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SPECIAL "PLANT BASED ALTERNATIVES"

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Publisher: B&L MedienGesellschaft mbH & Co. KG Hilden, Verlagsniederlassung Bad Breisig, Zehnerstr. 22 b, 53498 Bad Breisig/ Germany, Fax: +49(0)2633/454099, Internet: www.international-dairy.com

Managing Director: Harry Lietzenmayer, Stephan Toth, Björn Hansen

Object Manager: Burkhard Endemann, Direct line: +49(0)2633/4540-16, Email: be@blmedien.de

Editor: Roland Sossna (responsible), Office Dülmen/Germany, Direct line: +49(0)2590/943720, Cell phone: +49(0)170/4185954, Email: sossna@blmedien.de

Anja Hoffrichter, Office Dorsten/Germany, Cell phone: +49(0)178/2330047 Email: ah@blmedien.de

Graphics, layout and production: Silvia Schneider, Office Solingen/Germany, Cell phone: +49(0)170/2975864 Email: s.schneider@blmedien.de

Advertising Manager: Heike Turowski, Office Marl/Germany, Direct line: +49 (0) 23 65/38 97 46, Fax: +49 (0) 23 65/38 97 47, Cell phone +49 (0) 1 51/22 64 62 59, Email: ht@blmedien.de

Publisher's International representative: dc media services, David Cox, 21 Goodwin Road, Rochester, Kent ME3 8HR, UK, Phone: +44 845 393 1574, Email: david@dcmediaservices.co.uk

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Plant-based dairy alternatives – an IDM International Dairy Magazine special focus edition

photo: aamulya_stock.adobe.com

The plant-based dairy alternatives sector has grown in developed countries at an astonishing rate. The plant-based category has long since become main-stream and even those who enjoy original animal products are becoming, in the face of ever increasing choice, more and more willing to give plantbased a try. Once they have tried, a great proportion of consumers is likely to stay on board – as product quality has improved greatly over the past years. So, flexitarians are all over and everywhere.

Now that inflation has hit most markets round the globe, the quality of plant-based alternatives becomes even more crucial. Given the fact that they still cost more than the animal-based originial, consumers must not be disappointed by this category. Manufacturers who have invested in product development, production capacity, packaging and markets run in danger to lose sales volume if they start to downgrade ingredients they use.

This special issue of IDM International Dairy Magazine explores the ways of improving plant-based alternatives or quite simple: how to make good tasting products. Readers will find a number of solutions and proposals for how to address the plant-based product category.

We think that we have compiled interesting information in this special issue that will help dairies (and companies in other fields) to tackle some of the challenges in making the very best plant-based alternative products.

Roland Sossna, Editor

CLARANOR **Primoreels and Pulsed Light**

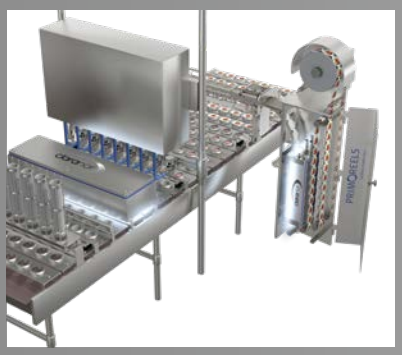
Together with Primoreels, Claranor is now able to retrofit the lid station of filling machines with a sustainable and economical solution. Dairy, plant-based and food producers will benefit from the many advantages of the Primoreels lidding system combined with Pulsed Light cup and lid decontamination, Claranor promises.

Primoreels precut lids are delivered on reels, which removes the continuous check and refilling of lids magazine; it thus increases productivity. Less handling and the smart integration of the Claranor module offer a high level of hygiene, 3 to 4 log reduction on moulds and bacteria, depending on the product and aligned with Class IV VDMA code of practices.

This integrated equipment solution offers brand-owners to meet their demand for sustainability and greener processes:

- The reels system allows the use of very thin films and the Primoreels patented optimal layout reduces film and overpack consumption. Claranor Pulsed light lid decontamination, as a non-thermal treatment, is very well adapted to respect the thinnest films. This enables significant material savings.
- Even PP lids are used, so together with PP cup the recyclability is ensured.
- Claranor technology saves >80% energy compared to UVC or chemical treatments.

If calculated on the packaging and productivity savings, the ROI of the Primoreels solution is often less than one year, Claranor says.



A combination of precut lids and UV decontamination saves resources and money (photo: Claranor)

Planteneers unites indulgence and health

Protein enrichment in plant-based cheese alternatives

Katharina Schäfer, Product Manager Planteneers

About 44 percent of Germans are flexitarians, seven percent are vegetarians and one percent are vegans. These figures are from the current Nutrition Report 2022 recently published by the German Federal Ministry of Food and Agriculture. Like many other domestic and international market surveys, it confirms that the demand for plant-based alternatives to conventional animal products continues to rise. The main driver is curiosity, along with ethical reasons, flavour and health.

Flavour is a reason to buy for 64 percent of consumers, while 47 percent choose plant-based foods for health reasons. These numbers reflect the general expectations consumers have of foods – for 99 percent of them it is important that food taste good. According to the Nutrition Report, health aspects are determining factors for 89 percent. For this reason, more and more producers of plant-based alternatives are looking to enrich their products with nutrients. In plant-based drinks, for example, the addition of micronutrients is standard practice. Here, Planteneers works very closely with its sister company SternVitamin, which has developed many target group-specific concepts. Its micronutrient premixes not only prevent deficiencies, but also meet specific needs, such as mental power, heart health, gut health, bone strengthening and immune system support.

Boosting protein content

Protein enrichment of foods is much more difficult. Even the best nutritional values won't save foods whose flavour and texture aren't appealing. We stepped up to the challenge and developed various functional systems for plant-based camembert alternatives. In these systems, the focus is both on texture and on enrichment of the final product with protein. What makes these fiildDairy-series products unique is that they enable the production of creamy camembert alternatives with a protein content of 10 to 13 percent. By comparison, plant-based alternatives to products like hard cheese, pizza cheese and processed cheese preparations usually contain less than one percent protein, much less than in real cheese. Plant-based soft cheese alternatives using cashews are an exception. They often have a somewhat higher protein content, but the texture and flavour of these expensive products are quite different from the familiar original.

The manufacturing process of plant-based alternatives to hard and pizza cheese is also quite different from regular cheese. The alternatives are usually made in a double-walled process cooker with integrated shearing blade. In it, melted fat, starch, hydrocolloids and other ingredients are typically heated to at least 85°C and then filled hot. This is much simpler than conventional

fiildDairy-series products enable the production of creamy camembert alternatives with a protein content of 10 to 13 percent (photo: Planteneers)

cheese processes, and therefore feasible for all kinds of industries. However, up until now protein content was a limitation. Proteins can interact with the starches, giving the product a very high fill viscosity. We set out to overcome this hurdle, step by step, with good results. For example, with specific Planteneers systems it is now finally possible to produce elastic alternatives to hard cheese with five percent protein.

Traditional manufacture as a basis

However, we took a different route for the plant-based alternative to camembert. We invested in a new cheese line as used in traditional cheese production. Naturally, ours is in smaller scale for pilot tests. We also did some basic research, testing all kinds of raw materials for both the proteins and the hydrocolloids. After many tests we selected soy and pea protein. For each we created a blend with a vegetable fibre and a hydrocolloid. From this we made a plant-based alternative to starter milk, to which we added a vegan starter culture in our trial cheese plant. Just like in traditional cheese manufacture, this was followed by steps like thickening, cutting and pressing, and finally resulted in a comparatively high protein content. Finally, we sprayed our camembert alternatives with a mould culture and let them rest in a ripening cabinet. The results were convincing. Both blends gave a product with a soft, creamy texture. The mould culture brings them very close to the aromatic flavour of classic camembert. The plant-based product also behaves very similarly in use. It can be eaten on bread, or breaded and baked. The traditional production process on conventional cheese-making machinery is an advantage, as are the declaration-friendly ingredients.

In addition to soy and pea protein we also tested almond protein, but that has the problem of allergenic potential. For this reason we can use almonds at only a few of our locations. Therefore, currently we're concentrating on pea and soy, but will be testing other protein sources going forward. As a next step we're planning to try out other cultures and work on additional specialities.

Plant-based cheese alternatives for every need

With plant-based camembert, Planteneers is bringing to the cheese alternatives market for the first time a product that has comparatively high protein content, a pleasant flavour and a creamy mouthfeel. With the many all-in compounds in our fiildDairy range, manufacturers can make plant-based alternatives to cream cheese, pizza cheese, and hard cheese in slices and blocks. Alternatives to cheese fillings, for example for plant-based schnitzel and the like, are also no problem. Another idea is plant-based solutions as alternatives to processed cheese preparations, spreadable or in triangular form. Recently we made it very easy to configure them with our Plantbaser.

As an adjunct to R&D capabilities the Plantbaser makes it easier for mid-size companies to enter the plant-based market. With this digital product development tool, companies can save a huge amount of time. They can reduce the number of coordination processes and get new products to market much faster. At the same time, the Plantbaser greatly simplifies the process of developing innovations. Within 15 to 20 minutes users can put together the plant-based product they want in a variety of categories. This makes product development possible around the world and around the clock. Users can see for themselves at https://plantbaser.planteneers.com/.

fiildDairy range enables manufacturers to produce various plant-based alternatives to cheese like cream cheese, pizza cheese, and hard cheese in slices and blocks. (photo: Planteneers)

Consistently sustainable

Plant-based drinks in Pure-Pak provide a welcome market boost

(photo: Elopak)

For many consumers, plant-based drinks have become a popular alternative to conventional milk as they are associated with being healthier and more environmentally friendly. Statistics provided by the market research company GfK show that "alternative" products in Germany now account for approximately 40% of dairy drink purchases and that sales of plant-based beverages even boasted growth rates of 30% in 2021 compared with the previous year.[1] To ensure effective marketing, packaging plays a crucial role in the authenticity of sustainably labelled beverages. Elopak's Pure-Pak beverage cartons and filling lines offer manufacturers that exact solution.

