Ensuring Quality In Packaging Material

quality packaging

Packaging is an emerging science that has become a great contributor to the success of the food industry. It plays an important role to primarily protect the food product against physical, chemical and mechanical damage as well as contamination. Packaging has also become the core sector for marketing and the means by which manufacturers can differentiate their products from those of their competitors. Here we look at two examples of the seal strength and peel strength of packaging materials in the food industry.

Seal strength

For manufacturers in the fast moving consumer products arena, packaging their products in sachets is a quick and easy way for consumers to access their product. In the food industry, many condiments such as ready-made sauces and dressings can be packaged into sachets and is also a means by which new products can be promoted in the market place.

Figure 1: Brookfield CT3 Texture Analyzer with Dual Grip Assembly Fixture

The aim of packaging a product is to maintain the cleanliness or sterility of the product throughout all stages from the manufacturing plant, to transportation, shelf-life, and storage. For the manufacturer to ensure successful packaging of their products, the integrity of the seal must be assessed.

A seal strength test using a Texture Analyzer measures a quality of the seal purposed to provide a barrier protecting the product from its external environment. Using the tension testing method, seal strength can be measured by the capability of the seal to resist separation. A typical example of a fixture used for this type of tension testing is the dual grip assembly fixture (TA-DGF) see figure 1.

The dual grip assembly is a multipurpose fixture used in tensile testing. The grips are 25 mm wide and fitted with rubber inserts to maximise the secure clamping of the sample. These grips are capable of holding rectangular samples of up to 5 mm in thickness. Figure 2 is a typical graph from a tension test using the dual grips with a Texture Analyzer to measure the seal strength of a black pepper sachet.

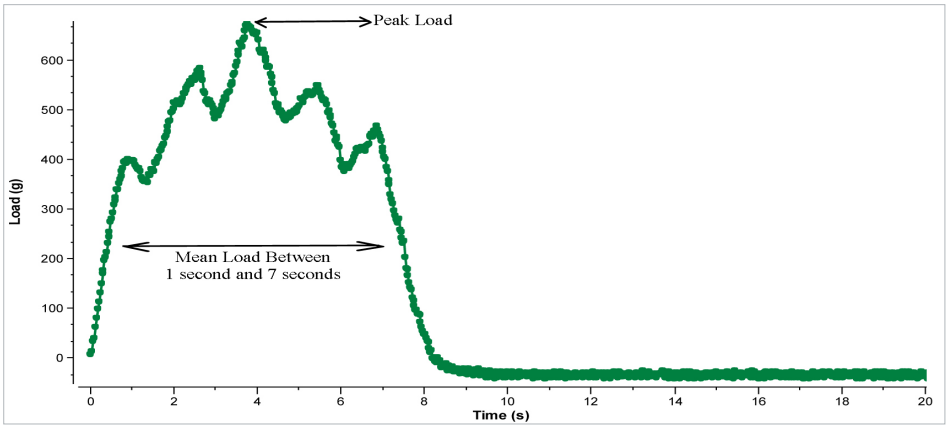


Figure 2: The Load Verses time graph for the seal strength of a black pepper sachet. As the tensile force increases the seal begins to be weakened at various points seen by the fluctuations on the load values on the graph. The maximum force value on the graph is a measure of the force required to initiate tearing at the seal. When the

maximum tension force is reached, the seal begins to tear away more easily seen by the gradual drop in tension load until total separation when the load value drops down to zero. The mean load indicated on the graph is the average force required to weaken and tear at the seal.

Figure 3 is a typical load/distance graph for a tension test using the dual grips with a Texture Analyzer to measure the seal strength of a black pepper sachet.

