2020 – 3 years to go and counting!

The impact of ingredient and processing developments on R&D

Dr Pretima Titoria
2020 – 3 years to go and counting!

‘2020’ has long featured in research & development strategies as a key milestone date, but now with only 3 years to go, food and beverage companies must decide where to focus their efforts. In this white paper, Dr Pretima Titoria plots key industry trends against the new ingredients and latest processing technologies to identify what can realistically be achieved.

In June 2016, Leatherhead conducted interviews with innovation professionals in the food and beverage industry to find out how they are approach innovation\(^1\). Interviewees talked about innovation playing a role in a number of different core business activities, across a range of timescales, to drive business growth. As shown in Figure 1, these activities can be broadly divided into four areas or work streams: protecting the existing portfolio, stretching the product category, acquisitions & mergers and developing next-generation products.

What is practically feasible now?

Projects across these four work streams within the next 3 years require innovation teams to consider the developments within the ingredient market, as well as the availability and practicality of implementing innovative and energy-efficient processing technologies.

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\(^1\) Leatherhead Food Research (2016) Poised for an age of innovation – how food and beverage companies are preparing for growth.
Innovation teams need to be realistic about what is achievable and screen ideas and concepts, whether these be small or big. Adoption of the traditional stage-gate exercise or a Technology Readiness Level (TRL) study will ensure that the right ideas/concepts are incorporated within company strategies at the right time and pace.

It is also important to consider what is driving the innovation activity: is it the consumer/market trend or the ingredients/technology? The success of a product is ultimately dependent on meeting or even exceeding consumer demands, yet projects are constrained by the available ingredients and technologies. This is further complicated by consumers who are increasingly becoming more knowledgeable about food sources, manufacturing processes, healthy & nutritional benefits and spoilage & security.

In this white paper, we will look at some of the key 2017 consumer and market trends, identified from a range of sources such as Mintel and Food Navigator. We have plotted them against the new or emerging ingredients and processing technologies in order to consider some of the opportunities and challenges in delivering these trends (see Figure 2).

**What is going on in the ingredient market?**

As shown in Figure 2, sugar reduction continues to be an important and crucial theme within the health trend, particularly with the high profile involvement of public health organisations in the issue, such as the UK Scientific Advisory Committee on Nutrition (SACN). According to a recent SACN report, a 5% reduction in sugar content in breakfast cereals, yoghurts, biscuits, cakes, confectionery, morning goods, puddings, ice-cream and sweet spreads categories is required by August 2017, with a 20% reduction by 2020.

Current sugar reduction strategies include optimal use of intense and bulk sweeteners. Stevia and agave are gaining attention because of the ‘natural’ label, and there are a lot of products and grades available on the

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**Figure 2: Some of the key trends / mini-trends dominating 2017 and beyond**
market. It then requires expert knowledge in identifying the best sweeteners or sweetener blends for different applications without having a detrimental effect on flavour profiles or cost implications.

Exploitation of flavours as a sugar reduction tool is now gaining attention, especially with the recent announcement by DouxMartok. The company claims to have developed a flavour-carrying particle which can reduce sugar content and calories by more than 50% without losing sweetness or raising costs. This proprietary product is expected to be on the shelves in Europe by next year, and applications include yoghurts, baked goods, breakfast cereals and snacks. Interestingly, Nestlé announced that it has ‘successfully’ modified the structure of sugar, leading to successful sugar reduction in chocolate by 40%; it aims to start using its new sugar across its chocolate product range in 2018. It is unlikely that this modified sugar will be available to other food & beverage manufacturers.

Consumers are demanding exciting and innovative products that are clean label, natural, as well as made with plant-based and/or traditional ingredients. Development of products with clean label or natural additives, especially emulsifiers, remains a challenge and replacing chemical emulsifiers with natural versions is far from straight-forward. As discussed in a Leatherhead white paper, to date, natural emulsifiers have simply not been found to be as effective and versatile as their synthetic counterparts. However, considerable research is on-going, and focus is now on proteins from plant sources, polysaccharides, phospholipids and saponins. Table I summarises some of these ingredients. Once the isolation, fractionation, purification and characterisation steps have been achieved to deliver these pure ingredients, the prospects are excellent. At the moment, one saponin, isolated from the Quillaja saponaria tree, is commercially available on the market, being promoted by Ingredion as Q-Naturale and by Naturex as SapNov™.

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<th>Proteins</th>
<th>Polysaccharides</th>
<th>Phospholipids</th>
<th>Saponins</th>
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<td>Pea</td>
<td>Basil seeds</td>
<td>Sunflower</td>
<td>Quilla</td>
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<td>Lupin</td>
<td>Corn fiber</td>
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<td>Soy</td>
<td>Maitard reaction complexes</td>
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<td>Corn germ</td>
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Table I: Prospective ‘natural’ emulsifiers

Plant-based and traditional foods are at the top of many consumers’ watch list, and evidence shows that the use of plants, nuts, seeds and ancient grains can bring about nutritional benefits. For instance, meals prepared with beans and peas have been found to be more satiating than meals prepared with veal and pork. Interestingly, a vegetable-based meal with low protein content was found to be as satiating and palatable as

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an animal-based meal with high protein content in a recent study. There are additional benefits in using ancient grains, for example, the majority of ancient grains are gluten free.