Adjusting to market dynamics

According to a recent study by the University of Halle-Wittenberg, Germany, consumers are willing to pay more money for food packaging that they perceive to be sustainable.[2] Therefore, it is essential to choose packaging that meets the highest ecological standards. Michael Oppenheimer, Market Unit Manager at Elopak, Germany, comments: "Many leading brands select Elopak's Pure-Pak beverage carton to package their plant-based drinks. Being a highly recyclable packaging that consists largely of renewable raw materials, our Pure-Pak beverage carton meets the high ecological

The Pure-Pak eSense carton has no aluminium barrier yet still meets all the requirements for aseptic filling and a long shelf-life outside the cold chain (Foto: Elopak)

Ikea offers three plant-based dairy alternatives in its Swedish food section (photo: Elopak)

standards demanded by many consumers. In addition, manufacturers benefit from a wide product variety and a sterile filling system that offers the agility required to perform successfully in dynamic markets."

Industry highlights

During the last few months, numerous interesting beverage products have been launched in Pure-Pak cartons. As of this year, the Swedish furniture chain Ikea has added three different plant-based drinks to its food section. The oat drinks are produced by plant-based experts at The Green Dairy. The aseptically filled drinks come in a 1 L Pure-Pak Sense Aseptic carton with a corner panel and are available as Oat Drink Natural, Oat Drink Chocolate Flavour and Barista Oat Drink varieties.

The grocery store Lidl also offers new plant-based drinks in 1 L Pure-Pak cartons in Sweden and the Netherlands. With their private label brand Vemondo, they

offer different oat drinks in chilled and ambient distribution, one of which is mango, ginger and lime flavoured. Also this year, Tesco in the UK launched a range of plant-based barista drinks in Pure-Pak under their own Wicked Kitchen brand. Consumers can choose between four varieties, including oat, soy, almond and coconut.

A variety of possibilities

For its Pure-Pak, Elopak offers numerous options that make the beverage carton even more customisable and sustainable. For example, for cartons with Natural Brown Board the usual white coating and the bleaching process are omitted; they therefore have a lower carbon footprint than conventional white cartons. Their authentic, natural look makes it even easier for consumers to recognise them as sustainable packaging.

Already available on the market is the Pure-TwistFlip tethered cap solution by Elopak. The connection with the packaging ensures proper disposal of the lid all the way to recycling. What's more, it is Elopak's lightest screw cap so far. Plastic consumption is thus further reduced without compromising either convenience or product integrity.

A new product that has recently become available is the Pure-Pak eSense carton. This product has no aluminium barrier yet still meets all the requirements for aseptic filling and a long shelf-life outside the cold chain. Instead of the aluminium barrier, a mixture of polyolefins is used, which – compared with a conventional aseptic Pure-Pak carton – reduces the carbon footprint by approximately 30% and offers the potential of a fully renewable aseptic carton.

"We want to offer our customers the most versatile yet user-friendly packaging solutions possible," concludes Wolfgang Buchkremer, Chief Technology Officer Innovation & Engineering at Elopak. "This is also reflected in the latest generation of our E-PS120A aseptic filling machine. Thanks to ultrasonic sealing, it can not only process conventional composite material, but our aluminium-free Pure-Pak eSense aseptic carton as well. Many other features, such as the new combi-filler and the possibility to apply two closure sizes on one machine, provide further added value and even more flexibility in the aseptic sector."

1 *Source: GfK Consumer Panel FMCG, Milk product alternatives, Key Facts, Year 2021 vs. 2020*
2 *Source: https://pressemitteilungen.pr.uni-halle.de/index.php?modus=pmanzeige&pm_id=5382*

SVZ

Processing of ports' surplus fruit and vegetables

As two of the largest seaports in Europe, Rotterdam and Antwerp play an important role in the global trade of fresh produce. In 2020, for example, approximately 2.2 million tons of fruit and vegetables entered Antwerp via the North Sea, while the Port of Rotterdam processed an enormous 5.2 million tons across the entire year.

The popularity of fresh produce shows no sign of abating two years later, either. There is currently a strong call for 100% natural, healthy foods and drinks as consumers become more aware of the effect what they eat has on their overall health and wellbeing. The tons of imported fruit and vegetables that the ports of Rotterdam and Antwerp process every day are crucial to meeting this continued demand.

However, this imported produce also includes fruit and vegetables which aren't considered suitable for selling fresh - either due to their level of ripeness or appearance. This results in an estimated 5% of produce that is usually used for biofuel, if not wasted – primarily apples, bananas, pears and tropical fruits such as mangoes and pineapples.

SVZ is committed to implementing sustainable initiatives throughout the supply chain that minimise the environmental impact of their business. It already takes in excess kiwi fruit from Belgian ports, but now the business is looking to take more surplus fruit and vegetables from Rotterdam and Antwerp. In fact, SVZ's soon-to-be expanded Rijkevorsel processing plant is perfectly positioned to take in produce from both ports.

"The consolidation of agreements with importers and fruit companies that operate in the ports of Rotterdam and Antwerp is an exciting development for us," says Monique Behrend-Dullaert, Director of Procurement & Agronomy at SVZ. "We're passionate about making the agro supply chain more sustainable, and we're already making headway with programmes focused on biological control and the promotion of wellbeing in farming communities.

Dairy and dairy alternatives: positive nutrition is on trend

The Fi Global Insights Dairy and Dairy Alternatives Report 2022 sheds fresh light on dairy trends and consumer expectations

Author: Julien Bonvallet, Informa Markets

Organic options, innovative product concepts, a vast range of plant-based dairy alternatives, protein enriched and fortified dairy drinks and spoonables – it's difficult to find another category in the food industry that has seen more change, innovation and variation than the dairy segment recently.

This very positive development is driving growth in the category, and it opens up the possibility of reaching completely new consumer groups, offering indulgence and added health benefits, plus products that are a perfect fit for a conscious and sustainable lifestyle.

So what is driving this new blast of innovation and multitude of product launches? What do consumers expect of the sector? And how can manufacturers profit from its development? A deeper look into the Fi Global Insights Dairy and Dairy Alternatives Report 2022 maps the road to success in these markets and aids the understanding of consumer needs and attitudes. The report brings together the findings of some of the leading market researchers, including Euromonitor, Innova, Mintel and FMCG Gurus, providing valuable insight into the dairy and dairy alternatives markets today as well as an outlook for tomorrow.

Dairy or non-dairy? Both please

First of all, it is important to understand that most consumers don't compare dairy and dairy alternative products on the basis of ethical beliefs – unless they are strict vegans, a group who are still in the minority. A growing number of consumers simply see both as being on a par, and they appreciate having more variety to pick from. To them, milk, yogurt, cheese or cream can come from lots of different sources.

For dairy manufacturers and marketers, it can therefore make absolute sense to adapt their portfolios and offer alternatives. They have long regarded milk alternatives as a temporary trend. Only now they are realizing that they will lose more and more volume if they don't open up to this segment. Looking at the German market, which is strong in dairy alternatives, Schwarzwaldmilch

Most consumers don't compare dairy and dairy alternative products on the basis of ethical beliefs (photo: AdobeStock)

with Velike is a great example. And FrieslandCampina just has launched a range of dairy alternatives under its very strong Landliebe milk brand, and it will be very interesting to see how it performs.

A great example comes from another segment: Traditional German sausage producer Rügenwalder Mühle have added vegetarian and vegan options to their portfolio and enjoyed overwhelming success. Today, the meat-free options have even exceeded the revenue from the traditional products – a success story that could be a blueprint for other segments.

Perfect for positive nutrition

Whatever consumers choose, the broader variety of options on offer now means they can make a positive contribution to their overall health at the same time as selecting products that fit their own personal needs. Whether it's protein enriched for muscle growth and maintenance, lactose-free for dietary intolerances, calcium enriched for bone and tooth health, pro- and prebiotics for gut health or low fat for weight management, dairy and dairy alternatives allow people to make choices that satisfy their individual nutrition requirements and preferences.

Consumer research has shown that many dairy products fit perfectly into the trend for positive nutrition, with consumers viewing them as being healthy and natural. In the EU, protein or calcium on-pack claims even allow for better communication of a product's potential benefits, especially for muscle, bone and tooth health.

Gut health too is a key issue for consumers today, and manufacturers of dairy and dairy alternative products can benefit from a deeper look at this area. Prebiotic, probiotic and fermented foods are interesting for consumers who have digestive problems, but they are also appealing to those who just want to support gut health and digestive wellbeing. The fermented nature of dairy products makes them the ideal vehicle for adding pre- and probiotics to the diet. And because most people already consume dairy products every day, adding

For manufacturers, it is important to build trust through honest and clear marketing (photo: AdobeStock)

probiotics and prebiotic ingredients like fiber to them is an easy way to promote gut health without requiring people to change their habits or take dietary supplements. EFSA health claims are mostly related to the fiber content of these foods, but there are many other ways that brands can communicate the positive health effects of beneficial bacteria, including via consumer education.

Sugar, lactose, fat – are they the bad boys?

While there are ingredients that have positive associations in the minds of the consumer, there are others that have the opposite effect. Sugar, lactose and saturated fats, for instance, are constantly under fire, and manufacturers who are able to provide satisfactory alternatives are reaping rewards.

