

BAKINGEUROPE

June 2014

Campden BRI
Bakery Technology
Conference

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BAKINGEUROPE

EDITORIAL

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Clean and precise

Bread cutting: Self service solutions



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Welcome

to the June 2014 issue of Baking Europe!

Welcome to the June issue of Baking Europe, media partners of Europain in Paris last March, and of the Campden Bakery Technology Conference this month. The buoyant atmosphere at “The world’s largest bakery and pastry shop” was a good indication of how well the bakery sector has withstood the more generally subdued economic situation, while the technical presentations at the Campden Conference suggest how new developments (such as in dough stability, mixing and processing) promise a bright future for the industry. Meanwhile, Graham Duckworth of Campden BRI explores for us the

complex nature of dough stability and the interplay between gas content and elasticity.

He reviews batch mixers and their applications and ventures into the physics of work done on the dough. Shearing, sheeting and formulation adjustment fully justify his conclusion that dough is complex!

Elsewhere, Nina Veflen Olsen of Nofima explores a novel approach to product development. Design Thinking seeks to engage the consumer much more, and much earlier, in the process. Building on its four guiding principles, Nina considers designing bakery

products around human needs, behaviours and preferences, citing numerous examples of the approach in action and the new business opportunities it generates. Olivier Gibert, Alexandre Bouniol, Frédéric Bakry of CIRAD explore the exciting potential of discarded bananas for new intermediates and new bakery products.

This is but a small sample of what is on offer because, as you already know, there is a lot more for you to read inside...

Michael Edmund
Editor

An independent or better together bakery industry in Scotland: you decide

By Alan Clarke, Chief Executive, Scottish Bakers (pictured)

On the 18th of September this year there will be a referendum on Scottish independence, the result of which will shape Scotland's future either as part of the union, or as an independent Scotland. This has implications for all businesses in Scotland including bakers.

This is a without doubt a



colossal decision which will map Scotland's political and economic future. Scottish Bakers, is the trade body for the bakery industry in Scotland and at our recent conference in Glasgow on the 16th & 17th May we gave our members the opportunity to listen to both sides of the debate.

We had presentations from the former Secretary of State for Scotland Michael Moore MP and the current Cabinet Secretary for Rural Affairs Richard Lochhead. Mr Moore outlined why it's better for bakers in Scotland to remain part of the UK and Mr Lochhead argued why an independent Scotland would give more autonomy to the Scottish Parliament to manage its own affairs without having to rely on a Government based in London.

The debate was very interesting with strong views on both sides, but the reality is that for many bakers it is 'business as usual'. For me, this is exactly the way to approach September and I'm pleased to see that our fantastic industry in Scotland continues to work through the many business challenges that they face as a priority over the forthcoming

question posed to the Scottish electorate.

With this said, we have an abundance of astute prudent managers, directors and owners within the bakery sector and without a doubt they'll all be keeping a close watch on the political debate in order to draw up their own bespoke continuity plan. After all, these are uncharted waters for all industries when it comes to fiscal policy and currency affairs.

Within the context of the impending Independence Referendum, bakers in Scotland continue to face major challenges. From rising ingredients costs, the demise of the traditional High street, to new policy introductions including carrier bags levies and new food waste regulations. Despite these challenges, our industry's resilience is strong and there are many bakers now exploring new markets both at home and abroad to sell their products. Our product basket is getting heavier with a clear rise in NPD activities and a significant increase in the number of bakers reformulating existing recipes to increase nutritional value and



provide customers with healthier products.

As the trade body, Scottish Bakers is working hard to raise the profile of the bakery industry by building media attention around our events and awards. Over 20,000 customers took part in our recent 'Scottish Baker of the Year' competition which saw Ashers Bakery (Nairn) crowned with the winning rolling pin with the awards featuring on national TV.

We also continue to build strong strategic partnerships and provide a member services portfolio that adds value to our members and wider bakery industry. As bakers look to diversify into new markets Scottish Bakers are delighted to be part of a new unique Scotland Food & Drink export partnership, enabling us to work with other food and drink focused trade associations and Scottish Government departments to jointly fund business development resources in key international markets.

These resources will work in international markets developing leads and contacts for bakers back in Scotland. On the back of this unique partnership Scottish Bakers have also launched our own industry export group to

assist bakers achieve their export market ambitions.

We were also delighted to sign and launch a partnership agreement with the Clydesdale Bank at our recent annual conference and awards. Amongst other things the partnership will provide support to local bakery businesses in identifying further growth opportunities both here in the UK and in foreign markets. It will also see the delivery of many business and finance events and initiatives which will

be open to all Scottish Bakers members.

So, interesting times and uncharted waters for the bakery industry in Scotland but we look forward to the next six months which will no doubt be very exciting and interesting for the people of Scotland and the UK as a whole. We are however assured that regardless of the independence referendum, Scottish Bakers will continue to work on providing a world class service to bakers in Scotland. ■





Small but tasty snacks for all

By Linda Bellekom-Allen, Customer Application Specialist – Food, Dow Pharma and Food Solutions



be ideal. Maybe two bites of exquisite full sugar and fat cake instead of six bites of a lower calorie but more boring, less indulgent one. The difference in calories? Probably lower for the two bite cake versus the six bite one. The difference in value to the baker? The smaller cake would have several advantages:

- The price could be lower than the larger portion but pro rata higher, giving better margins, maybe half the price for 1/3 of the quantity
- Manufacturing, ingredient, storage, transport and display costs would be lower
- And let's not forget the loyalty that a smaller but indulgent snack with half the calories would promote

Taking the concept a little further, those vulnerable to malnutrition might be tempted to eat by the smaller portions of tastier food, so the hospital and care home markets might be opened up.

A development that never seemed to take off a while back was for savoury cakes. They are popular it appears in France but I've never seen them elsewhere. Sugar-free, they surely are one of the answers to the reduced sugar and fat calls for baked snacks, with the added advantage that diabetics could snack on them in the same way as their more sugar tolerant neighbours. ■

The irony of working in two diametrically opposite sections of the food industry continues to both frustrate and amuse me. One day I am looking at reducing the sugar and fat content of cakes to help reduce the obesity endemic in a large proportion of the population, the next I spend working on increasing the fat content (but rarely the sugar) to make small portions of higher calorific value for those in hospital and care homes. The latter customers need greater nutritional benefit from small quantities of

food because their failing health or age has led to a smaller appetite. The former, overweight customers say that they want healthier snacks but don't buy them; they are not willing to compromise on the indulgence factor – the sheer pleasure of eating high calorie foods.

So where is the market for the baker in this?

To me, with a slight weight problem, much smaller portions of really tasty cakes would

Holistic reformulation strategies to reduce sugar and fat

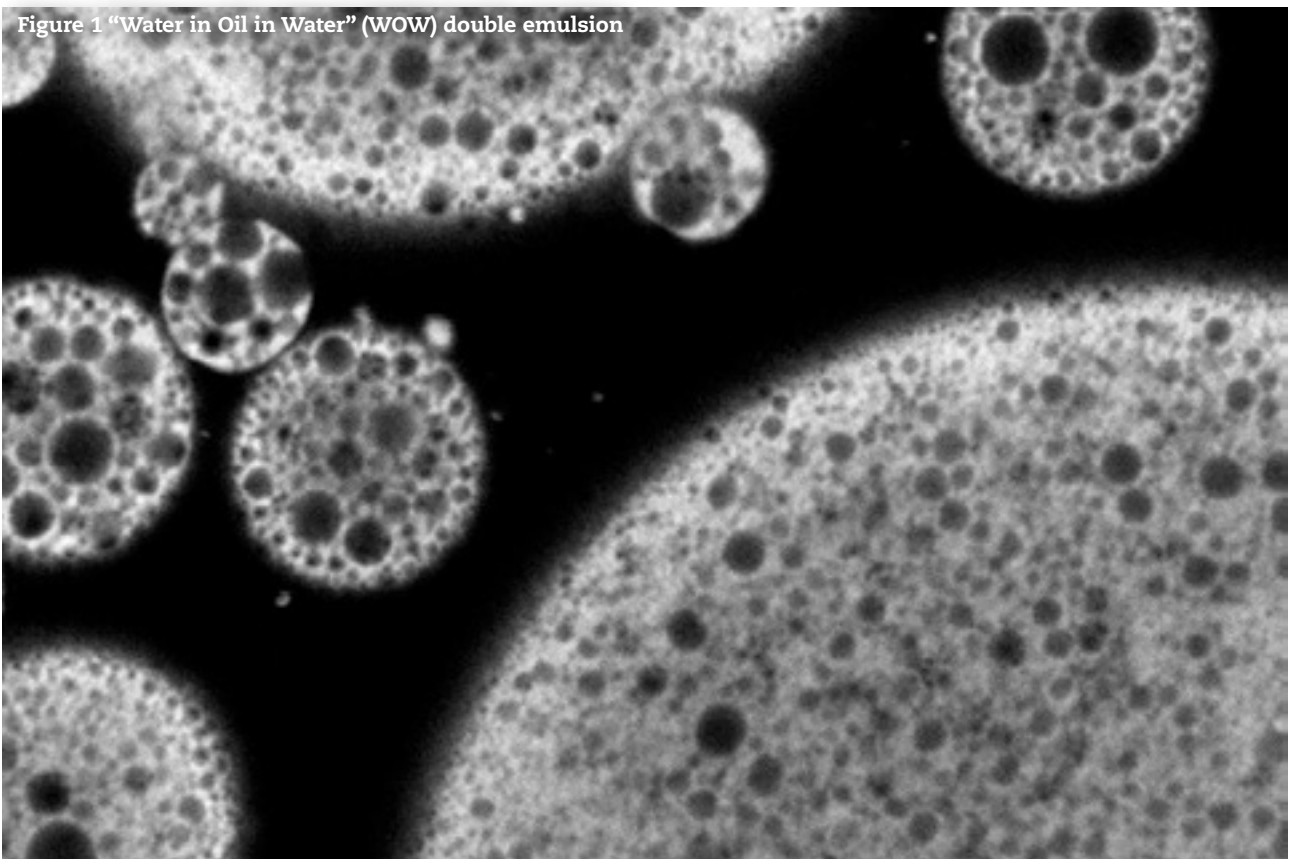
By Steve Osborn, Business Innovation Manager, Leatherhead Food Research

A week doesn't go by without further focus on the need to improve the health profile of food. This is increasingly confusing for the consumer as from the outside these seem to conflict and change. Of particular focus in 2014 has been the

suggestion that it is sugar and not fat that is the root cause of the 'obesity crisis'. The overall picture is likely to be much less specific in that as a society we eat too much of everything, in the 'wrong' proportions and exercise too little.

However, as an increasing number of studies focus on the range of ingredients, and highlight the impact that overconsumption of each can have, an ongoing set of re-formulation challenges are laid out. In our modern world, food provides enjoyment as much as it

Figure 1 "Water in Oil in Water" (WOW) double emulsion



does sustenance, and the demand for bakery products will always remain high. However, these types of products are typically high in sugar and/or fat and consumers increasingly demand the same organoleptic quality but with measurable improvement in the health profile of the product, i.e. reductions in fat, salt and sugar.

Salt consumption is still considered too high, however it is becoming widely accepted that the systematic and stealth reductions of salt have reached their limits and only adoption of new technology will be successful in achieving the ever stringent targets.

Replacement of sugar presents a number of challenges since it provides a range of functions in the product: structure, taste, texture, colour and sweetness; so removal leaves a developer with a number of issues to address. Built into this set of challenges is the conflict of other macro consumer trends such as natural and clean label: in the context of which, the replacement of sugar with multiple ingredients is counter-intuitive.

SUGAR REDUCTION

On one level the sugar replacement strategies are well established, with the use of polyols and sweeteners such as isomalt and stevia glycosides to replace the bulk and sweetness of sugar whilst achieving the reduction in calories. However, the polyols do not contribute to the Maillard Reaction, which require the interaction of a reducing sugar and an amino acid

to achieve the flavor and colour formation. This may lead to the addition of colour and flavour, thus contradicting and clean label agenda.

