Application manual No. 123

Production: DRY LASAGNE

Objective: Comparison of breaking stress/strength of 3 types of dry lasagne using a three-point bend test

Type of action: Bending test

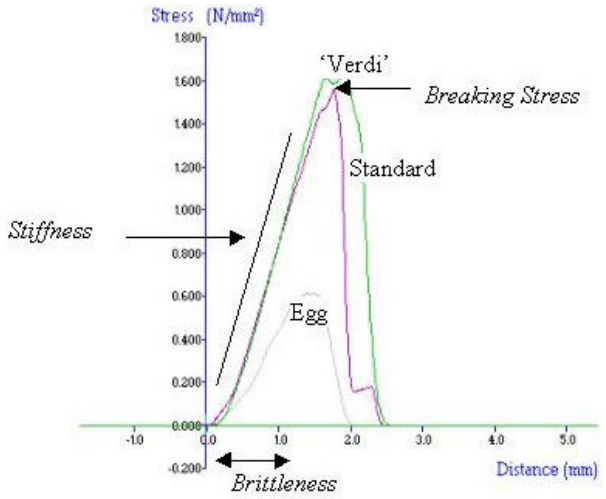
Test mode settings:

Speed	Test mode	Trigger	Target	Hold
3 mm/s	Distance (c)	15 gf	5 mm	0 sec

Accessory:
Three-point bending rig, Platform

Test Set-Up:
The two adjustable supports of the rig base plate are placed a suitable distance apart so as to support the sample e.g. 36mm. For comparison purposes this gap distance should be noted and kept constant. The base plate is then secured onto the Heavy Duty Platform. The Heavy Duty Platform is moved and locked in a position that enables the upper blade to be equidistant from the two lower supports. The samples are removed from their place of storage and are placed centrally over the supports just prior to testing.

Typical plots:



The above curves were produced from 3 different types of dry lasagne: Standard vs. Egg vs. Spinach (or 'Verdi'), tested at 20C.

Observations:
Once the trigger force is attained, the graph proceeds to plot the effect on the lasagne sheet under compression. The maximum stress value of the curve is taken as the breaking stress (force per unit area) or breaking strength (force per unit width) of the sample. Other textural characteristics that may be of interest are the distance to break and the gradient of the slope during application of force. The distance to break gives an indication of the brittleness of the sample as this shows how far the sample can be deformed before fracture. The gradient of the slope indicates sample stiffness, the higher the gradient, the stiffer the sample.

There appears to be no distinct differences between the standard and verdi lasagne types. It is quite clear however, that egg lasagne requires considerably less force to break and is certainly not as stiff as the standard and verdi lasagne types.

Data Analysis:

☒Max Force

☒Peak Distance

Results

Lasagne Type	Mean Max. Stress 'Breaking Stress' (+/- S.D.) (N/mm2)	Mean Distance to Break 'Fracturability' (+/- S.D.) (mm)	Mean Gradient 'Stiffness' (+/- S.D.)
Standard	1.62 +/- 0.05	1.83 +/- 0.03	1.01 +/- 0.04
Egg	0.71 +/- 0.07	1.90 +/- 0.34	0.55 +/- 0.03
Verdi	1.64 +/- 0.14	2.13 +/- 0.27	0.99 +/- 0.09

Notes:

- When comparing samples, ensure that they are of constant dimensions and that the distance between the supports are identical. A larger sample (and hence larger contact area) will require more force to fracture. Similarly a larger force would be required to fracture the samples if the lower support blades were moved closer together.
- Storage, packaging and handling of the sample before testing are considered variable conditions under which the lasagne sheets are tested. These conditions should be identified and kept constant for comparison purposes.
- The gluten strength/quality of the parent semolina may determine the dry strength of the pasta. Breaking stress/strength gives a measure of the strength of the dry pasta. This determines how well the product tolerates shipping and may indicate how well a product holds together upon cooking.
- Processing conditions however, have a much greater effect on breaking stress/strength than flour/semolina quality. For this reason, breaking stress/strength has seldom been used in the literature to predict the cooking quality of pasta. Nevertheless, it may be useful as a QA procedure for the pasta industry, as the measurement can be done more rapidly than a cook test, and it can be used as a near-line procedure.
- Breaking strength/stress of dry spaghetti, noodles or sheeted pasta can be determined by performing a three-point bend test, such as the procedure described. Such a test may, for example, be used to assess the effect of different ingredients used or to examine typical finished product problems such as moisture uptake.
- 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.