



TETRA PAK® SERVICES THOUGHT LEADERSHIP TECHNICAL PAPER

FRONTIERS OF FOOD QUALITY

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WHAT IS FOOD QUALITY?

Consumers expect that the packaged food they choose to buy will taste good and be safe to eat or drink. Retailers demand that the packages they offer for sale can be handled through complex supply chains without damage or wastage and are attractive on their shelves. And food manufacturers must be able to pack their products economically while guaranteeing that they will maintain their nutritional value, appearance, taste and smell for the required shelf-life and most importantly, will not cause harm to consumers.

Tetra Pak plays a vital role in meeting these various, and sometimes competing, demands. This paper explains how Tetra Pak® Services helps customers maintain the highest possible standards of Food Quality and demonstrates how our services add value through the supply chain from packaging through distribution and on to a consumer's home.

ENSURING FOOD QUALITY

Food Quality is concerned with taste, colour, texture and nutritional value. Therefore to make sure food is maintained at the required quality standard we need to consider the experience of eating or drinking a product and the effects it has on the consumer. As it is difficult to set, measure and maintain consistent food

quality standards for characteristics such as taste, smell and texture, after the essential food safety evaluations, manufacturers must rely on more subjective measures and often use food tasting panels or people with a standard palate (for example a tea taster). Considerable effort is needed to recruit and retain these people as changes in the make up of a panel can introduce unwanted changes in food quality. Considerable effort has been made to complement these qualitative measures with more objective measurement techniques that can be standardised, such as electronic noses, but at present most Food Quality Assurance systems focus on the development of an overall structure into which these measurements can be inserted.



Fig 1: Tasting panel members need to calibrate their senses so they focus on the key characteristics of the product.



FOOD QUALITY ASSURANCE SYSTEM DESIGN

Fig 2: A food quality assurance system should include three components



1

DESIGN STANDARD

This defines the product standards. It should be based on maximising consumer pleasure without compromising nutritional value. It should list the quality attributes for each product.

2

MANUFACTURING PROCESS

The processing, packaging and distribution system should be designed and validated to deliver the design standard. Using an adaptation of the generic V-model for use in a food manufacturing setting, Tetra Pak uses the model shown in Fig 3 to design packaging systems.