However, one of the criticisms levied at the food industry is that the use of sugar is unnecessarily high in certain products, and in particular became a common fat replacer; successfully reducing fat and calories whilst maintaining the structure and desirable mouth-feel.

This drives the need for a more holistic approach to reformulation; it is not necessarily desirable from a clean label perspective to replace a single recognizable ingredient with four or five less natural alternatives, but sugar reduction is becoming mainstream. This will drive the need for functional and beneficial replacement strategies, and can be likened to the success of the salt reduction activity. Small, incremental reductions in salt have resulted in big overall success. This in turn has driven innovation and a return to fundamental food development with an increase in 'blended salts' sea salts, and the use of umami impact ingredients such as mushrooms.

There are significant trends in the use of protein and fibre – both macro nutrients and both with widely reported health benefits.

Protein is increasingly being associated with improving satiety effects¹ and their increase in use will not only satisfy the healthier positioning of the product but will 'shift' the overall nutritional

profile of a product to have a lower sugar and fat content. This may allow the sugar to remain and deliver its wide range of functionality even at its relatively lower level. The rate of innovation in protein is very high, with new products for a variety of applications becoming available such as pea and potato. Other more unusual sources, such as sprouted rice protein, claim to be competing with more traditional proteins such as whey.

It is well known that low fibre intake is associated with obesity, inflammation and other metabolic conditions, so any increase in fibre content is seen as beneficial. This can also contribute to changing the balance of a formulation, which increases the healthy profile and intrinsically decreases the proportion and level of consumption of sugar. Fibres such as inulin are widely used for sugar reduction, but are also used in fat reduction strategies. Novel fibre sources are also entering the market with stevia, bamboo shoot and potato fibre all entering the market.²

FAT REDUCTION

A simple removal is not an option as the product will fail to deliver sensorial as well as introducing a range of processing issues, and there is a limit to the incremental reductions that can be achieved. Some of the key developments yet to be fully embraced include novel emulsion technologies the so called 'WOW' (Water in Oil in Water) emulsions for example³ (Figure 1) and extending this philosophy further into 'Oil in water in Oil' ("OWO") emulsions

and 'Oil in Water in Water'.⁴ The primary principle being that the emulsified fat is carried on and in other components; this has the ultimate effect of reducing the overall fat content but can still deliver on functionality – taste, texture and structure.

Cryo-crystallisation has also been identified as a potential technology to reduce fat through enhancing functionality.⁵ Atomised liquid droplets come in contact with liquid nitrogen, causing the droplets to instantaneously solidify. For instance, a molten fat or a molten blend of oil and fat can be processed through the cryo-crystalliser and a free-flowing powder will be produced. Preliminary studies have indicated that cryo-crystallisation of oils, fats, and blends can lead to changes in terms of crystal morphology, size and shape, therefore leading to altered functionality. These studies also indicate that the cryo-crystallised powders are more stable than the conventional products during long-term storage, with very little crystallisation changes. Leatherhead Food Research undertook a project (2009), which looked at reduction of saturated fat content in short crust pastry. The results showed that the use of a cryo-crystallised blend of

fat and oil led to a significant reduction of saturated fat content in the pastry product without significantly affecting the taste and texture.⁶

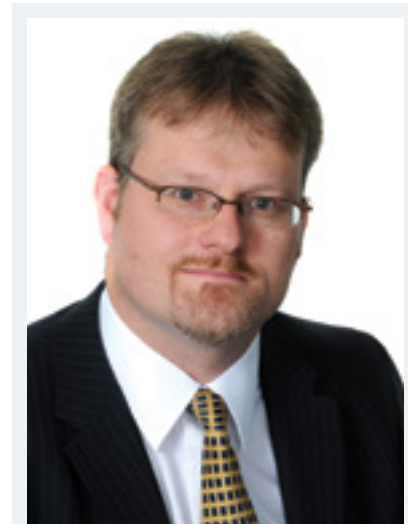
Use of such technologies can therefore allow the use of fat, but reduce its overall presence in the product.

HOLISTIC REFORMULATION

The way forward for sugar and fat reduction in bakery products is considered a holistic strategy. No one solution will exist – and becomes at risk of a future backlash in the light of new science. There are also conflicting trends such as 'clean label and natural' that may present blocks to the use of some ingredients. A broader overall consideration of the macro nutrient profile of the product, the relative proportions of the fat, sugar, fibre and protein content, may present the opportunity to improve the product profile as a whole. And with nutrition, sensory and product development input it's not impossible to have everything! ■

FIND OUT MORE

About Leatherhead Food Research
Leatherhead Food Research delivers integrated scientific expertise and international regulatory advice to the global food, drink and related industries.
www.leatherheadfood.com



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Having graduated as an Analytical Chemist, Steve completed a Research Masters on Maillard Reaction Flavours, with the University of Reading. He then spent many years in Confectionery Manufacturing with Nestlé and Northern Foods, working as scientific and technical support to key brands, and later, Technical Manager at Ashbury Confectionery, a leading manufacturer of retailer and contract branded products. Steve joined Leatherhead Food Research in 2006 bringing with him a wealth of industry knowledge and understanding. He currently undertakes a wide range of commercial and project management activities for the Food Innovation group. Steve's technical and industry knowledge are often drawn upon to deliver technical training courses and conference engagements on a variety of topics, including confectionery, and for running Innovation workshops, including Food Innovation: INTENT, Leatherhead's Open Innovation community. Steve is Fellow of the IFST and chairs the Consultancy Special Interest Group.

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Rejected bananas

From the uses of rejected bananas to the delivery of innovative and added-value products to the market

By Olivier Gibert, Alexandre Bouniol, Frédéric Bakry

As the 6th-largest starchy resource worldwide, with a production estimated at 102 million tonnes (MT) in 2012 (FAOStat), the banana sector is currently subject to a great deal of change and uncertainty. Well-known for its environmental impact, banana cultivation has been associated with harmful impacts of fertilizers and pesticides upon the health of stakeholders and labourers. Banana production is also thought to be associated with overexploitation of small-scale growers in developing countries. Moreover, at the beginning of the twenty-first century, a severe threat emerged in South-

East Asia with the discovery of virulent diseases (e.g. the highly destructive *Fusarium oxysporum*), against which the only sustainable alternative is the selection and development of new hybrids.

The market for dessert bananas in northern countries represents a volume of 15 MT, out of 60 MT/year produced. This extremely well-integrated sector is characterized by the exclusive contribution of stakeholders towards the delivery to the market of a single standardized Cavendish cultivar, with precisely-defined specifications of its required

properties. Some 15 to 25 % of harvested bananas for export, about 4 to 5 MT/year, are found to be defective, and are discarded. A significant proportion of rejected bananas goes to satisfy local markets (because of the short supply chain); other uses include biomass, animal feed and processed products. Weak estimated volumes of production have discouraged attempts to use rejected bananas in industrial food processing, such as for flours, breakfast flakes, pastes, tomato-sauce thickener, soft beverages sweetener and alcohols. This limited industrial exploitation of rejected bananas is further explained by the



Rejected bananas at Madrigal farm (Bananeras de Uraba S.A., Colombia).

Photo: D.Dufour, 2010.



Banana bunches hanging at Madrigal farm prior to sorting and washing (Bananeras de Uraba S.A., Colombia)

Photo: O.Gibert, 2010.

banana type itself, which has been designed for the fresh consumption market and not for alternative uses.

However, discarded bananas may have a high potential for innovation, to design new products (such as low-fat fried crisps, juices with optimal quality, ready to use pastes for bakery), and for the delivery of new-intermediate products for later processing in the food industry (such as flour, starch, and high-value extracted fractions). In addition, the functional properties of bananas, including nutritional properties of compounds and various micronutrients, could be suitable also for the formulation of stabilized products. Two approaches might be considered:

- To use banana flour as an additive or substitute to cereals in bakery for consumers requiring special diets (such as those with gluten intolerance

or phenylketonuria)

- To use banana within a new matrix, while making use of its functional or organoleptic properties (such as texture, aroma, flavour and colour), and nutritional properties (e.g. process-driven glycaemic index)

Innovation has always been the keystone of the evolution of banana commodity chain. Recently, tremendous efforts have been made, in particular in Europe, to encourage more respectful conditions for banana growth, and to limit the use of synthetic pesticides. The ultimate expression of this evolution is the rise of organic agriculture. As a consequence, a sustainable banana market (organic and Fair Trade) was developed, which nowadays represents about 20% of World export trade (about 4 MT of fresh fruits). Rejected bananas derived from sustainable cultivation may confer product-

formulation benefits through labels of quality and labels of origin, so enhancing final product added-value.

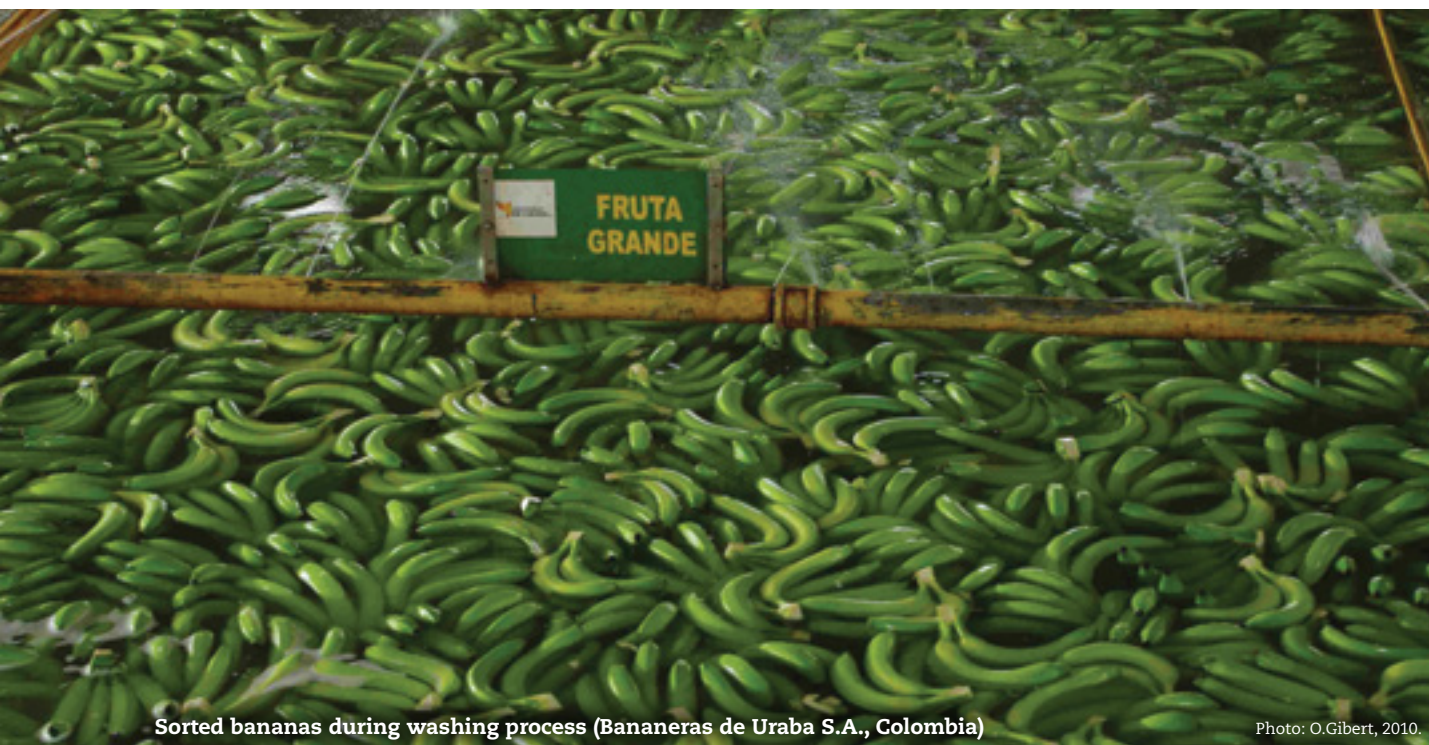
New improved varieties, more productive and resistant to pests and diseases, could be also source of major progress in the future. Some current varieties are selected for export on the basis of their fresh value but suffer from high post-harvest constraints dictated by the banana export sector. Some varieties may be thought suitable for alternative uses driven by the food processing chain specific demand. As for future crops, new banana varieties may be developed to meet requirements for a high yield organic label, some for fresh consumption and others specifically used for industrial processed products with a high-added value segment.

