

I N T E R N A T I O N A L

DAIRY

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SPECIAL "PLANT BASED ALTERNATIVES"



magazine

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The next frontier

From alternatives to everyday relevance

From coffee breaks to meals on the move, dairy alternatives are creating new reasons to choose plant-based. Discover how dsm-firmenich combines taste, texture and nutrition expertise to help manufacturers earn a place in the moments that matter.

dsm-firmenich The dsm-firmenich logo, consisting of three small circles.



(photo: AI generated)



Dear Readers

Plant-based dairy alternatives have become an established part of the European food market. Across six major European markets, plant-based food and drink sales reached €16.3 billion in 2025, up 5.1% year on year, with dairy alternatives accounting for 21% of sales.

At the same time, innovation continues to broaden the range of possibilities. Alongside established raw materials such as oat and soy, new protein sources, functional ingredients and fermentation-derived components are creating opportunities for product development. Precision and biomass fermentation are further expanding the technological options available to manufacturers.

For the industry, ingredients and processing go hand in hand. Proteins and other functional components influence texture, stability, taste and nutritional profile, while technologies such as separation, homogenization, fermentation and heat treatment determine how these properties can be translated into products on an industrial scale. Scaling new concepts from pilot to commercial production remains a key challenge.

For dairies in particular, these developments offer opportunities to apply existing expertise in ingredients, processing, fermentation and food safety to new product categories.

Your IDM editorial team



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Imprint

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NOURISH INGREDIENTS scales Creamilux production with SD Guthrie

Australian ingredient company Nourish Ingredients has completed a 10-tonne industrial production run of Creamilux, its animal-free specialty lipid, at the Netherlands facility of SD Guthrie International Speciality Ingredients. The production run was completed within a matter of days using existing industrial infrastructure.

SD Guthrie will act as Nourish Ingredients' lead European manufacturing and scale-up partner for Creamilux, providing access to established production capacity without the need for Nourish Ingredients to build its own large-scale facility. According to the company, SD Guthrie's facility can support production of up to 20 tonnes per day.

Creamilux is designed to reproduce the creamy mouthfeel and functionality of conventional dairy fats. According to Nourish Ingredients, the ingredient can be used at inclusion rates of around 0.2%. The 10-tonne production run could therefore support approximately 5,000 tonnes of finished food products, including spreads, milk and



(photo: Nourish Ingredients)

dairy alternatives, and bakery applications.

Nourish Ingredients is currently conducting customer trials across plant-based dairy, spreads, milk, confectionery, and hybrid and low-fat dairy applications. The company expects the first products containing Creamilux to reach shelves within six months.

Further production increases will be tied to customer demand. Nourish Ingredients plans to scale from 100 tonnes to 500 tonnes and beyond as customer trials convert into commercial orders and offtake agreements. SD Guthrie will also support customer development and distribution for Creamilux and Tastilux, Nourish Ingredients' animal-free fat-derived flavor solution.

SUNOPTA commissions new production line

SunOpta has commissioned a fourth production line at its beverage facility in Midlothian, Texas. The USD 35 million line is expected to increase capacity across the company's production network by 10%. The Minneapolis-based co-manufacturer, which became a sub-

siary of Dutch beverage group Refresco earlier this year, recently announced the opening.

The Midlothian facility produces plant-based milk alternatives, creams and tea for brand owners, retailers and foodservice operators.

According to SunOpta, the additional volume is intended to serve both existing customers and enable the company to take on new customers. The company adds that the additional production capacity in Texas brings manufacturing closer to its customers' distribution areas.



Efficient production process

High-protein vegan semi-hard cheese alternatives

Vegan dairy products, particularly cheese alternatives, continue to gain importance among consumers. Against this backdrop, Handtmann Processing, in cooperation with Planteneers (Ahrensburg, Germany), has developed a new vegan semi-hard cheese alternative that can be produced in a wide variety of formulations. Its distinguishing feature is a high protein content, setting it apart from many comparable products currently on the market.

At industrial scale, a vegan semi-hard cheese alternative with a protein content of 6% has been successfully produced. Planteneers' ingredient system enables a broad product portfolio with protein contents ranging from 2% to 10%, various flavour profiles, and formulations based on wheat protein and fava bean protein, as well as allergen-free and gluten-free options using fava bean protein exclusively. In addition to traditional semi-hard cheese alternatives, the concept also



Vegan semi-hard cheese alternatives in a wide range of formats, including sliced and shredded products



Portioning and clipping process



Semi-hard cheese alternative as clipped portions or deposited into moulds

(photos: Handtmann)



supports innovative snack formats such as cubes and sticks. Product specifications can be tailored to individual requirements, including small- and large-caliber portions or logs produced in artificial casings. As an alternative to clipped portions, the hot product mass can also be deposited directly into moulds using Handtmann dosing solutions and subsequently sliced into deli-style products.

Overall production process

The overall production process includes chopping and melting of the fat blocks, mixing of water and dry ingredients, heating and emulsification into a homogeneous mass, followed by filling and portioning either as clipped products or through depositing into moulds. The line incorporates a Handtmann Inotec BC 175iT process unit, a VF 800 series vacuum filler, optionally equipped with a heated hopper and mobile heating unit, as well as a Handtmann depositing system or clipping machine.