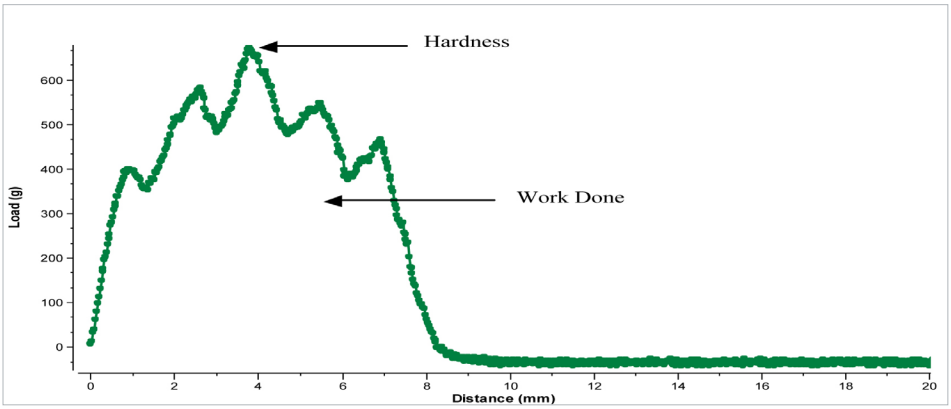


Figure 3: The Load verses distance graph for the seal strength of a pepper sachet . This is an alternative option of displaying the graph. Here the peak force and work done to weaken and tear at the seal is measured. The work done is measured as the area under the graph.

A summary of the results for one sachet is shown in the table below:

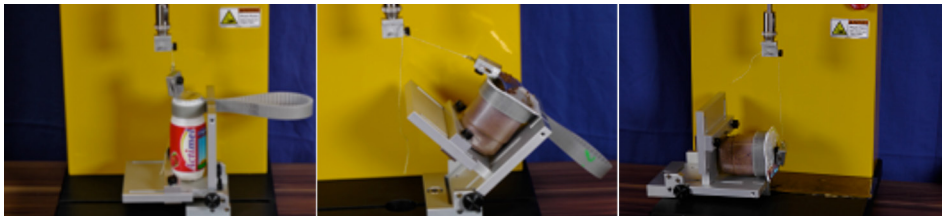
Sample	Peak Load (g)	Mean Load (g)	Work Done (mJ)
Black Pepper Sachet	672	497	13.3

Peel Strength

Peel tests measure the adhesive or bond strength between two materials. Typical examples include films and backing materials for adhesive patches amongst others. A peel test is performed when a tension load or force is applied to the materials under investigation in one of three ways as listed below:

(1) Pulling a *flexible* material away from a non-flexible material both of which are held vertically.
(2) Pulling a *flexible* material (positioned vertically) away from a non-flexible material (positioned horizontally).
(3) Pulling *two flexible* materials axially from each other. This is known as the T peel test.

A typical example of a peel test fixture is the General Peel Jig (TA-GPJ) see figure 4 below. The universal peel rig is designed such that it can perform a 0°, 45°, and 90° peel test based on the position of the fixture platform to the base of the instrument.



0⁰ **45⁰** **90⁰**

In preparation for the test, the free end of the flexible material (backing, film, etc) is inserted into the grip (or partially peeled prior to inserting into the grip) and the product (e.g., the non-flexible material) is locked into position on the

the protective material (e.g., backing or film) is peeled away from the product. The force required to peel the flexible material from the product is a direct measurement of bond strength.

In quality control, performing a peel test is important in order to assess the seal integrity and safety of the product. The tests also ensure the proper functioning of the adhesive seal by ensuring that the seal is strong enough to keep the product sterile yet easy enough to peel without causing spillages or inconsistencies in peel strength.

The results below have been taken from a 0 ° peel test of a seal on a yoghurt bottle using the universal peel rig.

