Campden BRI
Station Road
Chipping Campden
Gloucestershire
GL55 6LD, UK

Tel: +44 (0)1386 842000
Fax: +44 (0)1386 842100
www.campdenbri.co.uk

Campden BRI
food and drink innovation

Ensuring that your packaging is fit for purpose

This briefing note provides a succinct explanation of the tests available to check the physical robustness of packages and the suitability of packaging materials for particular applications. It should be of interest to anyone who packages food and drink products or supplies packaging to food and drink companies - and especially those considering 'lightweighting' (packaging reduction strategies). This note is supplemented by videos of some of the tests and an audio podcast on the Campden BRI website.

When deciding what packaging to use for a particular product, the packaging itself cannot be evaluated in isolation. It must be viewed as an integrated whole with the food or drink (or any other material) it contains and with the processes and environment to which it is going to be subjected. Consideration of these three elements - the package, its contents, and its handling - collectively as well as individually is essential in assuring end product quality and safety.

Not only must packaging retain its integrity and have the correct physicochemical characteristics to do the job, it must also not affect the product by causing taints or loss of quality. Campden BRI's expertise in all these areas enables us to take this holistic approach. We have a range of facilities for packaging analysis and for strength and integrity testing, as well as both chemical and sensory taint analysis capabilities.

Different materials have very different properties and uses, and have to withstand different types of treatment. This brief fact sheet looks at some of the types of analysis that can be carried out on glass, metal, plastics and paper/board packaging to determine both its inherent fitness-for-purpose and whether it has been damaged or compromised in any way.

For a fuller picture of Campden BRI's packaging activities see:

www.campdenbri.co.uk/services/packaging.php

Created October 2010

Updated September 2014

GLASS

Internal pressure resistance testing

When carbonated drinks are filled into glass bottles, or the liquid becomes carbonated through fermentation in the container, the glass needs to be able to withstand the internal pressure exerted on it by the liquid. Internal pressure resistance testing can be used to evaluate the suitability of the glass being used - perhaps during product development, or as a result of a change in glass suppler or a change in product formulation. It is also very useful as part of an investigation into failure of the glass.

The test can also be used for plastic bottles used to pack carbonated drinks.

A video demonstrating internal pressure testing can be viewed at:

www.campdenbri.co.uk/videos/packaging-pressure-video.php

Impact testing

Glass can be subjected to impact during storage and distribution. A pendulum impact tester can be used to replicate 2 objects colliding. This is useful for assessing the robustness of the container in relation to knocks and bumps during distribution. A pendulum is raised and dropped towards the glass sample at an angle; the energy absorbed by the sample on failure (i.e. breakage) is calculated. This can then be related to the container's ability to withstand impacts during distribution.

Thermal shock resistance

Some types of glass are not suitable for processes which involve significant and rapid changes in temperature. However, glass is becoming increasingly popular again as a container for heat-preserved (either hot-fill or in-pack processed) foods. Therefore, it is important to verify that the grade of glass in the containers being used is suitable for the process that will be applied. This will help minimise problems with new products or when changes are made to the container, contents or process. Thermal shock tests are designed to test the weaker outer surface of the glass container. The container is stabilised in hot water for a specified time (with water both inside and outside the container), and then it is immersed in cold water up to the neck whilst still containing hot water.

METAL

Can seam assessment

The lids of metal cans are joined to the body of the can with a folded double seam, which provides a hermetic seal to prevent microbial contamination. It is essential that the double seam is formed correctly, as there is a realistic risk that it could be compromised, especially through heat-driven expansion during the canning process. By tearing down the seam and measuring the seam parameters, an assessment can be made as to whether the seam is sufficient. This test is used by canned food suppliers and retailers as a quality check and also to investigate spoilage issues.

Microbiological leakage test

This is also known as the biotest. It is an integrity test method used on cans and ambient stable products packed in plastics. It involves immersing the packages into a known solution of microorganisms and storing them to see if microbial growth subsequently occurs within the product. ThIs will indicate ingress of the micro-organism and therefore indicate whether there are any leaks in the seal area.

Tin and lacquer layer assessment

The shelf-life of canned food is as dependent on the properties of the can as it is on the nature of the food. Tin or lacquer layer characteristics are one of the most important features. Microscopy is used to determine the nature and cause of any corrosion or delacquering, and to identify perforations in the coating.

PLASTICS

Burst testing

This is carried out to determine the strength of a seal and its ability to withstand transportation and handling (It is different to Mullen burst testing, which is carried out on carton and board - see below). It provides valuable information on the robustness of packs such as pouches. The pack is inflated at a uniform rate until the seal ruptures. This method is ideal for finding the weakest part of the seal area, and can be used for most plastic packages. It can be used as a quality check by food manufacturers or as part of seal failure/contamination investigation. A video demonstrating the burst test in pouches can be viewed at www.campdenbri.co.uk/videos/packaging-burst-testing-video.php

Integrity testing (leak detection)

The integrity of a seal can be tested using methods such as vacuum testing and dye testing. These should be used as quality checks, but can also be used to investigate seal defects.

