newfood

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Issue 5 · 2015

Food Safety

James Marsden, Distinguished Professor at Kansas State University, discusses dealing with and preventing Listeria contamination

Brewing Supplement

Pioneering processing technologies with Hanlons Brewery, and Food Safety Assist unveil a new quality standard for the brewing industry

Fi Europe

The ingredients show returns to Paris

Ingredients Supplement

Fonterra introduce a new way of designing high protein products, and we get an insight into innovations in healthy fibres

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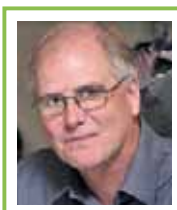

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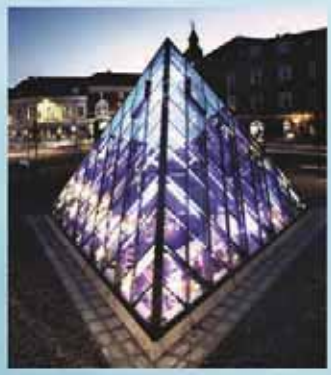

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Full to the brim

Welcome to another issue of *New Food*, and as always, it is stuffed with major food and beverage matters plus views from industry experts. Two informative articles to bring to your attention include controlling Listeria monocytogenes in food plant environments, from James Marsden, Distinguished Professor at Kansas State University (on page 10), and Michael Govro, Technical/QA Manager, NSF International tells us what to expect from a traceability audit (page 66).

The first of this issue's supplements – on Ingredients – discusses whey protein, and introduces a new way to design high protein products. This comes from the scientists at Fonterra (page 24). As well as this we have an article on healthy fibres, and innovations within this sector (page 29).

The second supplement focuses on Brewing, with articles from Hanlons brewery, a family-run business which produces world class craft beers (page 54), and Food Safety Assist, who have been working alongside Langham Brewery to trial a new quality standard for the brewing industry (page 57).

To tie in with the aforementioned supplements we have show previews from Food ingredients Europe (Fi) which, alongside Natural ingredients (Ni) forms the world's most important food ingredients event (page 33); and for Brau Beviale (page 61), the world's leading exhibition for the beverage industry.

Earlier this month I moderated *New Food's* latest webinar 'Food safety, hygienic design and cleanability' – sponsored by Bürkert. The webinar attracted a great deal of industry attention and touched on many topics within this important field, such as CIP technology, zoning models and SAW technology (see the review on page 40). Our upcoming webinars, which will be broadcast live later this year, will be on topics such as the many ways of analysing fat species in foods, and another about techniques for efficient colour management. You can find previews about these webinars, when they will take place and how to sign up on pages 51 and 62.

As always, if you would like to contribute to a future issue of *New Food* with an end-user article or an informative news item, please do not hesitate to contact me via the email address below. Please also bookmark our website – www.newfoodmagazine.com – where you can find details of past, current and future issues, daily industry news updates, plus conference and event details. Don't forget you can also join our groups on LinkedIn, Twitter and Facebook– details are opposite.

Stephanie Anthony
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Innovation with Integrity

Contents

CMA approves Müller's acquisition of Dairy Crest's dairies business

The Competition and Markets Authority (CMA) has approved Müller UK & Ireland's acquisition of Dairy Crest's processing, trading and distribution activities relating to liquid milk, packaged cream, flavoured milk and bulk commodity ingredients.

The consideration payable by Müller remains at £80 million subject to previously agreed upward or downward adjustments. Müller has withdrawn its right not to complete the purchase should there be a deterioration of more than £20 million from the agreed level of profitability of Dairy Crest's Dairies operations. Dairy Crest has agreed to make a one-off payment of £15 million to Müller on completion to help meet the additional cost of the modified undertakings.

The acquisition, which includes Dairy Crest's dairy facilities at Severnside, Chadwell Heath, Foston and Hanworth together with around 70 depots, will complete no later than 27th December 2015.

The decision follows agreement by the CMA that Müller will toll process a nominated volume of fresh liquid milk for fresh milk processor Medina Dairy at the Severnside facility to ensure competition for national multiple tenders in the South West, Wales, the South and the Midlands.

Ronald Kers, Chief Executive of Unternehmensgruppe Theo Müller said, "As a family owned company, we aim to invest in businesses where we can add value through our knowledge, scale and entrepreneurial way of operating.

"This acquisition is very much in line with this mission and we are delighted that we can now press on, drive towards completion of this transaction and begin work with our new colleagues to bring these businesses together.

"There is no question that further consolidation is required in the UK fresh milk sector and with this hurdle now cleared, we have an exciting opportunity to create a more competitive, sustainable, efficient and innovative dairy processor in the UK."

Mark Allen, Chief Executive of Dairy Crest, commented, "This is a transformational moment for Dairy Crest and the wider dairy industry. The deal will help to create a more sustainable UK dairy sector. It will deliver economies of scale and cost efficiencies that will underpin investment in the sector and help the UK to compete more successfully in global markets. Dairy Crest will now be able to focus on growth, through both our branded cheese and spreads operations and new revenue streams from manufacturing products for the fast-growing global infant formula market."

www.muller.co.uk

Uhde HPT provides a high-pressure pasteurisation system for foodstuffs for customers who want to produce safe, clean and fresh products

Uhde High Pressure Technologies GmbH is a subsidiary of the ThyssenKrupp Group and is the world's leader in high-pressure engineering. With over 80 years of experience, a multitude of newly developed high pressure applications, many patents, close connections to our in-house steel manufacturer and a global presence say it all! For many years, Uhde HPT has been developing and building system solutions for the food, pharmaceutical and petrochemical industries.

Using the HPP process it is possible to denaturise pathogens, germs, parasites and moulds but the product itself does not change in taste, vitamin content or texture. One of the greatest advantages is that products can be treated directly in the final packaging stage, preventing any subsequent contamination. In addition, the process does not create any waste water or other waste products. This satisfies the resource saving requirements of many customers.

A large number of technical innovations make it possible to safely control the enormous forces that prevail at 6,000 bar. Using know-how gained from over 80 years experiences with related products like high pressure pumps, valves, piping and vessels, these days, Uhde HPP plants are installed in all parts of world, ensuring highest quality made in Germany.

www.uhde-hpt.com

Duty cuts tap growth for premium lagers, beers and ciders

Key Note's latest Market Report, Premium Lagers, Beers & Ciders, examines the market for 'premium' lagers, beers and ciders in the UK.

According to the report, the UK market for premium lagers, beers and ciders was estimated to have grown by 1.2% year-on-year in 2014, as the economic recovery, lower duty rates and a return to growth in volume beer sales helped to drive value growth in the market for premium beer and cider products.

Value growth, and the annual increase in volume sales, has mainly been driven by the recent reductions in the level of alcohol duty paid on beer and cider products. For beer, all categories – covering low-, average- and high-strength products – saw cuts in duty ranging between 0.75% and 6% in the years ending March 2014 and March 2015. As a result of two consecutive cuts in the level of beer duty, beer prices were estimated to have fallen, on average, by 1% across the country.

Stable annual growth in value sales predicted for premium lagers, beers and ciders

For cider, budgetary announcements were not as favourable, with a 2% above-inflation increase in duty rates imposed for the year ending March 2014, under the alcohol duty escalator policy. For the 2014/2015 financial year, this policy was abandoned across the sector, and duty rates for cider – alongside spirits – were frozen during the year. While this was a positive move for cider and other alcohol sectors, it was not until the latest budget that rest of the alcohol industry, like beer, received a reduction in duty levels.

Owing to cuts in cider duty for the year ending March 2016 and the third consecutive reduction in beer duty levels, combined with sustained economic growth in the UK and the return to growth in volume beer sales, Key Note is predicting stable, albeit, slight annual growth in value sales of premium lagers, beers and ciders over the next five years.

www.keynote.co.uk

New unrivaled *Vibrio* Identification Kit by BIOTECON Diagnostics includes toxigenicity genes

Vibrio parahaemolyticus, Vibrio vulnificus and *Vibrio cholerae* are known to be potential waterborne contaminants of seafood and cause severe health problems worldwide. A rapid and reliable method for the detection is required, as seafood typically has a short shelf life. Traditional methods are time consuming and error-prone, while real-time PCR can be done in less than 24 hours with a high specificity and sensitivity.

BIOTECON Diagnostics has designed an innovative and cost effective assay, unique in many respects: in one single test, the foodproof® Vibrio Detection LyoKit detects and discriminates between *V. parahaemolyticus, V. vulnificus* and *V. cholerae*. Additionally the pathogenicity factors ctx, tdh, trh1 and trh2 can be identified by melting curve analysis.

By using novel targets, false-positive and false-negative results known from other methods (using targets like e.g. tlh or hlyA) are avoided. With unique 100% specificity for the detection of species and pathogenicity factors, the assay is superior to official methods like the FDA BAM method for *Vibrio*.

The assay is compatible with all relevant raw and processed seafood matrices like whole squid, raw oysters or smoked salmon. The rapid and easy sample preparation includes a live/dead discrimination by usage of Reagent D, minimising background of dead *Vibrio*.

www.bc-diagnostics.com

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UK food and drink exports generate £1 billion

A record 4,000 UK food and drink businesses have exported almost £1 billion of their British produce to shops and restaurants around the world in the past two years.

In 2013, the UK government announced a new ambition to directly help 1,000 UK food and drink businesses sell their produce abroad by October 2015, generating business wins of £500 million. Two years later it has smashed those targets, with four times that number of companies using free advice and support from UKTI to win £985 million of business around the world.

Visiting British companies exhibiting at Anuga, Farming Minister George Eustice said, "This Government is backing Britain's world-class food and farming industry, helping a record 4,000 British businesses to put their top-quality produce on supermarket shelves and restaurant menus around the world."

He continued, "I'd like to see even more of our food and drink companies starting to export their great British produce, using the support and advice the Government can offer and making the most of the opportunities created as we negotiate to open new markets."

Dairy exports outside the EU have also risen, with cheese to the US worth £22 million in the first six months of 2015, up 20% in value on the same period last year.

Wyke Farms, one of the UK's biggest cheese manufacturers which exports its award-winning cheddar to 160 countries, has recently launched a new British flag-themed brand specifically targeted at export customers. Exhibiting at Anuga, Rich Clothier, Managing Director of Wyke Farms, said, "In October we will export over 300 tonnes of award-winning Wyke Farms cheddar to over 160 countries worldwide. Our new bespoke global 'British brand' for our export range allows us to communicate all of our credentials such as quality, provenance and green energy, all of which are so important to the global market. We have had good support along the way from the UKTI and the CBI who have helped us by using their network of contacts, giving us advice in these new and emerging regions."

Last year the UK exported to 228 countries and territories around the world and exports of UK food and drink have doubled in the last decade, worth nearly £19 billion in 2014. The UK government has negotiated to open almost three new global markets a week since 2010 – including beef to Thailand, processed pork to India and poultry meat to Angola this year.

Food and drink remains the UK's biggest manufacturing sector – greater than cars and aerospace combined – contributing £103bn to the economy.

www.gov.uk/government/organisations/department-for-environment-food-rural-affairs

Supporting customers from concept to finished product

In product development, it is one thing to understand what consumers want, and quite another to develop products that meet these expectations. To do so requires a fundamental understanding of ingredients, and what happens when they are processed, and this is the kind of intelligence that RSSL has been providing to its customers for nearly 30 years.

"To successfully turn a concept into a viable product requires a lot of fundamental knowledge," notes Sarah Marshall of RSSL. "This includes understanding the physical and structural characteristics required of the ingredient and finished product, the analysis of ingredients and analytical work to be able to substantiate any claims that need to be made."

RSSL provides a wide range of highly sophisticated analytical techniques to address a whole host of issues around product acceptability, safety and legality, helping customers develop better products and substantiate claims.

Of course, every project is different and has different challenges, but RSSL can draw on an extensive team of experts, with experience from every part of the industry.

Many customers view RSSL as a trusted partner and value the expertise that its scientists and technologists can bring to every project. With the investments RSSL has made in recent years, the company has signalled its firm intention to continue providing the best analytical and consultancy support to its customers for many years to come.

rssl science with service

www.rssl.com

Kerry establishes Kerry Health and Nutrition Institute

Kerry Group has launched the Kerry Health and Nutrition Institute with the aim of providing expert insight into the science and policy of health, taste, nutrition and general wellness.

Kerry says the new Institute has three guiding principles: to educate on health market trends; to connect with the scientific community on regulatory matters and evolutions in research; and to advance scientific knowledge to deliver nutritious foods and drinks.

Across the globe, public health challenges such obesity and diabetes are increasingly prevalent across all ages and in all corners of the globe. This has substantially increased the focus on improving the nutritional quality of food supply to enable more nutritious and healthier food and beverage choices, while maintaining convenience. Despite this taste remains the most important factor to 41% of consumers globally when choosing food or drink products meaning that manufacturers cannot afford to look at nutrition in isolation.

Satya Jonnalagadda, Ph.D., MBA, RD, Director of Global Nutrition at Kerry said, "The challenges we are facing in terms of public health are varied, complex and are at a global scale. Action is needed at industry, social and individual level to tackle crises, such as the obesity epidemic. As a taste and nutrition leader, we want to help guide the development of evidence based products that will have a significant impact on health and still taste great."

The Kerry Health and Nutrition Institute is supported by a Scientific Advisory Council, which is made up of recognised leaders in nutrition science and research. Council members augment the Kerry Health and Nutrition Institute with their learnings on scientific advancements in the areas of general wellness and nutrition for future nutritional and technology innovation. The Institute is also supported by internal Kerry advisors.

"These prominent experts hailing from exceptional institutions will help Kerry, through the Kerry Health and Nutrition Institute, achieve its commitment to discovering new nutritional technologies and applications, and ultimately help consumers around the globe pursue healthier lifestyles with innovative and great tasting nutritional solutions", said Albert McQuaid, PhD, Chief Technology Officer, Functional Ingredients & Actives.

www.kerryhealthandnutritioninstitute.com

Animal-free meat company raises $108 million in financing

Impossible Foods, a company that creates meat and dairy foods directly from simple plant ingredients, has raised $108 million in Series D financing.

The financing was led by UBS and with participation from Viking Global Investors, among others. Earlier round investors, including Horizons Ventures, Khosla Ventures and Bill Gates, also participated.

"This latest financing ensures that we have more than enough runway to bring our first products to market," said Patrick O. Brown, M.D., Ph.D., founder and CEO of Impossible Foods. "We are grateful to our visionary investors, whose support will enable us to transform the global food system by providing consumers with delicious and sustainable meat and dairy foods made directly from plants."

"To achieve a sustainable future, we need to further invest in companies like Impossible Foods that minimise the environmental impact of our food system through innovation without compromising taste," said Samir Kaul, partner at Khosla Ventures.

Impossible Foods was founded in 2011 with the aim of offering consumers a better choice: animal-free meat and dairy foods made directly from plants that are delicious, healthy, affordable, and use far fewer of Earth's finite resources to produce than animal-derived foods. But how does Impossible Foods produce animal-free meat? According to the company's website, they separate proteins, fats, and other nutrients from plants, selecting those that give foods desirable flavours and textures. They then combine these proteins with vitamins, amino acids, and fats, all from plants, to make meats and cheeses. The company expects to release their first product, the Impossible Burger, in 2016.

www.impossiblefoods.com

Pulsed Electric Fields (PEF) as an alternative to HPP

The contamination by Listeria represents a high health risk due to its ability to cause a serious infection termed listeriosis. The traditional process for inactivation of Listeria is thermal treatment of the product. As a result the microbial safety of the product is ensured, but equally the quality of the product is affected in terms of degradation of flavor and vitamin content.

Alternative treatments for successful inactivation of Listeria are novel technologies such as HPP and PEF. HPP as a batch process can treat pre-packed products with pressure levels up to 6,000 bar for several minutes. PEF in contrast operates as a continuous process, which is approximately 10 times more cost efficient, and the capacity using Elea PEF systems ranging from 200 up to 5.000l/h.

During the PEF process, the product is pumped through treatment chambers, where it is exposed to the electric field. This electric field affects the microorganisms suspended in the liquid food product in terms of porating the cell membrane leading to cell death. In contrast to thermal treatment the fresh taste and nutritional value of the product is maintained by the PEF process. Consequently, Elea PEF systems offer the possibility to produce a high quality product whilst safeguarding the microbial integrity of the product.

www.elea-technology.com

AB InBev and SABMiller agree takeover proposal

Anheuser-Busch InBev and SABMiller have announced that they have reached an agreement in principle on the key terms of a takeover offer from AB InBev of £44.00 per SABMiller share.

SABMiller rejected previous offers from AB InBev saying that the offers substantially undervalued the company.

If the deal, worth approximately £70 billion, eventually goes ahead, the combination of AB InBev and SABMiller would result in a super brewer that would also be one of the world's leading consumer products companies. The combined group would have operations in virtually every major beer market, including key emerging regions with strong growth prospects such as Africa, Asia, and Central and South America.

AB InBev is already one of the world's top five consumer products companies. The company's portfolio comprises over 200 beer brands including Budweiser, Stella Artois and Corona. AB InBev has approximately 155,000 employees based in 25 countries worldwide. In 2014, AB InBev realised $47.1 billion revenue.

SABMiller's has a portfolio of more than 200 beers, including Peroni and Grolsch. The group employs around 69,000 people in more than 80 countries.

www.ab-inbev.com

New research highlights consumer attitudes to artificial ingredients

New research has found that 62% of UK consumers say they would be more likely to purchase from a particular brand if it removed all artificial ingredients from its products.

The new research comes from Instantly who polled 1,517 people in the UK to explore perceptions around artificial vs. natural ingredients.

Instantly's research suggests that concerns over health are the overriding reason for consumers preferring products without artificial ingredients. More than three-quarters (76%) of consumers agreed with the statement that: food products with artificial ingredients are less healthy than food products with natural ingredients. Even in traditionally unhealthy categories, like snacks or frozen pizza, many people believe products will be healthier when artificial ingredients are removed.

Nestle, Kraft and General Mills have all pledged to remove artificial ingredients from their products signalling how the industry is being shaped by consumer attitudes and the shift to more natural ingredients. According to the study 64% of consumers would have a more positive perception of a brand if it removed all artificial ingredients from its products.

It seems that consumers are even willing to buy products with decreased shelf life and taste following the removal of artificial ingredients, with 65% of consumers saying they would be prepared to purchase these altered products.

The research also uncovered the differing consumer attitudes towards independent and large established companies with only 25% of consumers saying they would trust a large established company to produce a product with all natural products. This is compared to 75% of consumers who said that they would trust a small independent company to do the same

Ben Leet, UK MD of Instantly, said, "People in the UK are becoming increasingly health conscious and this is reflected in their attitudes towards the inclusion of artificial ingredients in the products they consume. There is also clearly a perception issue that larger companies need to address, as consumers tend to link natural food brands with independent suppliers. With natural food brands seemingly becoming more popular, corporations may have their work cut out for them when trying to convince consumers to continue purchasing their products."

www.instant.ly

James Marsden, Ph.D.
Distinguished Professor Food Safety and Security, Kansas State University

Listeria in ready-to-eat-foods

Controlling Listeria monocytogenes in food plant environments – Listeria contamination is preventable.

My original intent was to write an article about how to respond to a regulatory and/or public health crisis involving contamination with Listeria monocytogenes. I will get to that, but first I want to make it clear that the efforts made to avoid Listeria contamination are of the highest importance and may very well prevent regulatory and public health crises. I've never been involved in a Listeria recall that couldn't have been prevented.

It's been 30 years since the food industry became aware of Listeria monocytogenes and the need to control it in clean room environments and Ready-to-Eat (RTE) food products. I remember the first case involving meat products that occurred in 1989. USDA's Food Safety and Inspection Service followed the steps that had already been taken by FDA and declared Listeria monocytogenes to be an adulterant in RTE products. At the time, the absolute control of Listeria in plant environments seemed to be an impossible task.

Listeria does pose unique challenges. It likes the cold, wet environment that exists in many food plants. Often, the very things that are done to make plants microbiologically clean successfully eliminate the microorganisms that would otherwise compete with Listeria. Listeria problems do tend to occur in plants that appear to be very clean. Listeria contamination of foods usually occurs as post-process-contamination. When contamination of this type occurs, typically, RTE products are processed using a pasteurisation step and are then recontaminated with Listeria before the product is packaged.

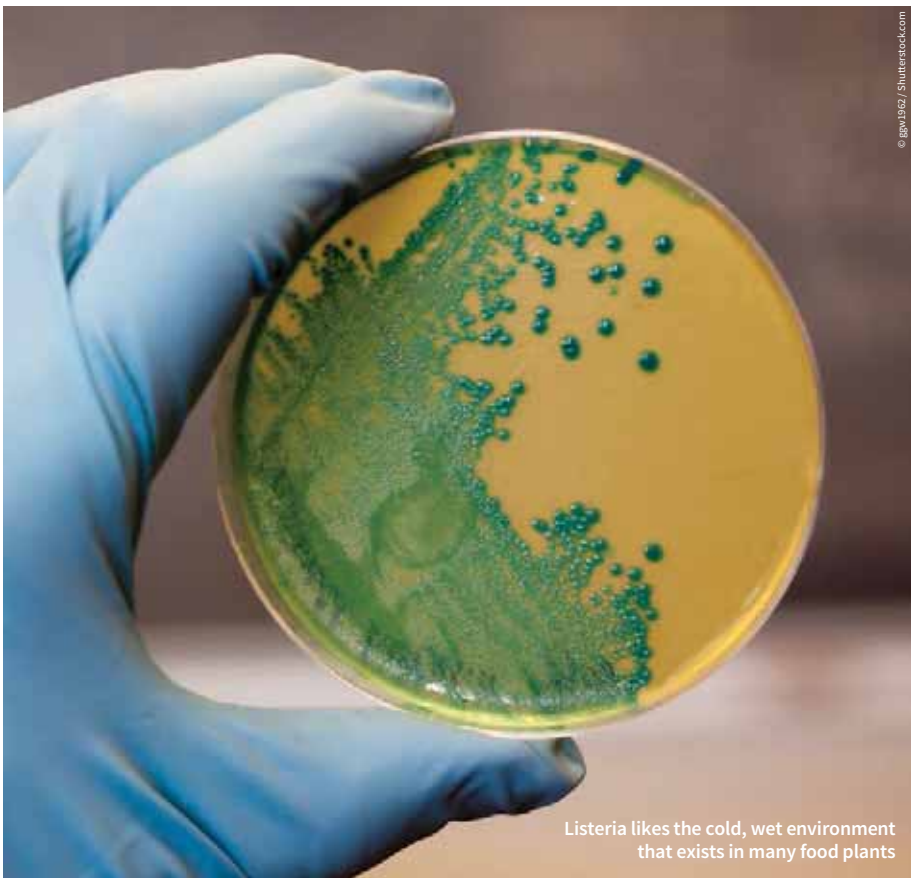
Controlling Listeria to levels that prevent food contamination requires extraordinary efforts and the application of technologies that weren't available 30 years ago. It's certainly one of the most difficult challenges the food industry has ever faced.

In my experience the only way to control Listeria in food plant environments, thereby reducing or eliminating the risks of recontamination, is to identify each and every vector of contamination and implement control measures that eliminate Listeria at each point of

entry. These include drains, floors, processing equipment, walls, floors and ceilings, refrigeration units and air/particle borne sources. In addition, measures must be taken to prevent the introduction of Listeria by plant workers, inspectors and visitors.

The good news is that technologies are now available to accomplish this level of control. It goes far beyond routine sanitation and employee training. It requires state-of-the-art technologies and advanced applications that fully control each possible vector of contamination.

Improved control of Listeria outgrowth in foods can be achieved through the use of secondary inhibitors. These are usually the salts of organic acids that are added to product formulations. Another unique characteristic of Listeria is its ability to grow under refrigerated conditions in many foods. Sometimes levels of contamination that can't even be measured when foods are packaged can increase to high levels over weeks or months of refrigerated storage. Secondary inhibitors prevent the potential for outgrowth in these foods and may keep Listeria levels below the detection limit.



Listeria likes the cold, wet environment that exists in many food plants

Another major change that has occurred over the past years is the availability of technologies to re-pasteurise food products in the consumer package. This can be done using High Pressure Processing (HPP), a technology that involves the application of hydrostatic pressure at very high levels usually for a period of a few minutes. The result of HPP processing is the elimination of any possible Listeria in the consumer package.

Post-process-pasteurisation can also be achieved using thermal processing applied to packaged products. This can be used to re-pasteurise products such as whole deli hams and roast beef. Re-pasteurisation of these types of foods also results in the elimination of any possible Listeria contamination.

By applying extraordinary control measures to address environmental contamination in food plants with technologies such as secondary inhibitors and post-process pasteurisation, the risk of Listeria contamination in all RTE foods can be greatly reduced or even eliminated.

Responding to regulatory and public health crises involving Listeria contamination

Sometimes even the best efforts for control of Listeria aren't enough. If Listeria monocytogenes are detected in a RTE food product, both FDA and USDA will expect the manufacturer to initiate a Class I recall. Of course, the same is true when a food product is linked to a case or outbreak of foodborne disease.

Just over the past year, several major US food companies, including Blue Bell Creameries, Hot Mama's Foods and Graystone Foods have faced Listeria recalls. In some cases, companies have managed the crises in ways that minimised the inherent damages associated with food safety related recalls. In other cases, Listeria recalls have led to plant closing and threatened company's continued existence. The 2011 recall of cantaloupe produced by Jensen Farms resulted in 33 deaths. The owners of the company were prosecuted and sentenced to five years' probation, six months home detention and were fined for their role in the outbreak.

In my experience, companies can be faced with very similar challenges and respond with decisions that either minimise the effect of a recall or decisions that effectively close the business.

Cold pressed juices and HPP tolling drive the growth of Hiperbaric

The leading supplier of high pressure technology increases turnover 50% in 2015.

Cold Pressure Technology or HPP (High Pressure Processing) is becoming mainstream in certain food spaces outside the traditional ones (mainly guacamole, export continental meats, lobsters, to name a few). In the past three years, the cold pressed juice category has experienced explosive growth with well known names such as Suja, Evolution Fresh, Blueprint, Coldpress, Harmless Harvest etc. All of them are Hiperbaric customers. The Spanish company is growing this year to a turnover of more than €70m and has an order backlog for 2016 that indicates it might surpass €100m in 2016.