3

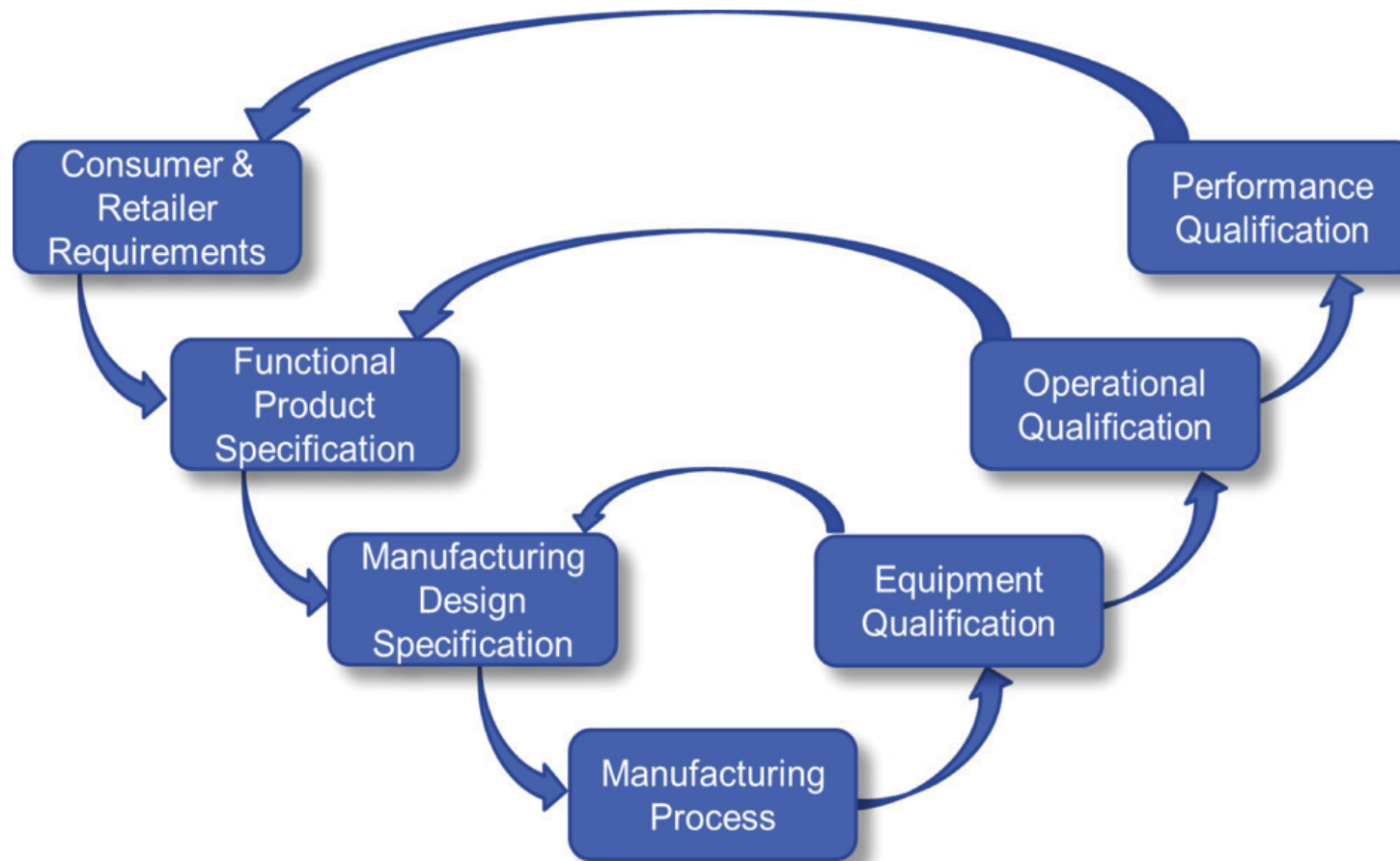
QUALITY MEASUREMENT AND ANALYSIS TOOLS

To ensure that output is within the required limits the manufacturing process is monitored using a range of continuous and discrete measurements. Failure Modes and Effects Analysis (FMEA) can secure against failures in the process and incorporate learnings back into the process design.



THE V-MODEL

Fig 3: The V-Model. By working through the steps of the model, a manufacturing process can be designed, equipment specified and operating procedures defined to deliver the required performance.





ADVANCES IN FOOD QUALITY TECHNOLOGY

As has already been mentioned, food quality specialists are using sophisticated technology to design tools and techniques that they can use to add objectivity to the measurement of characteristics such as taste, smell and texture. These hold the prospect of significant improvements in the specification and the maintenance of consistent and repeatable quality standards in food manufacturing processes. The following examples show how our industry is adapting tried and tested tools and techniques originally developed for entirely different purposes for food quality measurement applications.

RAMAN IMAGING

Pioneered by the pharmaceutical and biomedical industries, Raman imaging is a spectroscopic technique that is used to fingerprint a sample and give a detailed analysis of its chemical makeup. It provides a rapid, non-destructive food quality measurement technique that in early work has been proven to offer a reliable way to find the presence of adulterants, contaminants and pesticides.

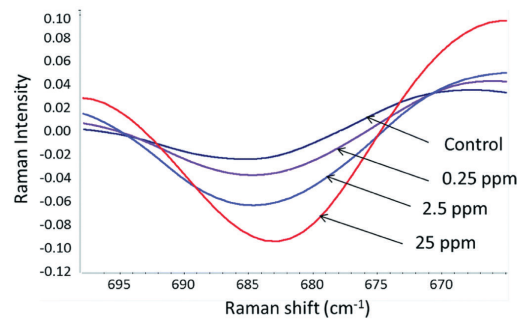


Fig 4: Raman laser analysis of milk samples containing different levels of Melamine.

Early studies are giving promising results and Raman imaging would seem to offer the prospect of becoming a powerful new food quality surveillance technique.

LIQUID CHROMATOGRAPHY AND MASS SPECTROMETRY

These technologies are increasingly being used in a variety of food testing applications as a flexible alternative

to traditional methods due to its high sensitivity, selectivity and faster throughput. Liquid Chromatography and Mass Spectrometry have been adopted by the Association of Analytical Communities (AOAC) for the analysis of vitamin D and research is underway to measure the presence of other vitamins in various nutrients and supplements. They have also standardised approaches developed by the US Food & Drugs Administration to reliably test for more than 300 pesticides in fruits, vegetables and grains. The scope of pesticides covered by the method can be expanded as needed.

HYPERSPECTRAL IMAGING

Hyperspectral imaging is a form of photography based on wavelengths of light that are not visible to the human eye. This technology that is also used in night vision cameras and deep space astronomy, has the potential for food quality applications. Molecules absorb and reflect light at distinctive wavelengths, allowing hyperspectral imaging to detect the presence or absence of different

chemicals and their concentration. As food characteristics such as ripeness, nutritional levels and bacterial contamination can be deduced from the presence of molecules, hyperspectral imaging could offer further opportunities for the application of technology to deliver objective food quality measurement.

