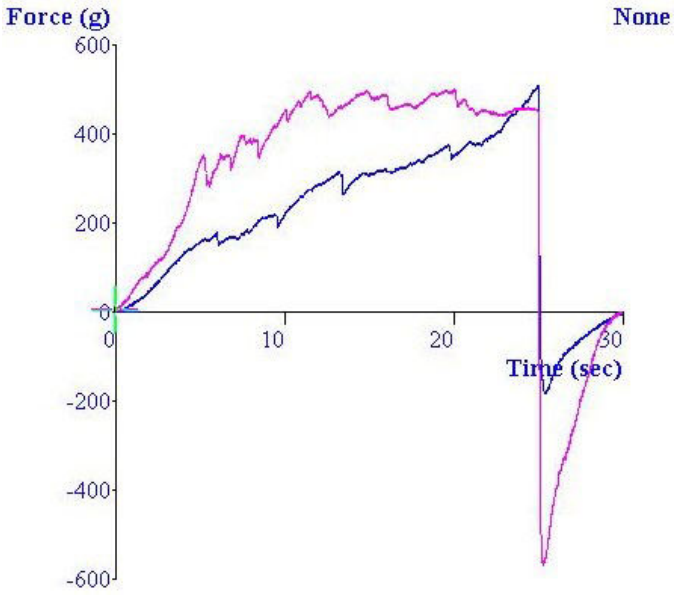
Accessory:
Multi-Penetration fixture (needle)

Introduction:

Quantifying the firmness/hardness of fruit preserves containing particulates, e.g. fruit chunks, fruit peel has always been difficult. The number, size, shape and distribution of particulates are usually randomly distributed within each container. While it is relatively easy to quantify the firmness of the gel matrix on its own using standard penetration probes this method is extremely difficult when the preserve contains particulates. A standard penetration test on such a non-uniform product is expected to have low reproducibility. The use of a Multiple Puncture Probe which penetrates the sample in several regions serves to create an averaging effect and is therefore usually more repeatable. Probes can be removed for cleaning and can be replaced easily if damage has occurred. In the event that forces produced are above the capacity of the load cell being used in the texture analyzer the operator has the option to remove probes to reduce the contact area and therefore the forces produced. One must note however that the use of fewer puncture probes for the testing of a non-uniform sample is likely to decrease the reproducibility of the results and is therefore a testing compromise.

Test Set-Up:
The Multiple Puncture Probe allows samples to be tested directly within their jars. Remove the sample lid just prior to testing. Position the sample jar centrally under the probe. Commence the penetration test.

Typical plots:



The above curve was produced from apricot and cherry preserve samples tested in containers with a diameter of 65mm.

Observations:
Force is seen to gradually increase as penetration depth increases. The total force required to penetrate to a chosen depth, i.e. the total work/energy involved in penetrating the sample the firmer/harder is the sample.

Data Analysis:
☒Area (+)

Results

Sample	Mean Area 'Firmness' (+/- S.D.) (kg·s)
Cherry Preserve	9.24 +/- 0.53
Apricot Preserve	6.37 +/- 0.16

Notes:

- Depending on the regularity of the surface (i.e. the contents of the container may not have settled as a flat surface or particulates may sit unevenly on the surface), it may be necessary to increase the trigger force value slightly. This ensures that the test starts collecting data once there is full contact between the probe and product.

- The product should be tested directly from the container in which it was originally dispensed, so as not to delay testing where the sample may begin to melt. When comparing different samples ensure that the temperature, container size and the volume of the product dispensed are the same (and should always be specified) when reporting results.

- The distance of penetration to be set in the test mode 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 be such that penetration probes do not come into contact (or indeed approach very close) to either the walls or the base during testing which could produce an erroneous result.

- During the tests' probe withdrawal stage (i.e. probe returning to start) the sample pot may be lifted-up. This can be prevented by physically holding onto the lip edges.

- 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.