A key advantage of the Inotec process unit is the integration of multiple processing steps within a single system, eliminating the need for additional equipment to produce the product mass. For semi-hard cheese alternative production, dry ingredients are first pre-mixed

with water. Water dosing is carried out automatically, and dry ingredients can likewise be fed automatically via a vacuum conveying system. The process continues with the addition, chopping and melting of fat blocks. The mixture is then heated with direct steam injection while being continuously recirculated through a fine grinder under shear, reaching a process temperature of approximately 90°C. In general, the process unit is capable of producing several tons per hour in batch volumes of up to 600 liters while reaching temperatures as high as 99°C.

Upon completion of these processing steps, the product is either automatically pumped to the vacuum filler or transferred manually. This is followed by hot filling, either into clipped portions or through depositing into moulds. In both production methods, Handtmann system technology ensures consistently high portion weight accuracy.

Typically, the products are then cooled and stored for several days. During this maturation phase, the structure develops and the mass firms up, ensuring reliable performance throughout downstream processing. Finally, the portions can be sliced into deli-style formats and packaged for retail distribution.



Production of the cheese alternative using a Process Unit



STUDY EXAMINES SAFETY OF PLANT-BASED DAIRY ALTERNATIVES

Plant-based alternatives prove largely safe

The Finnish Food Authority Ruokavirasto and research institute VTT have completed the three-year VEGETURVA research project investigating the food safety of plant-based drinks and vegan desserts. The study examined chemical and microbiological risks as well as consumer exposure compared with corresponding animal-based products.

Between 2023 and 2026, the project team analyzed plant-based drinks, vegan yogurt alternatives and sweet desserts available on the Finnish market for contaminants including heavy metals and mycotoxins, as well as spore-forming pathogens. A peer-reviewed review article produced as part of the project shows that plant-based dairy and meat alternatives have different risk profiles from their animal-based counterparts. Mycotoxins were detected in nearly all of the beverage and meat alternatives studied, while microbiological risks in heat-treated products were generally low.

The main contaminants varied depending on the raw material. Rice drinks contained inorganic arsenic, which is already regulated across the EU, while nut-based drinks were more frequently associated with aflatoxins. Soy drinks showed elevated levels of nickel and phytoestrogens.

Overall, the researchers assessed the level of food safety as good, although they identified several areas where further research is needed. Ruokavirasto considers plant-based drinks a safe option as part of a balanced diet. Among the alternatives studied – oat, soy, almond and rice – oat drinks received the most favorable overall assessment. According to Ruokavirasto, the chemical and microbiological findings documented in the accompanying scientific article remained below exposure levels considered relevant to health.

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The Sedicanter ensures optimum clarification of plant-based dairy alternatives
(photos: Flottweg)

Oat, soy, or almond

Separation technology as a key enabler for the industrial production of plant-based dairy alternatives

Vegan and vegetarian diets have become firmly established in Germany and around the world. Increasing numbers of consumers are consciously reducing their consumption of animal products and opting for plant-based alternatives instead. In particular, the market for dairy and meat alternatives continues to grow rapidly. From plant-based drinks made from soy, oats, rice, or various nuts to meat alternatives derived from peas, soybeans, or lupins, the range of foods that do not rely on animal-based ingredients is expanding continuously.

As demand increases, so does the focus on production processes. Plant-based dairy alternatives must deliver the right taste, mouthfeel, and product quality to gain consumer acceptance. Industrial centrifuges, such as those manufactured by Flottweg, play a crucial role in achieving these objectives. At the same time,

manufacturers face numerous challenges and decisions throughout product development and production. Which raw material should be selected? How should the raw materials be processed to maximize yield? Which ingredients should be added afterward? Which machines ensure the desired product quality? And how should the final product be positioned in the market?

Plant-based dairy alternatives: Why centrifuges play a key role

The production of plant-based dairy alternatives begins by mixing the raw material with water and grinding it into a fine slurry. This is followed by an extraction process aimed at transferring as many valuable components as possible into the liquid phase, i.e., the plant-based milk.



**Andreas Metzenauer, Head of Sales
for the Beverage and Dairy Industries
at Flottweg**



When starch-containing raw materials are used, enzymes are added to convert starch and other carbohydrates into sugars. The next critical step is the efficient separation of the extracted plant fibers using decanter centrifuges.

"Depending on the formulation, the plant-based milk is homogenized with edible oils, blended with additional ingredients, heated, and finally packaged," explains Andreas Metzenauer, Head of Sales for the Beverage and Dairy Industries at Flottweg.

The Decanter Centrifuge

Flottweg decanter centrifuges are among the most efficient machines for separating plant milk from extracted plant fibers. High centrifugal forces enable maximum clarification, high liquid yields through efficient dewatering, and consistently high throughput rates.

"At the same time, decanters must be properly sized and optimally configured to achieve the best possible separation result," explains Andreas Metzenauer. "This requires in-depth process knowledge and application expertise in order to select the right separation solution."

Only with the correct machine design can producers maximize plant milk yield and use raw materials as efficiently as possible. Efficient separation is also essential for creating an appealing mouthfeel, as excessive solids can result in an undesirable "sandy" texture for consumers.

In addition, Flottweg decanter centrifuges are manufactured in accordance with the latest hygienic design standards and can be seamlessly integrated into fully automated CIP systems. Depending on the desired product quality and machine configuration, multiple raw materials can even be processed on the same production line. "However, manufacturers must carefully consider allergen labeling requirements for their finished products," notes Metzenauer.