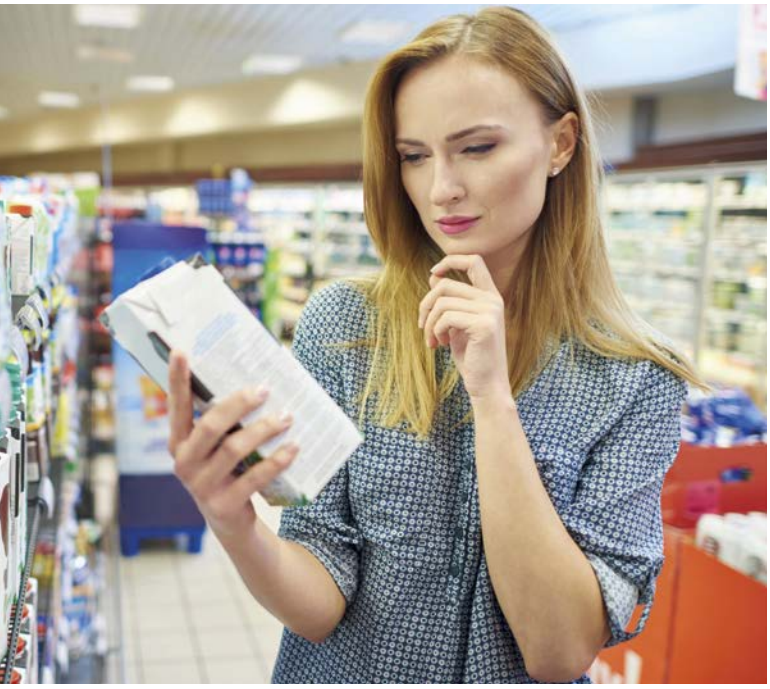
When it comes to products with healthy positionings, consumers expect low sugar levels, and no added sugars. Especially with indulgence products like chocolate drinks or fruit yogurts, conscious buyers check ingredients lists thoroughly. If sugar has to be added, it should be in small amounts, and natural sweetening solutions are far more acceptable than artificial sweeteners such as aspartame-K or sucralose.

Potentially misleading "no added sugar" claims are also under scrutiny: Manufacturers should be mindful that in some dairy alternatives, sugar is created by the enzymatic processes that take place during production. They must therefore be careful not to make claims that could lead consumers to think they are choosing a sugar free product. The Fi Global Insights Report explores the broad range of natural sweetening options that can give both dairy and dairy alternative products a more balanced nutritional profile and allow for positive consumer communication at the same time.

And then there's lactose. Bloating, cramping, digestive discomfort: Lactose can trigger gut health issues in sensitive or intolerant people who lack the enzyme lactase, which breaks it down in the body and makes it easier to digest. Lactose-free products have had a regular place on supermarket shelves for many years and have seen a steady increase in popularity. Their slightly sweet taste, which comes from the broken down sugars, can be a benefit in sweet products, and the Report notes that sweet segments like desserts have been ripe for creative product development.

Good fat, bad fat

For some consumer groups, the perception of fat has changed, however, partly because of the high fat, low carb keto trend, which is said to enhance energy levels and physical performance, promote weight loss and aid gut health. Saturated fats, however, can contribute to cardiovascular diseases and other health issues, so many public health organisations recommend reducing their consumption and switching instead to poly-unsaturated fats. Dairy fat is traditionally saturated, but the industry has reacted by offering alternatives. Some product innovations are enriched with phytos-



Consumer research has shown that many dairy products fit perfectly into the trend for positive nutrition (photo: AlamyStock)

terols, which can help to lower cholesterol levels. Others replace saturated fat with protein or with fiber. In desserts such as mousses, or in yogurts and spreading cheeses, gelatine can act as a clean label fat replacer, while the prebiotic fiber inulin creates a creamy mouthfeel that can mimic fat in many applications. An innovation presented in the Report is a Spanish brand that claims to remove all the saturated animal fat in liquid milk and replaces it with 100 per cent oleic vegetable fats for cholesterol reduction.

Rising stars: Dairy alternatives

A growing group of consumers favour a plant-based, dairy-free diet. According to a Euromonitor survey from 2021, 42 per cent of consumers globally say they prefer this sort of diet for digestive health reasons, and 40 per cent say they just feel generally healthier. Dairy alternatives therefore offer great opportunities for innovation and growth, accelerated by their positive associations with sustainability and climate issues.

But looking deeper into their nutritional profiles, plant-based dairy alternatives do not offer the same complete amino acid spectrum or vitamin load as products based on animal milk. With this in mind, the Report highlights studies that point to the fact that dairy alternatives may be a practical replacement, but not from a nutritional view.

In order to close this nutrient gap, scientists have drawn up a set of proposed nutrient standards for this category and recommended that the food industry and public health authorities adopt them, with the goal of ensuring plant-based alternatives match the micro- and macronutrient profile of dairy products.

What does this mean for manufacturers? Fortunately, there are many possible ways. At Fi Europe this year, plant-based will again be one of the key topics, with many exhibitors and speakers offering solutions for nutritional enhancement of all sorts of products. Attendees will find the perfect platform for exploring the latest developments and innovative ingredients and solutions available to help meet the expectations of consumers and nutritionists for this increasingly important category.

Clean label, clean communication

Amidst the vast array of possibilities in the dairy and dairy alternative fields, naturalness and a clean label are still key for consumers.

While milk drink alternatives are usually only minimally processed, this is not the case for many other categories, such as plant-based cheeses and yogurts. To achieve the desired mouthfeel and spreadability in these products, their ingredients lists tend to be much longer, plus they often require intensive processing.

The challenge for product developers in the future will be to find clean label ingredients and use gentle production processes that deliver desirable product properties and a favourable nutritional profile at the same time, and to offer dairy alternatives also for price sensitive consumers: Current alternative bases such as fermented nuts can be much higher in price, meaning that many finished products carry premium price tags. Interesting alternatives in the future could be milk protein obtained by using microbial fermentation, precision engineering and cell cultivation, once they received novel food approval in all regions.

Communication remains a sensitive subject too: For manufacturers, it is important to build trust through honest and clear marketing. As numerous examples have shown in the past, consumers and consumer associations react harshly to misleading messages and greenwashing. Transparency and honest communication definitely pay off and create trust in everyone's eyes.

At Fi Europe this year, a number of speakers will explore key topics in the dairy and plant-based alternatives segment, and share their expertise with the audience. The Fi Global Insights Dairy and Dairy Alternatives Report is available online here:

https://www.figlobal.com
https://bit.ly/figidairy

VEGAN CHEESE ALTERNATIVE

Violife produces less carbon emissions

Greek Vegan brand Violife claims that its vegan cheese has 50 percent of the climate impact of real cheese. The brand worked with leading sustainability advisor Quantis to calculate the climate footprint of eight Violife vegan cheese products through their entire life cycle. The assessment took into account the growing of the natural ingredients used in the products' recipes, and it considered all the steps involved in making the products, including transportation, production, packaging, distribution, and their disposal by consumers.

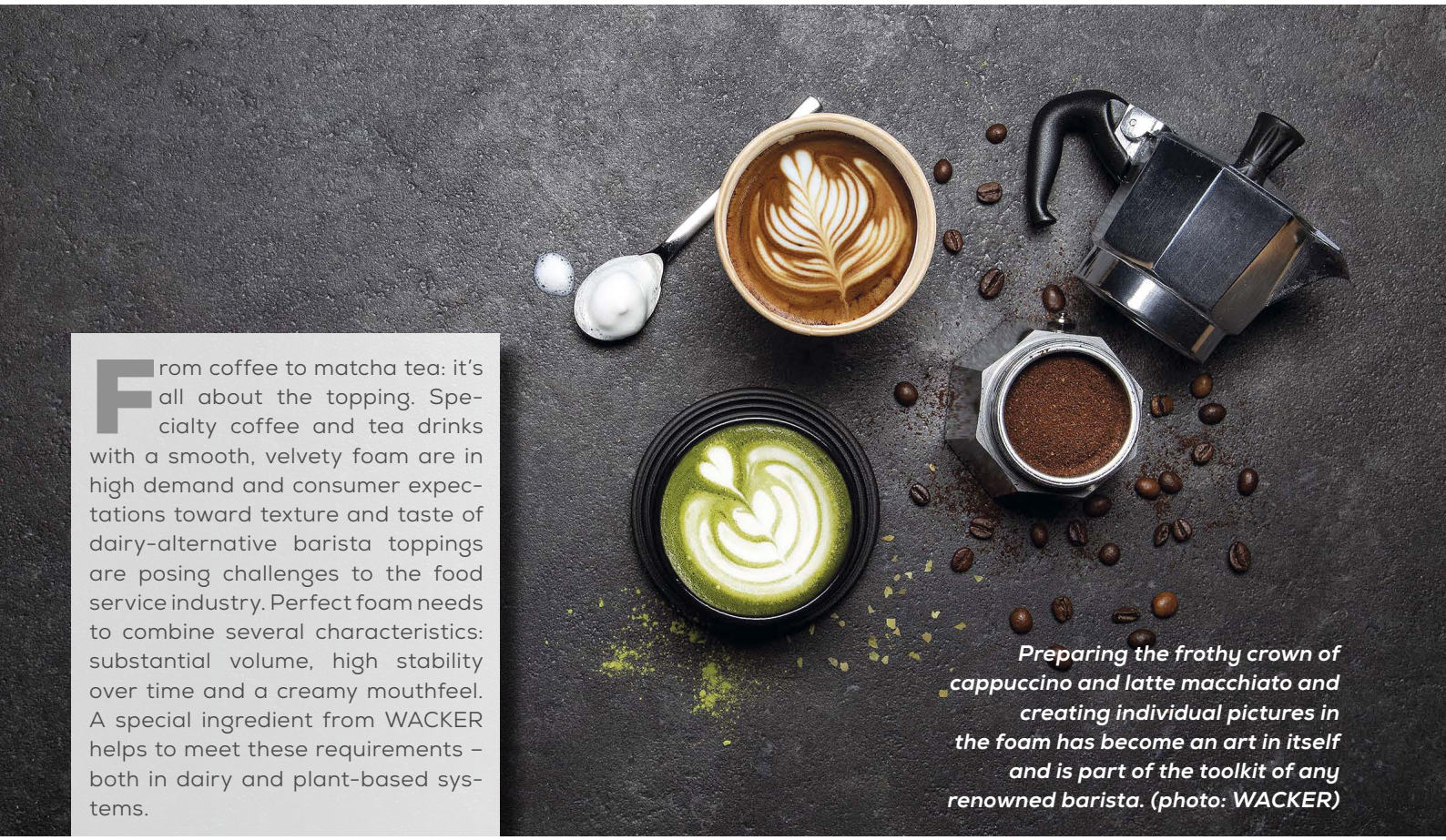
In addition to producing less than half the carbon footprint, the study revealed Violife cheeses occupy less than one-third of the land when compared to the same amount of dairy cheese. Violife undertook the assessment to highlight the importance of making the switch from dairy to dairy-free products, and the impact consumer choices have on the environment.