The second segment in which HPP technology is becoming more widely implemented is the Tolling/Copacking business model; in which contract service companies, refrigerated service suppliers and logistic platforms are adding Hiperbaric lines as a way to add value to their services. Using the network of toll HPP services, any food maker with a need for a pathogen lethality intervention, an extension of the product shelf life, or access to export markets, can access high pressure technology and pay on a per kg, per pack or per batch basis, without the need of investing in its own Hiperbaric system.

www.hiperbaric.com

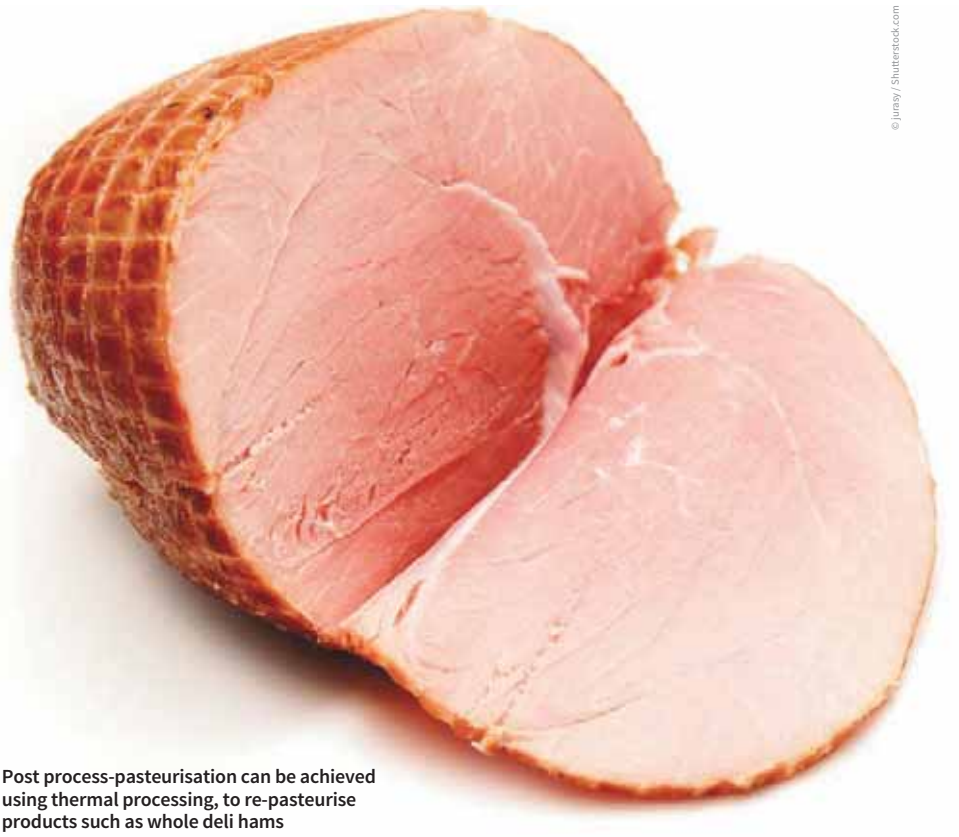
In today's world, bad decisions can even result in criminal prosecution.

These are the things that I believe minimise the effects of a regulatory or public health related Listeria recall:

1. Companies should establish a well-developed crisis management plan well before issues arise. The plan should include the appointment of a crisis management team and pre-existing agreements with a public relations firm, an experienced food attorney and an outside food safety professional. Most companies do not have the internal expertise to optimally deal with a recall. Given the fact that the US Justice Department now reviews food safety cases for possible criminal prosecution, especially when consumer deaths occur, I also recommend that the crisis management team have access to a criminal attorney to assure compliance with federal laws and regulations.
2. Effective trace back capabilities are essential in limiting the scope of recalls. When a recall occurs, the first order of business is to notify the public regarding which products are being recalled and then to get those products off the shelf and back under company control. When recalls balloon into enormous quantities, it's generally because plants can't identify the specific production lots that are implicated. Regulators always err on the side of public health. This means that if the specific lots can't be identified, then all possible lots are recalled.

The only way to control Listeria in food plant environments is to identify each and every vector of contamination and implement control measures

3. The effectiveness of crisis management plans and traceability systems should be tested through mock recalls. If weaknesses are identified in a mock recall, corrections can be implemented before an actual recall occurs.
4. When a recall does occur, the crisis management team must cooperate fully with the appropriate regulator agency and public health organisations. 100% transparency with regulators is essential.
5. The public relations aspects of the recall should convey that the company is committed to protecting its customers by removing the affected product from commerce and has brought in the necessary technical resources to solve the problem. These will help restore consumer confidence. Again 100% transparency with consumers and the media is essential. If the company has a social media presence, this provides an excellent way to communicate and inform consumers and the media.
6. After the recall is in effect, consumers have been notified and the process of removing product from commerce is underway, efforts should be made to identify the root cause of the Listeria contamination and develop a corrective action plan.



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Post process-pasteurisation can be achieved using thermal processing, to re-pasteurise products such as whole deli hams

It's also important that the establishment produce records to show that the operation has been running under control with respect to Listeria contamination in the plant environment. If there's a doubt

about whether the plant has maintained sanitary conditions, the scope of the recall can be greatly increased.

7. Following the development and acceptance of the Corrective Action Plan, steps should be taken to implement it and to verify its effectiveness. The verification should include a comprehensive microbiological mapping evaluation of the facility. The sooner the corrective action plan is implemented and verified, the sooner the plant will be back in production.
8. When the recall and corrective action activities are complete, I recommend that the company communicate that information to consumers and the media. Again, social media provides an excellent vehicle to do this.

Listeria contamination in cantaloupe melon resulted in 33 deaths in 2011

These steps will likely minimise the effects of a Listeria recall. Some of the things that can expand the scope and damage inflicted by a recall include a lack of transparency or even intentional deceit. When regulators uncover these types of activities, the continued existence of a company is in real jeopardy. Criminal prosecution is also likely. I have seen firsthand how poor decisions of this type led to the demise of a large national meat business.

Another negative factor is the lack of a pre-appointed crisis management team and crisis plan. Recalls happen without warning and leave very little time for organised reactions. If a company isn't proactive, there simply isn't time to organise an appropriate and effective response. As a result, mistakes are made and the scope and seriousness of the recall is exacerbated.

I want to reiterate that similar circumstances surrounding Listeria recalls can result in vastly different consequences depending on the decisions that are made under highly stressful circumstances. Recalls are never painless. However, they can result in minimal permanent damage and may even lead to improved control strategies and safer products.

A recall can also lead to the worst imaginable consequences, including criminal prosecution. It all depends on whether a company is sufficiently prepared and has the expertise on hand to guide the decision making process in a way that satisfies regulators, public health officials, the media and consumers.

About the Author

Dr. James Marsden has over 40 years' experience in the food industry with a strong background working with government officials, regulators, food companies, trade associations and in academia. He advised the White House on food safety and nutrition and testified on numerous occasions to the United States Congress, the US Food and Drug Administration (FDA) and the US Department of Agriculture (USDA). After working for several food companies and technology providers, he served as Vice President for Scientific Affairs at the American Meat Institute and President of the AMI Foundation. In 1994, he became the Regent's Distinguished Professor of Food Safety and Security at Kansas State University. He has extensive experience as an educator, inventor and researcher.

Brett Ira
Key Account Manager, ACO Group

James Marsden
Ph.D., Distinguished Professor Food Safety and Security, Kansas State University

Hygienic drain design, sanitisers and drain management

The ACO Group is one of the world market leaders in drainage technology. With its integrated approach, ACO stands for professional drainage, economical cleaning, and the controlled release and reuse of water. In an interview for New Food, James Marsden from Kansas State University, put some questions to Brett Ira, Key Account Manager at ACO Group, to further explain hygienic drain design.

In today's food production environment, the installation of proper drainage is very important for numerous reasons; to keep the food safe from cross contamination, to keep employees safe by minimising the risk of slips and other accidents in the workplace, and to minimise operational costs for a facility by having a proper drainage system in place which enables easy maintenance. As such, James' first question was: "How are drains engineered to allow for thorough cleaning and sanitation?" Generally the main features that ensure this are rounded inner corners, butt welding of the end caps and outlet, and a removable foul air trap which can be thoroughly cleaned due to the overall design.

"When a drain has a protruding spigot fashioned as a foul air trap, standing water can often be difficult to remove along with any other food particles left after floor cleaning," explains Brett. "The longevity of the drains also comes into play in this case as a rusted corroding drainage system is often impossible to keep thoroughly clean and free from bacteria and pathogens." Brett continues to explain that provided the surface is properly treated after the welding of outlet and end caps, stainless steel drains – whether they are made from 1.4301 or 1.4401 grade steel – can increase the life of the drainage system and ensure it is an easily maintained component of a food production environment.

Stainless steel facilitates superior cleaning and sanitation, but if stainless steel is not used, sanitisers could be used instead to provide an on-going antimicrobial effect. In Brett's opinion, when it comes to the food safety aspects of a food production environment, the only option when looking for a hygienic drainage solution is to choose one constructed from stainless steel: "Often drains are constructed from plastic or cast iron, but both materials are more difficult to clean thoroughly and properly." Activated time release sanitisers can also be used to reduce build-up of bacteria between cleaning, but cannot take the place of a properly constructed stainless steel drain.

James went on to ask about biofilms – as sanitisers can be used to address the issue of biofilm build-up within drainage. "These sanitisers do have an impact on biofilms and can be more effective on materials such as stainless steel but less effective on Teflon or plastics," explained Brett. Reduction in biofilm density will always be higher when sanitisers are applied to stainless steel as opposed to other materials. If properly used, sanitisers such as peroxide or QAC will have a minimal effect on drainage when diluted correctly before use and providing that drains are constructed from the proper materials, and include joint welding and the surface treatment of the stainless steel after welding to return it to its original state. Brett continued: "The uses of proper mechanical actions with brushes or pressurised flow systems will ensure a correct removal of the biofilm which was intended by the use of correctly selected sanitisers."

Moving on from sanitisers to continuous disinfection – for which quat rings can be used in drains – James enquired if this is a process Brett approves of. "Quat rings can be a way of minimising infection of a drainage system, but they are not to be seen as an alternative to a proper maintenance and cleaning regime," Brett answered. He went on to explain that this should include using the right cleaning agents along with a scheduled regime of manual cleaning to reduce the risk of cross contamination. Quat-based sanitisers often have a lesser effect on Gram – strains, bacterial spores and viruses, limiting the required kill rate.

Certain pathogens, such as Listeria, can be particularly damaging for a food company and therefore must be controlled – James queried if drains are tested to verify control, and what the advantages of regular drainage testing are. "The testing of drains in any site comes down to the planned checks of the quality assurance department, the local food safety authorities and the hiring of an external company to conduct a drainage system assessment within the facility," Brett answered. Drains should be tested on a frequent basis by internal teams to keep the standards of that plant on par. Internal teams should also conduct overall drainage assessments on a more scheduled basis to reduce the risk of Listeria and pathogen build-up or cross contamination.

Lastly James mentioned drain management programmes – how can they prevent blockages that can result in contaminated water backup and positive air pressure? These type of programmes can assess the current state of the drainage and piping system and potentially reduce the risk of positive air pressure by using CCTV systems to view the inside of the pipes where current build-ups may be, or could, occur. "By implementing a drainage management programme, you can greatly reduce the possibility of microbial build-up and blockage, and ultimately increase the life of your drainage system for years to come," explains Brett. "Such programmes can be conducted more easily on a high performance stainless steel drainage system. For example, gratings can be lifted without excess effort and all internal components can be easily removed including the silt basket, foul air trap and FAT support ring."

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Potential health risks related to the presence of acrylamide in food: the EFSA's risk assessment

Acrylamide is a chemical that naturally forms in starchy food products during every-day high-temperature cooking, such as frying, baking, roasting and also industrial processing usually above 120°C and low moisture. In view of the known toxic effects, the discovery of its presence in certain foods stimulated new research studies on its toxicity, on the influence of processing on the acrylamide levels in food, and on possible mitigation measures. The European Food Safety Authority (EFSA) has performed a risk assessment concluding that acrylamide in food potentially increases the risk of developing cancer for consumers in all age groups.

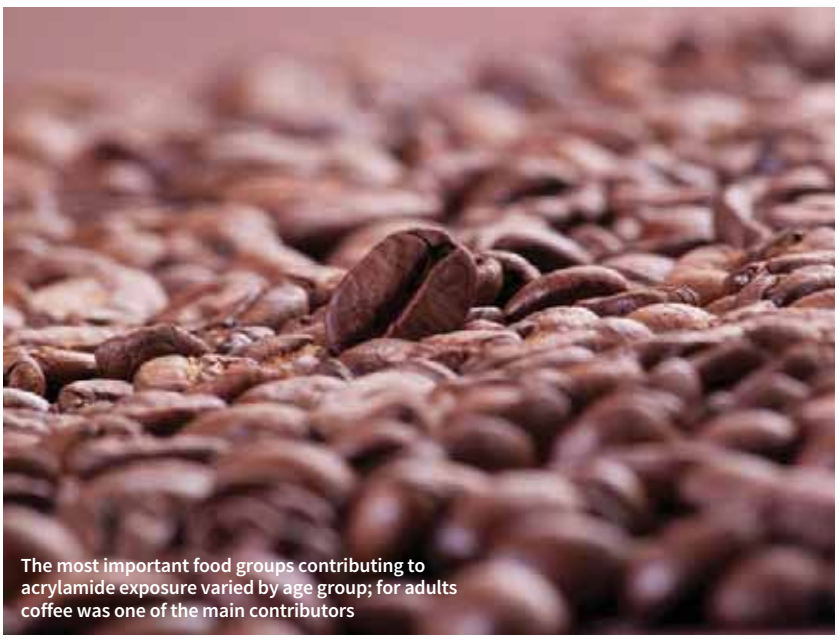
Acrylamide (CH_2=$CHCONH_2$) is a low molecular weight, highly water soluble, organic compound, that is used among others, as an industrial chemical. Heightened concerns about human exposure to acrylamide arose in 2002 when it was discovered that it forms in certain foods during every-day high-temperature cooking, such as frying, baking, roasting and also industrial processing at temperatures usually above 120°C and low moisture[1,2]. As it forms in numerous baked or fried carbohydrate-rich foods, including French fries, potato crisps, breads, biscuits and coffee, there is widespread human exposure. Several pathways and precursors have been proposed to contribute to the acrylamide formation in food, the main formation mechanisms being the reaction of the free amino acid asparagine with reducing sugars that are naturally present in many foods, via the Maillard reaction[3,4].

The toxicological properties of acrylamide had been well studied and included neurotoxicity, genotoxicity, carcinogenicity and reproductive toxicity. In 1994 the International Agency for Research on Cancer (IARC) classified acrylamide as a Group 2A carcinogen (probably carcinogenic to humans)[5]. In view of the known toxic effects, the discovery of its presence in certain foods stimulated new research studies on its toxicity, on the influence of processing on the acrylamide levels in food, and on possible mitigation measures.

Since 2007 the European Commission has recommended Member States to monitor the levels of acrylamide in foods known to contain high levels and/or contribute significantly to human exposure, and has set 'indicative values' for acrylamide in various foodstuffs. These are not safety thresholds or legal limits, but only intended to indicate the need

for an investigation if the values are exceeded in order to explore whether appropriate measures have been taken to control the acrylamide formation.

In 2012, and in order to identify the need for further measures regarding acrylamide in food, the European Commission requested EFSA to assess the risks for human health related to the presence of acrylamide in food taking into account the most recent toxicological studies and occurrence data available.



The most important food groups contributing to acrylamide exposure varied by age group; for adults coffee was one of the main contributors

The EFSA's risk assessment: how was it done?

Within EFSA, the task of developing the assessment of the risk for human health related to the presence of acrylamide in food was allocated to the Panel on Contaminants in the Food Chain (CONTAM Panel), and a Working Group of external scientific experts was established to develop the draft opinion. The assessment was done following the risk assessment paradigm: hazard identification and characterisation, exposure assessment, and risk characterisation.

The exposure assessment combined the data on human consumption available for the different food categories using the EFSA Comprehensive European Food Consumption Database, with the occurrence data on acrylamide in the respective food categories. A range of intake/exposure scenario estimates were considered to also cover specific groups of the population, such as infants and children. In addition, specific scenarios were designed to assess the influence of specific home-cooking behaviours and to reflect preference for particular products and places of consumption on the total dietary exposure to acrylamide. The data on occurrence in food from the EU-wide acrylamide monitoring recommended by the EC were used, and to ensure a human exposure assessment as comprehensive as possible, acrylamide occurrence data collected outside official controls, e.g. by industry or food associations were also included.

To characterise the critical adverse health effects caused by acrylamide in experimental animals and humans, i.e. the hazard

identification and characterisation, EFSA considered toxicological, toxicokinetic and epidemiological studies available in the open literature until the adoption of the opinion.

Before the finalisation of the risk assessment, EFSA publicly consulted on its draft risk assessment, and held a stakeholder meeting with the contributors to the public consultation. Overall, EFSA received 120 comments from various interested parties including national agencies, academia, industry and individuals in their private capacity. These comments allowed EFSA's experts to refine aspects of its assessment, and the final document was published in June 2015[6].

Main outcomes

The assessment of the dietary exposure resulted in mean dietary exposure estimates that ranged from 0.4 to 1.9µg/kg body weight (b.w.) per day, and from 0.6 to 3.4µg/kg b.w. per day at the 95th percentile of exposure. The most important food groups contributing to acrylamide exposure varied by age group: for infants, baby foods, processed cereal-based baby foods (mainly rusks and biscuits) and other products based on potatoes were the main contributors, while for children and adolescents were potato fried products, soft bread, breakfast cereals, biscuits, crackers and crisp bread. These food groups were also the main contributors for adults together with coffee. Preferences in home-cooking (e.g. conditions of potato frying, preference for particular potato or coffee products) were shown to have a substantial impact on the dietary exposure to acrylamide.

The evaluation of the data in experimental animals indicated that oral exposure to acrylamide can lead to harmful effects on the nervous system, pre- and post-natal development and adversely affect male reproduction. In addition, laboratory animals exposed to acrylamide have shown an increased likelihood of developing gene mutations and tumours. The most likely cause of the genotoxicity and carcinogenicity of acrylamide is glycidamide, its main epoxide metabolite.

Results from human studies have shown no consistent indication of an increased risk for most types of cancer, except for some limited and inconsistent evidence of increased risk for renal cell, endometrial and ovarian cancer. In relation to developmental consequences, two studies have reported an inverse relation between exposure to acrylamide and birth weight and other markers of fetal growth. However, it has not been established whether this association is causal. Studies among workers exposed to acrylamide in the workplace have shown an increased risk of neurological alterations.

> "Results from human studies have shown no consistent indication of an increased risk for most types of cancer"

EFSA's conclusions

Since acrylamide and its metabolite glycidamide are genotoxic and carcinogenic, a tolerable daily intake (TDI) could not be set, as any level of exposure to a genotoxic substance could potentially damage DNA and lead to cancer. Instead, EFSA's experts estimated the dose range within which acrylamide is likely to cause a small but measurable tumour incidence (called "neoplastic" effects) or other potential adverse effects (neurological, pre- and post-natal development and male reproduction). The lower limit of this range is called the Benchmark Dose Lower Confidence Limit ($BMDL_{10}$).

By comparing the $BMDL_{10}$ to human dietary exposure to acrylamide, scientists can indicate a 'level of health concern' known as the margin of exposure (MOE). The MOE approach provides an indication of the level of health concern about a substance's presence in food while recognising that it is not possible to quantify the risk. Use of the MOE can help risk managers in defining possible actions required to keep exposure to such substances as low as possible.

From this exercise, EFSA's main conclusions are:

- acrylamide in food potentially increases the risk of developing cancer for consumers in all age groups. This concern applies to all consumers but children are the most exposed age group on a body weight basis. This is in accordance with previous evaluations made by other international bodies[7].
- the possible harmful effects of acrylamide on the nervous system, pre- and post-natal development and male reproduction were not considered to be a concern, based on current levels of dietary exposure.
- the ingredients, storage and processing conditions (particularly temperature) greatly influence acrylamide formation in food. Home-cooking choices can have a substantial impact on the level of acrylamide humans are exposed to through the diet.

Some potato fried products contain acrylamide

What comes next?

The risk assessment of EFSA will inform the European Commission and European national decision-makers when weighing up possible measures for further reducing consumer exposure to acrylamide in food. These may include, for example, advice on eating habits and home-cooking, or controls on commercial food production. However, EFSA plays no direct role in deciding such measures.

EFSA also made recommendations to cover gaps identified in the development of the risk assessment, and that could reduce its uncertainties, such as the improvement of the reporting to the acrylamide occurrence data regarding the mode of preparation of the foods before analyses, or the conduction of

toxicological and epidemiological studies to confirm or refute some of the results obtained.

Can exposure to acrylamide in food be reduced?

The raw material, the storage method and the processing (e.g. temperature at which food is cooked) can influence the amount of acrylamide formed in different foods. Although it is not possible to totally eliminate acrylamide from food commodities, in the last few years numerous research activities have been carried out to understand the formation mechanism, the influence of various parameters that have a potential impact on the acrylamide levels in food, and the possible mitigation measures to keep the acrylamide concentrations in foods as low as reasonably achievable[8,9]. In this context, the 'Acrylamide toolbox'[10] has been developed by a cooperation between FoodDrinkEurope (representing the European food and drink industry) and national authorities of the European Union, to investigate pathways of formation of acrylamide and potential intervention steps to reduce its levels in food, and therefore exposure. The aim of the Toolbox is to provide national and local authorities, manufacturers (including small and medium size enterprises) and other relevant bodies, with brief descriptions of intervention steps which may prevent and reduce formation of acrylamide in specific manufacturing processes and products. This tool is not meant as a prescriptive manual, but aims to be a 'living document' with a catalogue of tested concepts at different stages that will be updated as new findings are communicated. The latest 2013 toolbox focusses especially on the categories 'potatoes', 'cereals' and 'coffee' which were found to have a higher risk of acrylamide formation. Other international bodies have also developed guidance, such as the US-Food and Drug Administration draft guidance for industry on 'Acrylamide in Foods'[11], that 'provides information to help growers, manufacturers, and food service operators to reduce acrylamide in certain foods' suggesting a range of possible mitigation approaches.

While these tools are mainly intended to assist manufacturers, recommendations for measures to reduce the acrylamide concentration in food have been published by national authorities and the food industry primarily addressed to the general population in the context of domestic cooking. Newspapers, journals and the internet provide recommendations, e.g. for frying potato-derived products and toasting at home, sometimes accompanied with punchy slogans, such as 'gilding rather than charring'.

It should also be noted that acrylamide is present in tobacco smoke, which is, therefore, a non-dietary source of exposure for smokers and non-smokers (through passive smoking). For smokers, tobacco smoking is a more prominent source of acrylamide exposure than food. In addition, due to the wide variety of industrial uses of acrylamide, exposure in the workplace through inhalation or dermal absorption can occur.

Acknowledgements

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About the Authors

Diane Benford is a European Registered Toxicologist, and is Head of Risk Assessment at the UK Food Standards Agency, with overall responsibility for risk assessment of all types of chemicals in food, microbiological risk assessment, and laboratory methods. She was a member of EFSA's Panel on Contaminants in the Food Chain from 2006 to 2015, and served as Chair of the Panel for the 2012-2015 mandate.

Peter Fürst holds a PhD in Food Chemistry. His main working areas are the analysis and evaluation of environmental and process contaminants, pesticides and pharmaceutical active compounds in food. He is working in official food control since 1981. In 2009, he was appointed Honorary Professor at the Chemical Faculty of the Westphalian-Wilhelms-University in Münster/Germany. Since 2014 he is the director of the Chemical and Veterinary Analytical Institute in Münster. He was a member of EFSAs Panel on Contaminants in the Food Chain and several of its working groups between 2006 and 2015 and served during the last three years as Panel Vice-Chair. He was the chair of the EFSA Working Group on acrylamide in food.

Luisa Ramos Bordajandi holds a PhD in Science and carried out her post-doctoral research on the development of certified reference materials for contaminants in food. In 2008 she joined the European Food Safety Authority (EFSA) and is since then a Scientific Officer at the Unit on Biological Hazards and Contaminants providing support to the Panel on Contaminants in the Food Chain and its Working Groups in the development of risk assessments related to the presence of contaminants in food and feed.

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A new way of designing high protein products with micro-particulated whey proteins

Whey is the highly nutritious liquid by-product that results from the coagulation of milk and is generally produced from the manufacture of cheese or casein. Whey protein is a valuable nutrient that is of interest to numerous consumer segments, including infant formula, healthy aging, weight management, sports performance and recovery, and the medical nutrition market.

Whey protein is a high quality dairy protein – with an excellent protein digestibility corrected amino acid score (PDCAAS) – and is not only naturally high in essential amino acids and the branched chain amino acids but also uniquely high in the amino acid leucine, the amino acid that is thought to be critical to the stimulation of muscle protein synthesis. This high level of leucine, as well as a unique fast digestion profile, enables whey protein to stimulate muscle protein synthesis to a greater extent than casein and soy protein in young[1] or older adults[2,3]. Through all these unique nutritional properties, whey proteins deliver a broad range of health and application benefits to different consumer targets, across life stages.

Whey protein is often used to increase the whey protein content of

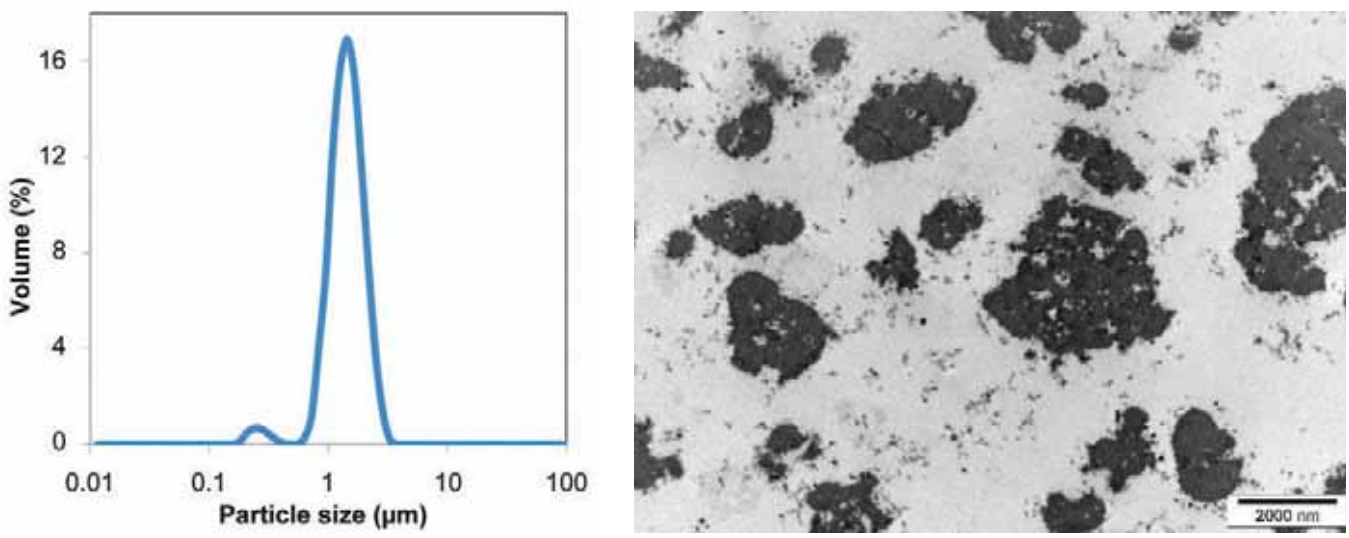

Figure 1: Particle size distribution and transmission electron microscopy image of MP WPC80 at a protein concentration of 10% (w/w)

infant formula to replicate the high whey protein content that is found in human breast milk.