The production of plant-based dairy alternatives involves a range of technical and operational challenges. For Metzenauer, several questions are particularly important: Which raw material should be selected? How finely should the raw materials be milled to maximize yield? How should the extraction process be designed? Which ingredients should be added afterward? How should the product be heat-treated? How will the final product be marketed?



Because every project presents unique requirements, Flottweg develops customized solutions for each application. "Our flexible, tailor-made, and optimally designed separation solutions always depend on the specific project, process line, and customer requirements," says Metzenauer. "That is why we support our customers from the very beginning, advising them on machine sizing, installation, and process planning to ensure all interfaces are coordinated efficiently."

Flottweg Sedicanter

The Sedicanter® is a Flottweg decanter centrifuge specifically designed for soft, flowable sediments that are difficult to process with conventional decanters. "In these applications, standard decanters often reach their performance limits, making it difficult to efficiently separate very fine solids," explains Metzenauer. "The Sedicanter offers a decisive advantage through centrifugal forces of up to $10,000 \times g$. This enables optimal clarification and maximum product recovery."

The Sedicanter combines the advantages of a separator and a decanter centrifuge. Like a separator, it delivers highly clarified centrate. At the same time, like a decanter, it can handle high solids concentrations in the feed while producing a dry solids discharge. As a result, the Sedicanter is not only suitable for the production of plant-based dairy alternatives but can also be used in applications such as plant protein processing.

The future of plant-based dairy alternatives

Plant-based products, including dairy and meat alternatives, are expected to play an increasingly important role in the food industry in the years ahead.

"In my opinion, we will see many new product innovations in this segment over the coming years," says Andreas Metzenauer. "At the same time, new products will need to clearly differentiate themselves from the competition in order to achieve long-term success. The main challenges today lie in research and product development."

For Metzenauer, plant-based alternatives are far more than a temporary trend:

"From my perspective, this is a long-term development for several reasons. Consumers are becoming increasingly health-conscious and are seeking more diverse and balanced diets. At the same time, many people want to support sustainability and strengthen animal welfare. In addition, the sensory qualities and taste of plant-based products continue to improve and are being accepted by a much broader consumer base. Today, it is no longer just vegans and vegetarians purchasing plant-based dairy alternatives. More and more consumers choose these products simply because they taste good and have evolved significantly over the past few years."

The decanter centrifuge separates the plant-based milk from the plant fiber



SCALING UP ALTERNATIVE PROTEINS

EU research strategy focuses on protein diversification and fermentation

The European Commission has presented a new research and innovation strategy for the agri-food sector. Among its priorities are diversifying Europe's protein supply and expanding advanced fermentation technologies. However, targeted funding measures for alternative proteins remain limited.

The strategy is intended to guide future EU research and innovation priorities and improve the translation of research results into market-ready applications. Sustainable food production, biotechnology and advanced fermentation are among the areas receiving greater attention.

According to the Good Food Institute (GFI) Europe, however, the strategy lacks targeted research funding to further improve the taste, texture and cost of plant-based, cultivated and fermentation-derived foods.

Another focus is the expansion and scale-up of fermentation technologies. These include precision fermentation, a technology that has been used for decades to produce ingredients such as rennet for cheese-making and is now also being used to produce proteins such as whey protein. The strategy also addresses biomass fermentation, which can be used to produce protein from fungi.

The Commission also recognizes the challenges start-ups face when moving from research and development to industrial-scale production. Investment in testing and demonstration infrastructure could enable companies to trial new processes without having to finance the necessary facilities entirely themselves.

Regulatory frameworks are another area of focus. The strategy highlights regulatory "sandboxes", which allow innovations to be tested in controlled environments. For novel fermentation-derived foods, EU authorization procedures and safety assessments by the European Food Safety Authority (EFSA) remain key requirements for market access.

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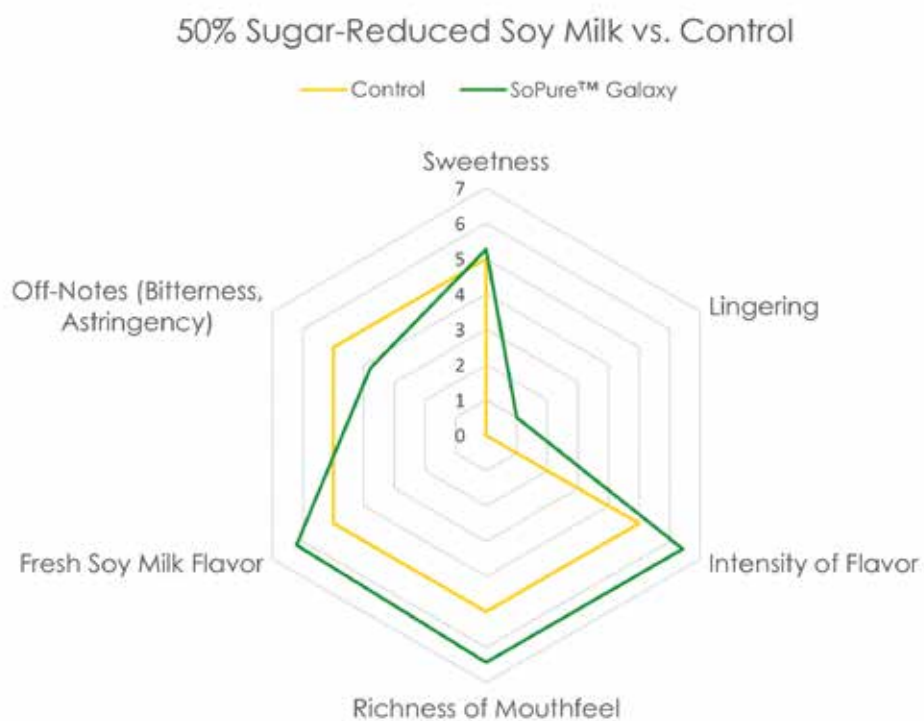
Solving the Plant-Based Paradox