To use this high potential for innovation, an integrated



Washing after banana dehanding process (Bananeras de Uraba S.A., Colombia)

Photo: O.Gibert, 2010.



Sorted bananas during washing process (Bananeras de Uraba S.A., Colombia)

Photo: O.Gibert, 2010.

approach is suggested, to ensure that both industrial and end-users' needs are taken into account. It implies that both technological and economic issues are identified: what are the costs to consider for being competitive? Structure and organization similar to those of cereal and potato food chains appear to be relevant models, where various uses of resources, stakeholder-specific activity, and a match between supply and demand all exist. Thus, a further structured organization

of the banana intermediate-products sector is needed to fulfil industrial requirements. It implies the establishment of primary processing industries dedicated to raw material stabilization and the development of optimized technological properties within high added-value intermediate products (ie cracking, driving unit operations and process control). The latter could be delivered to the remanufacturing food industries for wide uses, diffusion, and for integration within the

formulation of new products. The development of such new banana markets will encourage manufacturers to specify their requirements and refine their specifications. The tremendous Musaceae diversity and the acquired knowledge by those in the highly integrated-sector will be helpful. It will provide an additional degree of freedom to drive industrial processing needs for the benefits of the entire banana food chain. ■



Banana starch extracted from green banana pulp for wheat flour substitution in bakery products

Photo: D.Dufour, 2004.

“Cirad (agricultural research for development) the French research centre working with developing countries to tackle international agricultural and development issues, with the contribution of the joint research unit Qualisud (Integrated Approach to Food Quality) with Dr O.Gibert and Ing. A.Bouniol and the contribution of Dr F. Bakry for the joint research unit Agap (Genetic Improvement)”

Experience the excitement around whey: Lactose in the manufacturing of flour confectionery

By Dr. Günter Brack (1), Dr. René Floris (2), Dr. Joop Kleibeuker (3)

For many years, whey has been a source of ingredients for the food industry. Whereas initially the production of food ingredients from whey has been seen as a recovery of valuable components out of the secondary product obtained with cheese production, nowadays whey-based ingredients are highly valued for their functionality and contribution to healthy nutrition. The European Whey Products Association EWPA, the American Dairy Products Institute ADPI and NIZO Food Research are organizing on 7-9 September in Rotterdam the 7th International Whey Conference (IWC-2014), with the motto "Experience the Excitement around Whey". The conference will be an outstanding opportunity for whey processing and application industries to meet scientists, academics and researchers to exchange knowledge and new ideas in a stimulating environment (see www.iwc2014.com)

In this article we give an overview of the state of the art of lactose applications with the manufacturing of flour Confectionery. We will place this item in the context of the use of whey-based ingredients in food

products that will be discussed extensively at IWC-2014.

Lactose in the Manufacturing of Flour Confectionery

The practical experience of the use of whey powder is limited to small amounts when considered as an ingredient for flour confectionery, for instance in a scale of approximately up to one or two percent. If whey is present as a major ingredient, then undesired alterations, mainly of

the dough and baking behaviour or the taste of the baked goods, arise both from the nature of the protein and the mineral content of whey. Hence Lactose, when present as a component of whey, cannot exhibit its advantageous potential as baking ingredient. When Lactose is separated from whey, as sole ingredient and used in higher amounts, it demonstrates a totally different influence in the flour confectionery sector.





Furthermore, lactose takes an outstanding position compared to the common sucrose and sugar replacers, emerging from its exceptional functionality in preparing yeasted doughs and cake batters. The functionality is based on important differences of various physico-chemical

and sensory factors: solubility, fermentability and relative sweetness.

From the legal perspective, lactose can be used as bulk ingredient without restriction, except for products intended for persons suffering from lactose

intolerance or diabetes.

The correct application of lactose in yeasted, sweet doughs leads to improved rheological, fermenting and baking results; and to better pastry quality. Whilst the improved rheological properties, raising action and stability of the dough result from the effected gluten-protein in the wheat-flour, there is evidence that improved crumb properties are a consequence of the increased water absorption of the dough, increased pastry volume and reduced starch degradation.

A substantial advantage of lactose in yeasted doughs is the distinct ability to level up inferior wheat-flour quality in a manner that is not attained by any other common ingredient without using additives.

The increased water absorption, followed by an increased cake/pastry yield supports efforts in cutting ingredient cost.

In madeira cake batters and sponge cake batters, lactose exhibits the capability to replace sucrose to a great extent without causing major baking problems. Increased water activity of the cake must be considered (but neglected in the case of refrigerated or frozen cakes). Lactose reduces the extreme sweetness of industrially manufactured cake varieties, maintaining a good overall sensory properties.

With a well balanced combination of lactose and sucrose, it is possible to ensure the maintenance of the normal

Table 1: Major advantages of lactose over sucrose

Performance in sweet yeasted doughs/pastries

1. increased dough and pastry yield
2. less fermentation time; improved fermentation performance
3. levelling up inferior flour quality
4. increased pastry volume, improved pastry appearance
5. improved crumb softness/freshness
6. improved freshness (keeping quality)
7. fat reduction feasible
8. above mentioned advantages to be benefitted from without need of supporting additives

Performance in cake batters:

1. reduced sweetness in very sweet cakes possible
2. fat reduction possible (normally resulting in increased water activity)
3. increased batter yield feasible

sweetness of the cake/pastry while providing a physiologically attractive reduction of the fat content by approximately 50%. This applies both for yeasted pastries and cakes made from batters.

Lactose in non-yeasted doughs regarding biscuits/cookies/shortcrust can only successfully applied in very small quantities in order to improve colour and aroma. Higher quantities lead to dough stiffening/shrinking and biscuit hardening.

Conclusions

The use of lactose within the manufacturing of flour Confectionery is one of the examples of a longstanding fully developed application of whey-based ingredients in the food industry. Over the years many new products based on the partial or full fractionation of whey have been developed, all with very interesting functional and nutritional properties. With many food products these whey-based ingredients create new added value. At IWC-2014 both the new science behind the whey-based ingredients and the application of these ingredients will be discussed: on 7-9 September Rotterdam will be the place to learn how food companies can create indeed more added value by applying whey-based ingredients. ■

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IWC-2014

The 7th International Whey Conference to be held in Rotterdam on 7-9 September 2014 has a focus on the newest developments in industry and science with respect to whey.

The conference will be opened with presentations on the developments in the global supply of whey and the markets for various whey-based products. In key-note presentations, aspects such as emerging technologies in whey processing, new applications in food products, regulatory affairs and sustainability will be considered.

Whey proteins and their functionality, processing of whey, lactose and whey oligosaccharides and nutritional and health aspects of whey will be central themes with the scientific considerations.

In the area of whey proteins, whey fortification and high whey protein foods will be especially covered. In the area of processing, the use of membranes to obtain whey-derived products and whey fractions, as well as (cost) efficiency during drying are highlighted.

In the area of lactose and whey derived oligosaccharides, the focus is on FOS and GOS and new oligosaccharides. Micro-particulated whey, the modification of whey products structures and the relation of these structures to perception are at the centre of attention.

In the field of health the dietary need of adults, the needs of ageing people in relation the quality of whey will be discussed. Moreover, the immune response to minor whey proteins as well as oral tolerance and prevention of allergy will be highlighted.

The IWC-2014 Market Place will be the central point at the conference with an exhibition of processing equipment and products, poster presentations and demonstration stations. Here, business and science from all over the world will meet for two days.

For more information and to register see www.iwc2014.com

Continuous dough kneading

By Frank Zehle, IGV GmbH



The compositional changes that take place during dough preparation are very complex in nature. Wetting and hydration of the flour particles; separation- and swelling processes; bonding- and network formation processes, and gas input and gas retention occur in sequence during the kneading process, but may occur in parallel during batch processing, particularly at the start of the process. A variety of dough states from dry flour through to final dough may be observed within the batch process. This is most apparent with spiral kneading systems, which depend upon homogeneous mixing of flour and water. It is possible to achieve a very rapid wetting of the flour by an increased input of mixing energy at the beginning of kneading (blender), but this is very often associated with extreme heating of the dough.

Processes relying upon a continuous supply of raw materials to the kneading tray open up the possibility of usefully wetting flour with only moderate energy input; and when the process space (the kneading tray) is relatively small relative to the kneading tool, even very large hourly outputs of dough can be produced in a highly energy-efficient manner.

The continuous double spiral kneading method, the CODOS® System, is designed to integrate the linear sequence of compositional changes to the dough into the kneading process. The principle is based on two rotating spirals in an open kneading tray. By opposing the rotational direction of the two kneading spirals, a virtually pulse-free shear rate is transferred to the dough mixture. Due to the different force effects, the mixture flows from the entry point to the kneader exit, adding to the processes of mixing and kneading. Conditioned by the functional principle of the continuous double spiral kneading method, the individual phases of dough development run very smoothly and almost one after the other.

Due to the fact that open spirals are optimally adapted to the mixing procedures within the catchment area of the kneader, an almost homogeneous mixing of the dough ingredients is achieved after just a few centimeters of travel. As the blended dough flows further, shear intensity is increased by appropriate design of the second kneading stage: studies have shown that forces are greater in the area in which the spirals intermesh, which results in a more intense kneading effect. As a result of the different designs of the kneading spirals, variations of the axial force component (has influence on the kneading time) or the radial force component (has influence on the kneading process) can be obtained. The desired mixing and kneading effects can thus be chosen by controlling speed of rotation during the kneading

and appropriate choice of customizable kneading tools. Due to different kneading zones, the dough is alternately exposed to a higher and lower shear stress during the kneading process. This allows the dough to relax to some extent before it is subjected to renewed increased shear stress. However, the transition between the single kneading zones flows, so that the structure of the dough is not destroyed. As part of the further development of the process, preferred geometries for mixing and kneading tools have been developed that are applicable for almost the entire range of doughs. Depending on the type of dough produced, the technological installation may be configured as a single or two-stage arrangement, where each kneading stage is equipped with individual kneading tools. An intermediate band may be placed between the two kneading stages to give the dough (with wheat applications) the possibility to relax before renewing the energy load.

The advantages of continuous double spiral kneading include:

- Dough development stages run very smoothly and almost consecutively with improved gas entry into the dough texture
- Exploiting of aggregated Premix batches for special kneading effects
- Ingredients' supply is possible at each process stage
- Improved influencing of the dough temperature (adding of icy water, tray-wall cooling)
- Dough production without ice ■



Frank Zehle



View inside a working kneader system



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Dough stability du

By Graham Duckworth, Senior Bakery Technologist, Baking and Cereal Processing Department, Campden BRI

Dough for bread products is a complex material. It must contain gas cells that are expanded during proving and baking, and it must have elasticity to allow this expansion as well as viscosity that allows it to be processed. For no-time dough, such as that produced in modern plant bakeries, the

mixing element is responsible for delivering dough with the appropriate properties for further processing. This requires that dough has sufficient stability to cope with processing stages such as dividing, rounding, sheeting, curling and cutting. Each of these stages can change the gas cell structure and must be done with

care. Damage to the dough will result in bread of inconsistent quality. Therefore, mixing dough consistently is essential for creating stable dough.