As a result of these findings, Violife has launched a new "Change" campaign, that welcomes consumers to a world where simply changing dairy cheese to a vegan alternative can reduce one's environmental impact.

Based in Thessalonica, Greece since the 1990s, Violife's products are available in more than 50 countries around the world

(photo: Violife)

Effect of Alpha-Cyclodextrin on the Foaming Properties of Milk and Milk Alternatives



From coffee to matcha tea: it's all about the topping. Specialty coffee and tea drinks with a smooth, velvety foam are in high demand and consumer expectations toward texture and taste of dairy-alternative barista toppings are posing challenges to the food service industry. Perfect foam needs to combine several characteristics: substantial volume, high stability over time and a creamy mouthfeel. A special ingredient from WACKER helps to meet these requirements – both in dairy and plant-based systems.

Preparing the frothy crown of cappuccino and latte macchiato and creating individual pictures in the foam has become an art in itself and is part of the toolkit of any renowned barista. (photo: WACKER)

Baristas have developed a form of art: "latte art." This trend is all about the foam and provides worthwhile opportunities for the food service industry while at the same time creating new challenges. In addition, more and more consumers nowadays prefer plant-based alternatives to traditional cow's milk for ethical or sustainability reasons, or because they are intolerant to dairy ingredients. While research aimed at understanding and optimizing the foaming mechanisms in dairy has a long history, the increasing demand for vegan products requires the same studies for plant-based foams. Foam structure, texture and durability are key aspects to be considered.

With alpha-cyclodextrin (ACD), WACKER offers an ingredient that positively impacts exactly these properties. Alpha-cyclodextrin is a ring-shaped oligosaccharide, which is produced by WACKER in a patented fermentative process based on starch, a renewable raw material. WACKER markets alpha-cyclodextrin under the brand name CAVAMAX W6.

The food experts at WACKER examined the effect of alpha-cyclodextrin on various foam properties

Author: Verena Klaus,
Strategic Category Management,
BioIngredients at WACKER

such as volume, stability and texture. The model systems used in this study included ultra-high temperature treated milk and dairy and non-dairy powder formulations with varying fat content alongside different plant-based milk alternatives. Foam was created either by steam injection or by using a milk frother.

Foam Remains Stable for Longer

The addition of alpha-cyclodextrin to different model systems significantly improved the foaming capacity, i.e. the amount of foam generated. The addition of 1.4% alpha-cyclodextrin nearly doubled the overrun in a medium-fat dairy powder formulation (Figure 1). The same amount of an inert linear oligosaccharide (maltodextrin), used as a reference, caused only a slight increase in the overrun due to the increase in dry matter – not comparable to the substantial increase achievable by alpha-cyclodextrin.

Alongside the positive effect on foam volume, alpha-cyclodextrin also has other benefits. It retards foam degradation reactions (Ostwald ripening, drainage, coalescence, deformation and bubble creaming) and therefore positively influences the foam stability. The half-life time, as experts refer to the time taken for the foam volume to reduce by half, can be increased considerably by the addition of alpha-cyclodextrin – from 3 to 15 minutes in the tested powder toppings (Figure 2). This provides food service restaurants with a longer period during which the tea or coffee drink can be served with an attractive topping.

Test setup to measure foam firmness by texture profile analysis. (photo: WACKER)

The explanation for the foam-enhancing effects: alpha-cyclodextrin has a hydrophilic exterior and a lipophilic cavity. This lipophilic cavity can form inclusion complexes with milk constituents such as triglycerides via non-covalent interactions. These can control the convergence of the liquid phase, stabilizing the foam structure. Hydrogen bonds between the exterior part of the alpha-cyclodextrin and long-chain molecules, such as proteins, make the system more viscous and therefore positively influence the foaming properties of the matrix.

Improved Mouthfeel and Taste

Specialty coffee and tea drinks have meanwhile evolved into lifestyle products. Hence, baristas and consumers also place a great deal of importance on the appearance of the foam which should look nicely creamy with fine, homogenously distributed pores. The technical experts at WACKER were able to demonstrate that 1% of alpha-cyclodextrin already significantly improves the pore structure and mouthfeel of almond milk foam correlating with a more full-bodied impression of the drink.

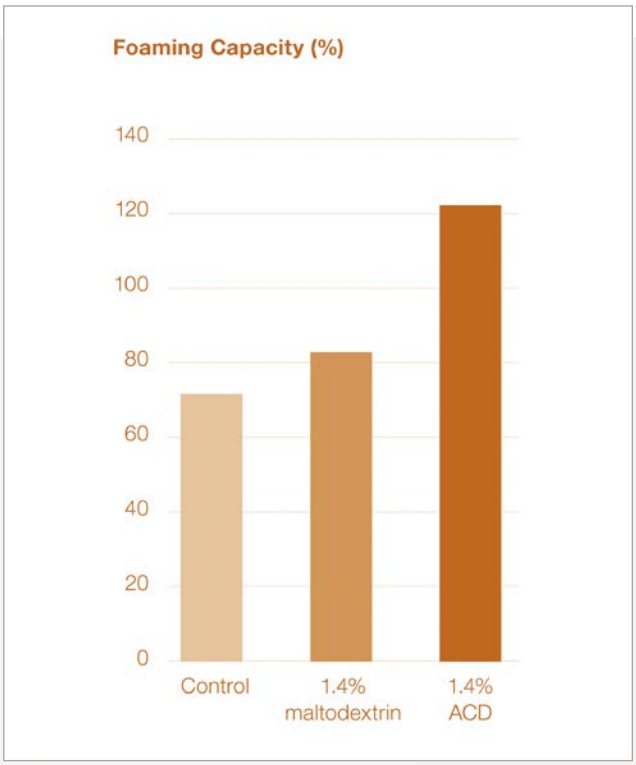


Figure 1: Foaming capacity of a reconstituted, medium-fat dairy powder formulation with 1.4% maltodextrin or 1.4% alpha-cyclodextrin (ACD). (graphic: WACKER)

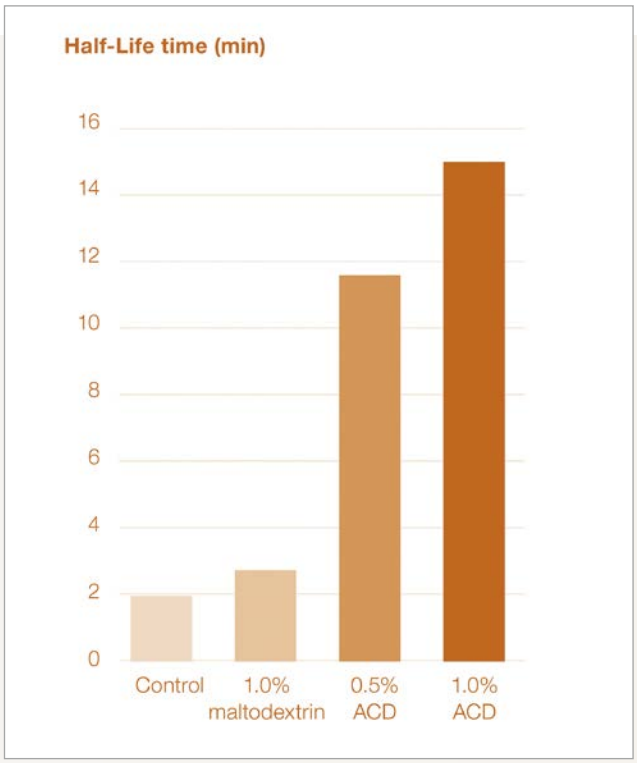


Figure 2: Foam half-life time (time required for the foam volume to shrink by half) of a high-fat dairy powder formulation with 1% maltodextrin or different dosages of alpha-cyclodextrin (ACD). (graphic: WACKER)

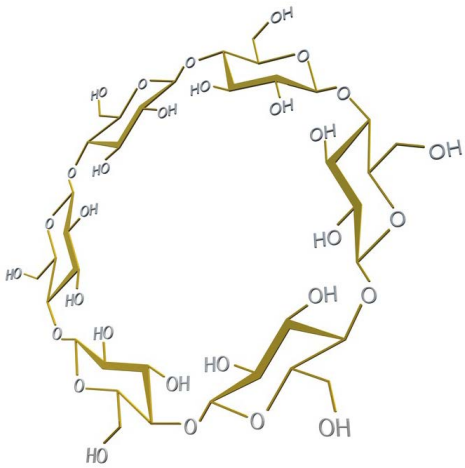
This positive effect was also confirmed in a sensory evaluation by a professional taste panel. In a blind triangle test, 12 out of 18 trained panelists preferred almond milk that was produced with the addition of alpha-cyclodextrin. While the standard almond milk was described as watery, lacking in body, nutlike, bitter and astringent, the almond milk containing alpha-cyclodextrin was characterized as having more body, less bitterness, an improved creaminess and a better mouthfeel.

Cyclodextrins are known for their potential to mask undesired flavors in different matrices. As part of this study, it was shown that alpha-cyclodextrin can also balance the cooking off-taste of high temperature treated milk and cover rancid off-notes of vegetable fat fractions in non-dairy powder formulations.

For more information visit:
wacker.com/barista

Cyclodextrins

Cyclodextrins are carbohydrates that WACKER manufactures from plant starch. They are characterized by their cyclic three-dimensional structure with a hydrophobic cavity. This cavity can interact with lipophilic molecules. The hydrophilic outer surface in turn ensures compatibility with aqueous systems. This special structure exhibited by cyclodextrins opens up a wide range of functionalities and applications.