Rebuilding dairy without sugar

The plant-based dairy market is no longer a niche segment; it is a powerhouse that reached USD 25.4B in 2023 and is predicted to hit USD 49.8B by 2030 (10.1% CAGR), with the number of plant-based dairy launches growing 9.1% annually. However, as consumer expectations of plant-based dairy continue to evolve, delivering the sensory experience consumers now demand has become a challenge that's increasingly difficult to ignore.

Low-sugar and unsweetened non-dairy milks have historically come with a compromise: choosing a healthier profile over the creamy, indulgent mouthfeel of traditional dairy. Today, that compromise is no longer acceptable. Nearly half of new plant-based dairy launches now carry sugar-reduction claims, reflecting the industry's urgency to solve a difficult formulation puzzle. The goal is to provide the health profile of low-sugar products without sacrificing the "dairy-like" richness consumers demand.

The core of this challenge lies in what many formulators call the "Plant-Based Paradox." In plant-based dairy, sugar is often added not only for sweetness, but to mask



inherent bitterness and astringency while supporting mouthfeel and flavor integration. Replacing sugar with high-intensity sweeteners can solve for sweetness but frequently introduces new sensory gaps. These systems may lose body and creaminess, while off-notes become more exposed or even amplified. At the same time, certain

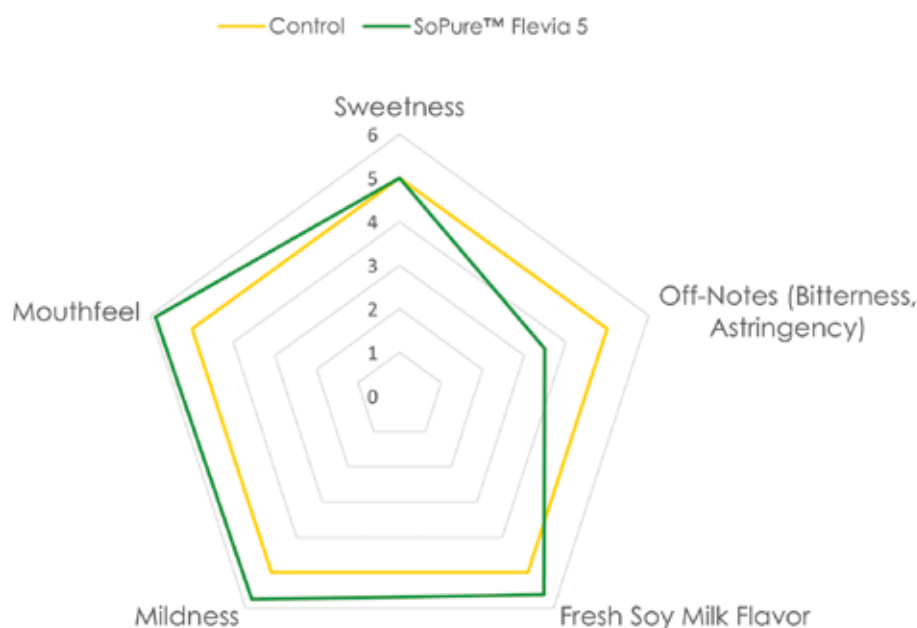
sweetening approaches can conflict with the clean-label expectations that are central to plant-based products.

To win today's vegetarian and flexitarian consumers, brands need a strategy that does more than replace sweetness; it must rebuild the entire sensory experience.



Plant Base	Primary Strength	Common Sensory Risks	Sugar Reduction Impact	Formulation Priority
SOY	High protein, nutritional halo	Beany, grassy, peptide bitterness	Off-notes become highly exposed	Masking + sweetness rebuild
OAT	Neutral flavor, strong category growth	Thin mouthfeel when sugar reduced	Texture collapse risk	Body + sweetness support
ALMOND	Light, clean positioning	Can taste watery or hollow	Sweetness loss noticeable	Sweetness quality
COCONUT	Natural fat richness	Oily, steamed, cooked notes	Less sweetness masking	Off-note modulation
PEA	High protein positioning & hypoallergenic	Earthy, vegetal notes	Bitterness amplification	Strong flavor masking

Flavor-Enhanced (Flevia) Soy Milk vs. Control



Growth meets higher sensory expectations

While the continued expansion of the category is undeniable, the nature of competition has shifted. It is no longer enough to simply be “plant-based.” Brands must now meet a much higher sensory bar as well.

A 2021 Innova survey found that 73% of global flexitarian consumers consider dairy-like mouthfeel extremely important when evaluating plant-based dairy alternatives. This creates a clear formulation tension:

» **Consumer Demand:** Low or zero sugar is the new standard.

» **Sensory Expectation:** Indulgence must match traditional dairy.

» **The Reality:** Plant bases introduce inherent bitterness, thinness, or “off-notes” that sugar previously helped to hide.