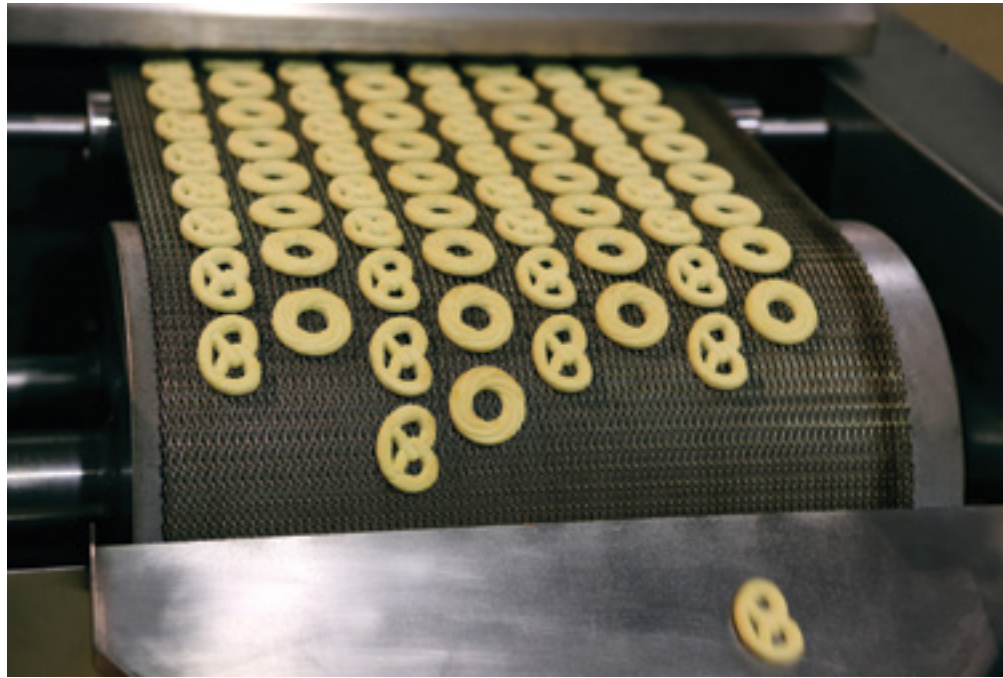
There are several different types of batch dough mixer used in bakeries. A key difference is the intensity of their mixing action,



ring processing

or in other words, how quickly the mixer develops the dough. In terms of intensity, mixers can be grouped into four categories: low, medium, high and very high.

- **Low-intensity mixers** include traditional twin-armed systems such as the Artofex mixer, usually for dough that will undergo further transformation during bulk fermentation. Dough is worked in a very gentle fashion, giving a similar effect to mixing by hand, and as with hand mixing, the mixing times are very long (typically ~ 30 minutes).
- **Medium-intensity mixers** include spiral type mixers that are probably the most common mixer type for baked products globally. Mixing times in the dough development phase, rather than the slow speed incorporation phase, are of the order of 8-12 minutes. Typical high speeds are of the order of 150 - 250 rpm, which gives rise to a temperature increase in the dough of 10 - 12°C. Although these mixers may be used for processes where bulk fermentation or sponge systems are used (i.e. where other mechanisms contribute to dough development), they may also be used in no-time dough systems.
- **High-intensity mixers** include the horizontal bar mixing systems that are popular in North America. Mixing times are shorter than with spiral mixers, typically 6 - 8 minutes



on high speed. Maximum speed of a bar mixer is of the order of 150 rpm, slightly lower than with a spiral mixer. This is possible because the rotating bars create more shear than with spiral mixers with the result of faster dough development.

- **Very high-intensity mixers** tend to be used in speciality processes such as the Chorleywood Bread Process (CBP). In this case, mixers are used as the sole mechanism for developing the gluten structure and initiating gas cells. Typical impeller speeds are of the order of 350 - 500 rpm, which gives rise to a temperature increase in the dough of around 15°C. A key element of the CBP is the delivery of a fixed amount of

work to the dough in a short period this was stipulated to be 39.6 kJ.kg⁻¹ (11 Wh.kg⁻¹) within a period of 2 - 5 minutes, and this figure is still used by many bakeries in the UK. It is important to note, however, that increasing the flour protein quality demands a higher work input because there is more gluten that must be developed. Energy input varies from as low as 10 Wh.kg⁻¹ up to around 13 Wh.kg⁻¹. An additional feature of high intensity mixing is the ability to control the atmosphere above the dough. Pressure and vacuum are applied in sequence for approximately equal times to achieve both dough oxidation and optimum gas cell structure.

Continuous dough mixers are an alternative that have been around for many years and have recently seen renewed interest. One advantage of a continuous system is that it can feed a processing line with fresh dough. This overcomes the issue of dough ageing resulting in increased softness and stickiness with increased floor time.

Shearing action with continuous mixers is of medium to high intensity and takes place within a closed barrel or cylinder. Important control points are to ensure the dry and wet ingredients are metered in

consistently and at a consistent temperature. Changes to the input conditions will change the dough stability and will result in inconsistent product quality. The introduction of mixing to energy on these mixers is fairly new but is valuable in matching energy input per dough piece at different flow rates.

Not all bakeries develop dough by mixing alone. Sheeting processes, similar to those used for laminated pastries, also develop dough. Underdeveloped dough is first produced in a mixer by combining the ingredients long enough for the water to absorb

into the flour. The number of sheeting passes can be thought of as similar to the time of mixing, in that dough changes its rheological properties as the gluten matrix develops with increased shear. As with standard mixing, an optimum exists and excessive sheeting can result in dough of poor quality and reduced gas holding capacity.

Formulation adjustment is another way of increasing dough stability during processing. This could involve the use of emulsifiers, oxidising or reducing agents, as well as enzymes. Understanding the way these ingredients work is essential because interactions between these ingredients takes place and so increased use of one ingredient does not always result in the expected result. There could also be different effects with the different ways of processing dough, as described above with batch and continuous systems. These relate to variations in shearing action, time and dough temperature. Hence, dough stability is a complex issue that requires both an ingredient and a processing solution. ■



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Energy efficiency in bakeries

An opportunity for large and small businesses

Bakeries and ovens – the two are simply inseparable. This shows already that baking is an energy-intensive process. The share of energy costs in bakeries' turnover mostly lies between 4 and 9 % - and counting! Not only during baking itself but along the entire production chain, the amount of energy required to process the dough is very high: From refrigeration to baking, transportation and finally sale in the shops. Savings in energy consumption can be achieved in almost all stages of the process. In addition to systems for heat recovery and efficient and well-designed refrigeration equipment,

good production planning (e.g. oven plan) is very important in production (in the factory). Another priority for energy efficiency measures is to be found in the bakery chains common in Germany (many bakeries have 20 or more sales outlets, in which goods are supplied directly to the consumer).

Studies by ttz Bremerhaven in the framework of "EnEff Bäckerei", a network project funded by the German Federal Ministry for Economic Affairs and Energy with the objective of raising energy efficiency in bakeries, have shown that frequently over half the energy costs of an entire company are incurred in its sales outlets (see Figure 1). Apart from the ovens, above all lighting, refrigerators and an increasing offer in the area of gastronomy are responsible for high energy costs. Apart from the use of energy efficient equipment, considerable savings can also be achieved here by optimizing processes and operating instructions. The basis for long-term reduction of energy consumption is always a precise analysis throughout the entire company of the status quo with regard to energy.

Large industrial bakeries have

many specific advantages over small firms: Multi-shift operation, mono-production and clear rules of procedure ensure thoroughly well-organized production processes. "Economies of scale" too are reflected in the low prices for energy carriers which large industrial customers can obtain. Nevertheless, the costs for energy are increasing for large production facilities as well. Energy savings can therefore constitute the deciding competitive advantage.

In the case of large enterprises, investment in equipment, for example for the utilization of exhaust heat, is a possibility, above all when there are suitable heat consumers in the production process. In order to avoid unpleasant surprises in terms of efficiency, overall conditions must, however, always be examined very closely.

Particularly in the case of large bakeries, measures are often linked with investment. With the right planning, the savings which can be achieved are equally high, so that it makes sense to analyse very accurately both energy supply and energy consumption. In firms equipped with large-scale heaters and burners (< 300 kW),



Jörg Schulz

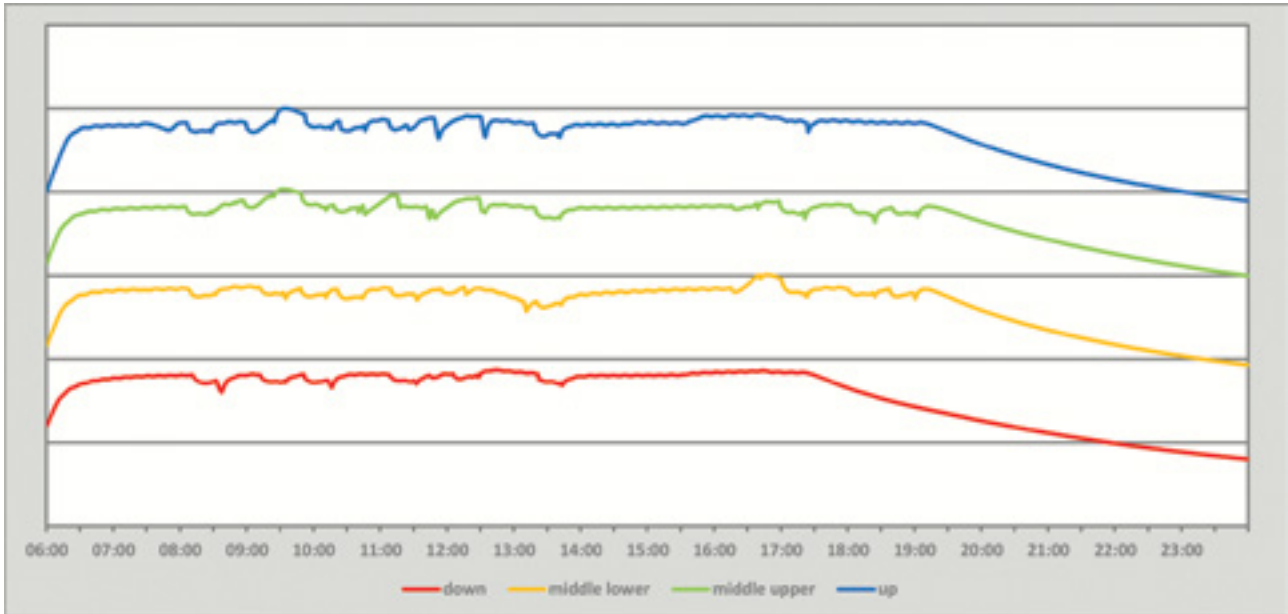
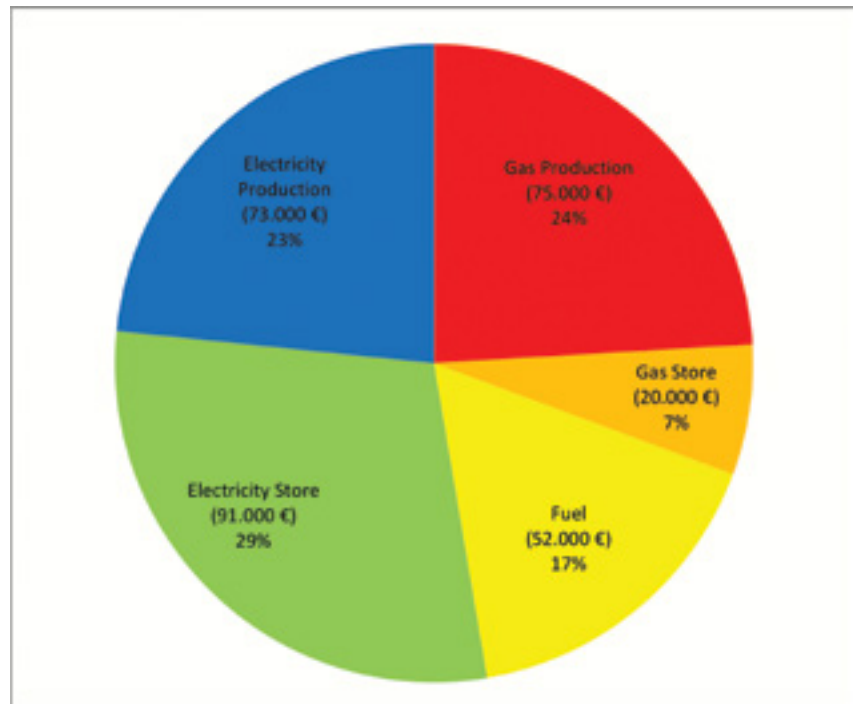


Figure 1 (above): Temperatures in an in-store deck oven (Temperature at all levels is the same at 07:00 hrs; 180°C)

Figure 2 (right): Distribution of energy costs in an average German bakery with 20 sales' outlets and a flour consumption of 1000 t per year



pre-warming of the combustion air, for example, is a very good possibility for reducing fuel consumption by 6-8 %. In larger firms, peripheral apparatus, such as pumps, ventilation systems or pressurized air generation, can cause a large percentage of energy costs. Attention should be given here - above all in the case of new investment - to the purchase of efficient equipment.

