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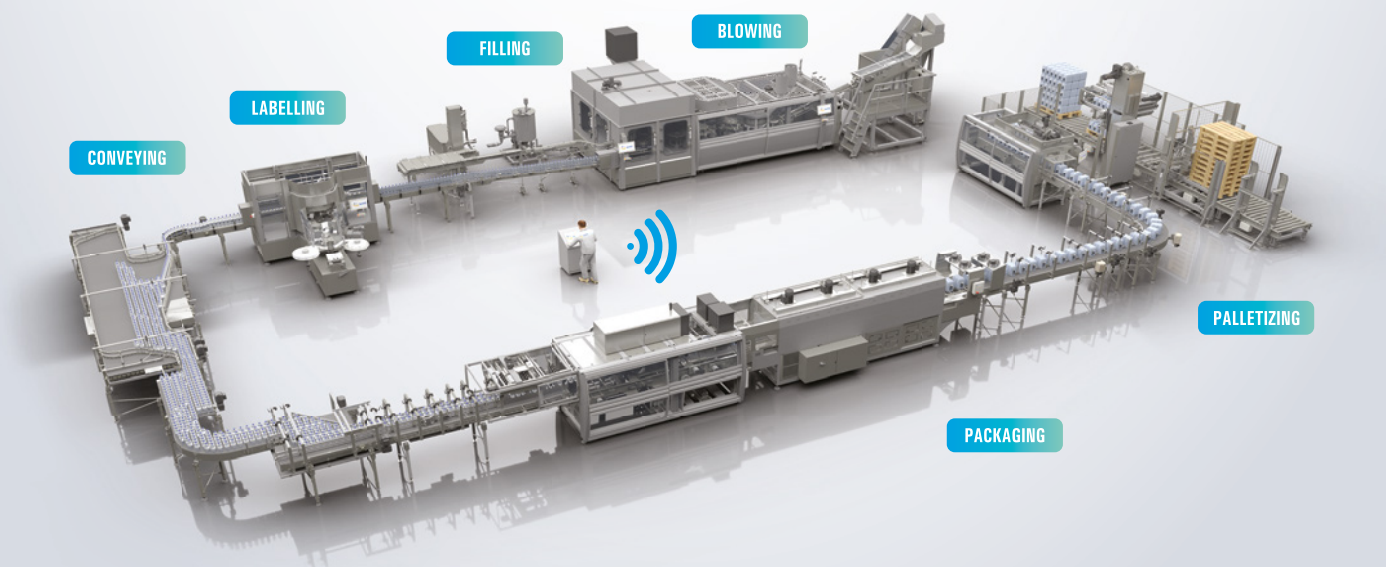
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Global Coffee Production Heading for a New Record

The global coffee sector is entering one of its strongest production cycles of the past decade. According to the latest **USDA** *Coffee: World Markets and Trade* report, global coffee production is forecast to rise sharply in the 2026/27 marketing year, increasing by 10.8 million 60-kg bags from the previous season to a new record of 189.7 million bags. Growth is being driven primarily by record crops expected in Brazil, Vietnam, Ethiopia and Uganda, which should offset projected declines in India and Indonesia. Global consumption is also forecast at an all-time high of 179.7 million bags, while ending stocks are expected to increase for the second consecutive year, reaching 26.3 million bags. Greater product availability contributed to a 25% decline in the International Coffee Organization's monthly composite price index during the seven months preceding publication of the report.

Brazil and the Performance of the Two Varieties

Brazil is expected to consolidate its position as the world's leading producer, with total output reaching 71.9 million bags, up 8.9 million and the highest level ever recorded. The country would thus account for nearly 40% of global supply.

Growth is mainly attributed to the recovery in Arabica production, which is expected to increase by 9.5 million bags to 47.5 million. Rainfall during the flowering period between September and October supported fruit development and yields close to historical highs in Minas Gerais, the region accounting for more than 70% of Brazilian Arabica production. The 2026/27 crop would be the second largest ever recorded for this variety, following five years affected by drought, high temperatures, frost and irregular rainfall.