Addressing sweetness alone is no longer sufficient; the goal is to solve the sensory gap while maintaining a clean-label profile.

Why sugar reduction is challenging in plant-based dairy

In plant-based dairy systems, removing or replacing sugar fundamentally changes how the product performs – both structurally and sensorially. While high-intensity sweeteners can replicate sweetness, they do not replace sugar’s broader functional role within the system. As a result, developers often encounter:

» **Loss of body and creaminess:** Without sugar solids, products can feel thin or watery

» **Greater sensory exposure:** Underlying bitterness, astringency, or beany notes become more noticeable



» **Disrupted flavor balance:**
The overall profile can feel less rounded and integrated

» **Labeling and positioning trade-offs:** Some sweetening systems may not align with the natural, clean-label preferences of plant-based consumers

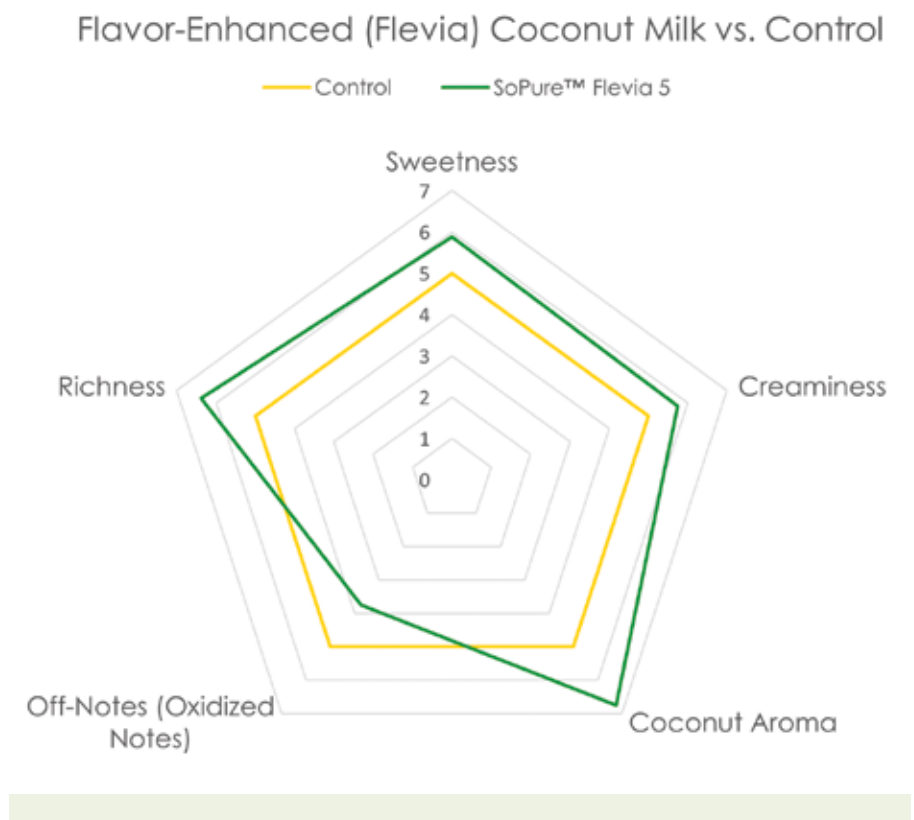
These effects are not uniform, however, meaning a “one-size-fits-all” approach would not suffice. Each plant base responds differently, creating the need for formulation strategies that are tailored to each specific system.

A modular strategy for precise control

Successful plant-based dairy reformulation increasingly relies on layered functionality. Within the SoPure portfolio, two complementary formulation tools help developers fine-tune plant-based systems: Used together or separately, these tools allow developers to tailor solutions to the specific needs of each plant base.

Clean sugar reduction with sensory support

SoPure™ Galaxy is a 100% plant-based, zero-calorie stevia sweet-



ener system developed for dairy alternative applications. It helps formulators achieve meaningful sugar reduction while maintaining sweetness quality, enhancing perceived milky character, and delivering a smoother overall flavor. Its high solubility also makes it suitable for a range of applications including

dairy alternatives, beverages, and concentrates.

Soy drinks are nutritionally attractive due to their high protein content, but sugar reduction poses particular formulation challenges. Lower sugar levels tend to expose the characteristic beany, grassy and bitter notes of

Formulation Need	Recommended Tool	Rationale
≥30–50% sugar reduction	Galaxy	Rebuilds sweetness and supports creamy perception
Unsweetened/zero sugar SKUs	Galaxy	Clean-label sugar replacement
Strong beany or grassy notes	Flevia	Targeted flavor masking
Bitterness or astringency	Flevia	Sensory smoothing
Premium dairy-like profile	Galaxy + Flevia	Dual sweetness + flavor optimization
High-protein plant bases	Galaxy + Flevia	Addresses both sweetness and off-notes



soy, while the reduction of sugar solids can result in a thinner, less creamy mouthfeel. In the application (figure 1), the sugar content was reduced from 6% to 3%. To compensate for the sensory and textural changes, a steviol glycoside-based sweetening solution was combined with soluble dietary fibre. This approach aimed to maintain sweetness perception and restore mouthfeel. According to sensory evaluations, the 50% sugar-reduced formulation achieved comparable, and in some cases superior, ratings to the reference product.