Often measures require little investment or even no investment at all. Above all, smaller and more flexible bakeries can profit here, which are now, for example, including for the first time their equipment's energy consumption in their production planning.

Considerable savings can also be achieved, for example, by examining and optimizing how ovens are loaded. In this way, savings of over 10 % are almost always possible, since downtime and unnecessary start-up losses can be avoided. In production,

many "little things", such as maintenance of the door seals on the cold stores or cleaning the condenser fan on refrigeration equipment, can be integrated into operational procedures.

By way of example: The use of



LED in place of halogen lamps and metal halide lamps leads to savings of 48%¹⁾. In sales outlets with a lot of business in the area of gastronomy, energy consumption can be considerably reduced through the use of an efficient dishwasher. In general, the avoidance of unnecessary downtime is a key task. Examining baking processes in in-store ovens (e.g. by measuring temperatures during operation; see Figure 2) offers the possibility to design the baking plan in a way which optimizes energy use. Instructing staff with regard to when and how many fresh batches are to be baked or when to switch off which shelf can lead to a clear reduction in electricity consumption with the same productivity.

“Energy efficiency” is a big word. It demands knowledge of production techniques and processes, an analytical approach as well - above all - as the time to structure operations in an energy-efficient way. The greatest task is mostly the documentation of the status quo.

Competent consultants can assist in investigating energy consumption. It is, however, nevertheless very important that a member of staff in the company itself is in charge of all tasks concerned with the topic of “energy”. In this way, the goal of reducing energy consumption in the entire company in the long-term can be achieved in mostly small steps. ■

ttz Bremerhaven

eneff
bäckerei

Jörg Schulz, an engineer in Energy Systems Technology, is a project manager in ttz Bremerhaven’s “Department of Water, Energy and Landscape Management”. He is working on energy efficiency in industrial and craft production processes. For over four years, close cooperation with ttz Bremerhaven’s baking department (BILB / EIBT) has led him to focus on the efficient use of energy in bakeries, e.g. within “EnEff Bäckerei”, a national network project.

1. Result of direct measurements by ttz Bremerhaven in a sales outlet

Innovative hygiene technology

A distinguishing quantitative and economic factor in competition, by Andreas Themann

Hygiene is the top priority in the production and processing of baked goods. In the consumers' best interest, hygiene justifiably fulfils the strict requirements of foodstuff legislation, as well as the assurance of quality that the manufacturers of baked goods provide to their customers. Quality is a key distinguishing factor, especially in the tough European market.

Besides product quality, the cost of production, and thereby indirectly also the final price of the product, are two additional factors that affect the competitiveness of every baked goods manufacturer. The challenge is producing baked goods with a high standard of quality - including and especially in regard to hygiene - while keeping costs as low as possible.

Infra-red sterilisation is an innovative and successfully field-tested hygiene technology for the slicing of bread loaves.

In bakeries, it is almost unavoidable that the surfaces of bread loaves are contaminated by bacteria in the circulating air. This usually occurs when the loaves are set out for cooling after baking. The resulting bacterial contamination significantly reduces the quality and shelf life of the bread. Furthermore, when slicing the loaf, bacteria from the exterior surfaces of the bread can be introduced into the space between individual slices. This means that mould, always a general risk, may now also form between the slices of bread. A conventional and very expensive approach to handling the problem is often the complex and costly structural modification of bakeries.

However, as an alternative, infra-red (IR) sterilisation can be used immediately prior to the slicing process. The use of IR systems with carbon infra-red radiators in various ranges of the IR spectrum, allows for the complete sterilisation of bread loaves in a very short time.

Using these radiators, the surface of the bread is heated



Infra-red sterilisation of a bread-rope

to a temperature of more than 80° Celsius within five to eight seconds. An essential characteristic and huge advantage of this application is that the temperature is created only on the surface of the bread. In conjunction with the correct wave spectrum, this prevents heat from penetrating into the loaf.

Treated thus, the bread's original quality, inside and out, is not affected. Parameters such as nutritional value and taste remain completely unchanged. At the same time, however, the process eliminates 100% of bacteria and spores present.

For manufacturers, the result is that even in the case of extremely high production capacity, there exists an economic, rational and space-saving solution that represents a quantum leap in hygiene, as compared to conventional technologies.

The minimum shelf-life of baked goods is significantly increased by IR sterilisation. The reduced rate of spoilage simultaneously decreases the rejection rate, resulting in fewer returns. Depending on production planning, the IR sterilisation process will provide manufacturers with a return on investment within as little as 18 months.

Scientifically conducted quality controls have proven that the shelf life of toast, for example, can be increased to 14 days; the same results as achieved by the much more complex and costly cleanroom technology.

Obviously, the bread's increased shelf life goes hand in hand with an increase in customer satisfaction.

Besides the hygienic treatment of the baked goods themselves, clean production and processing machines also play an important role in achieving a high standard of hygiene.

For the process of cutting bread ropes, this mainly concerns the hygiene of the cutting blades.

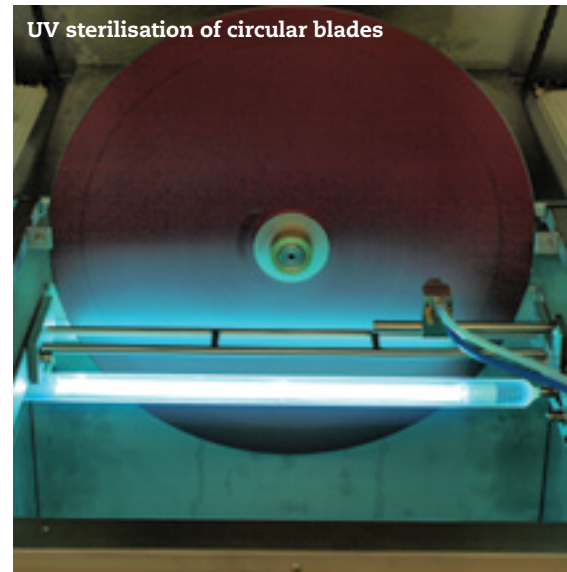
To provide a sterile environment within the cutting machines, and the associated guarantee of process security, UV sterilisation of the cutting instruments is a recommended technology that is in line with the most current standards, and provides hygienically impeccable results. Suitable coatings of the cutting blades – non-stick Teflon coatings have been proven to be reliable – which facilitate their cleaning in the course of the daily work routine, complete the full range of hygienic measures.

The use of modern, economic and efficient hygiene technologies allows manufacturers to manage the balance between producing baked goods of the highest quality, not only but especially in regard to hygiene, and the requirement to maintain production and processing costs at the lowest possible level.

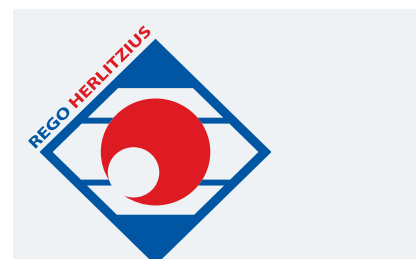
Quality and cost control are certainly not the only factors, but undoubtedly important to the competitiveness of a manufacturer. The technology through which to achieve this is available. ■



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is Managing Director of
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UV sterilisation of circular blades



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Thinking outside the box

Hyperspectral Imaging in the baking industry

By Helen Pratt, national co-ordinator, at Interface Food & Drink

When looking at ways of extending shelf life and improving recipes, Scottish celebration cakes supplier, Lightbody of Hamilton, decided to think outside the box – and ended up using technology previously used in the pharmaceutical and security industries.

Based near Glasgow, Lightbody, in association with The University of Strathclyde, entered the Interface Food & Drink Innovation Competition for funding to support the use of Hyperspectral Imaging (HSI) for the assessment

of the quality and longevity of its baked food products.

Interface Food & Drink promotes partnerships between businesses and academia – and its annual Innovation Competition showcases solutions to key themes in the food and drink industry such as energy and resource efficiency, waste reduction and improved manufacturing techniques. Lightbody's HSI submission was one of three winning entries which each received £25,000 to undertake their study.

Different from standard three colour imaging, HSI provides the complete spectrum of colours, and as light reflects from an object it leaves a fingerprint (or spectral signature) which allows clear analysis of an area – which enables identification of materials making up a scanned object. It has a number of applications, but is mainly known to the public as being a security and surveillance technology.

Lightbody had already undertaken a project with Professor Stephen Marshall at the University of Strathclyde, where a visible band Hyperspectral camera was used to assess the feasibility of deploying HSI technologies to quantify the eating quality of baked sponges. A score was computed for each sponge based on changes in the spectral properties of image data which are known to vary based on moisture/water

content. Simultaneously, two cakes from the same batches were each tested by a tasting panel that scored the sponges based on factors including taste, texture and appearance. The data collected from both trials, showed a strong correlation existed between the scores given by the tasting panel and those computed from the HSI data.

This result convinced Lightbody that there was merit in using HSI to analyse the quality of its baked goods. However, while the visible camera used in the earlier study was not optimal for the application, it was found that the Short Wave Infrared camera provided a much more accurate measure of water content, with the added advantage that chemical distributions such as sugar, salt, starch and glucose could also be observed and analysed in the spectral data. Furthermore, the specific stage of the breakdown and fusion of certain key ingredients which affect the taste of products could potentially be determined and by having this information available, the baking process could be modified to produce a product minimising both waste and energy use, and with an extended shelf life. If these properties can be accurately and rapidly measured, it may be possible to install such a camera at the end of a production line which can score sponges as they are baked in order to accurately predict shelf life.

Helen Pratt



the cake box



This was the first time that a process such as this had been used within bakery or cake manufacturing industries.

“Ultimately food has to be eaten and tasted,” said Ian Chree, Site Manager at Lightbody. “So while it’s unlikely the technology will replace taste panels, it does remove a high degree of subjectivity in terms of results,” he said.

Professor Stephen Marshall from the Centre for excellence in Signal & Image Processing (CeSIP)

at the University of Strathclyde concluded:

“This project introduced HSI to the baked goods sector for the non-destructive real time assessment of products and subsequent improvements in the process. Being able to analyse products in this way will lead to improved consistency and shelf life, thus reducing wasted raw materials and energy in the factory, and reduced in-store wastage due to longer shelf life. Improvements in shelf life results allow longer shipping times and

opens up, previously inaccessible markets for Lightbody to exploit.

“HSI is an ideal noncontact method for assessing a variety of food and drink products, and it’s satisfying to see our research having such practical value,” he said. ■

FIND OUT MORE



www.interfacefoodanddrink.co.uk

How to think like a

New opportunities for the baking sector

By Dr. Nina Veflen Olsen

Design Thinking is the new buzzword among business people. During the last 10-15 years Design Thinking has evolved from the way engineers think about a new technical product to become the new way of thinking among food product developers. In this article I will explain the concept Design Thinking by presenting a Design Thinking project conducted within the baking sector in Norway.

A Design Thinking approach, defined as a discipline that uses the designer's sensibility and methods to match people's needs with what is technically feasible and commercially viable, consists according to Brown (2008) of four main activities:

1. Begin at the beginning
2. Take a human-centred approach
3. Try early and often
4. Seek outside help

The clue is to involve Design Thinking at the very start of the innovation process before any direction has been set up, to focus on human behaviours, needs, and preferences along with business and technical considerations, to create an expectation of rapid experimentation and prototyping, and to expand the innovation ecosystem by looking for opportunities to co-create with customers and consumers.



Photos: Kjell Merok

a designer?

Back in 2010, an inter-disciplinary project team consisting of people from both industry (mills, bakers) and academia was put together to generate new opportunities for the cereal industry in Norway. The Design Thinking project, led by BKLf (A Norwegian member organization for bakers and confectioners) and financed by the Research Council of Norway, started out by letting all the participants (12 persons) immerse themselves in different situations

to learn as much as possible as fast as possible. The team wanted to understand their customers, how they think, what they feel and how they behave, to be able to spot new opportunities for the sector. By watching and listening, by collecting stories and inspiration from Norway, UK, Japan and US, the team generated useful insights.