(graphic: WACKER)

Depending on the size of the ring, a distinction is made between alpha-cyclodextrin with six, beta-cyclodextrin with seven and gamma-cyclodextrin with eight glucose units. WACKER is the only company in the world to manufacture all three naturally occurring cyclodextrins. They are marketed under the following trade names: CAVAMAX W6 (α-cyclodextrin), CAVAMAX W7 (β-cyclodextrin) and CAVAMAX W8 (γ-cyclodextrin).

Rice ingredients for authentic dairy-free alternatives

Author: Benoit Tavernier,
Product Manager Specialty Rice Ingredients at BENEO

In European supermarkets, plant-based dairy products are becoming as common as their dairy counterparts, with the category now one of the fastest-growing food segments globally. However, although their reasons for purchasing dairy-free alternatives may vary, consumers agree that taste, texture and mouthfeel are still key. With its portfolio of specialty rice ingredients, BENEO offers the industry the perfect opportunity to create full-bodied dairy alternatives that are more than a match for milk-based products.

As the popularity of dairy alternatives has gained momentum, manufacturers have become eager to experiment and offer a comprehensive portfolio of plant-based alternatives – from yoghurt and cream cheese to desserts and ice cream. As a result, the variety of free-from dairy labels on supermarket shelves is constantly growing, with such products getting more and more convincing in terms of authenticity, and thus appealing to even the most ardent of dairy product fans.

Rice is particularly suitable for the production of dairy alternatives, with rice starch and rice flour currently in great demand thanks to their good technological properties, high stability and clean label. Furthermore, consumers perceive rice ingredients as natural and easily digestible. A recent survey on behalf of BENEO even shows that 70% of flexitarians worldwide see rice as an appealing source for dairy alternatives.[1] The producer offers an extensive portfolio of rice ingredients for the production of plant-based dairy alternatives with appealing sensory properties, including organic varieties and a recently launched instant, functional, native rice starch.

Healthy, nutritious and familiar

According to BENEO's plant-based survey, almost half of consumers globally are (very) interested in plant-based nutrition (48%), and one in three consumers globally is already limiting their dairy consumption. Additionally, half of flexitarians already buy dairy alternatives, and another third of them are interested in doing so.

There are various drivers of the non-dairy trend, including animal welfare concerns and sustainability issues. Furthermore, plant-based alternatives have a reputation of being generally healthier,[2] and thus beneficial for overall wellbeing. However, lactose intolerance also plays a huge part, as nearly half of the world's population is considered to be lactose intolerant to some extent. Unlike those in northern and central Europe, people in Africa, Asia and South America consume much less cows' milk. As a result, more than 90% of the adult

(photo: shutterstock_©5PH)

population in these regions cannot break down lactose. In 2020, it was assumed that around 15% of the German population were also affected by lactose intolerance.[3]

So it's no wonder that the alternative market is booming, with growing demand for dairy-free ingredients such as soy, almonds and oats. However, after soy, the most commonly used raw material for the production of dairy alternatives is rice. According to Mintel, in 2019, 15% of new product developments in the beverage segment worldwide were dairy-free beverages based on rice.[4] And that's no doubt because consumers globally see rice as a healthy product (58%), nutritious food (56%) and familiar household item (67%).[5]

Creamy consistency with less fat

BENEO's rice starch, flour and syrup help capture the essence of dairy products, and can be used in a variety of recipes – for example, a dairy-free strawberry fermented dessert (see recipe 1) or a rice milk drink

Recipe 1: Strawberry fermented rice dessert

Ingredients (%w/w)	Test recipe
Water	65
Rice syrup	11
Strawberry	8
Rice starch & rice flour	6
Sugar	6
Rice bran oil	3
Minor ingredients (e.g. stabilisers, acidity regulators, emulsifier, yoghurt culture) q.s.	q.s.

(see recipe 2). Unlike soy, which usually has a beany aftertaste, rice is neutral in taste and therefore renders the use of masking ingredients unnecessary. BENEO's rice ingredients are also gluten-free, hypoallergenic and visually convincing with their clear white colour.

What makes rice ingredients particularly interesting, though, are their texturising properties. With a diameter of between two and eight micrometers, rice starch particles are comparable to the size of fat droplets. This means that they not only allow for fat reduction in many applications, but also ensure a creamy consistency and pleasant mouthfeel. Rice starch can also be used to produce dairy-free alternatives to foods with complex textures such as chocolate mousse, ice cream or cream fillings in baked goods – and without the use of thickeners or gelling agents.

Simple and stable

Incorporating rice ingredients into a recipe is simple, and does not require adjustments to existing machinery or additional investment in terms of production. Another plus point of BENEO's rice ingredients is that many of them are extremely stable during the production process. Functional native rice starches provide high stability for foods with demanding conditions, such as low pH values or high shear forces, and the new instant variant is particularly suitable for cold products such as desserts or bakery cream.

Comprehensive customer support

BENEO offers its customers comprehensive support throughout the entire product development chain – from a technical and nutritional perspective, as well as in terms of labelling and marketing. The company works with manufacturers to further expand the variety of high-quality, tasty and healthy dairy alternatives available, all of which will appeal to consumers who avoid dairy products for ethical, health or taste reasons.

1 *BENEO Global Plant-Based Survey 2021 - Insites Consulting conducted an online quantitative survey in July 2021 in Spain, France, Germany, Poland, UK, US, Brazil, Australia, China and Russia: min. 1000 consumers/ country = 11,990 consumers in total; sample of flexitarians = 2905*
2 *BENEO Consumer Research on Clean Label and Natural, 2018.*
3 *https://www.bzfe.de/ernaehrung/ernaehrungswissen/gesundheit/unvertraeglichkeiten-frei-von-im-trend/laktoseintoleranz/*
4 *Mintel GNPD, 2019.*
5 *BENEO Consumer Research on Clean Label and Natural, 2018.*

Recipe 2: Genuine rice drink.

Ingredients (%w/w)	Test recipe
Water	85
Rice syrup	10
Rice bran oil	2
Emulsifier	2
Rice starch & rice flour	1
Minor ingredients (e.g. tricalcium phosphate, calcium carbonate, stabiliser) q.s.	q.s.

Rice starch, flour and syrup help capture the essence of dairy products (photo: Shutterstock_©Davizro Photography)

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LET'S BRING GOOD THINGS TOGETHER

Palsgaard®

Health, sustainability and taste drive growth of plant-based dairy alternatives

Author: Jonathan Herrmann, Technical Sales Manager, Dairy Alternatives at Chr. Hansen, E-mail: dejohe@chr-hansen.com

Fermented plant-based alternatives to dairy products continue to gain in importance for consumers worldwide - steadily growing sales figures proof this ongoing trend. Plant-based products left their niche existence long time ago and entered the standard range of food retailers. Thus, most dairies and milk-processing companies in Germany offer a vegan product line in their range as well.

New raw materials offer more opportunities and challenges

The complexity of raw materials and bases has increased significantly. Whereas in the beginning development focused on single raw materials, for example oats, today's complex mixtures of different raw material groups, such as vegetable proteins, carbohydrates and fats, are standard for base formulation. Manufacturers can thereby create products with increased functionality, more diverse properties and improved nutritional profiles. As result more complex derived products can be developed from bases with mixed raw material groups. Fermentation plays a crucial role for manufacturers. Applying fermentation enables new product categories, such as fermented plant-based yoghurt and cream cheese alternatives.

(photo: Chr. Hansen)

Tastier and more valuable products through fermentation

When selecting raw materials for fermentation, it is important to ensure sufficient nutrients for the starter cultures, especially fermentable sugar and free amino acids. Cultures significantly influence value-giving properties of plant-based milk alternatives. Important flavouring substances such as lactic acid or flavours are formed during fermentation. This generates the characteristic fresh taste profile consumers expect when buying these products. In addition to taste, cultures provide a creamier texture and thus a fuller mouthfeel when enjoying the products. Texture increase results from binding water in the product via exopolysaccharides. Exopolysaccharides are complex carbohydrates produced by the cultures. Secreted into the extracellular surrounding the exopolysaccharides link with plant proteins in the base, thus binding water in this molecular network. A higher and creamier texture forms in the finished product as result of this natural process. In addition to the product properties, scientific studies show that certain culture strains can increase the added health benefit. Through probiotics, which, in sufficient high cell numbers in the product, can have various positive effects on human health. These positive effects must be proven in scientific studies. Probiotics are also applicable to plant-based dairy alternatives.

Less food waste thanks to fermentation

Fermentation-enabled bioprotection is the use of naturally occurring bacterial cultures, specially selected to protect fermented dairy alternatives from spoilage and contamination - naturally. They are added together with the main starter cultures during the manufacturing process and help to delay the growth of spoilage organisms such as yeasts and moulds. This keeps the final product fresher for longer. A longer shelf life can help increase production efficiency, provide access to new markets, and reduce food waste across the value chain.

Increase the potential of your dairy alternatives through greater flexibility with VEGA Boost

To help producers to meet the consumer demand for plant-based products that offer taste, texture, nutrition and sustainability, Chr. Hansen has developed a range of VEGA Boost cultures. They are the latest addition to the VEGA Culture Kit. The key benefits of VEGA Boost cultures include improved fermentation behaviour and more complex flavours. They provide flavour differentiation in plant-based dairy alternatives. Undesirable off flavours, such as beany notes from raw materials, can be reduced and desirable flavours from the fermentation can be enhanced. In addition to the raw material's own off flavour, some bases present challenges to the cultures' fermentation performance. A limited supply of nutrients causes fermentation to vary in duration and therefore fail to reach the desired cut pH. VEGA Boost cultures can help to increase the fermentation rate and thus improve productivity. Fast fermentation can reduce the risk of microbiological food safety problems.

Development of your customized product

With the good bacteria from VEGA cultures, manufacturers have an essential and versatile tool for developing new, tasty plant-based products. The individual selection and combination of cultures from a diverse range, allow manufacturers more creativity in the conception of products. In this way, consumers benefit from new fermented plant products with improved product properties as well.

Finding the right solution for a product is not easy. We are happy to support you with customized solutions tailored to your individual needs

Key benefits of VEGA Boost cultures include improved fermentation behaviour and more complex flavours (photo: Chr. Hansen)

Dairy sensations: Building from the base

The jury is still out on the taste of plant-based dairy alternatives. With the right building blocks, manufacturers can win over the doubters.