- Whey protein promotes healthy weight management by promoting satiety following consumption and by supporting muscle maintenance.
- Whey protein provides high quality amino acids to promote recovery from sports activity and to stimulate muscle protein synthesis. It is a particularly sought-after nutritional ingredient for the sports nutrition market because of its unique nutritional benefits, not only for elite athletes and professional body builders but also for people who are seeking an active lifestyle.
- Whey protein supports healthy aging by promoting more muscle protein synthesis to help to maintain muscle as we age.
- Whey protein is a protein that is of interest for medical nutrition as it is an abundant supply of essential amino acids, is easily digestible and promotes muscle protein synthesis, helping to maintain muscle mass for hospitalised and convalescing patients.

The increasing health and wellness trend among consumers drives many food and beverage manufacturers to seek opportunities to boost the whey protein content in their products. Although whey proteins have significant potential for use in beverage formulations at high concentrations, their use is limited because of their susceptibility to heat-induced destabilisation. Nutritional beverages, like many other liquid food products, are subjected to high heat treatments during processing (i.e. retorting or ultra-high temperature [UHT]) to ensure product safety and extended shelf life. However, the thermal treatments applied to liquid formulations to provide microbial control cause whey proteins to denature irreversibly and to polymerise into aggregates or gels. As a consequence, the products exhibit unwanted sensorial attributes such as chalkiness, sandiness, lumpiness and high viscosity, and limited shelf life because of sedimentation or gelation soon after production. These problems are more prevalent in formulations with high whey protein content, leading to products with unwanted aggregates and a risk of extensive fouling and blocking of the production plant, such as UHT heating equipment.

The design of whey protein ingredients with enhanced heat stability characteristics is essential for optimal performance in liquid

Table 1: Protein quality assessment of three whey protein ingredients (unpublished observations)

	Protein Digestibility	Protein Digestibility Corrected Amino Acid Score (PDCAAS)
Microparticulated whey protein	98.7%	1.00
Whey protein concentrate	98.8%	1.00
Whey protein isolate	99.1%	1.00

formulations. The microparticulation of whey proteins is an advanced technology for the production of micro-aggregates with enhanced heat stability[4]. Microparticulation is generally achieved by thermal aggregation or acid precipitation, combined with high shear and high pressure conditions[5]. Microparticulated whey protein concentrate (MP-WPC) can be regarded as a combination of native proteins and both soluble and insoluble protein aggregates of controlled size. The microparticulation conditions are well controlled so that the denatured whey protein is restricted to a certain degree of aggregation, and the aggregate particle size is tightly controlled. A commercially available microparticulated whey protein with 80% protein (Sure Protein™ Vital WPC550 from NZMP) is used here to demonstrate the functional and nutritional benefits of MP-WPC. The protein particles formed through the microparticulation process exhibit limited interaction with each other because the number of free thiol groups that is normally available to form larger aggregates is significantly reduced[5]. This essential feature enables microparticulated whey protein to be stable under high temperature heating (i.e. retorting or UHT) and to allow it to be added as an ingredient at high concentrations with no adverse effects during processing. The small protein particle size (**Figure 1**, page 25) is critical for good suspendability in beverage applications to obtain a long shelf life with no sedimentation. The size of the microparticulated protein particles is also important in delivering the desired mouthfeel; particles from 0.1 to 3µm impart a creamy mouthfeel whereas aggregates > 3µm cause a powdery to gritty sensation[6].

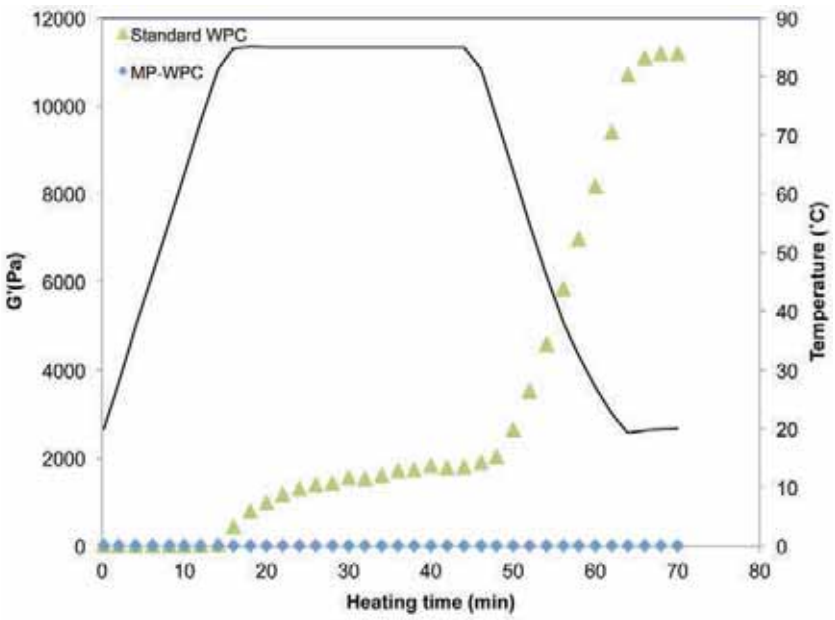

Figure 2: Changes in G′ during the heating of standard WPC80 and MP-WPC80 (15% w/v). The line indicates the temperature profile when samples were heated from 20 to 85°C at 4°C/min, held for 30min, then cooled to 20°C at the same scan rate and held for 5min at 20°C

During this protein modification, it is essential to ensure that the whey protein has the same nutritional properties that are desired by manufacturers and consumers alike. Although previous research identified a minor difference between intact whey protein and a microparticulated product[7], this utilised an old model of protein quality rather than the current gold standard of the PDCAAS. Using the PDCAAS method, there is no measurable difference between a standard WPC and the microparticulated product (**Table 1**, page 25). Another unique factor of whey protein is its rapid digestion, which results in a pronounced peak of amino acids in the blood following consumption. We have conducted additional research (publication in draft), including the analysis of the post-meal amino acid kinetics, which indicates that

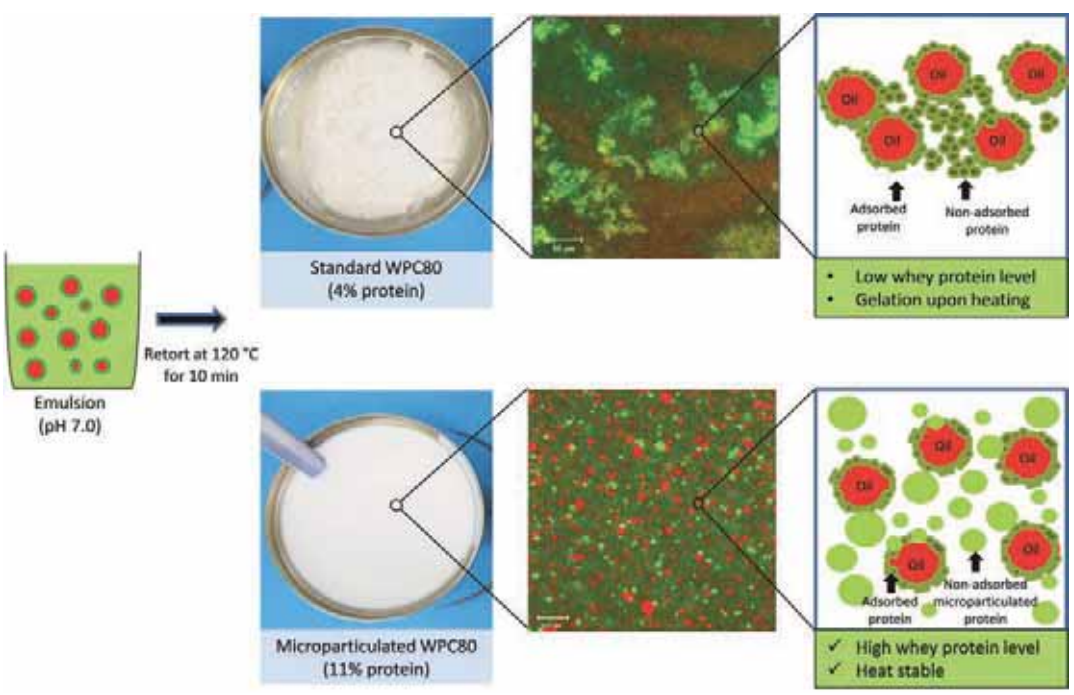

Figure 3: Comparison of the heat stabilities of model oil/water emulsion systems (10% oil w/v) prepared with MP-WPC80 at a protein content of 11% (w/v) and standard WPC80 at a protein content of 4% (w/v) under retorting conditions of 120 ˚C for 10min. Reprinted from Food Hydrocolloids, 47, Cakir-Fuller E, Enhanced heat stability of high protein emulsion systems provided by microparticulated whey proteins, 41–50 (2015), with permission from Elsevier

the consumption of a beverage containing MP-WPC results in the same plasma amino acid response as that achieved from the consumption of standard WPC.

Thus, a microparticulated whey protein ingredient provides the full nutritional value of a standard WPC while delivering good thermal stability with no gelation or sedimentation upon processing and after a prolonged shelf life (12 months) at ambient temperature.

Figure 2 (page 26) outlines the gelation behaviours of standard WPC and MP-WPC, as characterised by the change in the storage modulus (G′) during heating and holding for 30min at 85°C. For a standard whey protein concentrate (WPC80) solution at a protein concentration of 15% w/w, a significant increase in G′ is evident upon heating, corresponding to the formation of a strong gel. In contrast, a protein solution prepared with MP-WPC80 under the same conditions does not form a gel and the G′ remains stable throughout the complete temperature profile. This indicates that MP-WPC has a great potential as an ingredient for high protein beverage applications, for which gelation on thermal processing is undesirable.

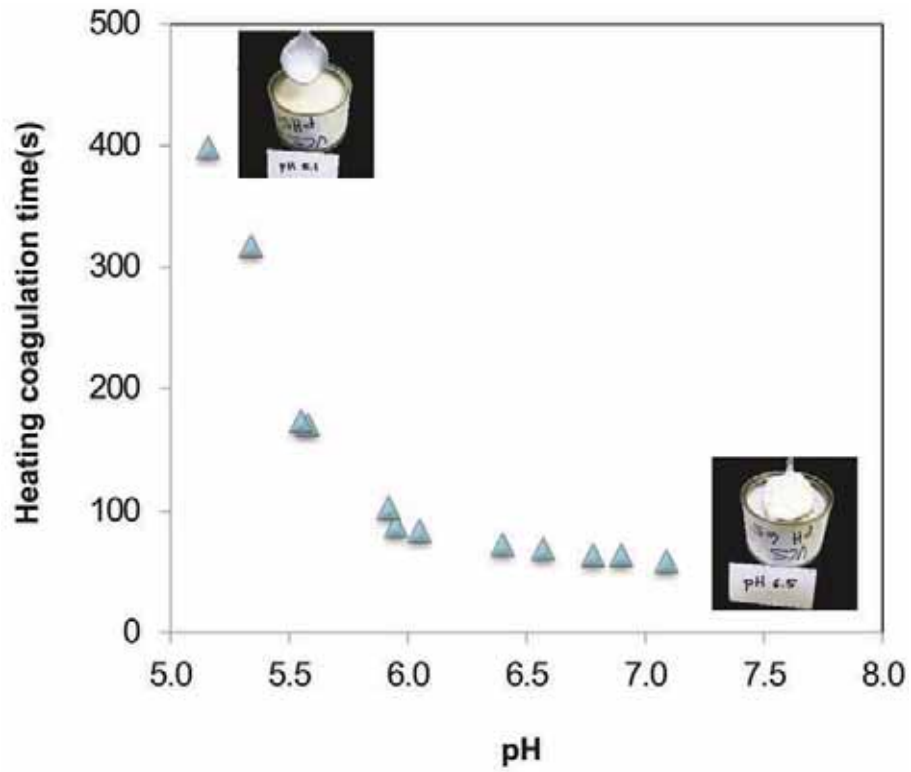

Figure 4: Heat coagulation time (at 140˚C) of model medical beverages at various pH levels. All beverages contained microparticulated whey protein at a protein content of 10% (w/v), carbohydrates at 14% (w/v) and fat at 6.2% (w/v). The insert pictures at two different pHs show the visual appearances of the same formulation after retorting at 120˚C for 10min

An example of high protein emulsion systems, similar to medical nutritional beverages, is used here to demonstrate the enhanced heat stability of MP-WPC under retort conditions in comparison with a standard WPC (Figure 3, page 26). When a neutral pH (pH 7.0) emulsion of standard WPC is subjected to a retort treatment of 120°C for 10min, a strong gel network is formed at a protein content of 4%. Confocal laser scanning microscopy (CLSM) of the retorted emulsion confirms the likely gelation mechanism of the standard WPC.

Whey is a by-product produced from the manufacture of cheese or casein, a result of the coagulation of milk

When standard whey protein is used in oil/water emulsions, part of the protein is adsorbed around the oil droplets and the excess non-adsorbed protein is present in the aqueous phase. Upon heating, the non-adsorbed proteins unfold and interact, producing large aggregates that, in turn, act as "glue" between adsorbed whey protein layers of neighbouring droplets. However, when MP-WPC is used, visible aggregation or gelation does not occur, even up to much higher protein concentrations (11%, w/v) upon retorting under the same conditions. CLSM images of retorted emulsions support that the micro-size protein particles in MP-WPC are in a stable, non-reactive conformation; they remain as non-adsorbed protein in the continuous phase and do not contribute to further aggregation upon retort heat treatment[8]. The results confirm that microparticulated protein particles lack the ability to form larger aggregates and remain inert in the aqueous phase. This allows a higher protein content to be added into

liquid formulations without compromising the texture.

Another unique property of MP-WPC80 is its stability to pH ranges in which a standard whey protein exhibits limited thermal processability. Whey proteins are prone to aggregation on heating at a pH near the isoelectric point (pI) of the protein (pH 5.0–5.2) because the net charge of the proteins is close to zero and protein–protein interactions are favoured. Typically, whey proteins can be used only when the pH of the beverage is sufficiently distant from the pI of whey proteins to avoid aggregation. However, microparticulated whey protein provides surprisingly high heat stability as the pH approaches the pI. Figure 4 (page 27) shows how the heat stability of model medical beverages produced with MP-WPC (10% protein, 1.6kcal/mL) increases significantly around pH 5.0. The heat stability of the beverages was determined by the heat coagulation time, defined as the time required to observe the formation of visible aggregates during heating in an oil bath at 140˚C. The same behaviour can also be observed under retorting conditions, when the same formulation does not form a gel and remains as a low viscosity liquid at pH 5.1 after retorting whereas lumps are visible at high pH ranges (pH > 6.5). MP-WPC provides significantly high heat stability at pH 5.0, which no other whey protein type can match at 10% protein (Figure 5).

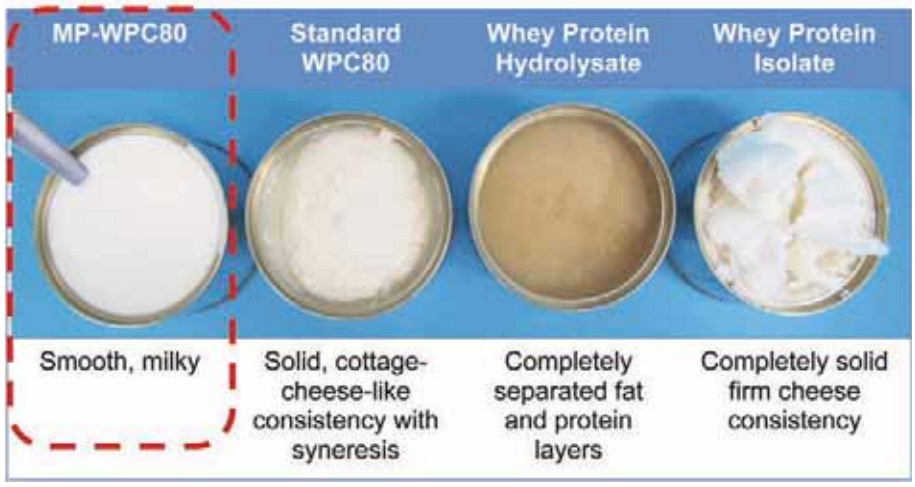

Figure 5: Visual appearances of retort-treated (120˚C for 10min) model medical beverages produced using different sources of whey protein at a protein content of 10% (w/v), carbohydrates at 14% (w/v), fat at 6.2% (w/v) and pH 5.0

Thermal processing of the liquid compositions in the pH range 5.0–5.5 also provides an advantage in flavouring options because a wider variety of flavours, including exotic fruity flavours such as mango, lemon, lime and berries, can be chosen rather than being restricted to common flavours like vanilla and chocolate. Also, it is well known that high temperature processing at neutral pH can lead to the generation of sulphurous off-flavours in whey-protein-containing formulations. Lower pH has been shown to reduce the heat-activated sulphydryl (–SH) groups of whey protein that evolve during heating at temperatures above 90˚C9. Microparticulated whey protein provides flavour benefits by enabling thermal processing at pH ranges below neutral pH, thus reducing the formation of sulphury/eggy flavours.

Table 2: Benefits of MP-WPC in liquid nutritional formulations

Properties	Benefits
Nutritional value	Identical to that of standard WPC ingredients
Heat stability	Use of high protein concentration, ease of processability for RTD beverages, long shelf life
Acid stability	Wide range of pH applications, flavour benefits
Small particle size	No sedimentation, no powdery or gritty mouthfeel
Low viscosity	Easy to drink, no gelation upon storage
Flavour	Negligible sulphury notes upon heating, compatible with a wide variety of flavouring options
Minimal interaction with other components	Range of product formulations from low fat, low carbohydrate options to nutritionally dense compact formulation alternatives
Colour, opacity	Milky appearance

In summary, the benefits of a microparticulated whey protein, such as Sure Protein™ Vital WPC550, in liquid nutritional formulations are listed in Table 2. This microparticulated whey protein is designed to overcome the current challenges that the food industry encounters with high protein products and provides an opportunity for incorporating high concentrations of whey protein in ready-to-drink (RTD) beverage formulations without altering the textural qualities and maintaining the nutritional properties.

About the Authors

Esra Cakir-Fuller joined the Fonterra Research and Development Centre, Palmerston North, New Zealand, as a Research Scientist after completing her PhD in Food Science at North Carolina State University in 2011. Her research focuses on using advanced technologies to develop new dairy protein ingredients with unique functional properties. This includes the design of heat-stable whey protein ingredients for UHT beverage applications. Her research goal is to provide an understanding of the physical and chemical mechanisms that control functionality so that the desired sensory and textural properties can be obtained. She is also actively involved in intellectual property management.

Aaron Fanning is a human nutritionist, working as a Senior Research Scientist at the Fonterra Research and Development Centre in New Zealand. Since joining Fonterra in 2004, Aaron has been responsible for the management of nutritional innovation projects to enrich our understanding of the nutritional value of dairy proteins, especially whey protein. This includes the management of animal and human research programmes in areas such as satiety, sports performance and recovery, obesity management, and the role that dietary proteins play in muscle loss with aging and illness.

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Innovations in healthy fibres

The daily intake of dietary fibres by the population is far below the recommendation. The British Nutrition Foundation concluded in a very thorough report in 2014 that a low fibre intake is associated with constipation and some gut diseases such as bowel cancer and that a high fibre diet can help reduce the risk of diabetes, lower cholesterol, and be part of a healthy diet. Indeed it can be expected that higher fibre intake can help to prevent chronic diseases and that products rich in fibres present an easy and healthy choice by consumers. However it is likely that not all fibres will have identical health-supportive effects. Indeed, some fibres have already shown convincing effects while others have failed to show these benefits when tested in a similar manner. In this article we will review the currently known, as well as the potential health effects, as a basis for communication in the future.

Several dossiers, focussed on the health effects of fibres, have been submitted to EFSA. The EU FibeBiotics consortium, a team that studies the health effect of fibres and in particular their effect in supporting gut health and the intestinal immune system, is evaluating the results. In **Table 1** (page 30) the current authorised claims related to dietary fibres are listed. An example are the beta-glucans from oat and barley, which have shown convincing evidence that they can lower cholesterol levels; this has been acknowledged with an approved health claim by EFSA. The OatWell™ is now applied in products like breakfast cereals, crackers and bars. In addition, the consumption of a food product with a high content of available carbohydrates and simultaneously an adequate quantity of cereal beta-glucan (four grams per 30 grams available carbohydrate) contributes to reducing post-prandial glycaemic responses and the risk of diabetes in the long term.

Bioactivity of fibres and possible upcoming health promotion aspects

Several companies have started to systematically collect information to prove immune supportive effects of fibres. The dossiers substantially build support for the claimed effects and the underlying mechanisms.

In short, the proposed mechanism is based on recognition of specific fibre structures receptors of the host immune system. Macrophages activate the complement system, present antigens and attract or programme other immune cells that collectively support an efficient destruction and removal of pathogens when these try to invade the host. It is therefore postulated that fibres can support the host by fighting conditions such as common cold, upper respiratory tract infection etc. Also in the EU FibeBiotics project, such effects have been studied for several fibres, and results of a pilot and pivotal study are approaching publication.

In the future it can be expected that health effects of fibres can also be underpinned towards the stimulation of the gut microbes; promoting bifidobacteria and lactobacilli of which an increased number mostly are associated with a healthy state of the host (prebiotic effect). Potentially these bifidobacteria and lactobacilli help to prevent the growth of and or colonisation of pathogenic bacteria and support a higher production of gut/health supporting metabolites. The mechanisms are not yet fully elucidated and no other official statement has been given by EFSA of probiotic-related health effects than log reductions of pathogenic bacteria. When more specific positive health-related effects are identified then fibres are the first functional ingredients candidate to think of.

Short Chain Fatty Acids (SCFA), like butyrate, propionate and acetate are the products of fermentation of fibres by the microbiota. These SCFA supply energy and have impact on function of the gut epithelium and exert immune supportive effects via identified receptors in the gut. Research was focussed to identify the relation between total SCFA or ratios of the individual SCFA and health outcome. However, lack of consensus on the health impact of SCFA hampers communication on how SCFA levels relate to health. There is a debate on which SCFA-analyses are more relevant, those in faeces, those in blood samples or those analysed directly locally in the gut. For this last reason, the FibeBiotics consortium is involved in the development of sensors that aim for on-line quantification of SCFA in the intestine.

> “Short Chain Fatty Acids (SCFA), like butyrate, propionate and acetate are the products of fermentation of fibres by the microbiota”

Fibres have the potential to affect appetite. One of the accepted EFSA claims is on weight management, but not yet on appetite control. Methods are available to evaluate effects towards appetite for specific eating occasions across the day, or are further developed and tested in EU projects like SATIN. As many appetite-controlling biomarkers are known, effects of fibres can be studied by a combination of self-reporting, analysis of intake of ad libitum lunches and by analysing the dynamics of hormone levels which together can be applied in models to analyse effects on appetite and weight management.

The group of Conny Weaver, at Purdue University, published that fibres, such as soluble corn fibres, can support calcium absorption in adolescents. This effect was positively correlated with an increase in specific strains of the phylum Bacteroidetes, indicating that also in this mechanism the gut microbiota could have a prominent role.

How can we apply these fibres in products, what challenges will the industry encounter?

The large variation in dietary fibre composition influences their performance in a biological system. Apart from the varying content of constituent monosaccharides, an important feature is the variation in rheological properties, which to a large extent can be linked to molecular size. Solubility of the fibres can range from completely soluble in water at room temperature, via soluble after preheating, to fully insoluble leading to suspensions that again can contain different particle sizes depending on the fibre and the treatments applied.

Table 1: Current authorised claims on fibres

Fibre	Health claim	Article	Dose
Barley and oat beta-glucan	Lowering blood cholesterol. High cholesterol is a risk factor in the development of coronary heart disease	14(1a)	>3g/day; 1g/portion
Pectin	Reduction of post-prandial glycaemic response	13(1)	>10g per meal
	Maintenance of normal blood cholesterol concentrations	13(1)	>6g per day
Beta-glucan from oats and barley	Reduction of post-prandial glycaemic response	13(1)	>4g per 30g available carbohydrate
	Maintenance of normal blood LDL-cholesterol concentrations	13(1)	at least 1g/meal information about necessary daily dose of 3g/day
Hydroxypropyl methylcellulose (HPMC)	Reduction of post-prandial glycaemic responses	13(1)	>4g per meal
	Maintenance of normal blood cholesterol concentrations	13(1)	>5g per day
Resistant Starch (replacing digestible starch)	Reduction of post-prandial glycaemic responses	13(1)	14% total starch as resistant starch
Arabinoxylan from wheat	Reduction of post-prandial glycaemic response	13(1)	>8g (60% arabinoxylan) per 100g available carbohydrate
Chitosan	Maintenance of normal blood cholesterol concentrations	13(1)	>3g per dag
Glucomannan	Maintenance of normal blood cholesterol concentrations	13(1)	>4g per day
	Reduction of body weight	13(1)	>3g in 3 x 1g doses taken with water before meal
Guar Gum	Maintenance of normal blood cholesterol concentrations	13(1)	>10g
Alpha-Cyclodextrin	Reduction of post-prandial glycaemic responses	13(1)	5g/50g starch per portion
Oat and barley grain fibre	Increased faecal bulk	13(1)	At least 'high in fibre' (6g/100g)
Lactulose	Reduction in transit time	13(1)	10g/portion; once a day is enough
Rye Fibre	Maintains normal bowel function	13(1)	At least 'high in fibre' (6g/100g)
Wheat bran fibre	Increasing faecal bulk	13(1)	At least 'high in fibre' (6g/100g)
	Reduction in intestinal transit time	13(1)	>10g

The fibres also display a large variation in binding properties, water absorption capacity and hydration properties which can be influenced by pH, ionic strength and nature of the ions. Dietary fibres can be charged which can influence mineral binding. These variations in intrinsic properties are the reasons that not all fibres can be incorporated in the same way and in the same type of foods. Fibres are versatile to thicken or impart viscosity to the aqueous phase, to provide texture, to influence mouthfeel, to stabilise suspensions, emulsions and foams and to impart freeze/thaw stability.