Examples:

- Norwegian bakeries bake during night to be able to deliver fresh

bread in the morning. But most consumers buy bread on their way home from work in the afternoon. Some even freeze the bread down. Why bake during the night, then?

- Customers that arrive late in the store find empty shelves.
- In Japan customers buy gifts from the baker. This happens rarely in Norway.
- Many customers like to slice up their bread in the store. This is not possible when buying bread at the bakery.
- Grocery retailers place oatmeal together with bakery ingredients in the store. Most Norwegian do not use oatmeal as an ingredient for baking, but rather eat it as a breakfast cereal: placement can be improved.





- Most consumers feel proud when they present a nice home-made cake. But many lack the knowledge and/or self-esteem to make advanced cakes.

Based on the insight generated, the team created a long list of new business opportunities.

Examples of new business concepts:

- Buy bread from work: Offer bread where the consumers prefer to buy it. Develop a distribution system that makes it possible for consumers to pick up fresh bread from the office on their way home.
- A WOW- cake set: Professional

bakers can create a building set that allows people to make their own cakes: a kit that gives people the ability to bake wonderful cakes with a personal touch and a wow-factor

- A present from the bakery: Bakeries can offer beautiful small cake packages, a perfect gift for the host of a dinner, for example.
- A bucket of dough: Consumers love to make their own rolls and bread, and to experience the nice smell of baking, but to make dough is time-consuming and a sticky affair. By selling buckets of fresh dough, the bakers solve a problem for the consumers.
- A cereal mix set: A building

set of cylinders with different cereals and different toppings that allows each consumer to make his own personal cereal mix.

The next step in the design thinking process was to test out the different concepts. Rapid testing was conducted with the aim of as much learning as possible for as low a price as possible. Design Thinking implies many small “test – improve – re-test steps” conducted in interaction with consumers. Innovation teams develop products with consumers, not for them. They give them prototypes, observe them, talk with them and learn how to improve the product. They formulate hypotheses with expected outcomes, test them, find out what works and what does not, and move on to the next learning step. Based on the outcome, they adjust the prototype and retest or reject. Design Thinking is a faster and cheaper way to include the voice of the consumer into the process, a new and interesting approach that more actors in the bakery sector should try out. ■

Brown, T. (2008) *Design Thinking*, *Harvard Business Review*, June, 84-92.

Author Bio:

Dr. Nina Veflen Olsen is head of the research group for food innovation management and a senior researcher in consumer behavior at Nofima, Norway.

Appetite for automation

within the food and bakery sector

By Grant Collier, PPMA





The British Automation and Robot Association (BARA) secured £600,000 from UKTI to send automation consultants into UK manufacturing to assess the viability for automation and robotics. They had 367 companies apply with 37% from the food sector which included a healthy number of bakeries.

At the outset of the Automating Manufacturing campaign, BARA identified the food and drink sector as having particular scope for improvement through the application of automation technologies.

Partnering with sector trade body the Food and Drink Federation, BARA quickly gathered some impressive case studies from food and drink's early automation adopters.

One such company is Barbers Farmhouse Cheesemakers where weighing and cutting equipment immediately started making an ROI of around £3,000 per day by improving accuracy in the division of portions. The automated weighing and cutting technology reduced product 'giveaway' and allowed Barbers to produce around 2,600 extra portions of cheese per shift.

SUPERMARKET ENFORCER TO HELP UNBLOCK FOOD SECTOR SUPPLY CHAIN

Barber's is a compelling story – but although many food manufacturers could experience the same benefits – BARA has found the sector faces a frustrating disincentive in the shape of short and unstable contracts with supermarket buyers. “We hear time and again that the ability of supermarkets to withdraw contracts at short notice is putting food manufacturers off making up front investment in automation,” says Grant Collier, head of

marketing at PPMA Group, sister body to BARA.

“Some food manufactures have even said they do not wish to disclose information about their enquiries into automation because they fear supermarkets will make it an excuse to squeeze them further on margins,” Mr Collier continued.

But there is hope. BARA and PPMA praised the recent appointment of the Government’s Groceries Code Adjudicator as a positive step for food and drink manufacturers. “This will make the groceries code of conduct for the fair treatment of suppliers more robust and should give more confidence to food manufacturers looking to invest in automation and robotics,” said Collier.

Tasked with ensuring that supermarkets treat their suppliers fairly and lawfully, the role of the Groceries Code Adjudicator (GCA) will undoubtedly have a positive effect on confidence in much needed Automation for the Food Sector. With her responsibilities backed up by law, Christine Tacon can not only launch investigations into suspected breaches of the Groceries Supply Code of Practice (GSCOP), she can also name, shame and even fine the supermarkets for any misconduct.

ADJUDICATOR TO SPEAK AT THE PPMA SHOW

The adjudicator and former boss of the Co-operative Group’s farming business will explain at the first day’s seminar programme at the PPMA Show

2014 on September 30th, and is keen to resolve issues affecting the entire supply chain, thereby encouraging greater investment in automation within the food sector. Underlining her commitment to improving conditions right across the supply chain, Christine Tacon is keen to hear from indirect, as well as direct, suppliers, either personally, anonymously or through a trade association – and this doesn’t just mean front-line organisations such as the Food & Drink Federation or the National Farmers Union; it also includes the PPMA.

At a recent seminar organised by the Westminster Food & Nutrition Forum, entitled ‘The Groceries Code Adjudicator and the next steps for the food supply chain’, Christine announced her plan to crack down on unscrupulous practices by the multiple retailers. Regarding retailers charging

suppliers hundreds of thousands of pounds for discrepancies on promotions going back up to six years, Christine stated that she was seeking agreements from the major retailers to restrict their use of such ‘forensic’ investigations.

Another frequent complaint that Christine is seeking to outlaw relates to retailers deducting payments from food suppliers for failure to receive full orders, as a result of ‘shrinkage’ in the supply chain after goods have been dispatched.

Whilst tackling the issue of the lack of contracts from the major multiple retailers curtailing the investment in automation, Christine Tacon would also like to hear from exhibitors and visitors to the PPMA show what their concerns are. She speaks at the PPMA Show, 11am on September 30th Hall 5 at the NEC.





MICHAEL PORTILLO TO OPEN 2014 PPMA SHOW

Former Cabinet Minister, politician and journalist Michael Portillo will be providing the opening address in the seminar area at this year's PPMA Show.

A keen advocate of British manufacturing, Mr Portillo will take to the stage on the first day of the show (30th September) to discuss the resurgence of British manufacturing and its role in rebalancing the economy. Following his address, which takes place at 10:15am, Mr Portillo will take to the show's floor to speak with exhibitors and further discuss the points covered in his address.

David Harrison, Group Exhibition Manager at the PPMA Group,

said: "I'm very pleased to confirm Michael's involvement in this year's PPMA show. I know that he strongly supports British manufacturing and I have no doubt his address will be the perfect way to open the event."

"Michael is very much looking forward to meeting with exhibitors at the show and discussing the role that the processing and packaging industry has to play in continuing the revival of the British manufacturing sector."

The PPMA Show is the UK's premier, free to attend complete production line event for processing and packaging machinery, automation and industrial vision. The show attracts hundreds of machinery

manufacturers and component suppliers across a wide range of industries including food, drink, pharmaceutical, cosmetics, dairy, snacks, construction and electronics.

Taking place 30 Sept – 2 October 2014, this year will see the event return to the sole ownership and management of the PPMA Group of trade associations. ■

FIND OUT MORE



For more information on the PPMA Show 2014, please visit www.ppmashow.co.uk or join the conversation on twitter (@PPMAshow #PPMA14) or the PPMA Show LinkedIn group. You can also like us on Facebook by visiting the PPMA Show page.

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- Status quo analysis
- Quote, including project plan
- CAD Design
- Disassembly / Restoration / Installation
- Launch



Due to their size, the baking lines require competent knowledge and operational expertise. An effective production line can only be made when you combine the individual stations. If one station fails or becomes defective, the entire system is interrupted. This often leads to high costs and a substantial waste of your time. With the all-around service of Backtechnik S.I., surprises like this can be a part of the past. From restoration to modular renovation and from expansion

to installation of a new system, you can rely on our years of experience in baking equipment and technology.

During an on-site visit we will make a detailed status quo analysis that will determine further course of action. After you have received your offer, which includes the project plan, you will also receive a CAD design drawing. Both disassembly and installation take place within a

few days of each other so you can return to operational standards as soon as possible.

1. REFRESHING / RESTORATION

Restorations are also advantageous, especially with industrial baking lines, because they will often still perform well. Because of this we have made it our task to preserve and optimize lines wherever it is financially beneficial. Not only will you have the advantage of maintenance at any time for all your machines and ovens, but you will also be avoiding any sudden shortfall that may cost you money and time as well as raw materials.

Small, worn-out parts are often the cause for an entire stoppage of a production line. The cost to review such cases can be much lower than reviewing a complete fallout of the line.

2. OPTIMIZE

Parts such as the mesh belt and other smaller parts can often





become faulty on older models and can lead to limiting the entire productivity of the line. It is often not necessary to purchase a new tunnel oven. If you replace one or two components of the heating zones or the burner tower, the oven can run for several more years.

Our products are always up to date and we will continue to provide seamless production. Through optimization, you are also allowing your system to be renewed step by step.

3. EXPAND

The demand on production can change over the course of time – some products are dropped and new ones are added. From a certain size, these lines cannot be easily upgraded anymore. Together we will be able to plan the extension of your line one module at a time, down to the smallest detail.

Consequently and without much

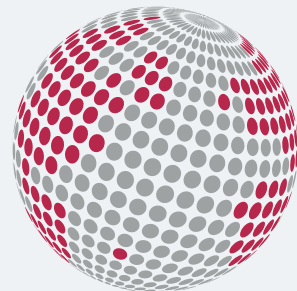
effort you are prepared for new challenges and can easily expand your product range. This helps us tailor our solutions to your needs.

4. RENEW

However, if it is apparent that neither restoration nor partial renewal makes economic sense, we will calculate the cost of a new “turnkey” production line based on your requirements.

With Backtechnik S.I. you have a competent and motivated partner by your side, allowing you to do what you do – the baking – without having to worry about the productivity of your line. Years of experience, international references and a dedicated team are what make us the specialists for you. We dedicate ourselves to helping you find or put together the perfect system. From innovative products to custom designs, our offers are tailored to your needs. Challenge us. We are looking forward to it. ■

THE WORLD OF BAKERY



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Development of sensory attractive bread products high in fibre and in bioactives

By Martijn Noort and Jan Willem van der Kamp, TNO, Department Functional Ingredients, Utrechtseweg 48, 3704HE, ZEIST, The Netherlands

Dietary guidelines recommend 25-35g fibre intake per day for adults, for which whole grain (WG) and cereal fibre products – due to their wide range of bioactive compounds as co-passengers – are increasingly mentioned as a preferred option.