Flavor modulation & sensory smoothing

While sweetness is essential, many plant-based dairy formulas struggle

more with underlying "base-driven" off-notes. SoPure™ Flevia acts as a precision modulator, designed to "polish" the sensory profile by:

- » Neutralizing beany and grassy notes.
- » Smoothing out inherent bitterness and astringency.
- » Amplifying the perception of milky, creamy roundness.
- » Harmonizing flavor integration across the entire system.

Different plant-based raw materials present different challenges during sugar reduction and reformulation. While some systems primarily suffer

from texture loss, others are dominated by pronounced off-notes that become more noticeable as sugar, a natural flavour masker, is reduced. In the examples (figure 2, 3), soy-based systems exhibited distinct beany and grassy notes, whereas coconut-based formulations were characterised by strong steamed and oily flavour attributes. To address these issues, a flavour modulation approach based on SoPure Flevia was applied. Rather than contributing sweetness, the system was used to suppress undesirable flavour compounds and improve overall sensory neutrality. In trials with soy flour, this resulted in a cleaner and more versatile ingredient profile that was considered more suitable for subsequent product applications.

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From imitation to the craft of cheesemaking

A process-driven route to better plant-based cheese alternatives



Authors: Dr Anton Pluschke, Team Lead Global Product Management Pulses & Proteins, and Florian Kimpel, Senior Developer Plant-based Applications Europe, Döhler





(photos: Döhler)

Plant-based cheese alternatives have moved from a niche segment into an established product category in recent years. Between 2020 and January 2026, 1,561 new plant-based cheese products were launched worldwide. Spreads, slices, blocks and grated products are among the most established formats. The global retail sales value of plant-based cheese increased from EUR 514.9 million in 2020 to EUR 826.5 million in 2025 and is forecast to reach EUR 1.11 billion by 2030. This represents a projected CAGR of 6.1% between 2025 and 2030 (Euromonitor, 01/2026).

Despite this market activity, many products continue to face recurring limitations: little or no meaningful protein content, high levels of saturated fat – often due to the use of coconut fat – high salt levels and flavour profiles created primarily through added flavourings rather than fermentation and maturation. Texture often relies mainly on the functionality of starches and hydrocolloids instead of a robust protein-fat matrix. These gaps are not solely ingredient-related; they are linked to the process itself.

Cheesemaking as the reference process

Traditional cheesemaking is based on a manufacturing process refined over centuries to create structure, stability and flavour complexity in a controlled manner. Key mechanisms include the formation of a protein-fat matrix, moisture reduction through syneresis followed by

drainage, controlled acidification to drive gel formation and flavour development through cultures and, depending on the cheese style, maturation. Cheese quality is therefore determined not only by the composition of the matrix, but also by how that matrix is fermented, structured and processed.

A process-driven development approach begins by examining the process flow of conventional cheesemaking and asking two practical questions:

- » At which stages can plant-based raw materials reproduce the behaviour typically associated with milk?
- » Where are compensation, process redesign or additional processing steps required?

Transferring dairy process principles to plant-based matrices

Adapting conventional cheesemaking processes to plant-based systems is complicated by the different properties of the underlying matrices. Without appropriate pre-treatment, many plant proteins behave differently from dairy proteins. In practice, a defined hydration step before coagulation and fermentation is often critical, carefully controlled through time, temperature and shear. The hydration history influences dispersion quality, water binding and subsequent gel formation and therefore affects mouthfeel as well as curd formation and pressing behaviour.



The fermentation process cannot simply be transferred from dairy to plant-based matrices either. It must be adapted to the specific characteristics of each system. One technical objective is often to achieve gel strength within pH ranges comparable to those of fresh dairy cheeses – approximately pH 4.7–5.2, depending on the cheese type.

This requires the appropriate selection of cultures and careful process control so that acidification kinetics and structural development are aligned with the plant-based matrix.

For dairy and cheese manufacturers, many familiar process steps remain relevant. Standardisation, heating and cooling, coagulation, cutting, pressing, brining and maturation can all provide a valuable technological basis. Different development routes have therefore emerged, depending on how closely a concept follows conventional cheesemaking.

Three development routes for plant-based cheese alternatives

Three main routes can be identified in product development:

1) Batch-cooker route: analogue approach

Operationally, this is often the easiest route. Plant-based ingredients, fats, proteins, stabilisers and flavourings are combined and thermally processed to achieve the target viscosity or gel texture. The approach is flexible and readily scalable, but fermentation often plays only a limited role in developing a distinctive cheese character.

2) Traditional cheesemaking route

In this approach, conventional steps such as coagulation, curd handling, pressing, brining and, where appropriate, maturation are applied to a plant-based, milk-like base.

The advantage is that the same underlying mechanisms used to develop texture and flavour complexity in dairy cheese can be employed. Established cheese cultures and maturation concepts may also be applicable.

The challenge is to create a matrix that forms curd-like structures, releases a separable serum phase and remains stable under mechanical stress during subsequent processing.



3) Hybrid route combining traditional processing and batch cooking

Hybrid approaches appear particularly promising because they combine established cheesemaking expertise with the specific requirements of plant-based matrices. Core cheesemaking principles – including acidification-driven gelation, structuring, drainage and pressing – are retained, while selected batch-processing steps are used to simplify processing and stabilise texture.

This can reduce process complexity and improve reproducibility, making hybrid processing a practical route for the development of plant-based cheese alternatives.