For instance, it could be used to determine the levels of starch and sugar in potatoes and therefore determine how it should be used its best use for the potato. High-starch potatoes are crumbly, so are perfect for mashed potato, whereas low-starch potatoes are firmer and better for salads.

¹ **FMEA** (also known as: Failure Modes, Effects and Criticality Analysis (FMECA) is a step-by-step approach used to identify possible failure modes in a design, a manufacturing or assembly process or a product or service.

Failure Modes - the ways ("modes") in which a system / process / product might fail. Failures are the actual or potential errors or defects.

Effects Analysis - the study of the consequences of the identified failure modes. To learn more, visit: <http://asq.org/learn-about-quality/process-analysis-tools/overview/fmea.html>

Fig 4 Source: <http://pubs.rsc.org/en/content/articlelanding/2015/ay/c5ay00955c#!divAbstract>



TETRA PAK® SERVICES

– PARTNER IN FOOD QUALITY ASSURANCE

Tetra Pak® Services are committed to supporting customers in all aspects of food quality. To deliver this, our teams include

not only a world-renowned microbiology team but also experts in a wide range of food science and technology specialities.



Fig 5: Guido Moruzzi, Tetra Pak's Aseptic technology specialist, was honoured to receive the 2016 Marvin A Tung Lifetime Achievement award from the Institute for Thermal Processing Specialists (IFTPS) in recognition of his contributions to the development of food packaging and preservation technologies. Guido works everyday helping Tetra Pak and our customers all around the world increase the robustness of our aseptic processes.

Working with customers, the Tetra Pak Services team helps achieve the highest possible food quality. We are continuously evolving our portfolio by developing services that will support our customers in improving their food quality in four key areas:

1

DESIGNING FOOD QUALITY MANAGEMENT SYSTEMS

– we are continuously updating our suite of software tools to set new best practices and standards so we can help customers design and develop quality management systems based on reliable information.

2

SUPPORTING THE IMPLEMENTATION OF A FOOD QUALITY MEASUREMENT SYSTEM

– Tetra Pak has built an unrivalled manufacturing equipment installed base and experience developing functional quality management systems over many years. This, coupled with the ground-breaking change management expertise gained from developing our own manufacturing capabilities has resulted in a pragmatic, hands-on approach to driving implementation of new systems.

3

RECOMMENDING APPROPRIATE FOOD QUALITY MEASURES AND MEASUREMENT TECHNIQUES

– measurement systems, the data they generate and the ability to analyse and interpret that data give manufacturers a competitive advantage. Tetra Pak is uniquely positioned at the cross-roads of technology and liquid packaging expertise to help customers take advantage of these new paradigms

4

DIAGNOSING AND RESOLVING SPECIFIC FOOD QUALITY ISSUES

– even with the most advanced manufacturing process and quality management system, quality issues will still arise. Tetra Pak's World Class Manufacturing (WCM) expertise not only allows us to resolve customers' issues quickly and effectively, but also allows us to advise how the manufacturing process or quality management system can be improved to prevent the recurrence of the issue.



FOOD QUALITY DELIVERS FOOD SAFETY ...AND VICE VERSA

This paper has focussed on food quality, but it will be clear that many of the points discussed will also have a positive impact on food safety. Without a well-designed manufacturing process and a fit-for-purpose quality assurance system, a manufacturer will struggle to deliver consistent product quality and therefore will risk compromising the safety of their food products.

Tetra Pak has developed our unrivalled food quality expertise and reputation for protecting food safety over decades working with leading food and beverage manufacturers. We are continuously developing the ways we support customers with packaging materials, equipment and services and explains why customers all around the world partner with Tetra Pak to guarantee their food quality and safety.

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ABOUT THE AUTHOR

Tetra Pak is committed to making food safe and available everywhere. We Protect What's Good. My contribution to meeting this commitment is to make sure that our expert services are helping our customers maintain food safety and quality. I work with customers and Tetra Pak's world-class teams of scientists, engineers and packaging experts to continuously improve our current portfolio and expand it by adding new services. Together we make sure Tetra Pak's customers maintain sustainable quality, reduce cost and improve production efficiency. I have worked in the packaging and pharmaceutical industries and developed expertise in the use of advanced problem solving techniques, world class manufacturing and lean six sigma quality techniques. I have a strong academic foundation with a BEng in Mechanical Engineering and an Executive MBA. If this paper has been of interest and you would like to the conversation, please contact me by email at alexander.bromage@tetrapak.com

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Tetra Pak® Services cover every aspect of your food production, from daily routines to business insights. Our tailored service solutions improve performance, optimise costs and ensure food safety throughout the lifecycle of your operation.

With Tetra Pak as your partner, you get the people, portfolio and presence to achieve your performance goals. Find out more about Tetra Pak® Services at tetrapak.com/services.