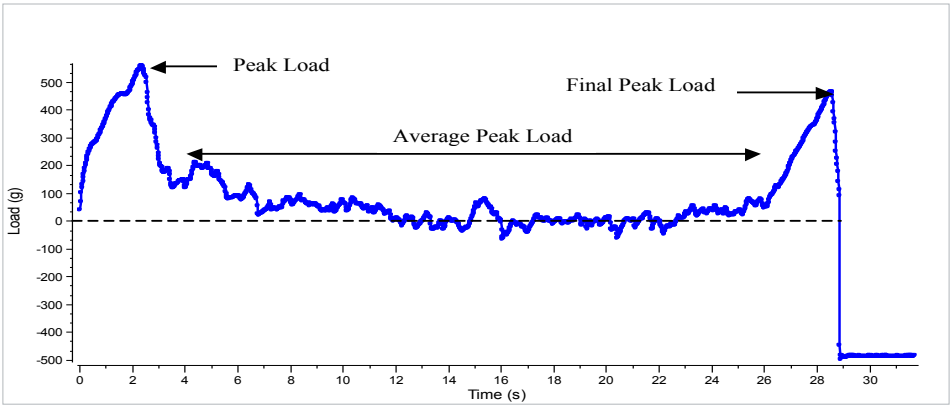


Figure 5: The peel strength of a seal from a yogurt drink bottle using a universal peel rig. The two peak values seen on the graph are a measure of the force required to break the rim-seal contact at the start of peeling and the force required to break the rim-seal contact at the end of the peeling. The plateau on the graph is the force required to continue peeling calculated as the average peak load. This region is consistent indicating smooth peeling as large fluctuations on the graph would indicate inconsistencies in peel strength.

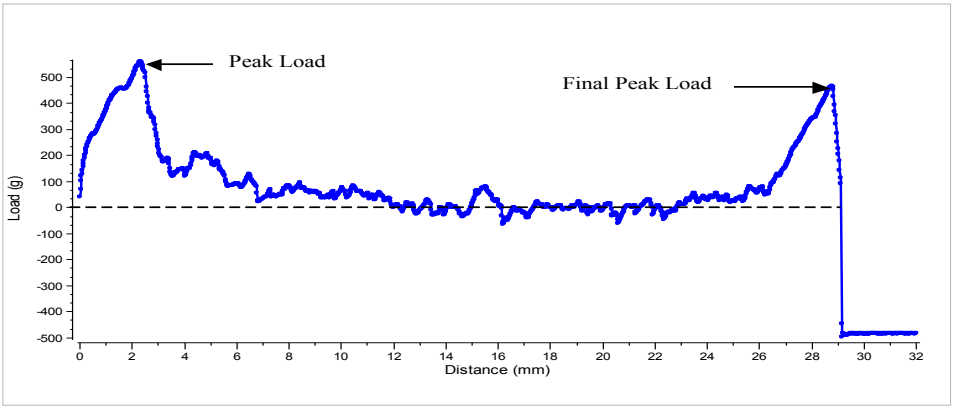


Figure 6: The load verses distance for the peel strength of seal from a yogurt drink bottle. This is an alternative option for displaying the results. The graph shows the distance travelled throughout the peeling process. The average peak load can however only be calculated from the load/time graph as the calculation involves a time period.

A peel test will indicate potential problems that may arise from the seal quality and can therefore be used to optimise seal strength. Where the peak force is very high at the start of the test followed by a rapid drop in force may indicate the possibility of spillages for low viscous products as the user attempts to peel off the seal from a lid. Moreover, large fluctuations in the force to continue peeling will also indicate poor seal quality with inconsistencies in peel strength and spillages also likely to occur. The advantage of this peel test is that it can be extended to all types of rectangular, oval, and circular containers.

The table below summarises the results as obtained from the TexturePro CT Software:

Sample	Peal Load (g)	Average Peal Load (g)	Work (mJ)
Yogurt bottle	561	35.7	14.43

Summary

Texture Analyzers are becoming popular tools throughout the food industry to quantify objective measurements for not only the food products themselves, but also for the packaging materials used to ensure their attractive appearance on shelf and safe transit from manufacturing plant to supermarket. Companies that still rely on visual inspection and subjective assessments for durability of packaging materials are missing out on a major opportunity to eliminate potential problems before they are reported by customers.

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