European consumers had a clear message for food manufacturers in a recent survey by ingredient company IFF. They want to buy more plant-based dairy alternatives. But two things are holding them back – one is their taste preferences, the other the size of their purse. If manufacturers can just do something about those issues, then the sales potential is big.

In fact, plant-based dairy alternatives have got a lot going for them. Consumers who already buy them list environmentally friendly, good for health, kind to animals and 'being trendy' among their positive associations. They also like how existing products on the market taste.

But, when IFF asked people why they don't buy dairy alternatives, then taste is a problem for more than a third of non-users across France, Germany, Italy, Poland, and Spain. Price is a concern for around one in five.

If you look at Germany alone, as market data company Statista did in early 2021, 37% of adults express a desire to avoid dairy products. Yet only 27% actually consumed a plant-based milk in recent months. That's a gap waiting to be filled.

The dairy comparison

At IFF, principal application specialist Joachim Schwobe and principal designer Astrid Gumbinger put their finger on the crux of the taste problem: consumers still compare plant-based alternatives to traditional dairy products.

"They are simply not yet used to the non-dairy taste and texture of plant-based alternatives," Gumbinger says.

It's not really surprising. Unlike established dairy products, plant-based drinks and yoghurt stand out for their lack of standardization.

"Everyone is trying to find the best taste, recipe and product using a huge variety of raw materials – not only plant bases like oats, almond, soy or pea but also different formats of the same plant base, such as oat flour, syrup or flakes," Schwobe explains.

"It makes the whole production process much more complex, and it means that new products come and go in supermarkets."

Start with the base

This is where manufacturers can benefit from a step-by-step approach to designing plant-based products that appeal to consumers who still prefer a dairy-like experience.

Compare plant bases with milk, and the challenges become quickly apparent. While whole milk contains 3.5% fat, 3.4% protein and 4.7% carbohydrate in the form of lactose, plant bases have a very different nutritional composition.

That's why you have to start with optimizing the base. Schwobe gives an example of the hurdles when producing an oat-based yoghurt.

"Oats lack the dry matter that can give some basic structure. To overcome that, you need to start with your base design, which means choosing the right culture, enzymes, and stabilizer."

THE IFF APPROACH TO PLANT-BASED PRODUCT DESIGN

TASTE PROFILE
Coffee, strawberry, chocolate, etc.

AUTHENTICITY
Cream, milk, etc.

ENHANCEMENT
Creaminess, juiciness, richness

PLANT BASE OFF-NOTES
Bitterness, protein/process taste

PLANT-BASED SOURCE, STABILIZER, CULTURES & ENZYMES

Finding the right match

The age-old process of fermentation is ideal for transforming plant raw materials into a textured base. What's important here is that each raw material is matched with a culture according to its carbohydrate content.

Enzymes are added to break down the carbohydrates and make them accessible to the culture. In the case of oats, for example, the enzymes degrade starch and release glucose for the culture to use as substrate. The outcome is a more efficient fermentation process, which also reduces unappealing plant off-notes. A combination of stabilizers then keeps the fermented base in shape.

"It's easy to make an oat-based yoghurt thick by adding lots of starch, but this will also make it less refreshing and bulkier, with poor flavor release. A tailored stabilizer is important to obtain a good balance between viscosity, mouthfeel, appearance, and taste," Schwobe says.

The taste of success

Once the base is in place, it's time to look at what flavor notes need to be masked or restored to give consumers a plant-based alternative that is not too far from the original dairy experience. Remaining off-notes such as bitterness and astringency must be dealt with.

In her work as principal designer, Astrid Gumbinger uses innovative flavor modulation tools that interact with taste receptors on the tongue and in the oral cavity.

"Modulators work by activating or deactivating specific receptors. An efficient way of masking bitterness, for example, is to block the bitter receptor so no bitter signal can be sent to the brain. In that way, you can eliminate taste issues that disturb the dairy impression."

Once that is achieved, the way is open to add the flavor tones that give plant-based drinks and yoghurts the creamy, milky taste of dairy. Beyond that, Gumbinger points to a broad selection of top notes, which manufacturers can use to give their products a distinctive flavor profile.

"We've tested a number of flavor pairings with pea, soy, oat, chickpea, and hemp. It's an exciting way to utilize plant-based notes that boost popular flavorings, such as chocolate, coffee, vanilla, and various fruits."

Familiar tastes and textures work best with consumers who are hesitant to choose a plant-based dairy alternative. By choosing the right building blocks from the base and upwards, manufacturers have every opportunity to finally win their hearts.

Legumes lead the way in dairy-free cheese innovation

Sustainable, clean label and nutritionally sound, chickpea and yellow pea are driving the plant-based cheese revolution

It may still be in its infancy, but the growing market for plant-based milk and cheese alternatives is already showing huge potential. And that's good news for manufacturers who are continually seeking ways to satisfy the demands of an increasing number of consumers who have decided to ditch dairy.

Many already lead a vegan lifestyle but for others, it's more a case of reducing animal-derived products for health or ethical reasons. However, the one thing they all have in common in their search for plant-based dairy alternatives is an unwillingness to compromise on texture or taste.

Up until now, the market for plant-based cheese has struggled to keep pace with rapid developments in the manufacture of pure milk or yogurt alternatives, for example. Why? Largely because cheese requires much more complex manufacturing steps that are not so easily transferable to plant-based raw materials. In addition, not all cheeses are the same: The production of fresh or processed cheese is fundamentally different to that of a fermented and ripened product – and plant proteins do not react in the same way as milk proteins. Here, pioneering technological work is required.

Special expertise

Most plant-based cheese analogs currently available on the European market consist of water, coconut oil, starch, stabilizers, salt, vitamins, flavorings and colorings. Assuming that consumers turn to cheese alternatives in a bid to eat more healthily and sustainably, the problem is obvious: a recipe based on oil and starch is a nutritional leap from the frying pan and into the fire. Nut-based alternatives, meanwhile, are significantly more expensive and also contain allergens.

So raw material composition plays an important role in cheese production, particularly since the amount of casein is key. Plant proteins differ from these milk proteins in structure and functionality; they have larger molecular sizes and more complex quaternary structures. As a result, they cannot form compact gel networks. Thus, the selection of proteins and their dosage requires special expertise in the development of plant-based alternatives.

Significantly superior

Together with manufacturers of enzyme preparations and leading dairy research institutes, Müller's Mühle is currently working on the development of various vegan dairy products based on legumes, including cheese alternatives. Christian Bärenwalde, Business Developer at Müller's Mühle, says: "For a number of reasons, legumes and/or legume concentrates are suitable as a basis for vegetable cheese variants. They contain legumin, a protein that is similar in structure to animal casein and therefore has comparable properties. This is a prerequisite for creating substitute products that are

In addition to being a plant-based feta alternative, chickpea flour is also suitable as a base for vegan cream cheese. (photo: Adobe Stock)

close to the original. In addition, pulses are an extremely sustainable source of protein. Their cultivation requires little water and, as so-called legumes, they naturally improve soil fertility by binding nitrogen from the air and thus ultimately promoting humus formation."

As well as proteins, legume concentrates also contain dietary fiber and minerals, B vitamins and trace elements – making them significantly superior to protein isolates. Müller's Mühle obtains its concentrates by an air separation process that does not change the structure of the ingredients, but merely allows the composition of the concentrates – and thus the protein content – to be controlled and adjusted.

Advantageous properties

The protein in pulses is similar to animal casein, especially in terms of structure. This makes it particularly suitable for the production of vegan cheese varieties, but the manufacturing processes must be adapted. Key is the legume-water ratio, which has a significant effect on the texture of the cheese. Hardness, chewiness and elasticity can also be controlled by changing the raw material-water ratio. And the legume type also plays a crucial role, as the protein, starch and fiber content can all affect the texture of the final product. Cheese applications typically benefit from the nutrient composition naturally found in chickpea and yellow pea, for example.

Christian Bärenwalde says of current developmental results: "Among other things, we were able to achieve promising alternatives to concepts based on cashew, almond or coconut in vegan cream cheese products. Here, it has been shown that chickpea in particular has advantageous properties. Remarkably for dairy applications, legumes have the ability to reduce off-flavor too."

Processes for flavor optimization are an important research topic at Müller's Mühle. After all, flours made from raw pulses have a strong bean taste and also contain so-called anti-nutrients. These can have a negative impact on nutrient absorption. Thanks to an innovative process, however, Müller's Mühle has succeeded in minimizing aftertaste and anti-nutrients.

In addition to these technological possibilities, a good nutritional profile and their advantages in terms of sustainability, legume flours are also clean label. They contain no gluten and are free of soy and allergens, opening up a wide range of positioning options for vegan cheese alternatives.

Concentrated protein power: The flours in the SMART Pulses Pro range (from yellow peas on the left and chickpeas on the right) have a protein content of up to 65 per cent. (photos: Müller's Mühle)

How to make plant-based, dual-use barista 'milks'

Palsgaard is continuing with its mission to develop emulsifier and stabiliser blends that can improve the quality of plant-based products. Here, Li Ying Chua, Senior Application Technologist for Dairy & Ice Cream with Palsgaard Asia Pacific, introduces the company's most recent addition, Palsgaard® MilkFoam 204, which helps manufacturers create not only the perfect frothy dairy-free coffees but also delicious drinks from a variety of plant sources.

(photo: Palsgaard)

Coffee's not just coffee anymore

The humble cup of coffee has now turned into an art form, with baristas and consumers working hard to create beverages which both taste and look amazing. However, to date, latte art has been difficult to replicate when using dairy alternatives because the stability of the foam is inconsistent, and the quality often does not match that of frothy dairy milks.

Li Ying explains: "We know that baristas in many countries can produce very homogenous and creamy dairy milk foams when they make lattes, and they can then add their artistic creations on top. At Palsgaard, we developed a new emulsifier-stabiliser blend, Palsgaard MilkFoam 204, for creating frothy UHT, dairy and plant-based 'milks'. It is perfect for enabling baristas to create latte art, which is popular with modern coffee drinkers."

