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Determining Shelf-life With Eurofins Food Testing UK

Introduction

While many customers are used to their own business' shelf-life protocols, others can be surprised to learn that there is no single test or 'one size fits all' method to establish the shelf-life of all food products. Recommendations differ depending on the nature of the food product.

To understand requirements, we recommend customers first take advantage of the guidance that is available free in the form of the Food Standards Agency (FSA) and Department for Environment, Food & Rural Affairs (DEFRA) endorsed guidance produced by the Waste Action Resource Project (WRAP)[1] .

Advice for new businesses is provided by the FSA labelling guidance on starting your food business safely[2].

There may also be advice available with/without charge from your local authority Trading Standards/Environmental Health.

If you need further assistance Eurofins Food Testing UK Limited is here to help. This document provides a guide to our services to support your shelf-life needs every step of the way.

Contents

Shelf-life definition
The period of time during which a food will remain safe and of a suitable quality for consumption while the packaging is intact, and it is stored as instructed.

The period for which the product will
- Remain safe
- Remain unspoiled (acceptable sensory, chemical, physical, and microbiological characteristics)
- Meet any nutritional declaration or product claims

Labelling

Use-By or Best-Before?

Most food products have to carry one of these date marks.[3]

Use-By

Dates are about safety. The term ‘Use-By’ should only be applied on foods which are microbiologically perishable and are therefore likely, after a short period of time, to pose an immediate danger to human health.

Best-Before

Dates are about quality. The term ‘Best-Before’ can be applied to many different types of food which will remain safe to consume before the date, so long as the instructions on the label are followed; but the quality may no longer be at its best.

For some products the decision is very easy to make e.g. products which are ambient stable should be labelled Best-Before.

For some others it is not so clear, e.g. cheese; the decision may rest on whether microbiological changes are likely to result in the food becoming an immediate danger to human health. This may depend on details of the specific product and require the expertise of a food microbiologist to determine.

How Eurofins Food Testing UK can help

- Determination of Use-By or Best-Before by assessment of microbiological risk
- Guidance and support for redesignation of products which historically had ‘Use-By’ to ‘Best-Before’ durability (see “A Eurofins Perspective on "Best-Before replacing Use-By dates")
- Storage and use instructions
  - Consultancy advice on storage and safe consumer handling instructions, including storage conditions after the packaging has been opened (multi-serve packs)
  - Open-life testing (‘once-opened’ storage instruction)
  - Validation of cooking Instructions

Setting shelf-life

Both the ‘Safe-life’ and the ‘Quality-life’ of a food product should be considered. The shelf-life (product-life) is limited by whichever is shorter.

Safe-life

The safe-life of a food product cannot be determined solely by testing. This is because microbiological contamination may occur on some occasions and not others, and is seldom evenly distributed in foods. There may be batch-to-batch, and pack-to-pack variation. Microbiological Risk Assessment (MRA) is required to determine safe-life[1]. Safe-life should be reviewed after any changes in product (including ingredients), processing, or packaging.

MRA

Microbiological Risk Assessment (MRA) is a methodical approach to identifying and appraising the risks which can arise from different microorganisms in specific food products. This can be used in HACCP studies.

It requires microbiological expertise plus knowledge of product characteristics, processing and intended use. Published scientific literature and historical product data can be considered where available. MRA sometimes can, but does not always, involve Predictive Modelling. In certain situations, challenge testing may be recommended.

Predictive Modelling

Computer-based models using laboratory-generated data can be used to predict the growth of microorganisms during the desired shelf-life under defined temperature and other conditions, based on product characteristics such as pH and water activity. The output from these models require expert interpretation, and have limitations, e.g.:

- Not specific to the food product
- Does not consider the effect of competing microflora or some other factors which may be intrinsic to the product
- Requires some assumptions about initial levels of contamination and the physiological condition of microorganisms to be made

However, predictive modelling can be a useful tool in assessing safe life.

Challenge Testing

Challenge tests are experiments to investigate the ability of microorganisms of concern to grow or survive in the food product following processing, or under reasonably foreseeable conditions of distribution and storage. A key feature of these tests is that live microorganisms are deliberately added to the food.

They can be used to establish if a microorganism, under specific conditions, will grow or survive in the product, or establish the rate of growth of a microorganism in product.

This specialist testing requires a comprehensive pre-assessment, a lot of laboratory resources, and often many samples. It can be useful where other approaches cannot provide the answers. It is not recommended where answers can be obtained more easily, faster, and at a lower cost.

Challenge testing can be used to address spoilage microorganisms and therefore quality-life, as well as pathogens and safe-life.

Setting shelf-life cont.

Legal criteria for foodstuffs, e.g. *Listeria monocytogenes* in RTE foods[4]

Must be taken into consideration when determining safe life of these products.