A major shift from white to WG bread will contribute to lowering the incidence of heart disease, type 2 diabetes and colon cancer. However, most Europeans prefer the mild taste, soft crumb and

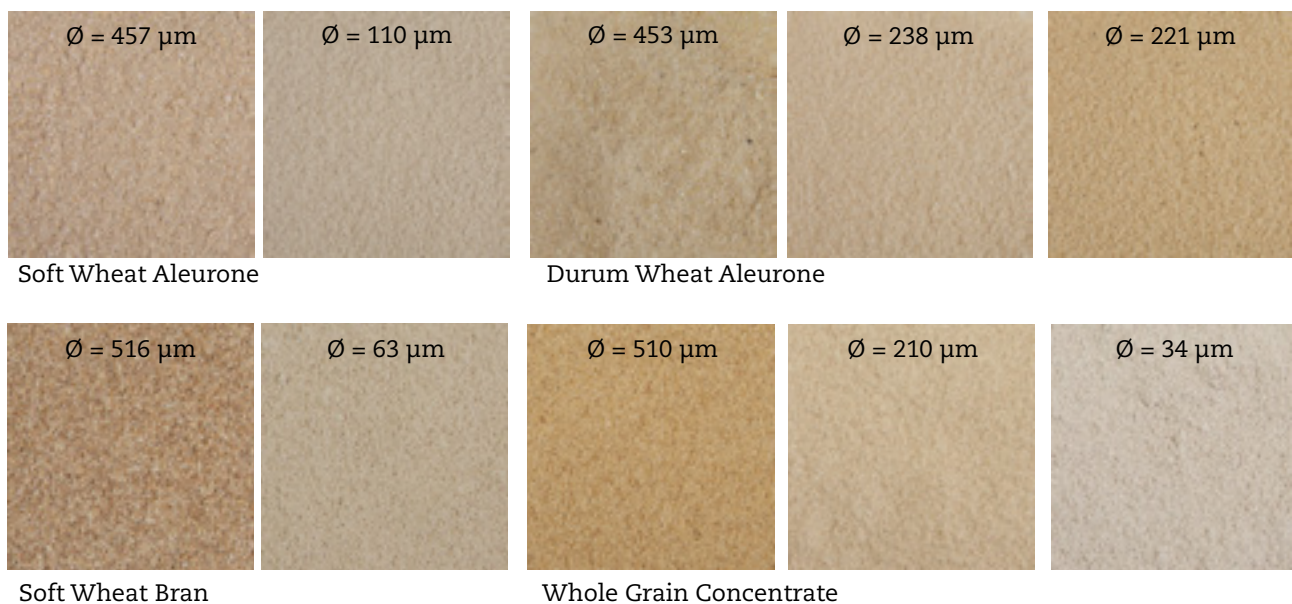
crispy crusts of white bread. The **HealthBread** FP7 EU project (2012-2014, www.healthbread.eu), based on FP6's EU project HEALTHGRAIN, aims to develop bread products high in bioactive compounds from grain, while retaining the desired sensory attributes.

Obtaining bioactive-rich wheat fractions

Different advanced dry milling techniques were used to obtain wheat fractions with light colour,

mild taste and with high levels of total dietary fibre (TDF), minerals, B-vitamins and other bioactive compounds such as anti-oxidants. Two soft wheat types and durum wheat were used for obtaining variations in composition and fractions' properties. Optionally, micronization was applied to reduce the particle size and hence liberate bioactive compounds, aiming to improve their bioavailability. A selection of bioactive-rich wheat fractions is shown in figure 1.

Figure 1: Bioactive-rich wheat fractions as produced by different advanced milling techniques.



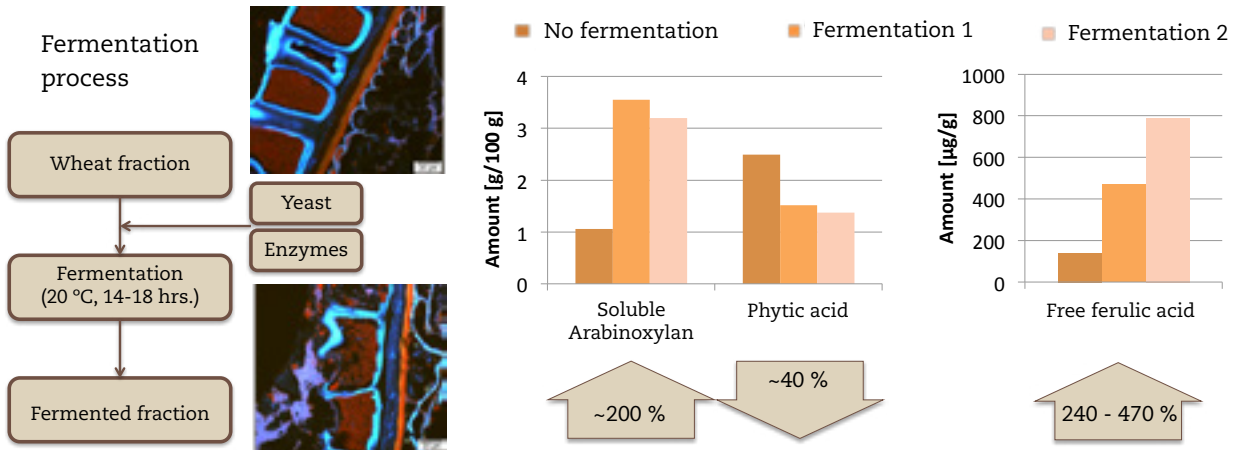


Figure 2: Schematic overview of fermentation process and effects of the optimized process on one of the bioactive-rich wheat fractions.

Improving the bioaccessibility of bioactive compounds in wheat fractions

Wet fermentation (‘bioprocessing’ Fig 2) was applied on wheat fractions to improve the bioavailability of bioactive compounds. Fractions were incubated with xylanase and feruoylesterase in a yeast fermentation process. Based on an experimental design optimal process conditions were defined, where bran modification was maximized whilst the increase of dough stickiness was kept minimal.

Guiding the formulation of bread products with substantially improved nutritional quality

The composition of each bioactive-rich wheat fraction was analyzed and the required addition level to white flour was calculated for producing bread products “high in fibre” containing > 6g TDF/100g bread. Most formulations also resulted in the required levels for “source of” nutrition claims for Fe, Zn, Mg, vitamin B1 and folate.

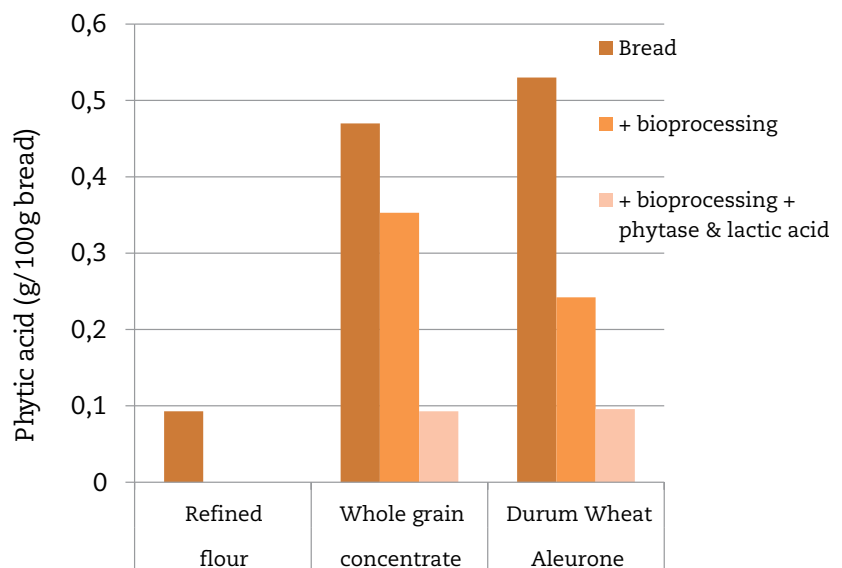
Substantial degradation of phytic acid (Fig 3) to could be realised by bioprocessing of the wheat fractions, whereas addition of phytase and lactic acid resulted in an even further degradation. In this way bread products with increased bioaccessibility of minerals were obtained. In HEALTHGRAIN, increased levels of free ferulic acid, not bound to fibre,

as realised here, were associated with major anti-oxidative and anti-inflammatory effects.

Optimizing the bread organoleptic quality

Using baking tests guided by an experimental design, the effects of the different wheat fractions and formulation-, enzymes- and process variations were studied.

Figure 3: Phytic acid degradation in crispy rolls with two different wheat fractions >6% TDF as compared to white bread



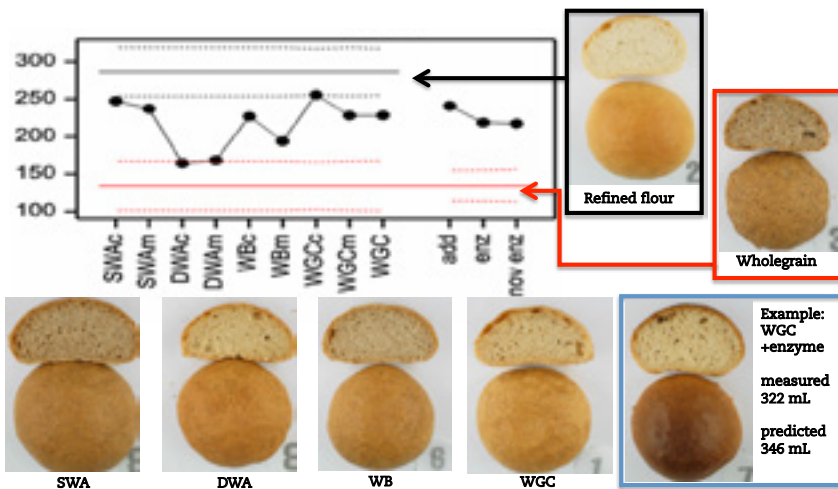


Figure 4: Results of baking tests of crispy rolls >6%TDF for one of the key parameters of bread quality: bread volume (mL).

The main effects and interactions were measured on the key quality parameters of the bread. In figure 4 the main effects on one key parameter (bread volume in mL) are presented. Significant effects of wheat fractions, their particle size, formulations and enzyme treatments were found, while interactive effects were mostly non-significant. The main effects were used to compute a predictive model based on

linear regression, to assist choice of fractions, formulations and process whilst obtaining the desired product quality.

Substantial quality improvements were obtained by using bioactive-rich wheat fractions in combination with optimized bioprocessing and formulation. Sensorially attractive breads were obtained with high volume, crumb

softness, light colour and positive flavour (see figure 5).

Product and business development

Eight SME bakeries - in Austria, Germany, Italy and the Netherlands - were involved in the HealthBread project to develop nutritionally enriched bread products with optimized sensory properties, which were positively evaluated by consumers. As a result, SME bakeries can strengthen their positioning with speciality products in a highly competitive market.

Conclusions

The HealthBread project successfully developed bread products with improved nutritional quality and sensory attractiveness, by elaborating and applying scientific and technological knowledge from the EU FP6 HEALTHGRAIN project. ■

FIND OUT MORE

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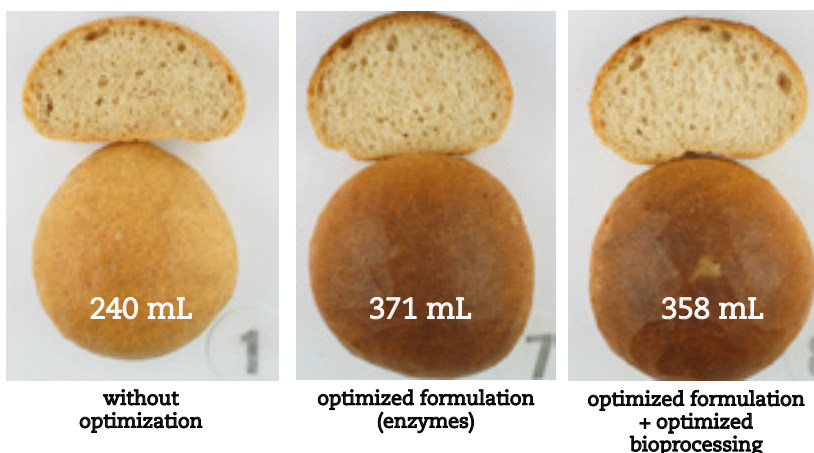


Figure 5: Example of optimized bread quality for whole grain concentrate on crispy rolls with >6%TDF.



It's all about PLEASURE food!