Figure 1: Preparation, consumer testing and rheometer based viscosity assessment a fruit based smoothie enriched with an oat beta-glucan fraction by high-pressure homogenization

Product development related to inclusion of new fibres is a challenge especially when the goal is to reformulate the product with as little impact as possible on the whole product taste, appearance, quality and shelf-life. When a collection of fibres is authorised for the same health claim then it would be interesting to also have a comparison of the physico- and chemical properties of the fibres. This will then support choices on which fibre to use in a certain product, with minimal unexpected changes in quality. In **Figure 1** you can see some steps during the development of an oat fibre smoothie drink.

Maintaining the bioactivity of a fibre in a product

Performing a properly designed human trial (power, doubly blinded etc.) is a conditio sine qua non to actually provide a solid base for a claim for a certain bioactivity. The next step is to use in vitro bioactivity analysis that can monitor and compare the specific bioactivity of different fibres and even different batches of fibres, or after processing steps in preparing the final products. To allow such in vitro analysis, recovering the active ingredient from the product matrix by a complicated isolation procedure might be needed. Then human cell lines and their response to the isolate can be compared to the effect of original ingredient. Preferably this analysis should include the food matrix, and undergo a simulation of the upper digestion. When exposed to human intestinal cells, and preferentially the combination of these cells with immune cells, an as close as possible mimic of the situation in the gut is achieved.

Bioactivity measurements are particularly important and helpful when the rather complicated structure-function-relationships for fibres are to be revealed. Experiments with structurally different fibres are

Several companies have started to systematically collect information to prove immune supportive effects of fibres

required to link functionality to either constituent sugars, chain length, glycosidic linkages or branching. Because of this, the quantity and the quality of a specific fibre ingredient in any food product should be subjected to control beyond calculations that are only based on ingredient lists. In FibeBiotics and other related projects, methods and protocols have been developed to analyse the fibres in complex matrix. Fibres like inulin, pectin and arabinoxylan contain some diagnostic monosaccharides that can be computed by chromatography after hydrolysis and provide basis for estimate quantification. For cereals, commercially available kits based on combinations of sugar and linkage-specific enzymes and spectrometry are at hand for accurate quantification of cereal beta-glucan that can be coupled to health claims. In FibeBiotics this enzymatic approach has been further combined with HPLC for quantification of beta-glucans in complex biological fluids such as serum, faecal water and cell culture medium.

For branched fungal beta-glucans, no such accurate quantification methodology with proper specificities and detection limits is available for use in foods rich in glucose from e.g. starch and cereal beta-glucan. However, polymeric fungal beta-glucans can be quantified by fluorescence spectroscopy due to a specific interaction between polysaccharides and aniline blue[1]. This is a similar approach as the frequently used calcofluor based fluorescence technologies for the quantification of cereal beta-glucans[2]. For quality measurements, i.e. molecular weight, the methodology is very limited. It most often requires a cumbersome solubilisation, an isolation and a purification of the individual dietary fibre and a subsequent size exclusion chromatographic analysis. If not, as for cereal beta-glucans, a specific HPLC detection system is at hand[3]. Although the health claim for oat and barley beta-glucan is at present only linked to quantity, it is realistic to expect that future claims must include the quality parameter molecular weight. Physical characteristics have a significant effect on intestinal viscosity during food digestion, and beta-glucans can be degraded by simple processes such as bread dough resting[4]. For arabinoxylans with similar claims, no such quality measurement methodology exists.

Many fibres to come

Based on the monomeric unit composition, the linkages, the side branches and length of the side branches, total MW, 3D-conformation etc., an uncountable number of carbohydrate polymers can be formed. Currently the ones from cereals and chicory have gained most attention. Fibres that hold promise for the future are likely those from the cell walls of fruits, vegetables, yeast, mushrooms, seaweed, or polysaccharides produced by bacteria in food formulations like yogurt. Also the carbohydrates that are modified by processing or enzymatic treatments will gain interest like some resistant starch types or non-digestible low molecular oligosaccharides with no contribution to viscosity such as such as isomalt and fructo-oligosaccharides. Currently the bioactivity of fibres, like immune support or gut-beneficial properties, are not fully understood and it is too soon to predict which of these fibres will have the largest potential. Genuine and solid scientific evidence on the health promoting effects, eventually supported by EFSA approval, will be an important step in this process.

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About the Authors

Dr. Jurriaan Mes is senior scientist at Wageningen UR – Food & BioBased Research in The Netherlands. He is leading the Food Quality & Health Effect group which focuses on the quality (e.g. taste, content) and health effects of food ingredients and products. Research is based on a combination of biochemical, molecular and cell based analysis and includes *in vitro* analysis and animal and human trial to unravel mechanisms of action and substantiate effects. The group focuses on the effects of food on the gut and the central role towards nutrition (bioavailability), effects towards the immune system, allergy and the gut-brain axis.

S. H. Knutsen has experience with structure elucidation of polysaccharides by specific enzymes, chromatography and NMR. Main activities at Nofima are towards dietary carbohydrates, fibre and glycaemic health. These involve contract work with Norwegian Food Industries as well as The Norwegian Research council, including maintenance of Mw of beta-glucans during bread making and incorporation of dietary fibre into new innovative healthy food products. In the EU project FibeBiotics activities are related to dietary fibre and methods for quantitative and qualitative analysis of polysaccharides and their biological activities in cell culture and *in vitro* fermentation for gut simulation.

Food ingredients Europe & Natural ingredients 2015 returns to Paris

The world's most important food ingredients event will unite the global food & beverage industry under one roof for three days

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Today's food and beverage professionals are demanding greater access to innovative reformulation solutions, new, tastier and better quality ingredients and greater industry thought-leadership. There are ever-changing and more complex consumer trends, a greater need for safer and healthier food and beverages, and higher demands to use purely natural ingredients in today's marketplace.

For over 25 years, Food ingredients Europe (Fi) & Natural ingredients (Ni) has provided the world with the leading food and beverage ingredients sourcing platform. This year, it returns to France, the third-largest food market in Europe and will take place from 1-3 December in Paris Nord Villepinte. The show will be 10% larger than the last edition and will showcase thousands of ingredients, innovations and solutions in food and natural ingredients, packaging and processing. Over 25% of all annual ingredient procurement budgets for food and beverage manufactures are influenced by a visit to Fi Europe & Ni making Fi Europe & Ni one of the most influential and important three day events for the industry. The show attracts a global audience of over 26,000 attendees and as it only occurs once every two years, it simply can't be missed!

Fi Europe is about bringing in new business, and inspirations, while providing innovative ideas and suppliers to the market and adapting the latest trends in the global food and beverage industry. Whether suppliers

and visitors seek to improve existing products or systems, get educated on market and industry trends, or radically innovate through new technologies and new business processes, Fi Europe is the place to be from 1-3 December.

"Fi Europe is my company's essential opportunity to strengthen key supplier relationships and to meet with new suppliers offering high quality products. As a food industry professional, it is the must attend event."

Sales Manager, Lactotecnia S.

SHOW HIGHLIGHTS:

NEW from the last edition

Building on the success of the last edition of Fi Europe & Ni, the 2015 edition promises more innovation, matchmaking and learning opportunities. With over 200 new exhibitors, more than 85 educational opportunities, a brand new Expo FoodTec pavilion which will showcase exhibitors with solutions in processing, packaging, equipment and associated services, there are so many features onsite to help visitors make the most of their trip.

Leading ingredients suppliers

Taking place at Paris Nord Villepinte, France, the exhibition will showcase the latest product developments and innovations from over 1,400 global, leading food and beverage ingredients suppliers and solution providers including Cargill, DSM, Beneo, Roquette, Rousselot, Nexira, JK Sucralose, GNT Group, Glanbia Nutritionals, Omya, Naturex, Hydrosol and Synthite ADM, Ingredion, Gelita, DMV, Brenntag and many more.

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Fi Europe conference

A four day, co-located conference will take place onsite during the show. The multifaceted, dynamic programme will help visitors and their peers from leading food and beverage companies identify the top trends and opportunities in the global food ingredients market. 100+ leading experts from companies such as Nestlé Research Center, Friesland Campina, Ingredion, Gelita, Innova, FoodDrink Europe, Mintel, Ketchum, Britvic and many more will ensure visitors get the latest insights in 20 different modules discussing natural colour and colouring foods, dairy innovation, category innovation, functional foods, health and wellness trends, and the global ingredients industry.

Futurals; the next generation of colouring foodstuffs

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ROHA is a leading manufacturer of colours with a worldwide presence. With significant investment in both our research and product development and production capabilities, we will be showcasing our Futurals brand of colours at FiE Paris.

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- Futurals RED NC is a Carmine Replacer for meat applications. It has very good performance and stability in cured and fresh products
- Futurals PAPRIKA complies with the Guidance for Coloring Foodstuffs and is cleanly labeled as Paprika Extract
- Futurals BLACK is the first clean label black food colouring
- Futurals RED RANGE works well in many different applications. The products in this range provide the most vivid red shades, some of which have been developed to provide intense, bright red shades for coating applications

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New product zone

This feature is one of the most popular at the show and is now a trendsetting spot for the food industry. Produced in association with Innova Market Insights, The New Product Zone will showcase new products and packaging displays, highlighting recent launches from exhibitors at the forefront of innovation in the industry. This feature gives new products a proper introduction to the market and to industry professionals, and is a very popular area for visitors and press.

Global seminar theatre

This theatre will host 25 minute seminar sessions which are free to attend. Here, key exhibitors will inform visitors about their latest innovations, developments and food trends by presenting new product applications, technologies and practical insights in the theatre. There will be a variety of educational seminars presented over the three days.

Industry insight theatre

The 30 minute sessions in this theatre are free to attend and will be presented by leading associations and research companies such as Euromonitor International, NutriMarketing, Leatherhead and more. They will inform and educate audience with content on the latest trends and innovations impacting the food and beverage industry in topics such as health and wellness and gluten free. These content rich, educational presentations will be free, and each will feature a five minute Q&A session at the end.

Colour – purely a matter of taste

Whether a food product is declared tasty depends on its ingredients, flavour and also the appearance of the final product. In many cases the first sense engaged when someone goes for a food product is vision. Especially with packaging, the only way to judge if it's a good product or not is optics. To measure colour hues of food products in a variety of conditions, complex technical solutions are required. Whether raw materials or solids and liquids, only special spectrophotometers can give precise data to help formulate colour and calculate values or differences. Length of a food process, ingredients, flavour and many more factors influence the appearance of a food product. With detailed analysis manufacturers can meet the ideal optical impression which is attractive for customers to buy the product.

D25 NC. Evolutionary. Revolutionary. Automated non-contact colour measurement:

Combining its unique automated motion with the ability to measure and average up to five readings per second, the D25 NC is unsurpassed in its ability to accurately measure large, irregular shaped samples of any type. From beans and chips, to plastic pellets, the D25 NC is the ultimate choice for colour measurement.

Interested to learn more about our solutions and unique colour measurement techniques? Join us at the Fi Europe Conference 2015 in Paris; HunterLab will give a presentation at the Natural Colour and Colouring Foods 2015 Conference.

With an unmatched reputation for delivering the right solution for the right challenge, HunterLab tailors products and technologies for every colour measurement need and budget, offering the broadest range of colour measurement solutions in the industry. HunterLab is ISO 9001:2008 certified and has knowledge based on 60 years of experience.

The world's true measure of color
HunterLab

www.hunterlab.com/d25nc.html

Ingredients in action

Innova Market Insights are returning with their feature Ingredients in Action – an ingredients application tasting bar. At this feature on the Innova stand on the show floor, visitors can use all five senses to explore how the latest ingredients are being applied to finished food products, while learning about current trends driving new product development.

Fi Europe innovation awards

Food and beverage ingredients companies that have excelled in their sector have contributed to the ingredients world as a whole and have demonstrated innovation in certain areas will be recognised in an awards ceremony at Fi Europe 2015. A showcase area will display those innovative ingredients that are leading the way in the industry.

Innovation tours

Industry experts NutriMarketing have produced and will conduct focussed, guided tours around the show floor at Fi Europe. Featuring six topical areas including innovations in dairy, innovations in bakery and vegetable supremacy, the Innovation Tours will highlight to visitors how key suppliers are responding to market trends through innovation.

Synergy Flavours launches new flavour range for weight management market

Synergy Flavours, the leading global manufacturer and supplier of flavours, extracts and essences, has launched a range of eight new flavours, specially created for the fast-growing weight management market. The new flavour range includes the following profiles; Cinnamon Danish, Cinnamon Bun, Strawberry Cheesecake, Caramel Coffee, Banana Smoothie, Vanilla Cream, Chocolate Brownie and Blueberry Cheesecake.

The eight impactful flavours have been designed to work with a high protein meal replacement concept that contains the highest quality macronutrients including healthy fats, complex low GI carbohydrates and complete proteins, together with the suggested necessary vitamins, minerals and trace elements.

Synergy draws on almost half a century of protein research in collaboration with its parent company, Carbery, a leading manufacturer of whey proteins. Recent research in partnership with North Carolina State University (NCSU) focussed on the sensory analysis and flavour chemistry of various protein sources. The research, along with Synergy's applications expertise and Carbery's protein capability, enabled Synergy to develop innovative, optimised flavour solutions for a variety of protein-based sources.

Synergy offers a range of flavour solutions for the sports nutrition, weight management and active aging markets and continues to drive innovation in the field of flavouring nutrition.

www.synergytaste.com

Discovery tours

Produced in conjunction with Leatherhead Food Research, the Discovery Tours offer visitors the opportunity to follow a trend specific tour around the show floor at their own speed, using a guided trail show map. With six focussed topics including protein innovation and natural colours, visitors can learn about key trends in the area while finding the perfect exhibitors that can provide solutions they need.

FiE mobile app

The official Fi Europe mobile app is free to download. It allows visitors to navigate the show floor, access the exhibitor list, store their agenda, mark seminars they want to attend, make appointments and network with industry peers at the show! It has all the information visitors need right at their fingertips!

Women's networking breakfast (NEW!)

This year's Fi Europe introduces a brand new feature, the Women's Networking Breakfast. Taking place on the morning of day two (8:30 – 10:30), this is a paid networking opportunity for women from the industry to come together and discuss, share and debate their ideas. Discussions will be coordinated by by Lu Ann Williams, Director of Innovation, Innova Market Insights and will also feature Laurette Rondenet-Smith, President & CEO, Edlong Dairy Technologies and Dinnie Jordan, Managing Director & Founder, Kudos Blends amongst others.

FiE press & VIP room

The Fi Europe VIP room onsite will provide a quiet setting away from the show floor where luxury and hospitality can be enjoyed by VIP and press attendees. There are a range of facilities to help visitors access their emails, network with other VIPs, hold meetings, enjoy refreshments and enjoy a break away from the hustle and bustle of the exhibition.

The venue

This year, Fi Europe & Ni will take place in Paris Nord Villepinte, a world-class business centre in the heart of France. Paris is a central and easily accessible location and is the ideal place to come and generate business. Being one of Europe's top tourist destinations with excellent infrastructure and attractions, it also promises to provide many exciting places to visit and enjoy.

Mark your agendas now!

Visit Fi Europe and we promise you will:

- Find high quality ingredients from 1,400+ leading suppliers, all under one roof, the quickest way to meet your sourcing needs!
- Build your network with 27,000+ food and beverage professionals from across the globe
- Get the latest insight on food and beverage trends from 86 free presentations and tours, or book to attend the high level conference.

No matter where you are located or in what sector you operate, Fi Europe & Ni is the must attend event for the global food and beverage ingredients industry. It is a unique platform to meet existing and potential suppliers, learn about the latest trends and developments, acquire priceless industry knowledge and explore endless networking opportunities.

How do you register?

You can pre-register on line at www.fi-europe.eu/preview which will save you €130 onsite fees! There are also four different visitor and conference packages to choose from. Visit the website for regular updates or follow @Fi_Global on Twitter or Fi Global on Facebook, and use #FiEurope.

About the organiser

UBM EMEA connects people and creates opportunities for companies across five continents to develop new business, meet customers, launch new products, promote their brands and expand their markets. Through premier brands such as Routes, CPhI, IFSEC, Ecobuild, Seatrade, and many others, UBM EMEA exhibitions, conferences, awards programmes, publications, websites and training and certification programmes are an integral part of the marketing plans of companies across seven industry sectors.

About Food ingredients Global – the trusted route to market since 1986

Food ingredients was launched in Utrecht, The Netherlands, in 1986. Its portfolio of live events, extensive data, digital solutions and high-level conferences are now established throughout the world and provide regional and global platforms for all stakeholders, in the food ingredients industry. Over 500,000 people have attended our shows over the years with billions of Euros worth of business created as a result. With over 25 years of excellence, our events, digital solutions and supporting products, deliver a proven route to market, with a truly global audience. For more information about the Food ingredients Portfolio please visit: www.figlobal.com.

UBM EMEA is committed to the continual improvement of sustainability

To ensure long term profitability, UBM EMEA aims to be a leader in sustainable business, aligning all key business decisions with our sustainability strategy. UBM EMEA sees it as fundamental that we are conscious of the impact that our actions have on the environment and the communities in which we operate. UBM EMEA strives to manage its impact by ensuring that the principles of sustainability are at the core of all our activities. A corner stone to our journey towards sustainability is our certification to the ISO 20121 Sustainable Event Management System. UBM EMEA is one of the first major organisers to successfully implement and certify our sustainable event management system against the International Standard ISO 20121.

Date 1-3 December 2015
Location Paris Nord Villepinte, France
Website www.figlobal.com/fieurope/home

Incoming inspection of cereal flakes with sieve analysis

Dr. Tanja Hanke
Product Manager, Retsch GmbH

Jennifer Franz
Graduate student, Food Safety

Graduate student Jennifer Franz has developed a new inspection procedure during her work at the German food producer Lebensgarten GmbH. With the help of sieve analysis the company can now reliably ascertain the fines and dust fractions of incoming cereal flakes; these have a negative influence on the mixing and packaging process of muesli.

The dust fraction consists of particles <500 microns and prevents tight sealing of the packaging by sticking to the welding seam. Another negative effect occurs during the production of so-called 'crunchy' products. Crunchies are crisply baked cereal flake products; by adding honey, for example, the ingredients are formed into a compact mass and are then baked. The higher the dust fraction, the more crumbly and fine-pored the consistency of the crunchies becomes. Separating the flakes into individual fractions by sieve analysis reduces these negative effects on the product quality by allowing reliable quality evaluation.


Test sieve 4mm (oversize)

New inspection procedure

The mixture of cereal flakes can be divided into different particle size fractions which are roughly whole flakes, half flakes, broken flakes and fines. The aperture sizes of the sieves used are 4mm, 2mm, 1mm, 0.5mm and <500µm (sieve pan). This last fraction is considered as the dust fraction which has a particularly negative influence on the packaging and production process. Before selecting the time intervals for sieve analysis, the structural composition of the flakes was evaluated. Based on the fact that cereal flakes are categorised as a fragile raw material which breaks easily and is subjected to natural deviations, a time interval of two minutes was defined. To ascertain a suitable amplitude for each flake type, care was taken that the flakes were not thrown with too high or too low intensity. If the throwing intensity is too low, the flakes are not properly dispersed resulting in low separation efficiency. If the amplitude is set too high the low-density particles are held in suspension and a comparison of individual flakes with the sieve apertures is not possible. For flakes of oat, wheat, rye, spelt or barley amplitudes of 0.9 or 1.00mm


Test sieve 2mm (broken flakes)


Test sieve 1mm (fines, coarse)

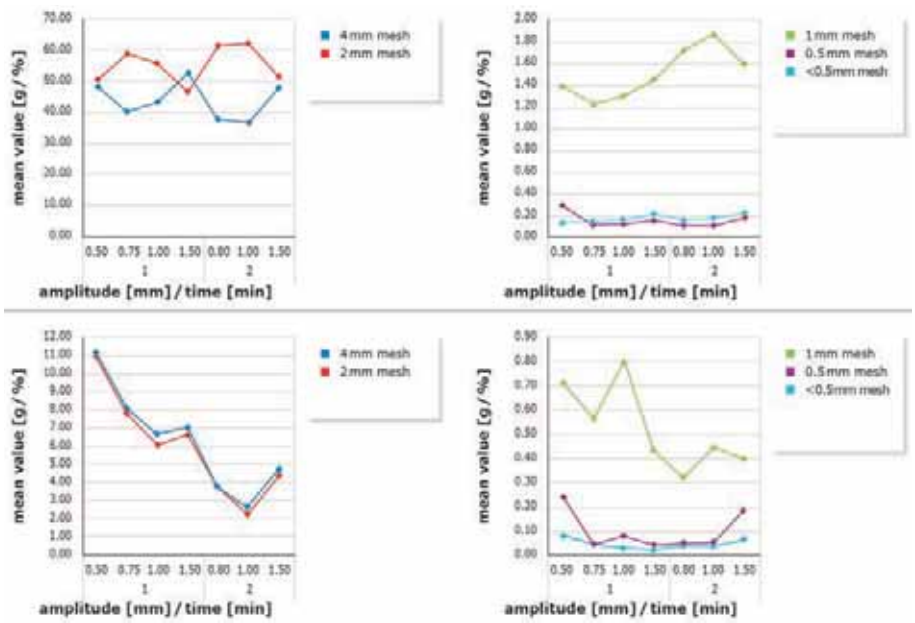


Figure 1: Mean values (above) and standard deviations (below) of the sieve fractions of *Bio oat flakes grbl. 480er*, sieved with varying parameters (amplitude and time). The lowest standard deviations occur when sieving for 2 min and with an amplitude of 1 mm. Hence, this is the most suitable sieving protocol for cereal flakes and is now used at Lebensgarten for their quality control process.

(instable flakes) and 1.5mm (stable flakes) were chosen according to the stability of the flakes. Four different sieving protocols were defined for the cereal flakes by experimental sieve analysis. This test series shows that sieve analysis is a highly suitable method to control the quality of the raw materials by separating the fines and dust fractions.

Vibratory Sieve Shaker AS 200 control

Jennifer Franz carried out the test series with a RETSCH sieve shaker AS 200 control. The patented controllable electromagnetic drive of RETSCH's vibratory sieve shakers allows for optimum adaptation to the material to be sieved. The drive produces a 3D throwing motion that moves the sample equally over the whole sieve surface and effectively separates particles in a size range from 20µm to 125mm. The sieve shakers accept a variety of sieve diameters from 100mm to 450mm. Sieve stacks with a maximum height of 450mm allow for separation of up to 17 fractions in one analysis. The 'control' series features digital setting and control of amplitude, time, sieve acceleration and interval. Up to nine parameter combinations can be stored to conveniently repeat routine analyses.

Table 1: Definition of flake fractions

Test sieves (sieve apertures in mm)	Definition of the flake fractions
4	oversize
2	broken flakes
1	fines (coarse)
0.5	dust (coarse)
<0.5	dust (fine)

SIEVE SHAKER AS 200 control

- 3-D throwing motion, powerful electromagnetic drive
- Excellent separation efficiency even with short sieving times
- Setting of sieve acceleration 'g' for comparable and reproducible sieving results worldwide
- Free digital adjustment of all process parameters


Test sieve 0.5mm (dust, coarse)


Sieve pan <0.5mm (dust, fine)

Food safety, hygienic design and cleanability

This was the topic of the latest webinar, organised by *New Food* and sponsored by Bürkert. Broadcasted live on the 8th October 2015, with presentations from three industry experts, it is now available for you to watch online.

Patrick Wouters, Global Hygienic Design Leader at Cargill, was the first to present. He began with an introduction to his company, Cargill, and how they ensure food safety. He discussed the five key areas of hygienic design, and the risk based food safety zoning model – which categorises each area of the factory, to ensure proper cleaning, and reduce food safety risks. Hygiene is very important to ensure food safety, and if the building and equipment used isn't designed with hygiene in mind, then it is very difficult to keep the end product pure. Patrick also mentioned the European Hygienic Engineering and Design Group (EHEDG) and how they are important, as they create clearer regulations which can be enforced across a larger range of countries. If equipment is EHEDG certified, it is a good indicator that it is hygienically designed and safe to use in food environments.

Next was **Hein Timmerman**, from Sealed Air. He is their Global Sector Expert for Food Care, with 28 years of engineering experience. He began with an introduction to Sealed Air, and moved on to Clean in Place (CIP) technology and cleanability. He explained the mechanical action of cleaning, laminar and turbulent flow, and how deposition can be prevented by turbulent flow. In CIP the correct flow is one of the most important parameters; without hygienic flow measurement CIP cannot be done. EHEDG also have guidelines on CIP, on points such as "how should a liquid food plant be designed to achieve cleanability" and in his presentation Hein explained these further.

Lastly was **John Van Loon**, Hygienic Segment Manager at Bürkert Fluid Control Systems. John's presentation focused on flow measurement technologies, whilst keeping in mind hygienic requirements and regulations in the food and beverage industry. He discussed the advantages and disadvantages of current technologies, and introduced surface acoustic wave (SAW) technology - used in Bürkert's FLOWave. As it uses SAW, this system can measure flow without any parts within the tube. This means no areas where build up can occur in the pipe, making it a much more hygienic system.

To find out more about all of the topics mentioned above, go to the *New Food* website to watch the webinar now.

Hein Timmerman
Diversey-Sealed Air

John van Loon
Bürkert

Patrick Wouters
Cargill

This webinar was sponsored by:

bürkert
FLUID CONTROL SYSTEMS

This webinar is available on-demand via the *New Food* website. VIEW IT NOW AT:
www.newfoodmagazine.com/webinar5

Assessing sanitation: A comparison performance testing of ATP devices

Adenosine triphosphate (ATP) is a compound found in every living cell and can be used as an indicator to determine if a surface was properly sanitised. ATP devices are utilised to detect the presence of bacteria and organic/food residue on surfaces.

Summary

This study was directed by NSF International, performing comparison performance testing of five different commercially available ATP systems[1]. The recovery efficiency and consistency of each system were evaluated against an ATP standard solution and orange juice at different dilutions inoculated onto stainless steel carriers. The study utilised varying methods to determine the effectiveness of each system; both a directly pipetted ATP standard solution and commodity onto swab surfaces, and surface swabbing of stainless steel coupons were employed with the test systems.