Brazilian Robusta production, by contrast, is expected to decline by 600,000 bags to 24.4 million. Lower temperatures and periods of heavy rainfall reduced yields in Espírito Santo, the country's main producing area. Greater overall availability is expected to push Brazilian green coffee exports to a record 45 million bags, 11 million more than in the previous season, while ending stocks would rise to approximately 4.4 million.

Globally, Arabica production is forecast at 105.9 million bags, compared with 94.4 million in 2025/26. Much of the increase is related to Brazil's biennial production cycle, characterized by alternating high- and low-yield years. Under normal conditions, the transition from one season to the next can result in variations of between 5 and 10 million bags, with significant effects on international supply.

In recent years, lower Brazilian availability has been partially offset by increased production in Ethiopia, Mexico and Peru. However, these gains have not been sufficient to fully close the gap, contribut-

ing to a 15.5-million-bag decline in global stocks between 2020/21 and 2024/25.

Global Robusta production is expected to reach 83.8 million bags, slightly below the 84.4 million recorded in the previous season. Projected declines in Brazil and Indonesia will be almost entirely offset by higher Vietnamese production and expected gains in Uganda and Tanzania.

Leading Producing Countries

Vietnam remains the world's largest Robusta producer, with output of this variety forecast at 31.4 million bags. The country's total production is expected to reach a record 32.5 million bags, 800,000 more than in 2025/26. Expansion of cultivated area and higher yields have been encouraged by the elevated prices recorded in previous seasons, allowing farmers to invest more heavily in fertilizers and other agricultural inputs. Green coffee exports are expected to increase by 300,000 bags to 25.4 million, while domestic consumption is forecast at a record 5 million. Including roasted and soluble coffee, total Vietnamese exports are projected at nearly 29 million bags equivalent.

In Colombia, the crop is expected to increase by 900,000 bags to 13.4 million. Adequate soil moisture following abundant rainfall in the previous year, together with increased use of fertilizers and crop protection products, should support a recovery in yields. Green coffee exports are forecast to increase by 500,000 bags to 12.2 million, mainly destined for the United States and European Union. This represents a recovery from the 2025/26 season, when production was reduced by excessive rainfall and persistent cloud cover.

Ethiopia is expected to achieve record production of 12.1 million bags, more than 500,000 above the previous season. Growth over the past four years has been supported by replacing more than half of the cultivated area with higher-yielding varieties. Green coffee exports are estimated at 7.1 million bags, an increase of approximately 160,000, while domestic consumption should rise from 4.5 to 5 million.

Total production in Central America and Mexico is expected to increase by nearly 600,000 bags to 17.7 million. Recovery is forecast in Costa Rica, Guatemala, Honduras, Mexico and Panama, although most of the increase is attributed to Honduras.

Honduran production is expected to rise by approximately 500,000 bags to just over 6 million, supported by an expansion in cultivated area and favorable weather conditions. Regional green coffee exports are forecast to increase by almost 400,000 bags to a total of 14 million.

Indonesia is expected to move in the opposite direction, with production declining by 1 million bags to approximately 11.4 million. The decrease concerns Robusta, forecast at 10 million bags, while Arabica should remain stable at around 1.4 million. Excessive rainfall disrupted flowering and berry development in the lowland areas of southern Sumatra and Java. Reduced availability is expected to lower green coffee exports by more than 800,000 bags to 7 million.

India is also expected to record a contraction, with total production forecast at 6.14 million bags, compared with 6.43 million in the previous season. The



crop comprises approximately 1.56 million bags of Arabica and 4.58 million of Robusta.

Exports and International Trade

Global green coffee exports are expected to increase by 11.9 million bags to a record 131.4 million. Brazil will provide the largest contribution to this growth, followed by Vietnam and Colombia. Total exports, including green, roasted and soluble coffee, are forecast at 158.9 million bags equivalent, compared with 145.9 million in 2025/26.