Other guidance

Microbiological status of safe foods must be considered for the food products to which it applies. One notable example is the FSA and Food Standards Scotland (FSS) guidance 'The safety and shelf-life of vacuum and modified atmosphere packed chilled foods with respect to non-proteolytic *Clostridium botulinum*'[5].

How Eurofins Food Testing UK can help

- Microbiological Risk Assessments
- Microbiological Predictive Modelling and interpretation
- Consultancy advice on management of food safety, including compliance with relevant legislative criteria and guidance
- Training and support for establishment and development of Food Safety Management Systems such as HACCP
- Challenge testing
- Training and support in management of *Listeria monocytogenes* in food manufacturing.

Quality-life

Food quality-life can be influenced by a number of factors including; growth of microbiological spoilage organisms, chemical deterioration, and physical changes. The nature of the food product, including its composition, physio-chemical properties such as pH and water activity, microflora, packaging and storage conditions, can all have an impact.

Testing of trial scale or new product development (NPD) kitchen samples can be carried out during product development to give an indication of likely quality life. Ultimately however, assessments should be made on samples from real-life production to give a valid representation.

Sensory assessment, often carried out by the food manufacturer themselves, is a key consideration.

Microbiological analysis over at least the duration of the proposed shelf-life is recommended for those products which may not be microbiologically stable.

Replicate samples are stored under conditions which are reflective of those to which the product will be exposed, e.g. while under the manufacturer's control, in distribution, at retail, and once purchased by the consumer. Samples are removed from storage and analysed on a number of occasions from start of life and thereafter up to or beyond the desired shelf-life to assess changes over this time.

Quality-life cont.

We recommend that testing is conducted across three separate production batches to take into account batch-to-batch variation. At least one intact pack (sample) per production batch is required for each test point.

Chemical analyses may be recommended for specific food types, e.g. Peroxide Value and Free Fatty Acids for rancidity in high lipid foods. These analyses supplement the sensory assessment of food products since changes in chemical markers can often be measured before changes in the organoleptic properties of the food are noticeable. Separate samples should be supplied for chemical and microbiological analysis.

Where the nutritional qualities of the food product may deteriorate, testing for compliance with declarations or claims for the duration of the proposed shelf-life is recommended, e.g. vitamin analysis.

The quality-life should be reviewed after any changes in product (including ingredients), processing, or packaging.

How Eurofins Food Testing UK can help

- Microbiological durability studies, or routine microbiological shelf-life testing, under a variety of conditions of storage as appropriate
- Chemical analyses during shelf-life
- Nutritional and vitamins analyses
- Consultancy advice on shelf-life testing, including recommendations for analyses, testing points, limits, and where appropriate experimental design of study, e.g. for products with long shelf-lives
- Interpretation of shelf-life testing results (microbiological and chemical analysis).
- Consultancy advice on conducting sensory assessment
- Training on good practice in establishing shelf-life of food products
- Consultancy support in managing product spoilage issues, including recommendations for investigative testing.

Verification of shelf-life

Ongoing verification of shelf-life generally employs the same types of checks and testing that were used in establishing the shelf-life initially; sensory, microbiological, chemical, physical.

Routine microbiological testing of finished product at start and/or end of shelf-life builds a body of results which should be reviewed and trended regularly. Other historical data relating to shelf-life, e.g. hygiene records can form part of the verification evidence.

Microbiological shelf-life testing over at least the duration of the shelf-life is often requested at regular intervals by brand owners. It is good practice to repeat these verifications periodically as there can be 'drift' over time in factors which impact shelf-life, and this is often a requirement of brand owners.

How Eurofins Food Testing UK can help

- Microbiological and chemical analyses at start and end of shelf-life
- Microbiological and / or chemical durability studies or shelf-life testing, under a variety of conditions of storage as appropriate.
- Consultancy support in reviewing and trending test results and other verification data.
- Interpretation of results (microbiological and chemical analysis), with recommendations for next steps if required.

Shelf-life extension

Extension of shelf-life is an attractive proposition for many food businesses. Not only is there potential to increase profitability and competitiveness, but there are also distinct benefits for the customer and the environment with a reduction in food waste.

Approaches to deliver a longer shelf-life while maintaining both safety and quality can be based on a range of factors. Successful projects have variously involved changes to the following:

- Materials quality
- Hygiene
- Processing steps
- Product formulation
- Packaging solutions

We can help

- Consultancy advice on shelf-extension projects from our experts
- Testing recommendations for assessment of trials, and interpretation of results.

References

1. Labelling guidance: Best practice on food date labelling and storage advice. WRAP 2019.
2. Starting your food business safely. FSA 2023.
3. Retained Regulation (EU) No 1169/2011 Food Information to Consumers.
4. Retained Regulation (EU) No 2073/2005 Microbiological Criteria for Foodstuffs, EU2024/2895 .
5. The safety and shelf-life of vacuum and modified atmosphere packed chilled foods with respect to non-proteolytic *Clostridium botulinum*. FSA / FSS 2020.

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