



Science-led shelf life determination unlocks innovation

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In this white paper, Mark Butcher considers how applying scientific principles to shelf life testing can be a key enabler for innovation in the food and beverage industry.

Understanding shelf life is an important part of the development process. At Leatherhead Food Research, we are often talking to clients about this, and while most consumers would typically associate 'shelf life' with whether a product is safe, or not, to eat, it's actually a multifaceted challenge. When you mention shelf life to us, of course we're looking at safety (microbiological safety and stability), but we're also looking at factors that impact quality, consumer perception, consumer experience, packaging selection and labelling.

Looking back 10-20 years ago, the general consensus for shelf life was that longer was better, and the industry did a good job in achieving that. Now, however, with a focus on 'natural' products, achieving the shelf life that consumers have become accustomed to is a real challenge. Striking the correct balance is also a consideration as, in some cases, a long shelf life, natural or not, generates a perception of a product with artificial preservatives.

Thankfully, over the past 10 years, our understanding of shelf life and its influencing factors has also grown; and with our ability to model shelf life and conduct accelerated trials, we've been able to accelerate product development efforts for our clients across most categories.

Interestingly, we see shelf life being considered at different stages of the development cycle by different groups; sometimes to inform reformulation at the beginning, and sometimes to check the product at the end. There isn't a right place, necessarily, to think about or determine shelf life. Ideally, you'd consider all things at once, because it is a complex, interconnected problem but clearly that is a challenge in itself – there are opportunities though for the food industry to learn from the engineering sector here, drawing parallels with efforts in Building Information Modelling.

Real-time and accelerated testing

Objectives for shelf life testing can range from adherence to food safety criteria to understanding micro-structural changes during storage. There are two core testing techniques: real-time and accelerated.

Real-time microbiology testing is the only option for products where microbial stability is the limiting factor. This includes perishable products with high water activity such as salads, ready-to-eat meals and refrigerated products. During assessment, changes in the smell, taste and appearance of the product are monitored as spoilage microorganisms develop.

Accelerated shelf life testing is a predictive method assessing microbiologically stable products for deterioration in sensory characteristics. Specimens undergo stability tests in a range of controlled temperature/humidity and light conditions. Exposure to extreme conditions accelerates the changes that the product would undergo in normal circumstances.

It is important to make sure that the product does not undergo any phase changes, when accelerated shelf life testing is being undertaken. Secondly, conventional real-time shelf life testing must be undertaken alongside accelerated testing, at least the first time, in order to benchmark the results from accelerated testing against real-time results.

For ambient stable products and those with low water activity, sensory and physicochemical changes can determine the shelf life. Criteria might include staling, rancidity development, breakdown of texture, loss of flavour, colour changes or loss of functionality. Findings serve as a benchmark from which to calculate actual shelf life.

When developing long life products, ascertaining a value for shelf life through accelerated testing is hugely advantageous.

Challenge testing

Foods that are likely to contain pathogens or spoilage microorganisms should undergo challenge testing as well as shelf life testing. This takes microbiological evaluation a stage further, simulating what might happen during production, processing, distribution or subsequent handling by consumers. It involves monitoring the growth of inoculated bacteria in a specimen to establish critical factors that

may eliminate pathogens or reduce spoilage bacteria growth. It's important here not just to select the correct pathogens, but also to ensure that the inoculation methodology is representative of the likely contamination pathway. In addition, the inoculation method must not alter the product's critical parameters, or the results will not be comparable with pathogen behaviour over product shelf life. If challenge testing reveals that a product does not have the required level of stability, findings can be used to aid reformulation and obtain a better shelf life. For some products, we've been able to optimise the formulation to naturally inhibit pathogen growth.

Aiding innovation

Shelf life extension techniques are continually progressing, and methods to ascertain 'use by' or 'best before' dates are more sophisticated.

Applying scientific principles to shelf life testing can be a critical enabler for food industry innovation. This is perhaps most evident in the way manufacturers have evolved the interplay between packaging and shelf life. Vacuum packed meats that are good for six months, year-round fresh produce, chilled juice and milk products with weeks or months of shelf life – some of these were inconceivable a decade ago, and their development has changed the face of our supermarket shelves.

The tension between the trend for fresh and healthy products and the conflicting desire for maintaining reasonable shelf life will only intensify. We believe that this will prove to be a driver for more innovation in the field – we see this both in science-led packaging innovation and a growing demand for different shelf-life testing options.

How Leatherhead can help

Leatherhead provides key services for those involved in creating, managing and improving the food safety processes and procedures in operation in their organisations. This includes assessing existing processes and products through challenge testing and advising on safety for new products with services such as shelf-life establishment.

About the author

Mark Butcher is Vice President of Commercial Sales at Leatherhead. He is a chartered member of the Institute of Engineering and Technology with experience spanning the water, energy and food sectors. He is passionate about the commercialisation of science and technology to create new markets, challenge the status quo and deliver a competitive advantage within a business environment. He is an experienced project manager and has worked with a globally and culturally diverse range of private and public organisations in regions including the UK, US, Europe, Asia and the Middle East.

About Leatherhead Food Research

Leatherhead Food Research provides expertise and support to the global food and drinks sector with practical solutions that cover all stages of a product's life cycle from consumer insight, ingredient innovation and sensory testing to food safety consultancy and global regulatory advice. Leatherhead operates a membership programme which represents a who's who of the global food and drinks industry. Supporting all members and clients, large or small, Leatherhead provides consultancy and advice, as well as training, market news, published reports and bespoke projects. Alongside member support and project work, our world-renowned experts deliver cutting-edge research in areas that drive long-term commercial benefit for the food and drinks industry. Leatherhead Food Research is a trading name of Leatherhead Research Ltd, a Science Group (AIM:SAG) company.

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