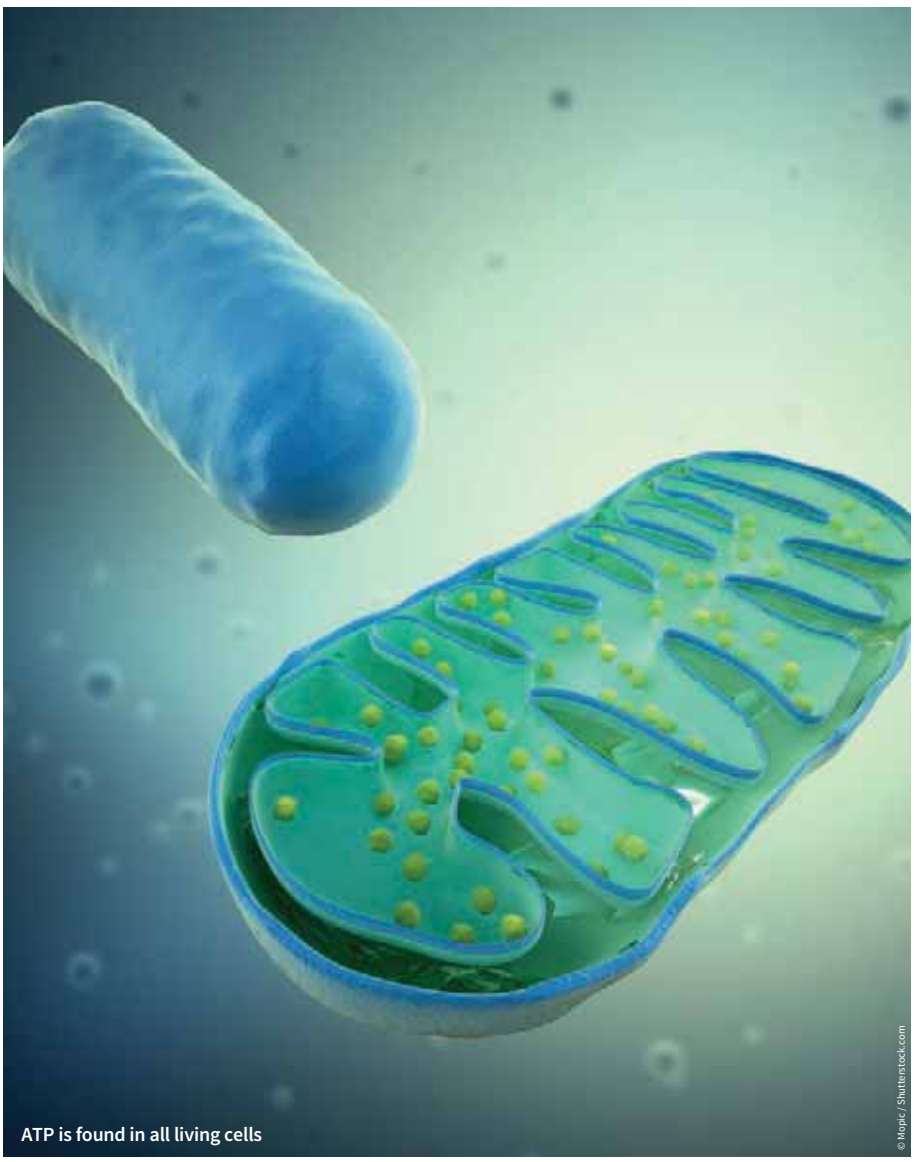
ATP hygiene monitoring systems have been used in the food production industry for over 20 years. The systems are used in facilities to measure the cleaning effectiveness, removal/reduction of ATP, on food contact surfaces. ATP has been incorporated as a key monitoring parameter for the food, beverage and healthcare industries. It is essential that these devices provide precise and consistent readings so that the hygiene practices of these industries can be accurately evaluated.

Our study attempts to mirror typical field usage by looking at the recovery of each system of ATP standards and commodity from a common surface (stainless steel).

ATP devices

Multiple manufacturers produce monitoring systems to detect ATP. The following systems were selected to be tested in this study.

- Neogen AccuPoint Advanced ATP Surface Samplers (Lot 216036)
- 3M Clean-Trace Surface ATP (Lot 1222C)
- Hygiena UltraSnap (Lot 02515)
- Charm PocketSwab Plus (Lot 4031315A-01)
- Biocontrol LIGHTNING MVP ICON ATP Surface Sampling Device (Lot 042915-01)



ATP is found in all living cells

Methodology

Evaluations of the sanitation systems were conducted in four sections:

Section 1. The goal of this experimental section was to determine the Relative Light Unit (RLU) response for each of the five test systems that corresponded to standard ATP solutions added directly to the sampling system. For each sanitation system, 20uL of each ATP standard (0, 12.5, 25.0, and 100 femtomoles of ATP) was pipetted directly onto the sample swab or pad of the sanitation system. Immediately following addition of the ATP standard to the sample pad or swab the instructions for the system were followed and the sampler was read on the appropriate luminescence reader. Each ATP concentration including a blank (sterile water) was tested 25 times using 25 different samplers. The ATP solutions were labelled by nanomolar concentration and 20µL of the 5.00, 1.25 and 0.625nM solutions of ATP or sterile water result in the following femtomoles of ATP on the sample pad or swab, 100, 25.0, 12.5 and 0 femtomoles, respectively. Results for the 100 femtomole solution are reported in **Table 1**. The calculated mean RLU response for the 100 femtomole solution was used as a reference for calculating ATP recovery for the experiments performed in Sections 2 and 3.

> "ATP hygiene monitoring systems have been used in the food production industry for over 20 years"

Section 2. The goal of this experimental section was to determine the efficiency of the five test systems in recovering an ATP standard that had been evenly spread across a stainless steel carrier. The surface recovery of ATP or commodities was determined by using a 4"x4" stainless steel plate. The initial cleanliness of the stainless steel plates was important to monitor and the testing was conducted in a laminar flow hood equipped with a UV lamp. Prior to each round of testing the stainless steel plates were cleaned and sterilised using a UV lamp with a twenty minute exposure. Between experiments the stainless steel plates were cleaned using 10% Contrad 70 in water, rinsed with sterile water, washed again with isopropanol and then air dried.

Sterile water and isopropanol used for cleaning was dispensed from a spray bottle which was sterilized using a UV lamp (20 minute exposure) and 10% Contrad 70 in water. Periodically a 4"x4" plate was checked for cleanliness using an AccuPoint sampler to ensure the reading was at background levels (below 25 RLU).

100 femtomoles of ATP was spread over the 4"x4" surface and air dried for one hour at room temperature (18-25˚C) to measure the amount of ATP that could be recovered utilising each monitoring system.

Table 1: Mean RLU response of five ATP monitoring systems against an ATP standard of 100 femtomoles.

Reader	Neogen AccuPoint 3.04	3M NG	Hygiena EnSure	Charm NovaLUM	BioControl MVP
Sampler	AccuPoint Advanced	CleanTrace	UltraSnap	PocketSwab Plus	Lightning
Mean RLU	593.32	871.56	206.64	29,809.04	594.12

This was accomplished by pipetting 20µL of a 5.0nM ATP solution onto the stainless steel surface. The tip of a pipette was used to distribute the solution over the surface. Ten 4"x4" stainless steel squares were covered with 100 femtomoles of ATP for each sanitation system. After the ATP was deposited homogenously across and dried, the surface was sampled using the sanitation system sampler in the manner recommended by the manufacturer's instructions. The amount of ATP was recovered was determined by comparing the mean response from the surface recovery to the mean response obtained in Section 1. Results are reported in Table 2.

Section 3. The goal of this experimental section was to determine the efficiency of the five test systems in recovering an ATP standard that had been spot inoculated at a random location on a stainless steel carrier. A 20µL of the 5.0nM ATP solution (100 femtomoles) was pipetted at a random spot on a 4"x4" stainless steel surface to determine the recovery capability of each monitoring system. The spot was allowed to dry for one hour and the plate was sampled according to the manufacturers sampling instructions. This was repeated 10 times for each sanitation monitoring system to determine the mean response, standard deviation and the coefficient of variation (CV) for the recovered ATP from the surface. The percentage recovered from the surface was determined by

ATP hygiene monitoring systems are used to measure the cleaning effectiveness, removal/reduction of ATP, on food contact surfaces

Table 2: Recovery of ATP standards from a homogenously contaminated stainless steel surface.

	Reader	Neogen AccuPoint 3.04	3M NG	Hygiena EnSure	Charm NovaLUM	BioControl MVP
	Sampler	AccuPoint Advanced	CleanTrace	UltraSnap	PocketSwab Plus	Lightning
Mean RLU Recovered from Surface	**Average**	**165.2**	**62.8**	**31.1**	**8,618.10**	**123.7**
	Std Dev	34.87	20.08	18.62	5,236.99	47.34
	%CV	21.11%	31.98%	59.86%	60.77%	38.27%
% ATP Recovery from Surface	**Average**	**27.84%**	**7.21%**	**15.05%**	**28.91%**	**20.82%**

Table 3: Recovery of an ATP standard from a single contamination spot on stainless steel surfaces.

	Reader	Neogen AccuPoint 3.04	3M NG	Hygiena EnSure	Charm NovaLUM	BioControl MVP
	Samplers	AccuPoint Advanced	CleanTrace	UltraSnap	PocketSwab Plus	Lightning
Mean RLU Recovered from Surface	**Average**	**240.3**	**71.3**	**20**	**3,435.40**	**106.5**
	Std Dev	97.51	45.34	13.25	2,900.68	88.79
	%CV	40.58%	63.58%	66.25%	84.43%	83.37%
% ATP Recovery from Surface	**Average**	**40.50%**	**8.18%**	**9.68%**	**11.52%**	**17.93%**

comparing the mean response from the surface spot recovery to the mean response obtained in Section 1. Results are reported in Table 3.

Section 4. The goal of this experimental section was to determine the efficiency and detection limit of the five test systems in recovering a standard commodity, orange juice, which had been evenly spread across a stainless steel carrier. This experiment was designed to replicate a typical situation that would be encountered in the field. For this evaluation, 10mL of orange juice was diluted 1:1,000 (1 part orange juice to 999 parts sterile water), 1:5,000 (1 part orange juice to 4,999 parts sterile water), and 1:10,000 (1 part orange juice to 9,999 parts sterile water).

> "ATP has been incorporated as a key monitoring parameter for the food, beverage and healthcare industries"

Surfaces for each dilution level were prepared by dispensing 50µL of a given dilution level across the surface of a 4"x4" section of stainless steel plate and allowing the samples to dry for one hour before sampling the surface according to the prescribed method for each brand of system. Ten surfaces were prepared and sampled at each dilution for each brand of sanitation systems. The mean, standard deviation and coefficient of variation was determined for each dilution and each brand of sanitation sampler.

To determine recovery, 50µL of each orange juice dilution was pipetted directly onto the swab or sample pad and the response measured using each brand of sanitation system. This was repeated 10 times to determine the mean response for directly pipetting the orange juice dilution onto the sampler. The percentage recovered from the surface was determined by comparing the mean response from the surface recovery to the mean response obtained from directly pipetting 50µL onto the samplers. Results are reported in Table 4.

Results and discussion

This study aimed to examine the difference in recovery of ATP standards when applied in a homogenous manner across the carrier as well as to a random spot contamination. The study also assessed the ability of the five ATP monitoring systems to detect a standard commodity food, orange juice, which was applied to carriers in varying concentrations.

During Section 1 of this study, the RLU (Relative Light Unit) outputs for the five test systems were observed when ATP standards were directly introduced onto the swabs/sample pads. The mean RLU output was calculated for 25 replicates and reported in Table 1 (page 42). This table contains the RLU observations for all five systems tested at the 100 femtomole ATP concentrations. The RLU data generated in Section 1

Table 4a: RLU values observed when the dilutions were amended directly to the ATP monitoring system's sample pad/swab. These RLU values were used as a reference for the calculation of percent ATP recovery in Table 4b. The average RLU reading from 10 replicates (n=10) is reported.

Mean RLU for Recovery of Orange Juice Pipetted onto the Sample Pad/ Swab

Orange Juice Dilution	Sampler	Neogen AP Advanced	3M CleanTrace	Hygiena UltraSnap	Charm PocketSwab Plus	BioControl Lightning
1:1,000	**Average**	**1,783.4**	**3,629.1**	**639.6**	**145,735.9**	**2,071.9**
1:5,000	**Average**	**418.5**	**832.6**	**165.6**	**34,517.6**	**582.4**
1:10,000	**Average**	**90.7**	**217.5**	**34.0**	**6,394.1**	**139.9**

Table 4b: RLU values observed from sampling 4"x4" stainless steel surfaces amended with three dilutions of orange juice. Percent recovery was calculated by dividing the mean RLU values below (homogenous stainless steel coupon inoculation) by the mean RLU values in Table 4a (direct swab inoculation).

Recovery of Orange Juice from 4"x4" Stainless Steel

Orange Juice Dilution	Sampler	Neogen AP Advanced	3M CleanTrace	Hygiena UltraSnap	Charm PocketSwab Plus	BioControl Lightning
1:1,000	**Average**	553.3	71.4	65.7	14,468.30	271
	% ATP Recovery	31.03%	1.97%	10.27%	9.93%	13.08%
	%CV	33.1%	74.3%	37.2%	47.6%	55.3
1:5,000	**% Average**	119.8	48.2	27.9	2,115.40	148.1 %
	ATP Recovery	28.63%	5.79%	16.85%	6.13%	25.43%
	%CV	46.7%	32.0%	43.3%	36.5%	38.8%
1:10,000	**Average**	14	26.6	0	14.4	10.5
	% ATP Recovery	15.44%	12.23%	0.00%	0.23%	7.51%
	%CV	146.7	111.52	NA	316.2	31.2

for was used as a reference for calculating ATP recovery in Sections 2 and 3.

Section 2 of the study utilised stainless steel coupons prepared with the 100 femtomole of the reference ATP standard as the sample. The surface was sampled using the monitoring systems' operational instructions but utilising a real world approach to the exposure time of the swab contact on the sample surface. A standard run/return pattern was used over the sample coupon on two axis/sides. Each side had the timed exposure of swab to surface of five seconds making the entire exposure 10 seconds. This time frame is relevant to compare the results of a lab study to a real world, situational use of the monitoring system. The percent of ATP recovered was determined by comparing the mean response from the surface recovery to the mean response of direct swab inoculation observed in Section 1. **Table 2** (page 43) contains the results for the Section 2 study. The two monitoring systems that had the highest percent ATP recovery from the stainless steel surfaces were the Charm PocketSwab Plus (28.91%) and the Neogen AccuPoint Advanced system (27.84%). The Neogen AccuPoint Advanced system also displayed the lowest percent coefficient of variance (21.11%), indicating that it achieved the most consistent (least variable) readings.

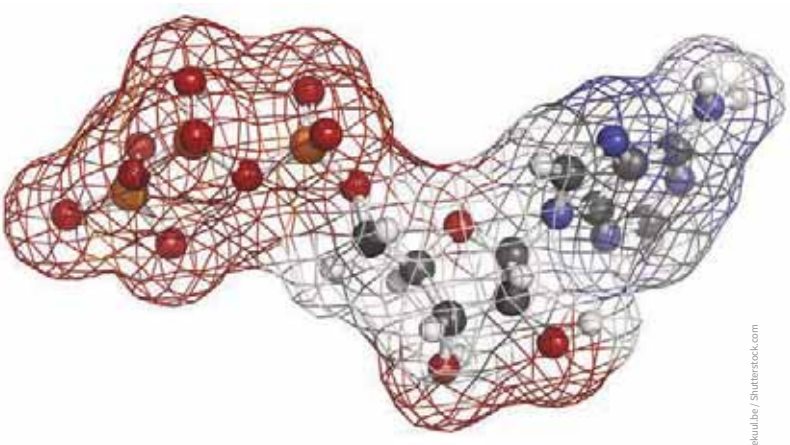
In this study the recovery efficiency and consistency of each system were evaluated against an ATP standard solution and orange juice at different dilutions inoculated onto stainless steel carriers

Section 3 involved assessing the ATP recovery efficiencies from stainless steel coupons with a random spot of 5.0 nM ATP solution of 100 femtomoles dried on it. The surfaces of 10 replicant coupons were sampled utilising the real world situational sampling method utilising each of the five monitoring systems to determine the mean response of each unit.

> "the Neogen AccuPoint Advanced had the highest observed percentage recovery"

The percentage recovery was calculated by comparing the mean response from the surface spot recovery to the mean response of direct swab inoculation observed in Section 1. The results for Section 3 can be found in **Table 3** (page 44). The results show that the Neogen AccuPoint Advanced had the highest percentage recovery of all five monitoring systems at 40.50% recovery of the ATP solution from the unit surface. This system also exhibited the greatest consistency in readings (with a CV of 21.11%). The next closest system was BioControl MVP system at 17.93% recovery.

In Section 4 the experimental protocol was designed to mimic real world contamination scenarios. This study involved contaminating stainless steel surfaces with orange juice at three dilutions: 1:1,000, 1:5,000 and 1:10,000. RLU reference values for each dilution were first generated by direct inoculation onto the ATP monitoring system swabs. Recovery sampling using a real world approach, as previously described, was performed on homogenously inoculated stainless steel surfaces. The percentage recovered from each surface was determined by comparing the RLU of the surface reading with the RLUs observed from direct swab inoculation. **Table 4** (page 44) provides the results for the RLUs observed from direct inoculation (4a), RLUs from stainless steel recovery and calculated percent ATP recovery (4b). Once again, the Neogen AccuPoint Advanced had the highest observed percentage recovery. The next closest system for recovery at 1:1,000 and 1:5,000 dilution factors was BioControl MVP. For the 1:10,000 dilution factor the 2nd highest recovery was the 3M CleanTrace.



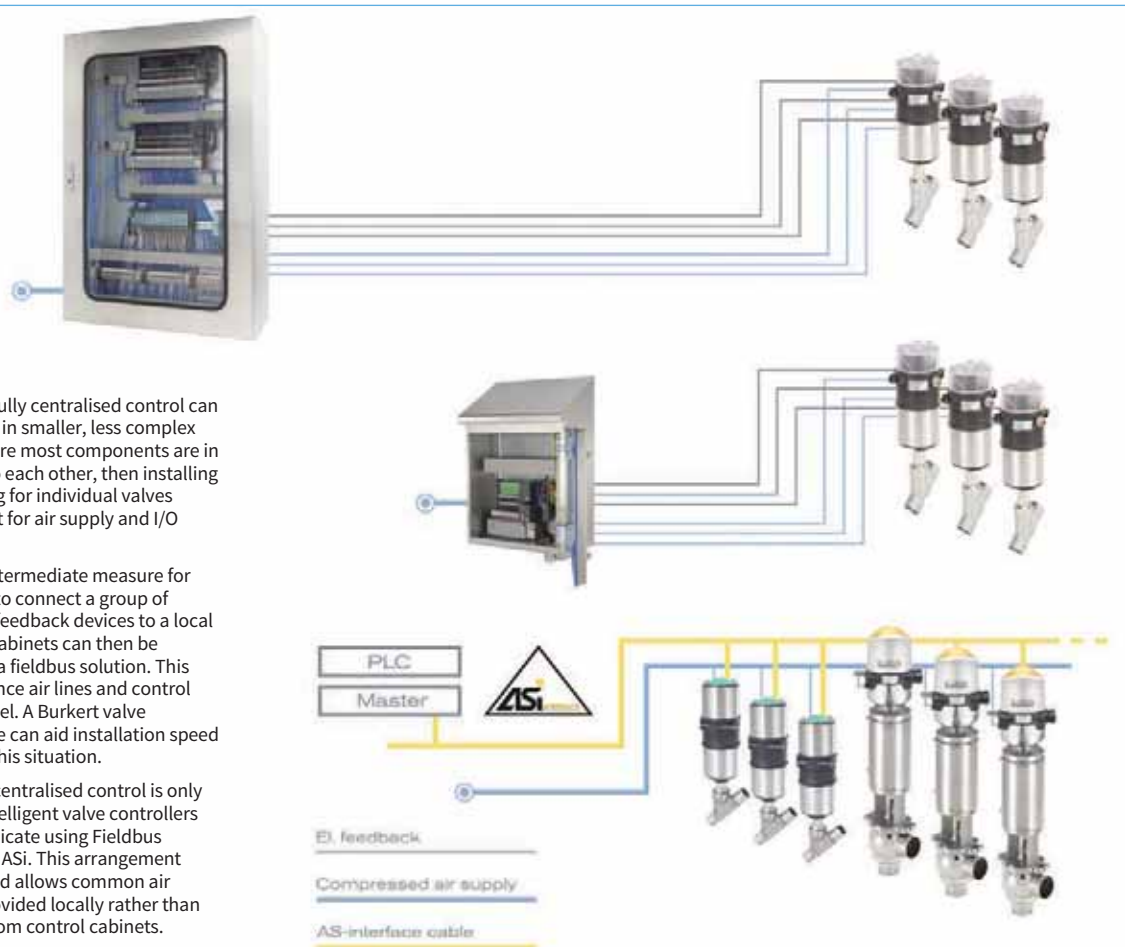
Adenosine Triphosphate (ATP)

Reference

1. B.Steiner and R.Sarver (2014) *Sanitation Sampler Assay Protocol*. Neogen Biochemistry Laboratory.

Automation of process control within the food and beverage industry

While most food and beverage businesses have adopted process automation in one format or another, the technology has evolved considerably over the past few years, leading to improvements in design, efficiency and reliability. One of the major drivers for businesses to increase levels of automation is legislation, but the need to compete in the market place and reduce production costs has also played a significant part.



Top: Traditional fully centralised control can have it's benefits; in smaller, less complex applications, where most components are in close proximity to each other, then installing airlines and wiring for individual valves direct to a cabinet for air supply and I/O makes sense.

Middle: A good intermediate measure for larger systems is to connect a group of valves and other feedback devices to a local control cabinet, cabinets can then be networked using a fieldbus solution. This reduces the distance air lines and control wires have to travel. A Burkert valve manifold interface can aid installation speed and economy in this situation.

Bottom: Fully decentralised control is only possible using intelligent valve controllers that can communicate using Fieldbus protocols such as ASi. This arrangement reduces wiring and allows common air supplies to be provided locally rather than individual lines from control cabinets.

Within the food and beverage industry, the key to finding the best automation solution is a thorough analysis of each individual part of the plant or installation. By carrying out an in-depth analysis of the application, it can be determined if a centralised control system using non-intelligent nodes, will deliver the required performance, or if the sheer size of the system means that the control has to be decentralised – using a fieldbus system working with field controls, intelligent valves and actuators.

Pneumatically actuated process and control valves play a key role in manufacturing within the food and beverage industry. They are the core element for controlling fluid movement within practically every production plant. However, the economic and hygienic aspects of these process fittings in a centrally controlled automation process are not without their difficulties.

Three automation approaches

The best solution for large and complex plants is usually not a single, one-dimensional automation concept covering the entire production process. In fact, each different part and section of the process, down to machine level, has its specific requirements. Consequently, an intelligent

combination of different automation concepts will provide the best results.

In order to achieve this goal, Bürkert is deploying three equally important automation approaches in parallel: fully centralised, fully decentralised and local distributed intelligence working under some level of automation supervisory control.

Traditional fully centralised control can have its benefits; in smaller, less complex applications, where most components are in close proximity to each other, then installing airlines and wiring for individual valves direct to a cabinet for air supply and I/O makes sense.

A good intermediate measure for larger systems is to connect a group of valves and other feedback devices to a local control cabinet, cabinets can then be networked using a fieldbus solution. This reduces the distance air lines and control wires have to travel. A Bürkert valve manifold interface can aid installation speed and economy in this situation.

The key to finding the best automation solution is a thorough analysis of each individual part of the plant

Fully decentralised control is only possible using intelligent valve controllers that can communicate using Fieldbus protocols such as ASi. This arrangement reduces wiring and allows common air supplies to be provided locally rather than individual lines from control cabinets.

Legislation

In the food and beverage industry stringent standards with regards to cleanliness and product quality are put in place.

There are specific requirements for each part and section of the process, down to machine level

These standards are intended to protect the consumer and they are enforced rigorously in most countries by specification and regulation. In order to comply with many of the statutory regulations, there will be a requirement to provide process data and analysis as evidence of compliance.

In addition to statutory requirements, there are also guidelines on process validation which require a basic level of data capture, which can be achieved even with older legacy equipment.

More modern process control systems can capture in-line data which can be exported to a database for analysis. This continuous monitoring ability not only meets production requirements it can also identify any anomalies very quickly and can either raise an alarm or make the necessary adjustments.

Competition

Companies operating in the competitive global market are however forced to make their production processes not only safe and hygienic but also as efficient as possible. This has led to an increased demand for improved automation solutions at process level.

However, the conventional approach of centralised automation of process valves cannot adequately meet the ever more stringent requirements of the industry. Intelligent process valves with integrated automation functions offer a viable and efficient alternative.

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Sophia Minero
Consultant, AliénorEU

Improved aquaponic technology for efficient and sustainable food production

Feeding the growing world population in a sustainable way requires both political and technological solutions. The European Union is at the forefront of the global debate on food security and protection of the natural resources that become scarcer and scarcer. In 2010, the European Union launched the Europe 2020 strategy aiming at driving the European growth in a sustainable way through ambitious targets. The strategy's objectives related to resource efficiency aims at finding innovative ways to optimise food production and to face the challenge of water availability in Europe and worldwide. The EU funded project INAPRO responds perfectly to these challenges as it is aimed at developing and demonstrating a model-based optimised aquaponic system as a green technology that could play a crucial role in sustainable food production and water saving.

Aquaponics is an environmentally friendly food production technology that couples aquaculture (e.g. production of fish) and horticulture as hydroponics (e.g. production of vegetables) in one system. The nutrient-rich water from the fish unit is used as fertiliser for hydroponically grown crops and so reduces the sewage of the fish unit as well. Compared to a single fish or plant production, aquaponics saves water, energy and nutrients. This technology has ancient roots with predecessors like the Asian polycultural farming systems (paddy fields) or the Aztec agricultural islands (chinampas).

The nutrient-rich water is used as fertiliser for hydroponically grown crops

Despite the great role that aquaponics could play in producing healthy and sustainable food, the technology did not spread out on the market until now. Indeed, currently existing commercial approaches of aquaponics vary to a large extent in size, complexity and technologies used, often lacking stability, technical and technological standardisation and economic profitability. Classical aquaponic systems couple both units (aquaculture/hydroponics) through a single water recirculating system. The wastewater from the aquaculture which is used to nourish the plants is directly recirculated back into the fish tanks. However, aquaculture and hydroponics have different requests, e.g. concerning pH values, and such systems do not reach the optimum nutrients requirements of plants with higher demands such as tomatoes.

The INAPRO project helps to overcome these limitations by introducing an enhanced technology and by developing standardised

modular solutions scalable and demonstrating the viability of large aquaponic sites.

INAPRO uses as innovation a double water recirculation system, one for the aquaculture and one for the horticulture part. The main advantage of such a double recirculation aquaponic system (DRAPS) is that optimum conditions can be set up independently in the aquaculture and in the hydroponic units; this allows the productivity of both sectors to increase without generating adverse interactions between the plants and the fish. Furthermore, INAPRO improves the water reuse system by regaining the evaporated and evapo-transpirated water via cooling traps and reintegrating it into the recirculating aquaculture system (RAS) to reduce the overall water consumption of the system. Indeed, compared to a conventional RAS which requires a daily water input representing 10% of the total amount of water circulating, the INAPRO system cuts this rate to 1-3%.