Fermentation as a processing tool

Beyond flavour development, fermentation also contributes directly to the structure and functionality of plant-based cheese alternatives. Cultures used in cheesemaking, including thermophilic lactic acid bacteria such as *Lactobacillus helveticus*, can be adapted to plant-based systems to control pH development and texture formation.

Some principles of maturation can also be transferred to plant-based systems, producing noticeable sensory and



Current opportunities and limitations

The greatest potential currently lies in products with mild flavour profiles and little or no maturation, including cream cheese- and feta-style products and sandwich slices. In these categories, functional properties such as spreadability and sliceability are particularly important.

They also offer realistic scope for nutritional improvement, including higher protein content and the incorporation of nutritionally valuable ingredients.

Long-matured, more complex cheese styles remain more challenging. Nuanced flavour development, surface-ripening cultures and performance in melting, stretching and browning require considerably tighter control over the protein network, moisture distribution and ripening ecology.

Outlook: hybrid dairy-plant matrices as an additional route

Alongside fully plant-based systems, hybrid matrices combining dairy and plant components may offer an industrially relevant route. Depending on the specific formulation, they may reduce costs and improve the environmental footprint while retaining important functional properties of dairy ingredients and incorporating the benefits of plant-based raw materials.

For manufacturers, this can create opportunities to make use of existing processes while developing tailored product innovations.

From development to industrial implementation

The transition from prototypes to industrially robust products is most successful when process expertise and matrix design are developed together from the outset. Collaboration between cheese manufacturers and technology partners can accelerate scale-up, establish robust process windows and validate quality targets under production conditions.

Döhler already follows this approach in the development of plant-based and hybrid cheese concepts, where technological performance, sensory quality and nutritional targets are considered together from the very beginning.

functional effects. These may include a more cheese-like flavour, a reduced perception of plant-derived notes, greater smoothness and elasticity and improved slicing or spreading performance compared with unfermented alternatives.

Alongside process control, the composition of the matrix plays a central role in fermentation, structural development and the final sensory profile.

Raw material selection and functional matrix components: soy and vegetables

From a functional perspective, soy extract is one of the more dairy-like plant protein sources. It offers a complete protein profile, established emulsifying and water-binding properties and good fermentability within defined acidification profiles.

Vegetable purées can also contribute to matrix formation. Cauliflower, for example, can add complexity to the flavour profile, reinforce cheese-like and fermented notes and improve water binding and microstructural homogeneity, thereby supporting the protein network.

Depending on the intended product profile, similar principles can also be explored with other vegetable components, including pumpkin and carrot.



(photo: ??)

New frontiers in plant-based dairy alternatives

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For more than a decade, plant-based drinks have been the category's breakout success story. It changed supermarket shelves, coffee menus and consumer habits, bringing plant-based consumption into the mainstream. Today, it remains the largest and most established part of the dairy alternatives market.

But the question facing the category is changing. It is no longer enough to ask whether a product is plant-based. Consumers want to know whether it tastes good in coffee, feels satisfying as a quick breakfast, delivers nutrition regardless the occasion or brings indulgence to an everyday snack. In other words, the next frontier is



not another alternative for alternative's sake. It is plant-based dairy alternatives designed around the moments people actually live.

The foundation: plant-based drinks still set the standard

Dairy alternative drinks such as oat, almond and soy beverages remain the category's commercial engine and its most visible success story. They continue to serve a broad range of consumers, from flexitarians and environmentally conscious shoppers to those looking for new flavor experiences, seeking variety, functionality, dietary alternatives or added benefits such as protein, energy and satiety.

Yet scale brings scrutiny. Shoppers are no longer forgiving plant-based drinks simply for being dairy-free. They expect natural sweetness, creamy mouthfeel, satiety, a clean label and reliable performance across the

ways they actually use the product: poured over cereal, blended into a smoothie, shaken into a recipe or steamed into coffee.

This is where formulation becomes the invisible difference between trial and repeat purchase. Enzyme solutions can help unlock natural sweetness from plant-based raw materials while contributing to a smoother, more rounded mouthfeel. Texture systems, including hydrocolloids, play a critical role in stability, suspension and the creamy drinking experience consumers expect from the category's everyday hero.

Where barista performance raises the bar

Coffee is where plant-based drinks are put under pressure. In a latte or cappuccino, there is nowhere to hide: foam structure, stability, mouthfeel and flavor release are all immediately visible. Consumers are not only asking whether a plant-based drink works as a dairy alter-



(photo: shutterstock_1345147970)



native; they are asking whether it can deliver the café-style experience they already love.

That makes barista performance one of the category's toughest formulation tests. dsm-firmenich supports manufacturers with ingredient and formulation expertise designed to create rich, stable foams, a smooth mouthfeel and a more premium sensory experience across plant-based barista drinks. Taste modulation and flavor solutions also help address unwanted plant notes, supporting a cleaner, more balanced profile. In coffee, performance is not a technical extra, it is the experience.

Beyond the glass: new formats, new reasons to choose plant-based

The same logic is now pushing the category beyond the milk aisle. Once consumers trust plant-based products in familiar formats, they are more open to seeing them in new roles: a ready-to-drink latte for the commute, a complete meal drink for a busy morning, a high-protein cultured product after exercise or a vegan cream cheese alternative that delivers indulgence without compromise.

These formats matter because they give consumers new reasons to choose plant-based. Not just because it is replacing dairy, but because it fits a mood, a need or a moment: convenience, wellness, protein, indulgence or flexibility. This is where plant-based dairy alternatives begin to stretch from a category into a broader lifestyle territory.