Vacuum testing involves submerging the test pack in a chamber of water; the lid of the chamber is closed and a vacuum is pulled. A leak is identified as bubbles escaping from the pack. Dye testing involves introducing a penetrative dye into the test pack. Dye will escape out of any leaks in the seal area.

A video demonstrating leak detection (vacuum testing) can be viewed at:
www.campdenbri.co.uk/videos/packaging-leak-video.php

Migration testing

It is a requirement of EU legislation that packaging materials should not pass their constituents to the food to the detriment of the product. There are migration limits set for many plastics components. To

carry out the test, the packaging material is put in contact with one of four standard simulants: distilled water, 3% acetic acid, 15% ethanol or rectified olive oil. The degree of migration of components can be determined per volume of food and per area of packaging material.

This analysis is used by food and packaging manufacturers on a routine basis, and to verify packaging specifications when there has been a change of supplier. As well as plastic materials, it is also used with paper and board materials.

Oxygen and water transmission rate testing

The barrier properties of a packaging material are an important consideration when it comes to the shelf-life of a food. A barrier to moisture can provide protection to dry and crisp food products, and a barrier to oxygen will provide protection to foods susceptible to oxidative rancidity. All plastic materials have different gas and water vapour transmission rates and it is important to be aware of these.

Transmission rate testing is used by packaging manufacturers when they require an independent measurement to provide to their customers. It is also used by food manufacturers during product development or modification, and as part of shelf-life trials, or when changing packaging material suppliers.

A video showing transmission testing can be viewed at: www.campdenbri.co.uk/videos/packaging-permeability-video.php

Tensile test

This test provides important information about a material, including elongation, yield point (break point) and tensile strength. The curve generated from the data collected gives an indication of how the material behaves when tension is applied.

The test can also be used to measure the strength of a seal. The seal is pulled apart by 2 jaws at a constant speed and the force required to do this is measured. If the force is low the seal strength may be inadequate for its purpose.

Peel test

A peel test measures the force required to separate a lid from a tray or pot. This test is useful when designing new pack formats during product development, particularly to ensure food safety/integrity. It can also be used to measure how integrity changes over time, particularly after distribution. Another use of this test is to make objective comparisons of 'ease of opening' of peelable lids - by altering the test speed and angle, the actions of human opening can be replicated.

A video of this test being carried out can be viewed at: www.campdenbri.co.uk/videos/packaging-peel-testing-video.php

PAPER AND BOARD

Cobb test

This test determines the quantity of water absorbed by a sample of paper or other sheet material in a specified time and under standardised conditions. Water absorptiveness of paper board or other materials is a function of various characteristics such as sizing and porosity.

The strength properties of paper and board will change with moisture content. All paper and board products will seek to achieve moisture content equilibrium with relative humidity of ambient conditions. As paper becomes wet/damp, its strength properties decrease.

Kit test or Grease resistance testing

This is used to measure the repellence of paper and board materials to grease, oil and waxes. This test is used to quantify the performance of papers and boards, used for food contact where resistance to grease is important. This test was originally used by the paper makers as a surface repellency test for fluorochemical treatments.

A sequence of numbered reagents are released on to the sheet of paper or board; the highest numbered reagent that remains on the surface without causing failure is reported as the 'kit rating' (up to 12).

Compression test

This can be used to assess the strength of a container, whether it be primary (i.e. it directly contains the food, such as a carton of drink) or tertiary (i.e. it contains food containers, such as a carrier for bottles of wine) . It is particularly useful for assessing how packaging can withstand stacking during transit and storage, for example.

An external load is applied to the container to replicate the load applied when containers are stacked. This test is particularly important for food manufacturers, distributors and retailers to ensure that the packaging is fit for purpose. By using the correct grade of carton board the packaging will protect its contents during storage and distribution, without being over-specified and therefore unnecessarily expensive. This test can also be used to measure the vertical load capacity of glass containers.

A video showing this test can be viewed at: www.campdenbri.co.uk/videos/packaging-compression-video.php

Mullen burst test and edge crush testing

These used in combination can help determine the grade and thickness of board required for a product during storage and distribution.

The Mullen burst test is a measure of the force required to rupture or puncture corrugated board. This force is indirectly related to the pack's ability to withstand internal and external forces – and thereby

protect its contents during storage and distribution. This test gives an indication of strength. Wet board will burst at lower forces than dry board.

Edge crush test (ECT) is linked to stacking strength. It is a measure of the edgewise compressive strength of corrugated board. A small piece of a carton is placed between two platens and compressed perpendicular to the direction of the flutes - to provide an objective measurement of the force needed to crush the material.

Conclusion

An array of tests is available for the objective measurement of specific attributes of packaging materials. These tests enable companies producing or using packaging materials to check that their materials are within specification, to assure the performance of the packaging during production and distribution of the food product, and to make comparisons between alternatives - for example, during light-weighting trials.

Campden BRI has extensive facilities to support you with your packaging testing. To discuss in confidence how we can help you, please contact:

Emma Hanby +44 (0)1386 842262 emma.hanby@campdenbri.co.uk