In aquaculture the wastewater is directly recirculated back into the fish tanks. In Aquaponics there is a double recirculation system, so optimum conditions can be set up independently

Science and research are essential in responding to the challenge of feeding the world's growing population. Producing more food is not the sole answer, it is also necessary to invest in sustainable and resource efficient technologies. The optimisation provided by INAPRO is based on modelling the water, energy and nutrients management of aquaponics. The model-based optimised INAPRO system solution has been integrated with cutting edge technologies such as remote diagnosis and controls technology, an innovative one-way water supply for horticulture and an optimised filter and wastewater system. The resulting INAPRO aquaponic technology allows a nearly emission free production of fish and vegetables with low water and carbon footprint. Moreover, INAPRO minimises the use of fertilisers and pesticides; it does not employ fish drugs and antibiotics and prevents these substances being released into the environment. INAPRO increases food production in a sustainable way, by reducing the pressure on already overexploited fish stocks and without creating negative impacts on the environment linked with intensive marine aquaculture thanks to the DRAPS.

The importance of technologies such as INAPRO has been fully recognised by policymakers. For instance, Michèle Rivasi, a French member of the European Parliament belonging to the group of the Greens has acknowledged the improvements provided by INAPRO and declared that *"Aquaponics is like aquaculture. But better! While aquaculture can lead to pollution, contamination and diseases, aquaponics works like the circular economy our society definitely needs. A self-sustainable production providing proteins and vegetables for a healthy diet respecting the environment! What else?"*

The facility in Abtshagen, Germany, consists of a greenhouse with separated aquaculture and hydroponics sections equipped for the production of tilapia and tomatoes

The latest achievement of the project has been the construction of an INAPRO aquaponic system in Abtshagen (Germany). The facility consists of a greenhouse with separated aquaculture and hydroponics sections equipped for the production of tilapia and tomatoes. The instalment has been built in order to run tests on all the different equipments and to collect data concerning e.g. oxygen values, air and leaf temperature. The results will be used to optimise the concept and to build INAPRO demonstration sites.

The INAPRO system has been conceived to be scalable and adaptable to different sizes and locations. The demonstration phase of the project, starting during the autumn of 2015, will be focused on the construction of greenhouses in Germany, Spain and China. The demonstration sites will show the viability of the INAPRO system in different geographical and climate conditions.

The European Commission promotes integrated approaches to sustainable water management and climate change mitigation. Rural areas with water scarcity issues are the perfect target for this improved aquaponic technology that could boost green growth, rural development and create green jobs.

About the Author

Sophia's main fields of expertise are research and innovation, energy and education related matters. She worked for two years as Public Affairs Officer at the European Association for Chemical and Molecular Sciences (EuCheMS). Sophia has a BA in Political Sciences from the University of Milan and a MA in International Relations from the University of Brussels.

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Webinar

Date: 19th November 2015
Time: 10.00 EDT (New York),
15:00 BST (London) and
16:00 CEST (Vienna)
Duration: 60 minutes

Novel techniques and new advances in the analyses of fat species in foods

This webinar will provide an overview on the topic of analysing various fatty species in foods, and methods to determine various classes, from total fat to various lipid fractions and the wide variety of analyses available for fat determination. Three industry experts will discuss these novel techniques and more in the webinar, which will be broadcast live on the 19th November 2015.

Len Sidisky is the R&D Manager of the Gas Separations Business Unit of Supelco, a division of Sigma-Aldrich. Len holds a Masters of Food Science from Penn State University and is the author of numerous papers, seminars, and other presentations. His specialist topics include capillary gas chromatographic, SPME and air monitoring devices/adsorbents. Len's presentation will discuss traditional and new stationary phases for FAME analyses and how these can be used to resolve various fatty acid species.

As well as Sigma Aldrich, we also have speakers from the University of Messina, and Hershey. **Dr. Peter Tranchida**, Associate Professor in Food Chemistry in the Department of Pharmaceutical and Health Product Sciences at Messina University, plans to talk on the use of GC×GC in the field of food lipid analysis. He will outline the considerable advantages of the two-dimensional approach (both with and without MS detection), in experiments related to a series of lipid volatiles.

Our Hershey representative is **Dr. W. Jeffrey Hurst**, Principal Scientist of the Hershey Company Technical Centre. He specialises in separation science and is a member of numerous professional groups, including the American Chemical Society, the Institute of Food Technologies, American Society of Mass Spectrometry, and a Fellow of AOAC International. "The reason for the odd spelling in the title is to reflect the huge variety of existing methods for the analysis of fat in foods", examples of the various methods and their applications will be provided.

Len Sidisky
Supelco

Dr. Peter Tranchida
Messina University

Dr. W. Jeffrey Hurst
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Brewing

SUPPLEMENT

Jim Bungard and Daniel Taylor
Directors of Hanlons

Suzie Creighton
Director of Castlegate Communications

Hanlons Brewery: Pioneering processing technologies

Tucked away off a leafy road just outside Exeter in Devon, in the evocatively named village of 'Half Moon', lies an oasis for beer lovers: Hanlons Brewery! This family-run business has a history of brewing excellent ales and a mission of producing world class craft beers. Jim Bungard and Daniel Taylor, Directors of Hanlons, bought the O'Hanlons brewery business in 2013, and promptly set about building high spec new premises on Dan's parents' farm, while successfully moving all staff and expertise to the new site. You may well have heard of their award winning beers, such as Yellow Hammer, Port Stout and Stormstay, as they are available both locally and nationally.

At the heart of the success of the business, lies, of course, the brewing! The bespoke building and equipment – all housed in an idyllic setting with a bar and restaurant – is key to Hanlon's continued success. Jim Bungard says: "Our mission is to provide excellent, real craft beer without the added preservatives. We use traditional methods mixed with leading technologies, using the best quality barley and hops from the UK's top suppliers and water from our rolling Devon hills."

The team are, however, conscious of challenges, such as the increase of small craft breweries, which could mean a peak in the market and business becoming more competitive. Daniel Taylor, Director, explains how they have solved this problem: "The question we faced was: how could we compete as a small brewery in this crowded market place? Other than giving our beer away, we had to look at what we could do differently to our competitors and we focused on our brewing

process and how we could avoid the high costs associated with full automation, whilst still operating efficiently and cost effectively." Hanlons' answer was to work with a local engineering firm and a brewing consultant to develop an innovative brewing control system, where process variables are controlled and monitored from a single panel.

Dan explains: "The project has been seamless – we struck lucky by using two superb local companies, so much so, that we are looking at working together and marketing the kit to sell to the trade as there's simply nothing like it out there!"

Hanlons' bottled beers

Innovative technology supported by traditional methods

Richard goes on to explain about the methods used for brewing at Hanlons: "All breweries have the same process elements of Mash Tun, Underback or Whirlpool, Copper and Hot Liquor Tank. Hanlons uses the classic British single infusion mash method, where the malt is mixed with water and poured into the mash tun to an exact temperature. This mixture is allowed to rest to allow the conversion of complex carbohydrates to fermentable sugars."

The liquid from this mixture (wort) is drained slowly from the mash tun. The wort is filtered through the grain bed and the sparge liquor (at another exact temperature) flushing out more sugars with it. The wort is then pumped into the copper for boiling, extra liquid is added to compensate for losses during boiling.

"The boiling process is the point at which hops are added to the beer," says Richard. "It also stops any enzyme activity and sterilises the wort. The hops have two main functions to add bitterness and aroma. When the boil is finished the hot wort is pumped and cooled via a heat exchanger to the fermenters where yeast is added. The yeast converts the sugars in the wort to alcohol as well as imparting subtle flavours. Once the beer has finished fermenting it is racked into casks and allowed to condition before being sold to the trade.

"The brewing process produces liquids that are a good growth media for bacteria and yeast, therefore cleanliness is of the utmost importance. The removal of wort residue from the mash tun and copper is necessary, but the heat exchanger and fermenter must be clean and sterile."

Manual connection and disconnection of the process vessels is labour intensive and a potential source of process and product variation. Hanlons' approach was to link all the elements together via a control panel that would not only enable complete control of the process from a single station, thereby improving labour efficiency but also enable major improvements in process repeatability. By adding suitable instrumentation to the process, an SPC (statistical process control) system is being implemented to maintain and improve process repeatability and product quality, to the point where every brewing run produces exactly the same beer.

Hanlons Brewery is a real family business

The new system also brings cleaning benefits with its ability to flush all the pipe work, valves, vessels etc with water and any cleaning fluids as required. The system significantly reduces the cost of production – not just in labour – but by using less cleaning products and replacement rubber pipe work and less wasted beer.

Cask washing

"Our other stage of improving production is a totally new cask washer,' explains Dan. 'The old cask washer was a fantastic German automated washer but it cost a fortune to maintain and was a real specialist piece of equipment to get fixed – which could leave us without a cask washer for a few days!"

"The new cask washer can clean 60 casks per hour, cleaning both inside and out,' says Dan. "It's a big bit of kit, but built to last and easily maintainable, it also extremely efficient. As it is a modular design, it can be 1, 2, 3 or more barrels wide depending upon required throughput. It has been designed so that the cleaning process can be stopped and started to enable barrel cleaning to be carried out when there is spare time during the brewing process. We have actually carried out a time study showing where processes could be improved and sped up, and we are really impressed with the way we have upped productivity."

Richard, Head Brewer says: "It's been great to work with experts in process control and then to find a solution through making a bespoke piece of equipment. The new control panel is a work of art and is like nothing else on the market. It enables us to consistently keep brewing our house beers, with no variation."

Meet the Head Brewer: Richard Mayne is Hanlons' Head Brewer and heads up the team in creating their beers. He has been in the brewing industry for 15 years. Originally from Sussex, he spent 17 years in South Africa where he developed quite a taste for beer! Richard learnt all about brewing as the Assistant Brewer for O'Hanlons and is now responsible for all things brewing at Hanlons.

Hanlons beers

These strict processes have no doubt contributed to the ongoing popularity of the beers. Port Stout has just been awarded a Champion Beer of Britain Awards 2015 bronze medal at the Great British Beer Festival– the only West County beer to win an award. As well as the core range Hanlons also produce seasonal beers such as the aptly named 'Nice Tackle' to tie in with the rugby world cup. Jim talks us through some of Hanlons' beers:

"Yellowhammer is our award winning golden beer, which has with bittersweet flavours, from Admiral and late hopped with First Gold and Cascade. It is aromatic with pineapple and banana fruitiness with a delicate hoppy finish from dry hopping with First Gold.

"Port Stout is our multi award winning, dark, Chestnut beer whose bitter chocolate and roast malt taste from the Dry Stout base is softened by the addition of rich Ruby Port, combining the hoppy pepperiness from Phoenix, Styrian and East Kent Goldings with vinous alcoholic fruitiness.

"Copper Glow, launched in February 2014, is now our second most popular ale. A traditional red ale with a deep copper colour. This ale has a beautiful burnished copper colour with a light bitterness and a hint of toffee aroma. The malty fruity taste combine with the definite perfume of rich roast barley. Phoenix, Williamette and Cluster combine in this complex ale."

Not only do the ales taste great, but they have some major 'green' credentials! All the water is from their own bore holes and the spent grains go to the local farmer and the Hanlons' pigs. Delivery mileage is kept to a minimum and the brewery have also recently installed a tailor-made solar PV system to power all their machinery. Using the expertise of a local company, SunGift Solar, energy-usage patterns were analysed in depth and the solar system installed to perfectly match requirements. They're not stopping there – the next project is a waste water treatment plant.

Conclusion

The team at Hanlons work hard to ensure that their business can thrive in this competitive market. Not only are their brewing technologies leading the way for craft breweries, but they have created a vibrant bar and dining room, Hanlons Bar, as well as a Hanlons shop and an impressive social media set up! Jim says: "The last two years have been such an exciting time for us, at all levels of the business. We have learned so much and we are really pleased with the way we are thriving. Our beers continuing to win prestigious awards is the icing on the cake!"

For more information go to www.hanlonsbrewery.com or call 01392 851160

About the Authors

Suzie Creighton is Director of Castlegate Communications, based just outside Exeter in Devon. Suzie has over 15 years' experience in marketing and PR, and has worked across many industries, including technology, healthcare and food. She established the agency in 2008. Suzie loves Hanlons' beer and can often be found at the brewery!

Dan Taylor was brought up on the family farm in the village of Half Moon, Devon. Having always been interested in agriculture, he studied at Bicton College and then spent several years as Manager in the family business. Today Dan is in charge of Production and Operations at Hanlons.

Jim Bungard has spent the last 24 years in the West Country and is now nearly a fully fledged Devonian with a great love of beer. Prior to Hanlons he spent 20 years in the motor industry in a variety of senior management roles, including Regional Manager for Porsche. Jim is responsible for Sales and Marketing at Hanlons.

Brian Humphreys
Client Services Director, Food Safety Assist

New quality standard for the brewing industry

Langham Brewery, working alongside industry experts Food Safety Assist, were hand-picked by the Food Certification Scheme, Safe and Local Supplier Approval (SALSA) to trial the new brewery focussed standard prior to its launch earlier this year.

In recent years the independent brewing industry in the United Kingdom has been growing more than any other manufacturing sector, creating thousands of new jobs and contributing to a growth in economic prosperity[1]. Dozens of new brewing businesses are setting up every year and, according to a report by Cask Marque[2], in 2014 there were three new breweries opening in the UK every week.

In the early 2000s there were around 500 breweries operating in the UK, that figure has now risen to over 1400 according to the British Beer and Pub Association, meaning there are now more breweries per head in the UK than any other country. The sector shows no signs of slowing down either, with SIBA (the Society of Independent Brewers) stating in their 2015 report[3] that three out of four brewers are expecting their turnover to increase in 2015 and a staggering 83% of SIBA members expect to create one or more jobs in 2015, providing much needed employment in deprived and rural areas.

As within any industry, rapid growth brings benefits and difficulties. For brewing, the main difficulty that arose was how this sudden upswing in beer production could be monitored, to ensure that producers were making safe, quality beer and maintain consumer confidence in the sector. This is where SALSA came in. The new SALSA *plus* Beer audit has been written by Cask Marque experts, alongside SALSA, in response to this substantial growth, creating a standard that focuses on compliance for small, local and craft brewers and bottlers throughout the UK.

SALSA *plus* Beer Audit, launched on the 30th of June 2015, allows small breweries and bottlers across the UK to follow a dedicated standard that gives confidence to customers and retailers that their beer is safe, and more importantly, of excellent quality. The aim is two-fold: to raise quality and compliance standards within the sector and to provide strengthened confidence for both retailers and 'on trade' buyers.

SALSA is a food-safety standard written by experienced food safety experts to reflect both the legal requirements of producers and the enhanced expectations of 'best practice' of professional food buyers. Certification is only granted to suppliers who are able to demonstrate to an auditor that they are able to produce safe and legal food and are committed to continually meeting the requirements of the standard. They are audited annually to ensure continued compliance. Businesses often employ registered SALSA mentors to provide invaluable advice and guidance to members, particularly those working towards certification for the first time.

The standard itself is divided into different sections, each with an area of focus vital to the production of safe food. The first section outlines and deals with pre-requisite controls that the business must have in place, such as personal hygiene, staff training, contamination and environmental control. Then comes the development and implementation of HACCP, required by law for all food businesses in the UK, followed by other management and audit systems. The third section

deals with documentation and the importance of maintaining records for liability purposes, and finally site standards, ensuring the environment and fabric of the site are suitable.

SALSA has grown in gravitas over the past few years, the standard is in its fourth issue, and is now the leading certification for small and micro producers and suppliers across the UK, with over 900 approved members. The plus beer audit is an extension of the existing standard, aiming to help regulate the growing brewery industry.

SALSA *plus* Beer Audit follows the same initial structure as the original SALSA standard, with the addition of two extra sections focussing on both legal and quality requirements of producing safe beer to a consistently good calibre. The legal section is concerned with the registration with HMRC for tax purposes, the breweries assessment and control of the ABV content of their products and ensuring the company has suitable liability insurance cover.

The audits are undertaken by specially trained SALSA Auditors with extensive experience of the brewing industry. Breweries will benefit from the extensive sector-specific knowledge Auditors hold, who have the ability to offer advice and recommendations where appropriate.

SALSA *plus* Beer has already been successfully piloted by a number of breweries differing in size and systems to reflect the UK's wide range of craft breweries. SALSA member and award-winning Meantime Brewery, based in Greenwich, London was one of the businesses who took part in the pilot. "As category leader in the UK, we feel a very real responsibility to emphasise the importance of quality and consistency and urge other brewers to do so too. The time is right for the launch of SALSA plus Beer and we're delighted to play a key role in developing industry standards," says Ciaran Giblin, Innovation and Quality Systems Manager, Meantime Brewing Company.

The scheme was piloted at four sites initially, another of which was Langham Brewery, an award winning, steam-powered microbrewery in Sussex. Langham's interest in the SALSA standard began back in 2012 when they started looking for ways to ensure their business was organised as efficiently as possible, and to ensure that their emphasis on quality and high standards was capable of being recognised in the wider market.

It was only when they were approached to provide supporting evidence of quality procedures by Waitrose, an existing customer, that they realised what they had been missing- a SALSA certification. The brewery only had a small team, and time was precious. After conducting research into consultancy firms who could help them gain this accreditation, they decided that a SALSA mentor (myself, from Food Safety Assist), was the perfect choice to guide them through the process.

Since gaining the SALSA certification business at Langham has grown apace and Lesley Foulkes, Partner of the company says "SALSA has given us a greater confidence and pride in what we do. To our customers, it is proof that we do things properly and this sets us apart from other small breweries. Not only do we say that we are a quality brewer-we can prove it! SALSA is not an easy accreditation to achieve, but the struggle is definitely worth it."

Langham Brewery continue to work and develop their systems to ensure that they always remain at the top of their game and so they jumped at the chance to be part of the trial for the new brewing standard. I worked alongside Langham, as I had myself helped review the beer module prior to release, mentoring Lesley, James and the

team at Langham through the trial of the new module and the results were very positive.

Lesley Foulkes at Langham has said: "The plus beer audit reinforces core SALSA foundations – and benefits – by ensuring all aspects of the brewing process comply with best practice. It has made our business operations more efficient and effective, giving customers confidence in the quality and consistency of our product. Brian was the perfect choice to guide us through the process, both because of his technical experience and his role within the development of the new SALSA plus Beer audit."

Langham were eager to trial the standard because of their long-standing dedication to quality and the unique feedback they would be able to provide to ensure the standard was perfectly tailored for craft brewers.

Sally Ball, SALSA Scheme Manager says: "We've been aware for some time that this sector needed a dedicated Standard and the results of the pilot are so positive. We hope other small breweries will take full advantage of the strong support structure offered by SALSA to see them through SALSA plus Beer."

Support from retail and 'on-trade' buyers is already growing. Oliver O'Mara, Local and Regional Buyer at Waitrose, welcomes the initiative. "We're proud to be involved in the development of the new SALSA plus Beer audit. It demonstrates a brewery's commitment to quality and consistency in their brewing process and the beers they create. The UK has a rich and diverse brewing industry with a vibrant heritage. It is important that smaller breweries are supported in their quest for quality to help grow their businesses. Retailers and 'on trade' are now able to provide their thirsty customers with the confidence that they are choosing a great beer every time."

SALSA *plus* Beer has been successfully piloted by a number of breweries differing in size and systems

If the brewing sector continues to grow as predicted, safety, quality and consistency will become ever more important factors in securing business and differentiating oneself.

Education throughout the sector of the benefits of this type of standard is crucial and the role of registered SALSA mentors could be pivotal in implementing this knowledge. As producers become more aware and better understand these benefits, beer will be produced that is of a consistently high quality. Once the standard gains momentum businesses that are less focussed on quality and safety, who could tarnish the reputation of the whole sector, will be marginalised, leading to more sustainable growth. Relevant stakeholders, including, SIBA, SALSA, the pub trade and retailers all need to be part of this education campaign.

About the Author

Brian Humphreys has over 25 years technical experience within the food industry including spells at Sainsbury's. He has managed/delivered projects in a wide range of sectors from meat, dairy, organics, fresh produce, bakery, warehousing and transport. He has an excellent knowledge of all the various food safety standards. Lead Auditor trained and a SALSA mentor/auditor. IFST approved auditor and mentor.

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Endress+Hauser at Brau Beviale 2015

At this year's Brau Beviale Endress+Hauser shows again its ability to support beverage producers with a complete basket of high class services, support and solutions to improve processes.

Beside topics like energy monitoring and calibration services, our new products will be shown. Serving a show like Brau, which revolves around communication, we start with a preview of the Proline Promag H100 electromagnetic flow meter. Equipped with direct Profinet communication, in addition to the Ethernet IP, it serves both major protocols to use all the data the sensor supplies to improve the process around it. The digital integration opens the door to extensive use of multiple information. Maintenance is actively supported by the Heartbeat Technology™. To improve process value, the H100 supplies a temperature compensated conductivity signal. This can either be used for phase shift, or to detect false liquid, like cleaning agents. In flow applications with changing temperatures, the temperature compensation sharpens the volumetric reading of the flow signal. Compact build and with a housing that stands IP69K, this is a good supporter for process optimisation. Also the smaller 'brother' – the Dosimag – sees some new features; the sensor is newly available in DN 25 for packaging of larger containers. The batching function allows very fast and direct communication from sensor to the valve. The integration in plant or machine controller has been made much simpler. Also stand-alone single valve options are possible. In addition the sensor can be used in very compact mixing and blending applications.

Right on the opposite side of sensor complexity, we present the Liquipoint FTW 23, a very simple conductive limit switch. The sensor completes the portfolio of limit switches like Liquipoint FTW 33, the all-rounder for non-ingressive applications with special requirements, but the Liquiphant family will also see a new member with the FTL 33. The FTW 23 works with all liquid and conductive media and does not require any adjustment to the conditions. The sensor function can be tested with a magnet and the operation status is shown with an LED. This sensor is also available with IP 69K protection.

For 10 years the best ingression protection has been supplied by the Memosens technology that Endress+Hauser invented for the water tight inductive integration of analytical sensors. The newest member of this family is the conductivity sensor Memosens CLS 82D. This is a very compact 4-pole conductivity sensor that has the same size and integration connections as the pH and Oxygen sensors have. A small footprint allows easier integration in smaller pipes and vessels, with easy to clean surfaces. The compensation is done with an integrated Pt 1000 temperature sensor. CLS 82D supports a broad measuring range and comes with all relevant hygienic certificates. The sister in connection technology, the Memosens COS 81D is the new coming optical oxygen sensor. As addition to the amperometric COS 22D this sensor supplies an optical measurement of the dissolved oxygen, so that the ideal solution can always be consulted to the customer.

Hopefully this short spotlight on some of the topics Endress+Hauser will show at this year's Brau Bevial will raise your interest to visit us in Hall 6-407.

Endress+Hauser
People for Process Automation
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BrauBeviale2015

Raw Materials | Technologies | Logistics | Marketing

Inspiring, constructive, solution-orientated

BrauBeviale is the world's most important capital goods exhibition for the beverage industry in 2015. Around 1,100 exhibitors (which in 2014 included 45% international) are presenting a comprehensive spectrum of high-quality beverage raw materials, innovative technologies, efficient logistics and sparkling marketing ideas in the Nuremberg Exhibition Centre from 10–12 November. The visitors (40% international at last years BrauBeviale) come from technical and commercial management in the European beverage industry.

37,200 trade visitors from Europe and the rest of the world used the creative atmosphere at BrauBeviale 2014 to develop solutions. 1,128 exhibitors, in nine exhibition halls presented products, solutions and trends for the production of beer, water, non-alcoholic drinks, spirits, wine, sparkling wine and liquid dairy products.

Trend theme this year: The Culture of Craft Brewing meets Premium Spirits

BrauBeviale is a compact exhibition: three days and nine halls give you an efficient and comprehensive overview of the current market. Here you find out everything about high-quality beverage raw materials and essences, innovative technologies and innovative ideas for marketing and modern sales concepts within the whole process chain. The spectrum of products and services is completed with interesting logistic solutions and innovations in marking equipment and beverage packaging.

The exhibition's popular mix of professional presentation and personal contact in a friendly atmosphere is convincing as the beverage industry's big family reunion. See you at BrauBeviale – welcome home!

Date 10-12 November 2015
Location Nuremberg, Germany
Website www.braubeviale.de/en/

FREE-TO-ATTEND

Webinar

Date: 2nd December 2015
Time: 10.00 EDT (New York),
15:00 BST (London) and
16:00 CEST (Vienna)
Duration: 60 minutes

Colour – Purely a matter of taste: Techniques for efficient colour measurement

In *New Food's* upcoming webinar the analytical importance of colour analysis within the food industry, as well as examples of systems that can be used for colour measurement will be explained by three industry experts; **Christian Jansen**, European Sales Manager, Hunter Associates Laboratory, Inc., **Thibaut Dedreuil-Monet**, Technical Specialist, Reading Scientific Services Ltd., and **Etienne Arman**, Analytical Specialist, Jacobs Douwe Egberts (JDE) GB R&D Ltd.

Christian studied business administration and entrepreneurial finance at the TUM Business School in Munich. In his role at HunterLab he is responsible for sales channel development and the key customer contact (primarily for customers in the food and bio pharma industry). He is also a member of various international organisations (such as the DFWG) which focus on colour communication and standardisation.

Thibaut has a degree in Analytical Chemistry from Paul Sabatier University, Toulouse, France. He initially gained analytical experience when working at Sanofi and Pfizer, specialising in HPLC, GC and spectroscopic methods. His analytical expertise within RSSL includes colour analysis of raw materials and finished products, HPLC and HPLC-MS methods development and validation.

Etienne is a food scientist at Douwe Egberts with four years' experience in the coffee Analytical Science department, which involves developing and implementing a wide range of physical and chemical measurement techniques.

Whether a food product is declared tasty depends on its ingredients, flavor and also the appearance of the final product. In many cases the first sense engaged when someone goes for a food product is vision. Especially with packaging the only way to judge if it's a good product or not is optics. To measure colour hues of food products in a variety of conditions, complex technical solutions are required. Whether raw materials or solids and liquids, only special spectrophotometers can give precise data to help formulate colour and calculate values or differences. Length of a food process, ingredients, flavor and many more factors influence the appearance of a food product; with detailed analysis manufacturers can meet the ideal optical impression which is attractive for customers to buy the product.

Christian Jansen
Hunter Associates Laboratory, Inc.

Thibaut Dedreuil-Monet
Reading Scientific Services Ltd.

Etienne Arman
Jacobs Douwe Egberts (JDE) GB R&D Ltd.