Developing products with plant/nut/seed-based ingredients and ancient grains is not without its challenges. While chickpeas, lentils, fava beans, soy beans, seaweeds and algae are already available on the market in raw and powdered formats, along with quinoa, teff, kamut, chia and farro grains, the use of these ingredients is application dependent. These ingredients will also have an impact on the textural and taste profiles of products; their usage requires expert knowledge of ingredient blending and understanding of how hydrocolloids, starches and proteins interact.

There is another challenge from the regulatory perspective; product developers cannot label products in the way they would always like. ‘Cashew cream’ or ‘soy cheese’ might be the manufacturer’s preferred title, but these labels are not currently permissible under current EU regulation. ‘Cheese’ where milk fat has been substituted with vegetable fat must be called ‘cheese analogue (or substitute) made from vegetable oil and milk proteins’ — while the products might be appealing to consumers, the labels can be off-putting.

**What about processing technologies?**

While consumer demand for ‘on-the-go’ products is still increasing, the ‘night shift’ food theme is gaining attention. These products can be largely delivered by exploitation of ingredient knowledge and product development tools, but it is the new processing technologies that will enhance the quality, appearance and functionality of these products.

According to Mintel, consumers due to their busy schedules need to wind down and relax in preparation for a healthy sleep. Drinking warm milk before bed time is a popular and traditional habit; milk contains an amino acid called L-Tryptophan which helps the body to produce melatonin and serotonin and these are two chemicals which tell the body to sleep. Functional ingredients which product developers are considering in relation to this ‘night shift’ trend include GABA, pyridoxine, calcium, potassium and ornithine, and these can be found in ‘bulk ingredients’ such as barley grass powder, maca, panax, whole grains and asparagus powder. The key challenge is the availability and effectiveness of key functional ingredients within products that will promote sleep.

There are a number of new and/or optimised technologies that are gaining attention for their capability to protect and deliver functional ingredients within the product structures. Non-thermal processes have gained importance in recent years due to the increasing demand for foods with a high nutritional value and fresh-like characteristics, representing an alternative

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6 Kristensen MD, Bendson NT, Christensen SM, Astrup A and Raben A (2016) Meals based on vegetable protein sources (beans and peas) are more satiating than meals based on animal protein sources (veal and pork) — a randomised cross-over meal test study. *Food & Nutrition Research*, 60:32634.


to conventional thermal treatments\textsuperscript{10}. Ultrasound and high-pressure processing are the most promising short-term ones, and can play a large role in the development of ‘night shift’ food; recently the utilisation of ultrasound and high pressure processing, both non-thermal, was found to preserve the fructo-oligosaccharide content of cranberry juice, therefore maintaining the prebiotic property of the juice, as well as increase the anthocyanin content\textsuperscript{11}. As demonstrated in this study, the prospects for delivery of functional ingredients using ultrasound and HPP, with minimal detrimental effects on product quality, are excellent and should be explored.

Furthermore, there is an additional benefit to using these technologies, and that is inactivation of microorganisms by non-thermal means.

Achieving a successful ‘on-the-go’ product requires a combination of processing and packaging technologies. Investment into smaller, more flexible and single-pack pouches is a must to meet consumer demand, and enabling the use of ‘green’ and ‘recyclable’ materials for packaging would be a bonus. All of these are available in the market, and can be a quick-win solution, providing quality is proven in terms of texture and microbiological stability.

\textbf{2020 and beyond}

With 2020 only three years away, innovation teams need to focus on projects which are achievable in this timescale. These projects will likely fall into the ‘protecting the existing product portfolio’ and ‘stretching the category’ work streams (from Figure 1). At their core, these projects must address a consumer or market need, but their activation will be dependent on the readiness of technology and ingredients. While goals help to focus the mind, the longer term picture must also not be forgotten – 2020 will come and go and innovation strategy must remember not to be completely distracted by near term goals, when it will actually be the longer term ones which will be key in ensuring the longevity of the business.

\textsuperscript{11} Gomes WF et al. (2016) Effect of ultrasound followed by high pressure processing on prebiotic cranberry juice. \textit{Food Chemistry}, \textbf{218}:216-268.
How Leatherhead can help

With strong links to various ingredient manufacturers/suppliers and emerging technology hubs, Leatherhead can work with you to ensure successful product development with the latest ingredients and technologies. Confidence in the product deliverables can be validated with designed product analysis on ingredient efficacy, product characteristics and shelf life stability, all of which Leatherhead can assist with. Furthermore, an understanding of the global regulatory landscape can be provided, ensuring that the products you develop comply with the local restrictions. With such a strong and increasing consumer demand for these products, the opportunities are great, and we can help you uncover them.

About the author

Pretima graduated with a B.Sc. (Hons) in Food Technology at University of Reading and obtained her Ph.D. in the area of rheological characterisation of food biopolymers/hydrocolloids at Cranfield University. She continued to develop her skills in this area over several years while working at the Institute of Food Research, Norwich and at Dupont Cereal Innovation Centre, Cambridge, before joining Leatherhead Food Research in 2001. Pretima now leads the Nutrition and Product Development Team, and project-manages several Confidential Contract Research projects. Pretima has many years’ experience in physico-chemical characterisation of ingredients, interim products and final products, focusing on the textural and microstructural properties and their effect on product quality and stability, as well as their role in oral processing. Pretima is also involved with assessment of emerging technologies for the food & beverage industry, and is the Fellow at the Institute of Food Science and Technology (FIFST).
About Leatherhead Food Research

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

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