Global exports of roasted and ground coffee are expected to rise to 6.83 million bags equivalent. The European Union remains the leading exporter, with 3.2 million, followed by Switzerland with 2 million. Soluble coffee trade is estimated at 20.63 million bags equivalent. Brazil remains the leading exporter with 4 million, followed by Vietnam, India, the European Union and Malaysia.



Total global imports are forecast to increase from 142.9 to 150.9 million bags equivalent. The European Union remains the largest importing market, with 50 million bags of green coffee, compared with 46.5 million in the previous season.

The United States is expected to import 24.5 million bags of green coffee and 26.9 million when roasted and soluble coffee are also included. It is followed by Japan, the Philippines, China, Canada, the United Kingdom and Russia. Chinese green coffee imports are forecast at 4 million bags, while the total, including other coffee types, should reach just over 6 million.

Consumption Continues to Rise

Global consumption is expected to increase by approximately 6.3 million bags to 179.7 million. The strongest growth is forecast in the European Union and the United States, which remain the world's two largest markets, with consumption of 42.5 million and 26.95 million bags, respectively.

Consumption in Brazil is expected to remain stable at around 22.4 million bags. Asian markets continue to expand, with China forecast to reach 6.75 million bags, the Philippines 6.73 million and Vietnam 5 million. Consumption is also increasing in Ethiopia, the United Kingdom, Russia, India, Turkey and Thailand.

Stocks and Market Outlook

Global ending stocks are forecast to reach 26.3 million bags, up from 24.4 million in 2025/26 and 22 million in 2024/25. Growth will be driven mainly by the European Union, where inventories are expected to increase from 7.5 to 9.3 million bags, and Brazil, where stocks are forecast at approximately 4.4 million.

Despite the recovery, stocks remain below the levels observed at the beginning of the decade, when they exceeded 31 million bags, and continue to remain below the long-term average. Market conditions will therefore continue to depend heavily on the Brazilian crop, weather developments in Minas Gerais and the evolution of global Arabica supplies.

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Global Dairy Markets 2026: Strong Trade, Changing Demand and New Competitive Dynamics

The global dairy industry is entering a new phase of expansion in 2026, driven by recovering milk production, robust international demand and significant changes in trade flows. According to the latest **USDA** *Dairy: World Markets and Trade* report, global milk production among the major exporting countries is forecast to exceed 300 million metric tons, while cheese and butter continue to be the fastest-growing traded dairy commodities.

The current market is characterized not only by higher production volumes but also by structural changes in processing strategies. Manufacturers are increasingly allocating available milk toward higher-value products such as cheese, butter and specialized protein ingredients rather than commodity milk powders. This shift reflects evolving consumer preferences, stronger foodservice demand and the growing importance of export markets.



Milk production continues to recover

Global milk output is expected to increase across nearly all major exporting regions during 2026. Total production from the principal exporters is forecast to reach 300.8 million metric tons, representing a 1.6% increase compared with 2025. The United States is projected to expand production by 2.1%, reaching 107.3 million tons, while New Zealand records the fastest growth among the major exporters at 2.6%, followed by Australia and Argentina, both expected to grow by 2.4%. The European Union is forecast to produce approximately 150 million tons, with productivity improvements compensating for the continued decline in dairy cow numbers.

Although climatic conditions remain an important variable, particularly with the possible return of El Niño, investments in genetics, precision feeding, automation and improved herd management continue to increase milk yields worldwide. In mature dairy economies, future production growth is increasingly being achieved through productivity gains rather than herd expansion.



Cheese becomes the preferred destination for milk

Cheese remains the most attractive dairy product from both an economic and strategic perspective. Processors across Europe, Oceania and North America continue directing additional milk supplies toward cheese manufacturing because of stronger margins and resilient global demand.

Worldwide cheese exports from the major exporting countries are forecast to reach 3.05 million tons in 2026, an increase of 8% over the previous year. The most remarkable performance belongs to the United States, whose exports are projected to increase by 23%, rising from 613,000 tons to 751,000 tons, largely thanks to expanded process-

ing capacity and highly competitive pricing. The European Union is expected to maintain its position as the world's largest cheese exporter with 1.48 million tons, while New Zealand is forecast to export 425,000 tons.