“When less sugar, salt and fat brings the same taste”



Matthias Kueck
Biozoon GmbH
PLEASURE - coordinator

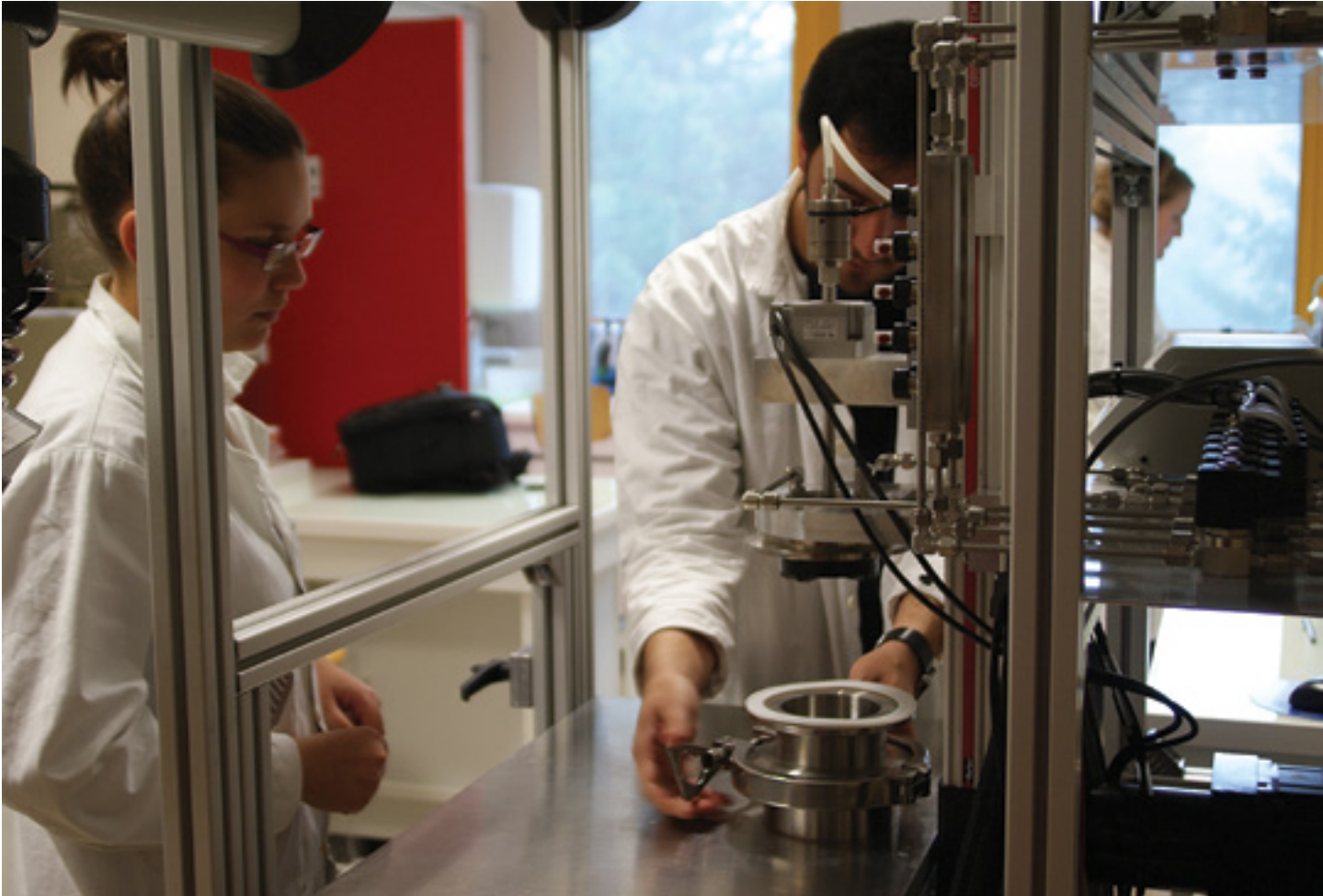
Since January 2012 a consortium of 16 partners from 8 different European countries, have joined forces, through the FP7 funded research project PLEASURE, to overcome the high consumption of salt fat and sugar. Since the early 90's, an epidemic growth of dietary induced diseases has been observed among the European population. More than 60% of all reported diseases in modern industrial countries are said to have their origin from malnutrition. Fat, salt and sugar fulfil important functions

in the human metabolism but meanwhile these compounds represent an important cause in the prevalence of malnutrition, their excessive consumption leading to enormous health problems.

Therefore, under the coordination of the SME Biozoon GmbH (Germany) and the scientific leadership of ONIRIS (France) the consortium established the PLEASURE project as a response to the need of finding solutions to develop new micro structured and naturally reduced foods with similar sensory properties compared to the conventional products. In the context that up to now application of replacers has been the main approach used by the industry to reduce the fat, salt and sugar content in food products, PLEASURE is having a unique approach as it obtained the reduction from the processing side, developing innovative processes and/or implementing novel technologies to allow the production of novel „reduced-in“ food products. For achieving its objectives the PLEASURE project is following three main routes:

- Physical structuring for fat and salt reduction
- Biotechnological processing for sugar reduction
- In depth understanding of the location of salt and sweet tastants in a complex food system





The concepts of physical structuring and biotechnological processing are first developed to “mono food” systems: Bakery, Cheese, Meat and Fruit & Vegetable. Later it is applied to different Ready-To-Eat meals with three model systems; a pizza and puff pastry with salty and sweet filling, gathering the previously optimized mono food systems. PLEASURE outcomes intend to bring about the scientific bricks which permit to develop optimized strategies of salt, sugar and fat reduction, already, the project developments having, besides others, a recognized and high impact on bakery.

PLEASURE BAKERY

Bakery products have been considered in close collaboration with CERELIA (France), a large company producing ready to bake dough. Salt reduction in bakery products addresses several challenges. The first one is to know what is the reference salt content; PLEASURE had to carry out investigations to determine country by country what was the „reference“. Then, targets have been defined to reach at least products matching with the nutrition claim „Reduced in“ which is defined by European legislation. The change in taste is a first big issue for the consumer,

Alain LeBail
ONIRIS
PLEASURE - scientific coordinator



even though he adapts slowly to salt reduction. Change in taste affects both „salty“ products like bread or pizza dough but also sweet dough. A model mouth has been designed and built at ONIRIS by Prof. PROST's group to get analytical responses on salt and sugar release during mastication using predefined masticating modes; these time intensity responses matched very well with the sensorial perception, confirming the interest of the model mouth.

Technological problems, in particular dough functionality

Elke Arendt
Univ. College Cork
PLEASURE - leader on bakery developments



Puff pastry control



is a second challenge which has been investigated by Prof. LEBAIL's group at ONIRIS. Salt reduction results in a faster mixing but also in more sticky dough and in a less cohesive gluten network. To overcome this, a prototype vacuum mixer (spirale tool) has been constructed by partner VMI. This system is used to assess the interest of low pressure to reduce dough stickiness and to enhance dough plasticity. This is very important in the case of laminated dough like pizza dough. Concerning the saltiness perception, tests have been carried out using encapsulated grain salt to produce salty domains in the dough while the salt content of the dough was reduced by 50%; no sensorial difference was observed by a trained panel (overall reduction by 25%). Since then, VMI has developed a new continuous mixer (CONTINUUM), which got an innovation award at the 2014 EUROPAIN fair held in Paris.

Puffing pastry has been studied by the University College Cork (Ireland) under the supervision of Prof ARENDT. The reduction of saturated fat in puffing pastry resulted in a softer fat, which is more difficult to insert and to stabilize during dough sheeting.

Puff pastry 30% salt reduced, 30% fat reduced (compared to control)



Using specific sheeting program, a reduction of fat by 30% has been achieved, while preserving the flaky structure and the volume of the baked system. Furthermore the overall salt level in puff pastry was reduced by up to 30%.

Sweetness development has been investigated by ONIRIS using amyloglucosidase. It was possible to produce sweet dough without any sucrose addition.

Investigations are still progressing with the objective of optimizing the shelf life of the product; indeed, dough produced by CERELIA has to be kept for 5 weeks in MAP at 4°C. Overall, the outcomes of PLEASURE yield in applicable technological solutions which permit to produce bakery products reduced in salt, sugar and saturated fat. ■



From Bulldogs, Beagles and Rattlesnakes to Designer Genes?

By Michael Edmund

It is an error to imagine that evolution signifies a constant tendency to increased perfection. That process undoubtedly involves a constant remodelling of the organism in adaptation to new conditions; but it depends on the nature of those conditions whether the directions of the modifications effected shall be upward or downward.

– Thomas Huxley

Nicknamed “Darwin’s Bulldog” for his staunch advocacy of the theory of evolution, Thomas Henry Huxley PC FRS FLS would probably have understood the implications when reports of “a new form of fungal wheat disease” began appearing a few years ago. The disease, wheat stem rust, is caused in this case by the Ug99 strain of *Puccinia graminis tritici*. Those early reports discussed in almost apocalyptic terms the threat to global wheat production. Today, neither this threat nor the language appears to have gone away: a recent study examines how Ug99 might continue its spread across Africa, the Middle East and southwest Asia to threaten food supplies for millions of people. The study observes that scientists have developed new wheat varieties with resistance to Ug99, but that the organism itself has evolved new forms that require in turn more new resistant varieties to be developed. An evolutionary arms race with very high stakes indeed; and one with striking parallels to the threat posed by *Fusarium oxysporum* to world banana production. The highly wilt-susceptible Gros Michel strain of

bananas has been replaced through selective breeding by the Cavendish strain, which is resistant to fusarium strains 1 and 2. The evolutionary response of the fungus, strain 4, now threatens banana production again.

Last year, an article in the UK’s Guardian newspaper warned about the threat to grain production from “the collision between population growth and water supply at the regional level”. Put bluntly, the wells are drying up in India, China and the US because of over-extraction of water for irrigation. More importantly, perhaps, grain production in a particular geographic region (the Middle East) is dropping, *with no prospect of reversing the trend*. Meanwhile, new research from the University of East Anglia makes for yet more sober reading. The work suggests that heat



waves could significantly reduce grain yields and threaten global food supply if climate change is not tackled *and reversed*.

So three different threats - disease, water shortage and climate change, now combine to threaten global grain production. We need hardly comment upon the potential significance for the baking industry - in Europe or anywhere else for that matter - of a global shortage of cereal, and perhaps especially of wheat. The most obvious response involves developing grain that is resistant to rust, drought and heat, which is where the controversy surrounding genetic modification enters the debate. These pages are not the best forum for discussion of that controversy, except perhaps to make the observation that the difference

between the selective breeding of Gregor Mendel's first experiments and the genetic modification of soybean for herbicide resistance amounts to little more than a question of timescale. And that selective breeding does not appear to be winning the race with *Puccinia* or with *Fusarium*.

And so to a recent article by Ed Yong, in which he explores a breakthrough in our understanding of the yeast *Saccharomyces cerevisiae*. He discusses the artificial synthesis of one of the organism's sixteen chromosomes. Artificial, you

note; and how the experience is equipping the researchers to study interactions between genes - and to meet the challenge of producing new yeast strains. Designer Yeast, if you will, that could be "programmed" to produce bread and cakes (and beer) with particular flavours, colours or textures; or that contain particular proteins. Yeasts that could improve the nutritional content of baked foodstuffs in ways at which we can only guess.

A second piece of recent research appears to explore even more

fundamental aspects of evolution by modifying DNA itself. Research that might ultimately lead to the design and development of entirely new designer life forms, freeing us completely from whatever threat natural pathogen and planetary change can pose. What price using the Moon as some gigantic cereal farm?

A final thought to suggest that even theories of evolution can evolve: it comes from Steven Wright, who has suggested (though, perhaps, not too seriously) that Darwin was adopted. ■

Wheat disease rust



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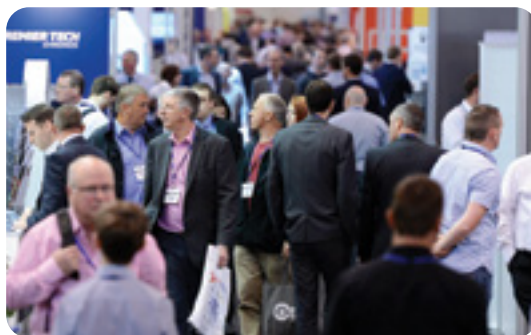
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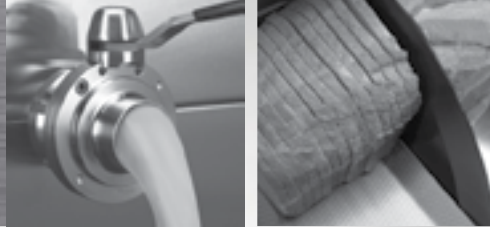


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