Getting the foam balance right

The production process for plant-based 'milks' can generate excessive foam, and this can be a hindrance for manufacturers, but it's one of the ways Palsgaard MilkFoam 204 can be of use. Li Ying explains: "When we go through the production with these plant-based 'milks'

Li Ying Chua, Senior Application Technologist with Palsgaard Asia-Pacific displaying barista milk made with Palsgaard MilkFoam 204

we need to minimise the amount of foam generated during processing, but at the same time, we want the final product to create a very good and stable foam, so it's a delicate balance.

"Our product, Palsgaard MilkFoam 204, has the added benefit of being able to reduce the amount of foam that appears during the production process while at the same time when you froth the finished product, it can give a very fine, micro-foam layer on top of the coffee. I would say one of the biggest challenges was trying to work with this excessive foaming produced during the processing, and we were able to develop Palsgaard MilkFoam 204 to help minimise that."

One solution for all plant-bases

Consumers now enjoy drinking such a wide range of plant-based options and for this reason, Li Ying and her team created three different concepts which she will gladly share to demonstrate the versatility of Palsgaard MilkFoam 204 in the plant-based arena:

Coconut barista milk for frothing and drinking

Coconut milk was chosen for one of the recipes because it has a recognised flavour and it is suitable for those who are lactose intolerant.

Li Ying says: "Coconut gives a very creamy mouthfeel, hence adjustments had to be made, and the proportion of fat and protein had to be assessed too. You need a certain amount of protein to get the foaming right for this recipe, so it was a fine balance to get the mouthfeel and consistency just right. And because coconut is high in fat it is more prone to separation or creaming, but we were able to tackle these issues using Palsgaard MilkFoam 204."

Soy-based barista milk for frothing and drinking

In contrast, soy milk was one of the easiest to work with, according to Li Ying, and it would therefore be a good starting point for manufacturers looking to create a latte-friendly dairy alternative product for their portfolios.

It has good frothing properties, and the team was able to create a stable, dense, and consistent foam, perfect for adding to coffee.

Li Ying says: "We found that soy milk had a similar consistency to standard dairy milk, which meant we were able to formulate the recipe really quickly."

Oat-based barista milk for frothing and drinking

Using oat milk as a base can work well because it brings a natural creaminess to the product. Manufacturers often encountered other issues though, particularly around mouthfeel and sedimentation, as Li Ying explains.

"We got a very different mouthfeel and consistency depending on whether we were using oat extract, or oat in powdered form. In the end, we decided to use the oat extract to create this recipe."

Li Ying's team also had to make sure no sedimentation could be observed in the product because consumer research* commissioned by Palsgaard last year showed

that while consumers are generally happy with existing plant-based products, sedimentation in plant-based 'milks' is one of the main areas where they would like manufacturers to make improvements.

Li Ying explains how this is another way Palsgaard MilkFoam 204 can play a key role.

"Sedimentation is one of the common problems we see in UHT beverages, and it was one of the things we were concerned about with the oat-based milk in particular, but Palsgaard MilkFoam 204 helps suspend the particles to prevent them settling to the bottom."

Palsgaard Milkfoam 204: an overview

The three concept recipes show the versatility of Palsgaard MilkFoam 204, demonstrating that not only can the emulsifier/stabiliser blend help to create beverages which can be drunk on their own, but all three have excellent frothing capabilities, and are perfect for creating plant-based lattes and coffee art.

Palsgaard MilkFoam 204 allows for making all kinds of plant-based barista 'milk' (photos: Palsgaard)

Li Ying says: "We want it to be easy for baristas to incorporate the latte art, and it also needs to be the correct consistency for consumers to enjoy."

"Palsgaard MilkFoam 204 is used to create plant-based 'milks' which have good frothing capabilities, and they can be sold to both food service and household. Many people have milk frothing devices at home, and with these three recipes you just put the milk into the machine, press a button and you will get a very good foam to add to your coffee."

Another plus point for Palsgaard MilkFoam 204 is that it can be used in very low dosages to create the desired effect, which consequently delivers a cost-saving to manufacturers.

FACT BOX:

Palsgaard MilkFoam 204 key features:

- Custom-designed emulsifier and stabiliser blend developed for barista milk and plant beverage.
- Facilitates incorporation of air, ensuring a stable, dense and uniform foam which is easy to work with by Baristas
- Helps to reduce unwanted foaming in mixing process before UHT treatment
- Can be used for both pouring milks/creamers and barista milks

Palsgaard MilkFoam 204 key benefits

- Provides an even suspension of particles at elevated temperatures in the liquid
- Provides a rich and creamy foam with great organoleptic properties
- Improves overall operational equipment efficiency
- Can be utilized across multiple applications

Palsgaard MilkFoam 204 customer value

- Higher user and consumer acceptance and sales potential
- Longer product shelf-life (around nine months)
- Better product quality
- Launch a versatile product for drinking and for frothing
- Potential of more efficient production by increasing the overall equipment efficiency
- Low dosage / cost saving
- Extend market share to brand CO_2 neutral products

Experience plant-based palsgaard

Palsgaard has developed a series of plant-based recipe concepts to help demonstrate how its emulsifiers and stabilisers can help customers create new products. These concepts form part of its latest plant-based campaign – Experience Palsgaard – which aims to bring together its unrivalled technical knowledge with its network of regional application centres and the latest consumer insights.

To find out more, visit www.palsgaard.com/p-b-experience.

KERRY

BC30TM probiotic for plant-based products

Spore-forming probiotic BC30TM improves protein absorption from plant sources, a new clinical study has shown. The findings are significant for food and beverage manufacturers because they demonstrate potential to offer an additional benefit in plant-based products containing BC30. There may be opportunities for products targeting seniors – who typically require higher protein intake to maintain muscle mass – as well as vegetarians, vegans, and athletes.

Part of Kerry's ProActive Health Portfolio, BC30 is a patented spore-forming probiotic which can be used in a range of food and beverage products. It is backed by over 25 published papers, including a 2020 study demonstrating that it supports protein absorption from milk protein concentrate.

A new study found that Spore-forming probiotic BC30TM improves protein absorption from plant sources (photo: Kerry)

Powering up plant-based cheese?

It's got to feel authentic

The plant-based revolution is now in full swing – not least in the cheese category. The plant-based cheese segment is now growing by around 9% each year[1] – with an astonishing 388 plant-based cheeses launched in 2021 alone.[2]

To some extent, we don't need market data and statistics to tell us this. The evidence is right there on today's supermarket shelves (which look very different compared to say, five years ago). But how many of the many new product launches we're now seeing are likely to be successful in the long run? Or to put it another way, what can brands do to capitalize on this momentum and ensure that their plant-based cheese is the one preferred and purchased by discerning consumers?

This is question that we've been asking ourselves at DSM for some time now. The answer is not too surprising. Consumers want products that more accurately mimic their traditional dairy choices and experiences. After all, there's a reason why dairy cheese is so enduringly popular. It looks, smells and tastes delicious – and even includes health benefits like calcium and vitamins

The next question – and traditionally far harder for the industry to answer – is how to achieve this. How can plant-based cheese manufacturers change their formulations in a way that meets both their needs and those of consumers? Now, we have the answer – in the form of the new DSM plant-based cheese portfolio.

Building on tradition

Our portfolio for this fast-growing segment doesn't just combine ingredients, solutions and expertise. It also draws on a 100-plus year dairy heritage to bring the experience of traditional dairy cheese to plant-based cheese – in taste, texture, nutrition and appearance: starting with taste. How do we replicate the wonderfully complex, distinctive flavors of traditional cheese in a plant-based equivalent?

Passing the taste test

Our experts understand the complex flavor palette of traditional cheese – and how this provides specific, signature taste. Now, they are using all this knowledge to do the same thing for plant-based cheese.

Specifically, we build taste complexity through a series of four steps – starting with masking agents that nullify off-notes from raw materials that can overpower traditional cheese flavors. Next, we add yeast extracts to build the basic savory foundation, followed by process flavors to impart typical lactic tones for a unique dairy taste profile. Finally, we use specific plant-based cheese top notes to round-out the robust, complex and dairy-like flavor that the customer desires.

Maximizing mouthfeel

Of course, plant-based cheese needs to feel like real cheese: whether its chewy and soft like mozzarella and young gouda, or hard and brittle like parmesan. Furthermore, it needs to perform like real cheese when manufactured and used by the consumer. How easy is it to slice, melt and shred?

This is another area where our portfolio comes into play for plant-based manufacturers, where our experts use ingredients like gellan gums, hydrocolloids and pectins to help create an authentic texture and mouthfeel. Take gellan gum, for example. Its functional properties are ideal for improving plant-based cheese texture thanks to a patented technology that combines with the application's starches and proteins – improving not only texture and bite but also the slicing and shredding qualities.

Plant-based cheese analogues must feel and perform like original cheese (photo: Stocksky)

In living color

We've talked about boosting the taste and texture of plant-based cheese. But it's also important that the product looks like traditional cheese. Our answer is a family of beta-carotene solutions that bring authentic color to plant-based cheeses – from yellow to orange. These solutions are nature-identical and mimic the color of traditional dairy cheese. This means that not only do they differentiate products on the supermarket shelf; they appeal to health-conscious (and label-reading!) consumers.

Bridging the nutrient gap

Finally, it shouldn't be overlooked that traditional dairy cheese delivers nutritional value – in the form of vitamins and calcium, for example. This is an area where plant-based cheese has struggled to keep pace, with these products often low in vitamins and minerals in comparison. Here, our nutritional premix blends of vitamins and minerals can help bridge this nutrition gap. In fact, as part of our new portfolio, manufacturers can now add a host of ingredients to their plant-based cheese – including micronutrients like vitamins A, B2 and B12; as well as calcium, iodine, selenium and zinc – all of which are prevalent in traditional dairy products.