The emergence of the “Meal in a Bottle”

For a long time, meal replacement drinks had a very specific image: practical, functional and often chosen when a “proper meal” was not possible. But that perception is starting to shift. A new generation of ready-to-drink products is moving the format closer to everyday lifestyle territory.

The reason is simple: consumers are trying to balance more things at once. They want health and wellness, protein, weight management, convenience and products that fit into less predictable daily routines. As traditional meal occasions become more fluid, there is





growing interest in drinks that can deliver meaningful nutrition without feeling like a compromise.

That creates a clear opportunity for plant-based complete meals. These products need to offer the nutritional value of a meal in a convenient, drinkable format – but they also need to feel smooth, satisfying and enjoyable. Satiety, balanced nutrition and high-quality protein matter, but so does the experience of drinking it.

For manufacturers, that makes formulation complex. Proteins, vitamins and minerals all need to work together, but many of them can affect taste, texture and stability. Plant proteins can bring earthy notes, astringency or sedimentation, while fortification systems may influence flavor perception, colour and shelf-life stability.

This is why a meal-in-a-bottle has to strike a careful balance. It must feel substantial enough to replace a meal, but still remain easy to drink. Texture, mouthfeel and flavor are not secondary details; they are what determine whether the product feels like a one-time solution or something consumers genuinely want again.

Meeting these expectations requires a holistic formulation approach. At dsm-firmenich, we combine expertise in nutritional solutions, flavors, taste modulation and texture design to help manufacturers manage the sensory and technical challenges of high-protein plant-based beverages. The aim is not simply to pack more nutrition into a bottle, but to create a product that feels credible as a meal and enjoyable as a drink.

In that sense, complete meal drinks do not replace the traditional dairy alternatives story; they expand it. They open new occasions, from breakfast on the move and post-workout recovery to moments when consumers want nutrition, satiety and convenience in a single format. For a category built on alternatives, this is an important shift: plant-based is becoming less about what it removes, and more about what it enables.

Enabling the future of plant-based dairy alternatives

For manufacturers, the message is clear: the next wave of plant-based dairy will not succeed on claims alone. Whether the product is an oat drink, a barista solution, a complete meal drink or a protein-rich cream cheese alternative, it needs to answer a specific consumer need with precision.

That raises the bar for formulation and process. Taste, texture, nutrition and functionality can no longer be treated as separate workstreams. They need to come together in one coherent product experience: the oat drink that foams beautifully, the meal drink that satisfies without heaviness, the cream cheese alternative that feels indulgent while delivering on protein.

In a crowded market, repeat purchase will come from products that feel designed for real life: their timing, their use, their sensory cues and their nutritional role. The most successful plant-based products will not ask consumers to compromise. They will make the plant-based choice feel like the obvious one.

dsm-firmenich helps manufacturers turn that ambition into products consumers want to return to. By bringing together expertise across nutrition, taste, texture and health, we support the development of plant-based dairy alternatives that do more than fill a category space. They earn their place in the moments that matter.



(photo: shutterstock_2536892863)



Bauer presents its product range at the inauguration event (photos: Bauer)

Process technology for the production of plant-based soy base

Bauer expands plant-based production

The German private dairy Bauer has built a new production facility for plant-based base products at its Wasserburg am Inn site. The process technology implemented by GEA covers the entire process, from soybean intake to the finished plant-based concentrate. It includes mixing and grinding technology, solids separation using decanters, thermal inactiva-

tion by means of a heating system, tank storage, water treatment and CIP cleaning systems. The facility, together with a new innovation center, was inaugurated on July 16. Until now, Bauer had sourced the soy base for its plant-based yogurt alternatives externally. With the new facility, this upstream production step is to be carried out at Bauer's own site.



Aerial view of Privatmolkerei Bauer's new production facility and innovation center in Wasserburg am Inn. GEA supplied raw material processing, process design and plant integration for the project.

Process chain from soybean to concentrate

The process line comprises the intake and storage of raw soybeans, mixing and grinding technology, and solids separation using decanters. It also includes thermal inactivation by means of a heating system, tank storage, water treatment and the associated CIP cleaning systems. The plant-based concentrate produced at the end of the process chain is intended for further processing into yogurt alternatives using Bauer's existing production facilities.

GEA acted as general contractor for the project and, in addition to supplying the plant technology, was responsible for feasibility testing, process design and engineering. The project involved, among others, the company's process test centers in Ahaus and Oelde as well as dairy processing specialists from Munich.

The process concepts and performance data were developed and validated at the test centers prior to implementation. Bauer commissioned GEA with the project in May 2025, and installation of the plant began in January 2026.

Process development and validation

GEA already has project experience with process solutions for producing plant-based bases from oats, rice, soy and other plant-based raw materials. These technologies are used by both dairies and specialized start-ups.

The test centers in Ahaus and Oelde were also involved in the process development and validation of the plant-based kefir drink "Bauer KFYR Plant-Based." The product was presented at the OMR Festival in Hamburg in early May. Bauer's new production facility provides the technical basis for producing the plant-based base required for this product at the Wasserburg site in the future.

Integration into existing production

With the new facility, Bauer is bringing the production of its previously externally sourced soy base into its own production process. The resulting plant-based concentrate is subsequently processed into yogurt alternatives using the company's existing facilities. The new process line therefore complements Bauer's existing production by adding the upstream production of the plant-based base.

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