Domestic cheese consumption also continues to expand in most developed markets, supported by stable retail demand, foodservice recovery and increasing tourism. In Europe, countries such as Germany, France, Italy, Poland and the Netherlands remain the principal production hubs, accounting for approximately three-quarters of total EU cheese output. Investment in premium and geographically protected cheeses further strengthens the long-term competitiveness of the sector.

Butter enjoys exceptional international demand

Butter has become one of the strongest-performing dairy commodities in international trade. U.S. butter exports have experienced unprecedented expansion, benefiting from abundant milkfat availability and a substantial price advantage over European and Oceanian competitors.

During the past year, butter exports increased by 148%, while cheese exports rose by 21%, together accounting for nearly two-thirds of the increase in U.S. dairy export value. Export growth has also become significantly more diversified geographically, extending beyond traditional North American destinations toward Asia, the Middle East, North Africa and Europe.

For 2026, butter exports from the major exporters are expected to reach 1.07 million tons, an increase of 11%compared with 2025. U.S. butter exports alone are forecast to rise by 40%, reaching 171,000 tons, while the European Union is expected to increase exports by 10%. New Zealand remains the world's largest butter exporter, shipping approximately 515,000 tons, although it faces growing competition from increasingly aggressive U.S. suppliers.

Strong international demand, particularly from Southeast Asia, China and MENA countries, combined with relatively competitive prices and expanding foodservice activity, continues to support butter consumption worldwide. The sustained price advantage enjoyed by U.S. exporters has further accelerated market penetration in countries such as South Korea, Saudi Arabia, Australia and Mexico.

Milk powders follow different market trajectories

Unlike cheese and butter, milk powders are showing mixed market dynamics.

Skim milk powder (SMP) production and exports remain under pressure as processors increasingly divert available milk solids toward higher-value dairy products. U.S. SMP exports are forecast to decline by 6%, while European exports are expected to increase by 5%, allowing the EU to strengthen its position as the world's leading SMP exporter.

Whole milk powder (WMP), however, remains the backbone of New Zealand's dairy processing industry. Exports are forecast to reach 1.5 million tons in 2026, supported by record milk production and continued demand from China and other Asian markets. Meanwhile, China itself is reducing domestic WMP production as processors increasingly prioritize butter, cream, cheese and protein-rich dairy ingredients that offer higher economic returns.

A more diversified and resilient dairy market

The 2026 outlook confirms that the global dairy sector is becoming increasingly sophisticated. Rather than competing solely on production volume, dairy industries are investing in efficiency, value-added manufacturing and diversified export portfolios.

The United States has emerged as the fastest-growing export competitor, particularly in cheese and butter, while the European Union continues to leverage its premium product portfolio and New Zealand strengthens its role as the world's leading supplier of milkfat and whole milk powder.

At the same time, rising consumer demand for dairy proteins, functional ingredients and premium cheeses is encouraging processors to allocate milk toward products offering higher added value instead of traditional commodity powders.

As international trade expands and supply chains become increasingly diversified, the global dairy market appears well positioned for sustained growth throughout 2026 and beyond, despite ongoing challenges related to climate variability, production costs and geopolitical uncertainty.

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Food additives - market share analysis, industry trends and, growth forecasts

Food Additives Market Analysis

According to the latest report published by **Markets Research** agency, the global food additives market is expected to grow from USD 144.89 billion in 2025 to USD 149.96 billion in 2026 and is forecast to reach USD 178.11 billion by 2031 at 3.5% CAGR over 2026-2031. This measured growth reflects the industry's maturation and the complex interplay between consumer demand for natural ingredients and the technical requirements of modern food processing. The market's trajectory indicates a fundamental shift from volume-driven expansion to value-oriented innovation, where manufacturers prioritize ingredient functionality and consumer acceptance over pure cost optimization. The industry is witnessing a substantial shift towards clean-label ingredients and natural food additives, reflecting evolving consumer preferences and regulatory requirements. Manufacturers are increasingly focusing on developing additives that can be labeled as GMO-free, natural preservatives, or organic, driving significant market growth in natural alternatives. This trend is particularly evident in categories such as colorants, acidulants, and hydrocolloids.