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Geoff Talbot
The Fat Consultant

Fat functionality in emulsified foods

An emulsion is a fine dispersion of liquid droplets in another liquid continuous phase in which the droplets are immiscible or insoluble. In food terms, the two phases are generally oils and water. Food emulsions tend to take one of two forms – either oil in water (O/W), e.g. cream and mayonnaise, or water in oil (W/O), e.g. butter and spreads – although more complex duplex emulsions such as water in oil in water (W/O/W) and its opposite oil in water in oil (O/W/O) are also possible. In simplistic terms, water is water but oils can differ in their properties and functionality so what is the best oil to use for a specific food emulsion? In this article, the basic properties of fats that play a role in this choice will be described and how these are important in food emulsions will be discussed.

Functional characteristics of oils and fats

Oils and fats are triglycerides or triacylglycerols and are esters of glycerol with three fatty acid groups. Largely, it is the types of fatty acid and their positioning on the glycerol backbone that define the important functionalities of fats. In terms of fat functionality in emulsified food, three parameters are important:

- physical characteristics, particularly crystallisation and melting
- nutritional characteristics
- storage stability, particularly stability against oxidation and hydrolysis

Physical characteristics

The fatty acids in triglycerides differ in three main ways – their chain length (number of carbon atoms), the number of unsaturated double bonds in the carbon chain, and whether these double bonds are in the *cis* or *trans* configuration. Increasing chain length increases the melting point. Increasing the degree of unsaturation decreases the melting point. Changing *cis* double bonds into the corresponding *trans* double bond increases the melting point. These general effects in the fatty acids also carry through to the triglyceride such that a fat rich in longer chain saturates is solid at room temperature while one rich in *cis*-unsaturates is generally liquid at room temperature. One in which the *cis* double bonds have been converted to *trans* double bonds by partial hydrogenation is higher melting than the starting oil.

Different products will require different melting profiles. For example, fats used in fridge-spreadable margarines will need softer, lower-melting, more unsaturated oils than fats used in bakery margarines where a degree of solid fat is needed at the mixing temperature (typically, 20-25°C) to get the right texture in the end product. Most fats will need to melt below mouth temperature but it is possible, even desirable, for fats used in spray-dried emulsions such as soup creamers to have higher melting points.

Nutritional characteristics

Although all fats have approximately the same energy content, different fatty acids have different effects on blood cholesterol levels. *Trans* fatty acids lower the 'good' high-density lipoprotein (HDL) cholesterol and raise the 'bad' low-density lipoprotein (LDL) cholesterol[1]. This is the main reason why they have largely been removed from today's foods. Saturated fatty acids raise both types but whereas once they too were demonised, recent research[2] indicates that they are a more acceptable part of our diet because the increase in HDL cholesterol counterbalances

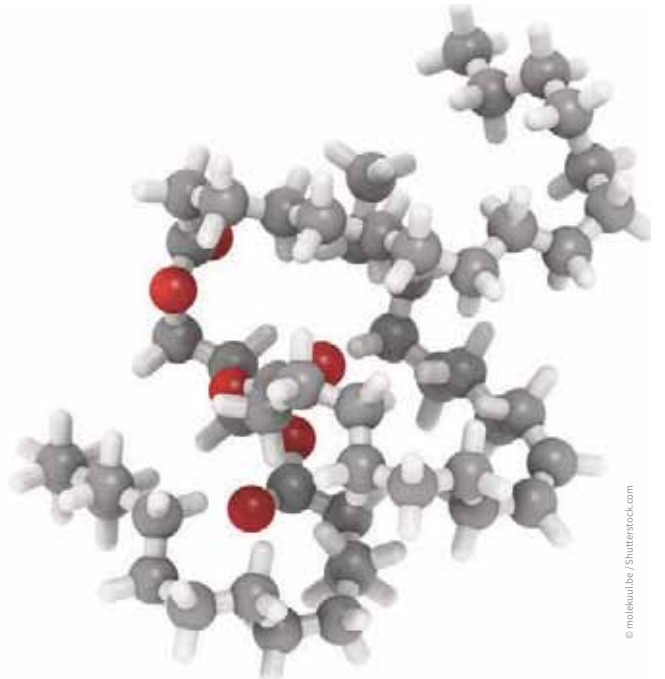
the increase in LDL cholesterol. *Cis*-unsaturated fatty acids lower LDL cholesterol and raise HDL cholesterol so they are good on both counts, but, because they are also low melting and generally liquid they are not able to form the whole base of foods that need structure. There is often, therefore, a compromise to be made between nutritional requirements and physical functionality.

Storage stability

There are two main reactions that cause rancidity or the taste/odour degradation of fats. These are oxidation and hydrolysis, one involving oxygen as the main cause of degradation, the other involving water. Oxidative degradation is a problem with all fats, irrespective of whether they are in an emulsion or not. If they are in contact with air (even within packaging) they will, in time, begin to oxidise. There is generally an induction period during which very little oxidation occurs but then, once oxidation begins, it goes very quickly. Oxidation involves the formation of free radicals; during the initiation stage of oxidation a hydrogen free radical is removed from one of the fatty acid chains. Hydrogen atoms on the methylene group next to a carbon-carbon double bond are most susceptible to this.

This means that cis-monounsaturated fatty acids are more likely (10 times more likely) to oxidise than saturated fatty acids, and that cis-polyunsaturated fatty acids are 100-150 times more likely to oxidise because they have one or two methylene groups between two carbon-carbon double bonds. Degree of unsaturation therefore plays a big part in defining the oils to be used purely to try and minimise oxidative breakdown. One of the reasons there is an induction period during which no oxidation occurs is because any antioxidants present (and there are usually some tocopherols naturally present in the oil) preferentially react with the free radicals that are formed before they break down further. Indeed, it is the breakdown of products in this first stage of oxidation that cause the off-flavours. Firstly hydroperoxides are formed, which then break down further into aldehydes and ketones. It is these that give the rancidity to oxidised fats. Highly unsaturated oils such as sunflower, soybean, rapeseed, and particularly fish oils, are especially prone to oxidation unless protected in some way.

Hydrolysis is a different reaction. Hydrolysis occurs when both oil and water are present together, as they are in food emulsions, but the reaction generally needs a lipase enzyme to also be present to catalyse the reaction. During the reaction water attacks the ester bond between a fatty acid group and the glycerol backbone of a triglyceride breaking off a molecule of fatty acid and leaving a diglyceride. Further hydrolysis can remove more molecules of fatty acid reducing the diglyceride to a monoglyceride and eventually to glycerol. The main problem with hydrolysis arises when a fat rich in lauric acid (C12) such as palm kernel or coconut oil is in the fat phase of the emulsion. When free lauric acid is produced in this way it quickly becomes apparent as a soapy off-taste. The threshold level of lauric acid needed to taste this soapiness can be as little as 0.07%[3]. It is quite common for non-dairy analogues of emulsified dairy products to use fat phases rich in such lauric fats so it is important to be aware of this problem in defining the oil for such products.



Saturated fat triglyceride molecule, typically found in animal (butter, cheese, beef) fat

Use of fats in emulsified products

Dairy analogues

Perhaps the most common form of processed food emulsion is one that matches one or other form of dairy product. This can be matching milk itself, cream (particularly in whipped toppings) and butter. Full-fat milk contains about 4% fat. Vegetable fat filled milks can be produced as alternatives. These are often used in small single-serve catering packs and are produced by homogenising skimmed milk and a vegetable oil. Early filled milks used coconut oil but, more recently, unsaturated vegetable oils have been used for nutritional reasons. These can also be produced in a powdered form by spray-drying. If the fat content is increased they can then be used in place of cream as powdered coffee whiteners. In this case an emulsion of vegetable fat, skimmed milk, sugars, emulsifiers and ingredients such as sodium caseinate is spray-dried to form a powder that can later be reconstituted. In such a process, high temperatures and an air flow are used so a high oxidative stability is required in the fat phase. After spray-drying, the

Cream is an example of an oil in water (O/W) food emulsion

powders are packed, often in large sacks that are then stacked and palletised. It is important, therefore, that the fat solidifies quickly to a reasonably high solid fat content to minimise the degree of aggregation that could then occur. The main fats used are palm kernel stearin or fully hydrogenated (i.e. *trans*-free) palm kernel oil for bulk whiteners, or coconut oil or palm oil and palm fractions for retail whiteners.

Dairy toppings are generally produced by whipping double cream. During this process the milk fat coalesces to form a continuous phase which can contain up to 50% incorporated air. The non-dairy alternatives are again made from vegetable fats, skimmed milk, sugar and emulsifiers. These can produce whipped toppings with a much greater stability than that achieved with double cream. Although the emulsifier plays a role in this the choice of fat is also important in giving a higher solid fat content and a greater crystalline area than can be achieved using milk fat. Coconut oil and palm kernel oil are often used. Campbell and Morley for example, describe a non-dairy topping based on 22.5% coconut oil, 22.5% palm kernel oil, 1% sodium caseinate and 3% buttermilk powder[4]. To move away from lauric-rich fats such as these with their potential attendant problems of hydrolytic soapy rancidity, the types of fats often used in cocoa butter equivalents have also been used in non-dairy toppings. The types of fats often used in this whole set of non-dairy analogues are summarised in Table 1.

Butter is a water in oil (W/O) food emulsion

Margarines and spreads

In many ways these are also non-dairy analogues of butter and, like butter, are water-in-oil emulsions. Margarine typically contains about 80% total fat; spreads have lower levels of fat, typically 60% or 40%. The fat phase is often a blend of a liquid unsaturated oil combined with a lower amount of a high-melting, solid fat, often called a hardstock. The hardstock structures the fat phase of the emulsion giving the correct combination of hardness and spreadability. The melting profile of the fat phase is chosen so that the level of solid fat between 5°C and 20°C is such that the margarine is spreadable without becoming too soft and liquid. The hardstock needs to crystallise quickly once the emulsion is produced so that it sets sufficiently quickly in a tub to allow rapid sealing and packing. It also needs to hold the structure of the crystallised emulsion to minimise any leakage of water from the emulsion. Historically, hardstocks were produced by partial hydrogenation of oils leading to *trans* fatty acid formation. Now, though, these have almost all been phased out and replaced by either non-hydrogenated hardstocks (such as palm stearin or more exotic tropical oils like pentadesma and allanblackia[5]) or fully hydrogenated hardstocks (such as an inter-esterified blend of fully hydrogenated palm and palm kernel oils[6]). The choice of unsaturated liquid oil in the spread is often dictated by nutritional and marketing needs, e.g. sunflower oil for a polyunsaturated spread, olive or rapeseed oil for a monounsaturated spread.

Table 1: Vegetable fats used in non-dairy analogues

Type of fat	% saturates	% *trans*	% solid fat at 20°C	Slip m.pt (°C)
Coconut oil	~92%	<1%	38	25
Fully hydrogenated coconut oil	>99%	<1%	58	33
Fully hydrogenated palm kernel oil	>99%	<1%	82	42
Palm kernel stearin	~91%	<1%	95	35
Blends of palm oil fractions	Varies	<1%	58 (typically)	39 (typically)

Summary

The use of emulsions is widespread in foods and so only a small selection of emulsified products could be considered here. These were chosen, though, to demonstrate how the factors considered above (physical characteristics, nutritional characteristics and storage stability) are important in defining the correct choice of oil for these products. They are, therefore, only examples of how important these functionalities are in oil choice.

About the Author

Geoff Talbot (also known as The Fat Consultant) has spent 47 years in the food industry, mainly with Unilever and Loders Croklaan before branching out into consultancy in 2003. He runs training courses, tailored to the specific needs of a client, on all aspects of oils and fats technology and use in foods. He also carries out literature reviews to clients' requirements on oils and fats technology and applications. He writes and lectures widely and has written and edited books on confectionery, on saturated fat reduction and on specialty fats and oils.

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Michael Govro
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What systems you need and what to expect from a traceability audit

Food manufacturers are required by regulatory agencies and most audit standards to establish procedures and maintain records to document the traceability of the products they produce, the ingredients they contain and the materials in which the products are packaged. While the specific requirements of these agencies and standards may vary slightly, they share the goal of facilitating the traceability of contaminated foods and ingredients in the event of a product recall. They also help build consumer confidence in product transparency through demonstrated label claims like organic, non-GMO and source of origin. Strong traceability programs also help prevent food fraud by regulating all aspects of an increasingly global supply chain.

This article discusses the current state of traceability and product recalls, the effects of regulation and voluntary industry standards on traceability, what to expect from a traceability audit and what systems ensure traceability.

Traceability today

Traceability is the ability to track any food through all stages of production, processing and distribution (including importation and at retail). It is a risk-management tool that also allows food business operators or authorities to withdraw or recall products which have been identified as unsafe. It is a cornerstone of the EU's food safety policy[1].

In the UK, the most common cause of food recalls in 2014 was microbiological contamination, at 24% (that includes *E. coli* at 10%, *Salmonella* at 4% and *Listeria* at 3%). Allergens accounted for 8% of all recalls[2]. In the EU from January through August 2015, 14% of food alerts were caused by allergens and 37% were due to pathogenic micro-organisms (which includes *Salmonella* at 19%, *Listeria* at 9% and *E. coli* at 4%)[3]. In the U.S. between 8 September 2012 and 7 September 2015, the most common cause of food recalls was undeclared allergens, which accounted for 43.6% of all recalls. The next most common reason for a recall was contamination with *Salmonella* at 28.7%, followed by contamination with *Listeria monocytogenes* at 17.3%[4].

Despite the progress the food industry is making in improving equipment and building design, process controls and management systems, product recalls are still a fact of life in the food business. There are several reasons for this. Food companies and distribution

systems are becoming increasingly larger, more consolidated and globalised and supply chains are increasingly complex. Although this in itself does not necessarily increase the risk of the occurrence of contaminated foods, it increases the number of points at which food could be contaminated and increases the number of people or other food manufacturers who may receive a contaminated product. For example, a contaminated basic raw ingredient such as a spice may be distributed all around the globe and be used by many other food manufacturers, triggering multiple finished product recalls.

Another factor that has increased recalls is the improved capabilities of health investigators and epidemiologists to properly attribute pathogens to a single source. National or regional information sharing systems (such as PulseNet) allow investigators to accurately match pulse field gel electrophoresis patterns and whole genome sequencing data. With this information, investigators can determine if a pathogen found to be the source of a foodborne illness in one area matches pathogens found in other illnesses in other areas. Other information systems for sharing and tracking foodborne illness include the Rapid Alert System for Food and Feed in the EU and the Food Alert System in the UK. By conducting food history interviews with the affected people, investigators can establish common food sources, eventually identifying a single source or ingredient responsible for the outbreak.

Regulation and voluntary standards aid traceability

Because of the cascading effect of illness and recalls, it is essential that manufacturers be able to trace their ingredients, products and packaging materials forward and backward. Regulatory and third-party audit standards (such as SQF, BRC, ISO 22000 and IFS) require food manufacturers to maintain traceability one step forward into distribution, and one step back toward the source of the ingredients. Manufacturers must establish systems for keeping records that will link ingredients and packaging to the products in which they are used and to the recipients of those products. **Figure 1** (page 68) illustrates how a raw material or ingredient is tracked from being received to being distributed. In order to achieve this, a manufacturer utilises systems to record specific information about raw materials, packaging materials and finished products.

What to expect in a traceability audit

In a typical audit, an auditor may use a technique called a vertical trace. The auditor will select a product with a unique lot number produced on a particular day. He or she will ask the manufacturer to produce all of the records related to the production of that lot of product, including production batch sheets, receiving records for the ingredients and packaging used in the lot, records of any rework or overrun added to the product or created by it, and inventory and distribution records of the lot. This allows the auditor to verify that the manufacturer documents the source, usage and distribution of materials and packaging according to its established procedures. Those records must link the unique identifiers of the raw materials to the identifier assigned to the finished product.

There are a variety of commercially available software systems designed to assist food manufacturers in documenting the identity of materials as they flow through the process of receiving, storage, production and distribution. They have the added benefit of assisting the manufacturer in the production of identity preserved products such as organic, non-GMO and kosher products. They may also assist in inventory control and inventory rotation. Some of these systems are very complex and the initial implementation can be a daunting task. These may not be suitable for smaller manufacturers.

Correct labelling is especially crucial when the product contains one or more allergens

Traceability exercises

In many audit standards, the manufacturer will be required to perform a traceability exercise during the audit. This is similar to a vertical trace performed by an auditor, but it places the burden of demonstrating an established traceability system on the manufacturer. The supplier will be

Figure 1: Raw material tracking from receipt to distribution

required to demonstrate that it can account for the whereabouts of all of a particular product, ingredient or packaging material through a mass balance exercise.

In an onsite traceability exercise, the auditor will select a finished product, and the supplier will be required to produce records of the disposition of the product and the source of the ingredients and packaging used to produce it.

The manufacturer should be able to account for all, or nearly all, of the lot in question. In addition to accounting for all of the finished product, a supplier should also be able to produce documentation of products or ingredients that don't end up in normal distribution channels. This could include raw materials or finished products removed for testing of raw materials, work in process or finished products, and promotional samples. The manufacturer should also be able to estimate or document normal amounts of loss it experiences through spillage or culling. The manufacturer's records should also indicate occurrences which result in extraordinary product loss, such as might occur when a product is processed to completion without a key ingredient. The purpose of the mass balance exercise is to demonstrate that the supplier can account for all of a lot of product, ingredient or packaging material, which is especially critical in the event that a lot has been determined to be contaminated or mislabelled.

The ability to trace forward is required when a manufacturer discovers that it has packaged a product using an incorrect label. This could happen when a worker uses the wrong ingredient when formulating a batch. It could also occur when a manufacturer changes an ingredient supplier and fails to notice that the ingredient does not contain the same sub-ingredients as the ingredient it replaced. In addition, incorrect labelling could occur if a worker selected the wrong label, container or packaging material for a product, or if the manufacturer is informed by its supplier that the ingredient it delivered was mislabelled.

Correct labelling is especially crucial when the product contains one or more allergens. The manufacturer must have allergen management systems in place to assure that allergens are excluded from products in which they should be absent. Therefore, the manufacturer must have robust systems to assure that the correct ingredients are used in its formulations, and that labels are correct and properly applied. In the event of mislabelling, the manufacturer must be able to trace the ingredients forward to issue a recall or public health alert that informs the public of specific affected products.

Allergen labelling requirements vary from country to country. The U.S. Food and Drug Agency has identified eight major allergens, Canada has identified 11 and the European Union has identified 14 foods and chemicals that fall under its allergen labelling requirements. Each country has specific requirements for labelling allergens. It is incumbent on the food manufacturer to comply with the labelling requirements in the country where the product is to be sold.

The manufacturer must be able to identify every recipient or the location of any mislabelled product in its own facility. Receiving records

such as bills of lading with lot codes or another unique identifier will establish the identity of products received. Raw material warehouse storage records with the same unique identifier will establish the location of the product in the warehouse. Warehouse 'pick' records will document the removal from the warehouse and delivery to the batching and/or production areas. Batch records, if properly created, will document the use of ingredients in each lot of finished product. Each of these records establishes a traceable link to the previous production step. The manufacturer can create a stronger record of the packaging used by saving a physical sample of the label or by taking a picture of the label or package used.

Bulk ingredients such as flour and oil also present a unique traceability challenge for food manufacturers. In large processing facilities, these ingredients are often received into storage silos or tanks without a clear designation of (or break between) lots. Using gravity, they are filled from the top and emptied from the bottom. These storage facilities may be emptied and cleaned infrequently, making it impossible to prove if or when a contaminant had been used and when it was no longer present in the tank or silo.

Manufacturers who use bulk ingredients without establishing verifiable breaks between lots will have larger amounts of product at risk of being recalled and will have more difficulty in tracing a product or ingredient. In the event of a recall, it is likely that the agency with regulatory authority over the manufacturer will insist that all products produced from the time the contaminated ingredient was initially used until a break occurred be recalled.

Traceability documentation

Audit standards require manufacturers to conduct tests of their traceability and recall systems at a least once per year. Audit standards specify an acceptable time allowed to conduct the exercise, usually between two and four hours. A manufacturer's traceability program should document the acceptable range for the accountability of product used in the exercise. The documentation for a traceability test should include the following:

- Ingredients used including quantities and unique identifier
- Packaging used including quantities and unique identifier
- Finished product lot identification and quantity produced
- Quantities of waste produced
- Location and quantities of product within the manufacturer's control and quantities shipped to individual recipients
- Start and finish time of the exercise

In addition to supply chain management, traceability is also important in monitoring and calibrating production and laboratory equipment to ensure food safety and regulatory compliance. To make sure the equipment performs accurately, and that the test methods used are valid, they must be calibrated to national or international standards, such as NIST, ISO 17025 or AOAC.

In conclusion, not only is traceability required by regulatory agencies and third-party audit standards, but it is a key component of risk management and the control of food safety and quality. Having a robust, documented system to ensure traceability assists companies in meeting regulatory or certification standards for food safety and helps to quickly identify and recall affected products in the event of contamination.

About the Author

Michael Govro is a food safety, quality and public health professional with over 35 years of experience in private industry and regulatory agencies. His experience includes state and federal inspections, third-party food safety, food quality and food defence auditing, emergency preparedness, epidemiological investigations and program management. He previously served as the Assistant Administrator of the Food Safety Division of the Oregon Department of Agriculture.

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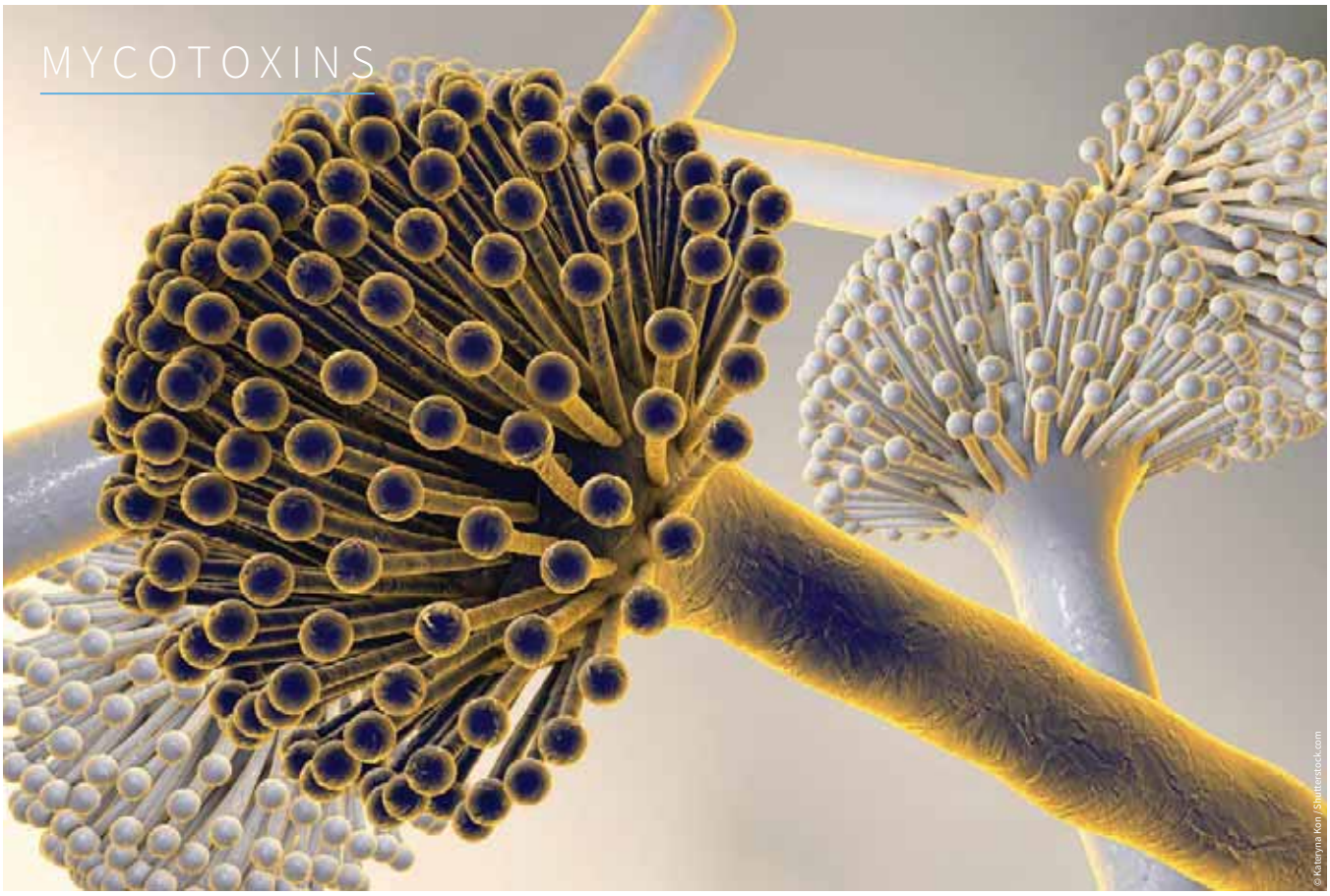

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Recent developments in mycotoxin analysis

Mycotoxins are natural contaminants of several agricultural products and derivatives produced as secondary metabolites by several filamentous fungal species. Their presence in food and feed can cause serious risks to human and animal health due to adverse toxic effects; therefore maximum permitted levels have been fixed for the major occurring mycotoxins in several commodities at European and international level. The mycotoxins of major concern are: the aflatoxins (aflatoxin B1 is the most potent naturally occurring carcinogen known), the trichothecenes (a structurally related family of cytotoxic compounds) including deoxynivalenol (DON), T-2 and HT-2 toxins, the zearalenone (a potent estrogenic mycotoxin), the fumonisins (predominantly fumonisin B1, a possible carcinogen to humans) and the ochratoxins (predominantly ochratoxin A, a potent nephrotoxin). Sensitive, reliable and accurate methods of analysis are hence required to gather adequate information on the levels of exposure to these mycotoxins and to fulfill regulatory requirements.

Analytical methods for mycotoxins in feed and food commodities generally include three steps: i) extraction of the toxin from the matrix with a suitable solvent, ii) purification of extract to eliminate co-extracted interferences, and iii) detection/determination of the toxin by an appropriate analytical instrument/technology. Due to the different chemical structures of mycotoxins and the wide variety of mycotoxin-commodity combinations, a wide number of different analytical methods have been developed and validated[1-5].

Purification of extracts is essential for the analysis of mycotoxins at regulatory levels, and it usually involves the use of solid phase extraction (SPE), multifunctional (e.g. MycoSep®) or immunoaffinity columns (IACs), the last being the most commonly used in official methods due to the specificity of antibodies providing cleaner extracts with respect to other clean-up methods. Recently, SPE columns based on molecularly imprinted polymers (MIPs) or aptamers have been developed for selective extraction of mycotoxins[6-8].