Meeting consumer expectations

Ultimately, the market for dairy cheese alternatives is booming. More consumers than ever are willing to experiment with new types of plant-based cheese. But if their chosen product doesn't deliver the type of experience they were expecting (or perhaps are even used to, with traditional cheese), they will almost certainly be seeking another 'alternative'.

With our portfolio for plant-based cheese, manufacturers can now meet these needs on all fronts – in terms of taste, texture, color and nutrition. There's no need to choose. Enjoy it all.

1 *Euromonitor 2022*
2 *Mintel 2022*

SACCO SYSTEM

Plant-based alternatives that intend to resemble cheese

A survey based on European consumer attitudes towards plant-based foods, showed that 28% of European consumers would most likely purchase plant-based cheese on a regular basis if taste and texture were identical to conventional cheese.

Consumers in Spain, Germany, Austria, Romania, and Italy are most likely to replace conventional cheese products with plant-based cheese products.

In terms of plant-based cheese, German consumers would especially like to see plant-based cream cheese (32 %), sliced cheese (32 %), and plant-based mozzarella (31 %) available in supermarkets.[1]

In Germany plant-based hard sliced cheese showed the highest value/volume sales (+64 %), followed by plant-based cream cheese sales value (+75 %). Plant-based mozzarella is more significant for discounters than for the overall market.[2]

Plant-based alternatives that intend to resemble cheese are complex colloidal dispersions consisting of lipid droplets, embedded within a viscoelastic polysaccharide and/or plant proteins network.

Plant-based cultured alternatives that intend to resemble cheese, are obtained from a range of different ingredients, such as soybeans (fermented tofu), soy, lupin, pea, chickpea and fava bean protein concentrates or different types of nuts (i.e., cashews, almonds) obtained after soaking, mincing and filtered water addition. The mass undergoes a natural fermentation and then is added with other ingredients like vegetable oil (coconut, palm, canola, sunflower), modified starches (potato, corn, tapioca), thickeners (carrageenan, guar gum) and Salt among many others (depending on the recipes).

Plant proteins used in plant-based cultured alternatives that intend to resemble cheese need to fulfil different functional attributes such as emulsifying, and gelation properties.[3]

Starches are used in plant-based cultured alternatives that intend to resemble cheese because of their ability to form a viscous paste or gel upon heating (gelatinization) and cooling (retrogradation/setback), which entraps fluids and other ingredients within the 3D-polysaccharide network formed.[4]

Sunflower, corn, and canola oils contain substantial amounts of unsaturated fatty acids, so tend to be liquid at ambient temperature and cannot form fat crystal networks. Coconut and palm oils form fat crystal networks at room temperature and generate desirable textural attributes in plant-based cultured alternatives that intend to resemble cheese.

Common manufacturing process employed to promote the sol-gel transition are heat treatment, acidification, and enzymatic crosslinking. The enzyme crosslinking approach coupled with acidification has been utilized to produce pea-based cheese analogs.[5]

Fermentation is a technique that has been used for centuries to improve the shelf-life of food, but also for food processing, hence changing the structure and functionality, as well as the flavors.

Improvement can be achieved in plant-based alternatives that intend to resemble cheese through microbial fermentation, since lactic acid fermentation has the advantage of having a positive impact

Sacco Srl, a member of Sacco System, is a biotech company that since 1934, has positioned itself in the international market as a producer and partner in research areas, scale-up, production, and packaging of selected frozen and freeze-dried microbial food cultures. Sacco's extensive knowledge and expertise supports the fermented food industry in the production of healthier foods and trending new consumer needs.

on structure and flavor attributes by metabolizing and transforming plant-derived ingredients into enhanced products with unique flavors, nutritional profiles, or modified textures. This allows to shape the product portfolio in unique ways to meet consumer expectations on the key drivers of consumer choice: 'plant' taste, price, and accessibility.

Innovation in the plant-based world by fermentation expertise: 4Choice by Sacco System

A dedicated screening of different unexplored microorganisms can lead to identify the most suitable bacteria not only able to ferment plant-based matrices, but also to improve textural and sensorial properties. Optimal microstructure, hence textural properties, could be created by identify the optimal EPS structure which could strength the binding between the plant-proteins, hence create a stable and stiff gel network, which in turn will result in reducing or even eliminating the texturizing hydrocolloids used to formulate dairy-alternative products. Moreover, the complexity of the aroma compounds and their perception should be carefully studied in order to achieve a balance aroma profile, with distinct flavor notes, such as creamy or botanic. Sacco Srl has been working on those topics for years, and it is enriching its knowledge by continuing and starting new collaborations with National and International leading Universities, as well as with ingredients producers, and customers.

We are aiming to achieve starter culture solutions which will be satisfy all the consumer's needs, in terms of texture and flavors, by keeping the nutritional benefits of consuming fermented products. We believe that the world of plant-based food is in continues evolution, and we want to bring the scientific knowledge generated in this field into the life of the consumers. We will do this by continuing our research and innovation in this field, and by listening to the desired of our customers.

SACCO SYSTEM technical expertise in strain development and manufacturing know-how to supply live microbial cultures, is eager to position 4CHOICE hypoallergenic solutions as the first CHOICE among plant-based product developers, providing solutions for the plant-based industry.

1 *'What consumers want: A survey on European consumer attitudes towards plant-based foods. Country specific insights' European Union's Horizon 2020 research and innovation programme (No 862957) (2021).*
2 *Plant-based foods in Europe: How big is the market? Smart Protein Plant-based Food Sector Report by Smart Protein Project, European Union's Horizon 2020 research and innovation programme (No 862957) (2021).*
3 *Grossmann & Weiss, 2021.*
4 *Kasprzak et al., 2018.*
5 *Holz-Schietinger et al., 2014*

Turning spent brewer's yeast into high-quality vegan protein

Foodtech firm launches demo scale-up for ingredient innovation

Upcycling for sustainable nutrition is the mission driving Swiss-based Yeastup AG. After the fermentation process, the yeast cells used by breweries become inactive and can no longer be used in production. However, these by-products contain protein and fiber which Yeastup founders Daniel Gnos and Urs Briner extract in a sustainable and energy-efficient, closed-loop process using specialist know-how.

Around 10,000 metric tons of spent yeast are produced worldwide every day in beer production, with around 90 percent of this utilized as animal feed. However, Daniel Gnos, founder and CEO of Yeastup AG, wanted to take things a step further and so, together with co-founder Urs Briner and a small team, decided to break new ground.

"Yeast has enormous nutrient density as it contains high-quality protein and fiber. Our goal was to use this directly for the growing protein needs of the world's population, without an energy- and resource-intensive detour via livestock farming and all its associated ecological side-effects," explains Gnos. So he combined his experience from the brewing industry and the development of protein-rich foods and, in collaboration with the FHNW University of Life Sciences in Switzerland, various engineering firms and equipment suppliers, devised a scalable process for isolating the valuable yeast components.

Upcycling for a sustainable circular economy

In the upcycling of spent yeast, the yeast emulsion is first standardized and then subjected to gentle cell disruption, which leaves the released components of the yeast cells largely intact. The next step is the removal of unpleasant flavors, such as hop bitters from the brewing process, followed by the purification and fractionation of the ingredients to produce a highly pure and tasteless protein powder with optimal processing properties. This product, called Yeastin, can be used in a variety of ways for human nutrition. Another valuable substance is polysaccharides from the yeast cell wall, especially beta-glucans and mannan, which are marketed as high-quality dietary fibers under the UpFiber brand and are of particular interest to the supplement

Yeast has enormous nutrient density as it contains high-quality protein and fiber (photo: Yeastup AG)

and cosmetics industries. The water used in the process is recovered, purified and recirculated. At the end of the process, a maximum of 2% of non-recyclable residues remain, which are biodegradable. In addition to yield, composition and purity of the products, the smallest possible CO_2 footprint and a water- and energy-saving closed-loop process are equally important developmental goals. "We want to make a clear difference to the production of animal proteins in times of global warming, and show a sensible commercial path to the circular economy," says Gnos, explaining Yeastup's overarching aims.

Mastering demanding challenges

What initially sounds like a simple idea is technologically demanding and involves many pitfalls, which Yeastup has successfully mastered. Extracting the proteins and dietary fiber requires expertise in process engineering and yeast metabolism, as the properties of yeast batches can vary greatly depending on storage and production conditions. For this reason, Yeastup initially focused on developing the process on a pilot plant scale in a process-safe manner, which means a clear competitive advantage in the upcoming scale-up to several 100 kilos per batch. Daniel Gnos says: "We are in the fortunate position that demand for our protein products was already huge before the start of demo-scale production in advance of industrial-scale production. Of course, this is also due to our product development expertise, which we share with selected industrial partners under joint development agreements."

Yeastup founders Daniel Gnos (right) and Urs Briner turn a byproduct into a valuable resource (photo: Yeastup AG)

Sustainable proteins for human nutrition

The proteins that will in future be marketed under the Yeastin brand are suitable, among other things, as ingredients for milk and cheese alternatives, for protein fortification of a wide variety of dairy products and for meat alternatives. Technofunctional tests also demonstrate increased gelling capacity and very good solubility, which means Yeastin can also be used as an emulsifier and egg substitute in vegan products. Applications for meat alternatives are also being developed. Here, yeast proteins offer advantages due to their natural aroma and flavor. Gnos, who has already attracted powerful partners in this market segment, is convinced of the potential: "The fascinating thing about our product range is that we can offer proteins that, with their complete amino acid profile, correspond to the nutritional and physiological value of animal protein, but are also vegan and sustainable. What's more, they don't compete with other plant-based foods in terms of resources, and the supply of raw materials is secure."

Brewers are keenly interested in high-value uses for their byproducts, which is why Yeastup has already secured several thousand tons of surplus yeast from European breweries through long-term contracts, with further talks underway. Going forward, the startup says it would like to expand its portfolio to include customized compounds and blends. A financing round is currently underway to raise additional capital from companies and venture capital firms for the further expansion of production capacities.

The startup Yeastup plans to expand its portfolio to include customized compounds and blends (photo: Yeastup AG)

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