Chromatographic methods are commonly used for the determination of mycotoxins, including gas-chromatography (GC), mainly for type-A trichothecenes, and liquid chromatography (HPLC, UHPLC) coupled with ultraviolet or diode array (UV/DAD), fluorescence (FL) or mass

spectrometry (MS) detectors. The method of choice depends on the matrix and the mycotoxin to be analysed. In addition, several commercial immunometric assays, such as enzyme-linked immunosorbent assay (ELISA), are frequently used for screening purposes. Recently, a variety of emerging methods have been proposed for the analysis of mycotoxins in several food matrices, mainly cereals, based on immunochromatography (i.e. lateral flow devices, dipsticks), fluorescence polarisation (FP), infrared spectroscopy (FT-NIR), electronic nose (e-nose) and optical/electrochemical biosensors[1-5,9-16].

A brief overview of recent developments on the determination of mycotoxins by liquid chromatography-mass spectrometry and rapid methods at the Institute of Sciences of Food Production, National Research Council of Italy (ISPA-CNR) is presented.

Analytical methods for mycotoxin detection generally include three steps; extraction of the toxin, purification of the extract, and detection/determination of the toxin

Liquid chromatography – mass spectrometry

Liquid chromatography-tandem mass spectrometry (LC-MS/MS) is spreading rapidly as a powerful technique for simultaneous screening, identification, characterisation and quantitative determination of a large number of mycotoxins, including their modified forms[17]. Just as an example, LC-MS/MS 'dilute and shoot' methods have recently been developed for the determination of 191 mycotoxins and 295 bacterial and fungal metabolites including all regulated mycotoxins in food commodities[18,19]. Accuracy, precision, and sensitivity of LC-MS methods may vary depending on the mycotoxin, matrix and instrumental sensitivity/selectivity. Quantitative measurement of mycotoxins by LC-MS is often unsatisfactory due to matrix effects and ion suppression.

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Mycotoxins are natural contaminants of several agricultural products; the presence of mycotoxins in food and feed can cause serious risks to human and animal health

Results of a proficiency test involving 41 participants for the LC-MS/MS determination of up to 11 mycotoxins in maize, showed that laboratories that carried out sample extract clean-up gave acceptable results for the majority of mycotoxins. Purification of extracts by MycoSep® or IACs is usually needed prior to MS detection[3,20,21].

LC-MS/MS and liquid chromatography high-resolution mass spectrometry (LC-HRMS) based on Orbitrap technology have been applied to investigate the presence of T-2 and HT-2 glucoside derivatives in naturally contaminated cereals and *Fusarium langsethiae* fungal cultures. Molecular structure details obtained by measuring exact masses of main characteristic fragments with high mass accuracy led to the identification of a monoglucoside derivative of T-2 toxin and two monoglucoside derivatives of HT-2 toxin[22]. In addition, two mono-glucosyl derivatives of neosolaniol (NEO) and one mono-glucoside derivative of diacetoxyscirpenol (DAS), two type-A trichothecenes, were identified and characterised by LC-MS/MS. These compounds were detected either in fungal cultures or in cereal samples naturally contaminated with the parent toxins[23].

Furthermore, a preliminary screening of naturally contaminated cereal samples (i.e. wheat, oats and barley) showed a widespread occurrence of type-A trichothecene glucosides in cereal grains naturally contaminated with the relevant unconjugated toxins. A chemically synthesised T-2 toxin-β-glucoside and a T-2 toxin-α-glucoside obtained by *Blastobotrys muscicola* cultures were characterised and compared with T-2 toxin-glucoside found in naturally contaminated oats and wheat samples. The study revealed the presence of the α-linked form of T-2 toxin-glucoside in naturally contaminated plants, showing MS behaviour identical to the yeast biotransformation product[24]. The availability of a reference standard made possible the collection of a first survey data aimed at obtaining more comprehensive information on the co-occurrence and contamination levels of T-2 and HT-2 toxins and their glucosylated derivatives in naturally contaminated barley samples[25].

Rapid methods

Immunological assays, such as ELISA, have become very popular in

mycotoxin screening since many years ago. Screening methods are intended to be rapid and easy-to-use and do not require skilled operators and expensive instrumentations. In the last years, several rapid immunoassay-based tests have been developed for the analysis of mycotoxins in food/feed commodities[9-16].

Fluorescence polarisation immunoassay (FPIA) is a homogenous assay based on the competition between the antigen and a fluorescently labeled antigen (tracer) for a specific antibody. The binding of the tracer to the antibody affects the rate of rotation of the tracer and increases the fluorescence polarisation value. The amount of bound tracer is inversely proportional to the amount of free analyte in the sample, as a result the polarisation value is inversely related to the analyte concentration. Recently, reliable FPIAs have been developed for the rapid determination of T-2 and HT-2 toxins in wheat, ochratoxin A (OTA) in wheat and deoxynivalenol (DON) in wheat bran and whole-wheat flour[26-28]. A preliminary treatment with activated charcoal was used to eliminate the strong matrix effect due to highly coloured interfering compounds present in raw wheat bran extracts. The overall time of analysis ranged from 10 to 15 minutes. The immunoassays were validated for comparison with widely used HPLC-IAC methods by analysing naturally contaminated samples showing accuracy and precision values similar to those obtained with HPLC methods.

Lateral flow devices (LFDs), also called immunochromatographic strip tests, are rapid immunoassays based on the interaction between specific antibodies and antibody-coated dyed receptors, e.g., colloidal gold, that react with the analyte to form an analyte-receptor complex. Generally, LFDs have been developed for the determination of a single mycotoxin. A multiplex dipstick immunoassay for the simultaneous

NIR and MIR have been proven to be promising tools to detect fungal contamination and estimate mycotoxin contamination in cereals

determination of zearalenone (ZEA), T-2 and HT-2 toxins, deoxynivalenol (DON) and fumonisins (sum of FB1 and FB2) in wheat, oats and maize has been recently developed[29]. Analysis of naturally contaminated samples and the comparison with an LC-MS confirmatory method showed how the developed multiplex immunoassay can provide a reliable tool for rapid and simultaneous assessment of the presence/absence of the six major *Fusarium* toxins at levels close to the EU regulatory levels within 30 min. A collaborative study involving 12 laboratories for evaluating the performances of the multiplex dipstick immunoassay showed the test to be able to differentiate blank samples from samples contaminated at

target mycotoxin levels with a false positive rate lower than 10% for ZEA, DON and fumonisins. Unsatisfactory results were obtained for the sum of T-2 and HT-2 toxins[30]. The assay is rapid, inexpensive, easy-to-use and fit for purpose of rapid screening of mycotoxins in cereals.

In recent years, near-infrared (NIR) and mid-infrared (MIR) spectroscopy associated to principal component analysis (PCA) have been proven to be promising tools to detect fungal contamination and to estimate mycotoxin contamination in cereals[31]. Among mycotoxins, the most investigated one was DON, mainly in *Fusarium*-damaged wheat kernels. The analysis is non-destructive, rapid and requires minimal or no sample preparation. The feasibility of using Fourier Transform-NIR (FT-NIR) spectroscopy for the qualitative and quantitative prediction of DON at levels up to about 2,000µg/kg in unprocessed ground durum and common wheat was reported for the first time by De Girolamo *et al*[32]. Recently, Partial Least-Squares (PLS) regression analysis was used by the same research group to determine DON in 464 naturally contaminated durum wheat samples in the range of <50–16,000µg/kg DON. Results indicated a very poor prediction ability of the quantitative PLS model. On the contrary, the classification model based on Linear Discriminant Analysis (LDA) successfully distinguished wheat samples based on their DON content with high overall classification rates and low misclassification. The classification model fulfilled the requirement of the European official guidelines for screening methods (*Commission Regulation No. 519/2014*) when a cut-off level of 1,400µg/kg of DON was used[33].

Fungal volatile metabolites can be used as an indicator of mycotoxins occurrence in cereals. Electronic nose technology has been shown to be able to determine the mycological quality of cereals as well as to predict the content of some mycotoxins. A rapid, easy to-perform and non-invasive method using an electronic nose based on metal oxide semiconductor (MOS) sensors has been recently developed to distinguish ground durum wheat samples in three classes based on the content of DON: class A ([DON] < 1,000µg/kg), class B (1,000 ≤ [DON] ≤ 2,500µg/kg) and class C ([DON] > 2,500µg/kg)[34]. Both the classification models (based on FT-NIR and e-nose) could be used as useful tools for high throughput screening of a large number of wheat samples for DON contamination. This would mean a reduction in the number of analysis to be carried out by HPLC of samples contaminated at levels closer or higher than the maximum permitted limit set by the EU for unprocessed durum wheat (i.e. 1,750µg/kg).

Future prospects

LC-MS/MS is presently the technique most widely used for the simultaneous determination of mycotoxins, although it generally suffers from matrix effects. Matrix-assisted calibration, isotopically labelled internal standards and improved sample preparation are essential for an accurate multi-mycotoxins determination. At present, no LC-MS methods are recognised as standard or official methods for mycotoxin detection, although LC-MS methods validated by interlaboratory studies for the simultaneous determination of mycotoxins are highly required. Proficiency tests for multi-mycotoxin LC-MS methods are a useful tool to provide insights on the used methodologies and related performances and could provide useful information for the optimisation and selection of methods to be used in interlaboratory validation studies. An emerging issue in the area of mycotoxins is represented by modified mycotoxins. LC-MS/MS has been shown to be a reliable

technique for their detection and characterisation, as well as for the identification of new secondary metabolites of toxigenic fungi. Standards of identified modified mycotoxins are necessary for their quantification in naturally contaminated samples. Reference materials for quality control of mycotoxin methodologies are commercially available for the major mycotoxins, although they are quite limited. Certified Reference Materials of complex matrices, as well as multi-mycotoxin standards and multi-mycotoxin reference materials are highly necessary to assess quality of methods, especially when LC-MS methods are used.

Rapid methods for mycotoxin analysis are increasing in the last years. The advantages of these methods, with respect to conventional methods, are the easiness of operations and the rapidity of analysis together with their low cost. However, the analytical performances of these rapid methods should meet defined criteria and performance parameters. Harmonised validation guidelines for rapid methods are not always available and do certainly have a highly priority. Recently, the European Commission has established criteria with which screening methods for mycotoxins have to comply with when they are used for regulatory purposes (*Commission Regulation No. 519/2014*). Moreover, reliable multiplex screening assays for simultaneous determination of mycotoxins are highly required.

About the Author

Dr. Michelangelo Pascale graduated in Chemistry at the University of Bari, Italy. He is Senior Researcher at the Institute of Sciences of Food Production (ISPA), National Research Council of Italy (CNR), and since 2006 is responsible of the CNR project 'Innovative methods for food characterisation and control of mycotoxins, toxigenic fungi and allergens'. Michelangelo has scientific responsibility for several national/international projects of ISPA relevant to food safety. His specific expertise is in toxigenicity of fungi, occurrence of mycotoxins in food and feed, effect of fungicides on cereal diseases and mycotoxin accumulation, fate of mycotoxins during food processing, development and validation of analytical methods for mycotoxins in food, feed and biological fluids, and organisation of collaborative studies for method validation. Nowadays he is engaged in the development of rapid analytical methods based on UHPLC, immunoassays and biosensors for the detection of mycotoxins in agro-food products. He is also (Co)-author of over 100 papers in peer reviewed journals.

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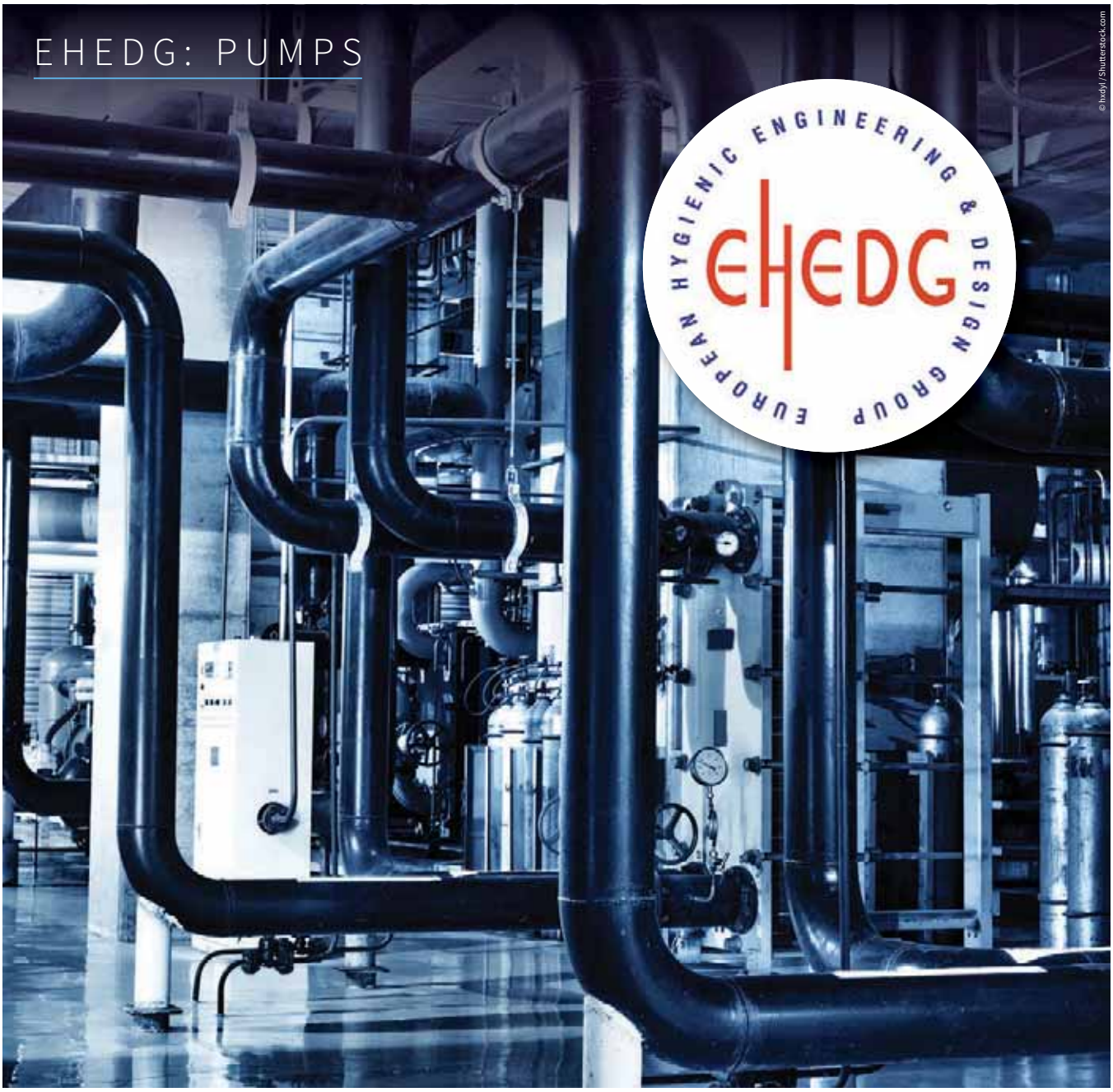


Ulli Zimmer
Head of Sales, Business Line, Hygienic Pump Technology, GEA Tuchenhagen GmbH

Hygienic design of pumps

Critical importance is placed on hygiene in the production of food and beverages. Strict hygiene regulations apply as they are set forth in legislation. In addition to assuring careful transport of food products, components used in the food-processing and cosmetics industries must satisfy the following stipulations:

- Fast cleaning and no contamination
- Minimum of downtime
- Great energy efficiency
- Low shear

They must be designed so as to be efficient and energy-saving, and to allow ease of preventive and corrective maintenance. They must also enable easy and thorough cleaning. They must not allow the danger of contamination by microorganisms, and they must not permit changes such as shear to take place in transported product media.

During industrialisation of food production in the mid-twentieth century, the demand for pumps rose accordingly for this area of application. To enable fast and reliable cleaning of pump equipment, importance was focussed to the selection of material and on the surface

finish of these materials. Above all, however, emphasis was placed on disassembling process equipment quickly and cleaning it thoroughly by hand. By using only a few threaded connections – for example, with T-handles or with a clamping band – the pump casing could be opened, rinsed out, and disinfected. This type of cleaning was typical in the food and beverage industry up into the 1970s. New methods, however, were called for by more demanding hygienic stipulations placed on production equipment, and by the expectation of consumers for elimination of preservatives and other methods of preserving shelf life. Especially to extend the use-by date of foods, it was necessary to minimise the possibilities of contamination by microorganisms. One of the methods to achieve this is cleaning in place (CIP). This involves cleaning in several stages of the production plant in cycle or in continuous-flow operational mode, without having to disassemble major parts of the production equipment. For some types of food, it is necessary to use aseptically designed and operated facilities. With founding in 1989 of the EHEDG, the European Hygiene Engineering and Design Group, industry has set as its goal the promotion of this development, the establishment of new standards, and the assurance of their implementation.

Today there are two typical methods of CIP cleaning: Single Use CIP and Recovery CIP. With Single Use CIP, the cleaning fluid is used only once: which means higher consumption costs, greater waste-water environmental impact, and additional costs associated with waste water. In Recovery CIP, the cleaning media are collected in tanks after cleaning, post-treated, and used again. The benefits are lower water consumption, less consumption of cleaning media, and above all greater environmental compatibility. Disadvantages – in addition to greater technical expense and space requirements owing to additional tanks – primarily include the danger of cross-contamination as a result of re-use of the cleaning agents.

Requirements for hygienic operations

To assure fast and gentle cleaning without microbial infection, production resources and components in the food and beverages industry – for example, hygienic pumps – are required to satisfy the following requirements:

- Uniform flow throughout all parts of the equipment casings
- Sealing grooves without dirt traps
- Easily exchangeable mechanical shaft seals
- Operating without vibration: i.e., no additional loads applied to bearings, connection fittings, valves, and the like
- Hygienically conducted wet connections
- Simple exterior cleaning (foam cleaning)
- Capability of complete emptying
- Quiet operation

From the very beginning of design work, a pump for hygienic uses must be developed on the basis of these requirements. There must be no dead spaces and no acute angles or corners in areas contacted by the media. The materials used are corrosion- and acid-resistant stainless steels. Flow routing must by all means be designed such that flow is uniform everywhere in the pump casing. In addition, pump design must allow ease of service, and it must be possible to exchange the mechanical shaft slide-ring seals quickly and simply. For use in aseptic areas, pumps must

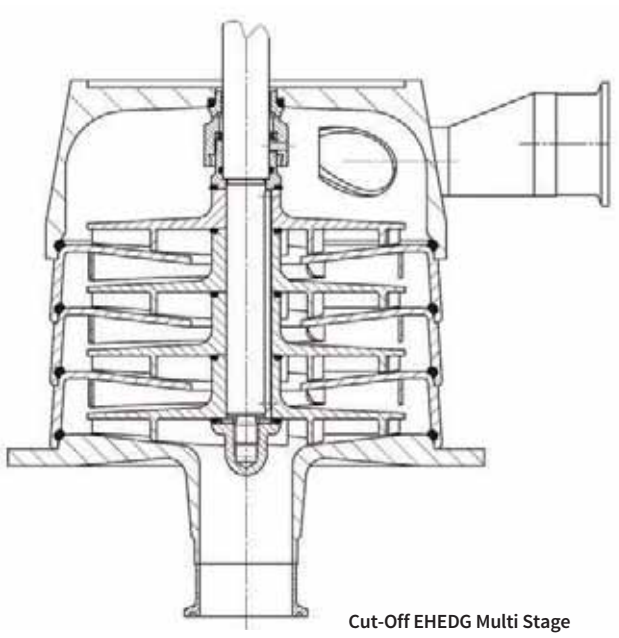
Centrifugal Multi-Stage EHEDG Pump

be able to undergo steam cleaning, at 125°C for up to 30 minutes, without damage to the seals. The following requirements accordingly apply to the engineering of such production equipment:

The design of all components that are joined to each other with seals must not allow gaps between the surface of the seals and the metal components. Such interstices could allow deposition of dirt and debris and, in turn, proliferation of microorganisms. Multistage pumps must allow draining of residual media. These stipulations can be met, for example, by vertical installation of a hygienic pump within the required design. In addition to deep-drawn material for the reversing stage, forged materials of the same quality are used for the impellers, the pressure stages, and the suction covers. The impellers and the fixed guide vanes of

Set of Hygienic pumps in a brewery

the reversing stage are open. Also for multistage pumps, sealing of the casing and the impellers is provided, for example, by O-rings in accordance with hygienic design criteria: with defined sealing pressure,


Cut-Off EHEDG Multi Stage

without a gap, and with metallic end stop. These features guarantee flawless cleaning capability and sterilisation with CIP/SIP processes – and, in turn, food safety for the user and operator of a plant with sterile production processes. The CIP return-flow pump – typically, a self-priming centrifugal pump – must likewise satisfy these requirements. The greatest risk of counter-contamination occurs here, from one product section into the next.

An additional, often neglected factor is the connections between the pumps and the piping. In earlier times, connection elements such as sanitary dairy fittings were used to enable fast disassembly. Designed to enable simple screwing and unscrewing, they had gaps in the seal areas that could not be CIP-cleaned. These gaps were then manually disinfected before the equipment was placed back into operation. From today's hygienic standpoints, however, these threaded connections no longer meet relevant requirements. There are now hygienic threaded connections in accordance with DIN 11853 that have no gaps in which bacteria can lodge. In addition, it is possible to seal these connections only if they have been properly joined together.

To prevent influencing – or even damaging – the media to be transported, the impeller must be designed such that it ensures uniform acceleration of the transported liquids from the intake to the outlet fittings. Computer simulation and the method of finite elements are

employed here to optimise the profile of the impeller and to assure maximum protection of the product.

In addition to hygienic design, present requirements involving sustainability and environmentally friendly plant equipment must of course likewise be fulfilled. For this reason, production itself is based on environmentally compatible engineering and processes. Manufacturers, moreover, shorten long delivery paths for out-of-house components and employ labor-friendly procedures, tools, and process aids. The pumps themselves must be optimally designed from the standpoint of energy efficiency – which is achieved not only by the use of energy-optimised motors, but also by optimally designed pump casings. For pump operation with frequency inverters, efficiency can be again optimised for the operating points being reached.

What are the benefits?

In addition to production reliability by design and manufacturing in accordance with EHEDG guidelines, the systematic observance of these standards offers further benefits:

Cross section of hygienic pump with cartridge pump seal

- Cost reduction owing to less energy consumption
- Additional savings resulting from less secondary energy required: e.g., reduced power for air conditioned production processes and areas
- Water consumption reduction
- Reduced amounts of cleaning chemicals because of shortened cleaning cycles

About the EHEDG

The European Hygienic Engineering & Design Group (EHEDG) is a consortium of equipment manufacturers, food industries, research institutes, and public health authorities. It was founded in 1989 with the aim of promoting hygiene during the processing and packaging of food products.

The principal goal of EHEDG is assurance of safe food practices by improving hygienic engineering and design in all aspects of food production.

EHEDG actively supports European legislation that requires the handling, preparation, processing, and packaging of food to take place on hygienic premises and with the use of hygienic equipment (EC Directive 2006/42/EC for Machinery, EN 1672-2 and EN ISO 14159 Hygiene Requirement).

About the Author

Ulli Zimmer began his professional career in 1982 as a development technician at Adam Opel in Rüsselsheim (Germany), where he was employed until 1989. He then moved to another sector, to a sensor manufacturer (flow and filling-level monitoring). Ulli Zimmer's career then led him into company management of GEMS Sensors. From there he entered the pump industry in 1999. From 1999 to 2005 Ulli was Regional Sales Director for diaphragm pumps at Rupp IDEX. From this position he moved within the same corporate group to his position as Regional Sales Manager for Central Europe, for the complete product range of IDEX pumps. At the same time he was responsible as Product Manager in the EMEA region for air-powered IDEX membrane pumps. Ulli Zimmer's move to GEA Tuchenhagen took place in 2010, where he has since been Head of Sales, Business Line, Hygienic Pump Technologies.

EVENTS

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Location: Chipping Campden, Gloucester, UK
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w: www.campdenbri.co.uk/food-microbiology-seminar.php

Food process validation and verification: effective use of microbiological data to ensure food safety and regulatory compliance
Date: 27 November
Location: Chipping Campden, Gloucester, UK
e: daphne.davis@campdenbri.co.uk
w: www.campdenbri.co.uk/food-process-seminar.php

DECEMBER 2015

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Date: 1 – 2 December
Location: San Antonio, Texas, USA
e: spress@nlsna.com
w: www.fqsna.com

Fi Europe & Ni Europe 2015
Date: 1 – 3 December
Location: Paris, France
e: swantje.voogdt@ubm.com
w: www.figlobal.com/fieurope/home

Plastic & Paper in Contact with Foodstuffs
Date: 1 – 4 December
Location: Barcelona, Spain
tel: Smithers Events +44 (0) 1372 80200
w: www.food-contact.com/plastics-paper

Policy on high fat, sugar & salt foods – next steps for Reformulation, marketing & regulation
Date: 10 December
Location: London, UK
e: morgan.rise@westminsterforum projects.co.uk
w: westminsterforumprojects.co.uk/forums/event.php?eid=1142&t=13213

JANUARY 2016

IFPAC 2016
Date: 24 – 27 January
Location: Arlington, VA, USA
e: Julie.kovach@ifpacnet.org
w: www.ifpacglobal.org

ProSweets 2016
Date: 31 January – 3 February
Location: Cologne, Germany
e: prosweets-cologne@koelnmesse.de
w: www.prosweets-cologne.com

FEBRUARY 2016

Fruit Logistica 2016
Date: 3 – 5 February
Location: Berlin, Germany
e: brifer@brifer.es
w: www.fruitlogistica.com

Europain 2016
Date: 5 – 9 February
Location: Paris, France
e: Murielle.guillou@gl-events.com
w: www.europain.com

GULFOOD 2016
Date: 21 – 25 February
Location: Dubai Trade Centre, Dubai, UAE
e: sofia.khan@dwtc.com
w: www.gulfood.com

APRIL 2016

Food & Drink Expo 2016
Date: 18 – 20 April
Location: NEC Birmingham, UK
e: emma.pellman@wrbm.com
w: www.foodanddrinkexpo.co.uk

Seafood Global 2016
Date: 26 – 28 April
Location: Brussels, Belgium
tel: + 1 207.842.5504
w: www.seafoodexpo.com/global

MAY 2016

IFFA
Date: 7 – 12 May
Location: Frankfurt, Germany
tel: +49 69 75 75 – 0
w: iffa.messefrankfurt.com/frankfurt/en/aussteller/willkommen.html

Vitafoods
Date: 10 – 12 May
Location: Geneva, Switzerland
e: maria.sidiropoulou@informa.com
w: www.vitafoods.eu.com

Food Safety Summit
Date: 10 – 12 May
Location: Rosemont, USA
e: coopera@bnpmedia.com
w: www.foodsafetysummit.com/

EPRW 2016
Date: 24 – 27 May
Location: Limassol, Cyprus
e: eprw2016@topkinisis.com
w: eprw2016.com

If you have an event you wish to publicise or are interested in setting up a media partnership, contact Martine Shirtcliff at: mshirtcliff@russellpublishing.com

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