Global Food Additives Market Trends and Insights

Rising Demand for Processed and Convenience Food

With the rise in urbanization and a growing middle-class population, the developed and developing regions across the globe are witnessing a rising demand for processed and packaged food, leading to more demand for food additives across the globe. The consumption of processed products like bakery, confectionery, and beverages is increasing among consumers due to product innovation and product attractiveness. Young consumers and the working population are opting to consume processed beverages like cold drinks, energy drinks, and others. Consumers are driven by the improved texture, flavor, and overall sensory experience of ready meals and processed food products, hence promoting the demand for food additives, artificial ingredients, sugar, and preservatives, among others. A report by the World Health Organization (WHO) and the Indian Council for Research on International Economic Relations (ICRIER)in 2023 revealed that the sale of ultra-processed foods has witnessed a rapid rise in India over the duration of 10 years. These ultra-processed foods contain sugar and fat for longer shelf-life, artificial colors and flavors, and artificial sweeteners, and with the increase in the consumption of ready-to-eat meals and sugary drinks across the country, is likely to support the demand for food additives in coming years as well.



Increasing Demand for Natural and Clean Label Products

The demand for recognizable ingredients has transformed product development, as manufacturers shift toward natural alternatives instead of synthetic additives. This change requires comprehensive reformulation strategies to maintain product functionality while ensuring ingredient transparency. Companies must reevaluate their entire production processes, from sourcing raw materials to adjusting manufacturing parameters. Plant-based and microbial preservatives are emerging as viable options, with companies such as Galactic developing solutions that extend shelf life and ensure food safety while meeting regulatory requirements. These natural preservatives undergo extensive testing to validate their efficacy across different food matrices and storage conditions. The clean label trend has created opportunities for biotechnology firms to produce fermentation-based ingredients that fulfill both natural and functional requirements, establishing them as premium substitutes for synthetic additives. These fermentation processes are optimized to yield consistent, high-quality ingredients that can effectively replace traditional chemical preservatives while maintaining product stability and safety.

Stringent Regulatory Frameworks

Regulatory complexity affects market participants through divergent approval processes across jurisdictions, creating barriers to global product launches and increasing compliance costs. Companies must navigate various regulatory frameworks, documentation requirements, and safety standards in each market in which they operate. The FDA's revocation of authorization for erythrosine (Red No. 3) in foods demonstrates the heightened scrutiny of food additives, requiring companies to maintain comprehensive safety databases and regulatory expertise. Companies must continuously monitor regulatory changes, update their compliance protocols, and invest in scientific research to support product safety claims. State-level regulations, including California's ban on specific chemical additives in schools, have created multiple compliance requirements that affect product formulation and market entry strategies. These varying requirements necessitate region-specific product modifications and separate supply chain management systems. This regulatory environment increases operational costs and complexity while constraining additive development innovation, as companies must allocate significant resources to compliance rather than research and development initiatives.

Other drivers and restraints analyzed in the detailed report include:

1. Enhanced Shelf Life and Preservation Needs
2. Technological Advancements in Food Processing
3. High Research and Development and Innovation Costs

Segment Analysis

Bulk sweeteners hold a 54.62% market share in 2025, serving as essential ingredients in food and beverage formulations across baked goods and processed foods. Food colorants are experiencing the highest growth rate with a 6.65% CAGR during 2026-2031, driven by increasing consumer preference for visually appealing products and the shift from synthetic to natural alternatives. These colorants maintain established safety standards through scientific validation and defined acceptable daily intake levels. Preservatives continue to show consistent demand due to food safety requirements and extended supply chains that necessitate antimicrobial protection. Emulsifiers are growing in importance due to the expansion of plant-based and convenience foods that require advanced texture control.

Natural colorants are gaining market value as consumers increasingly prefer products without synthetic chemicals, despite higher costs and processing challenges. Enzymes demonstrate strong growth potential in the product portfolio. Anti-caking agents and acidulants perform specific functions in powder and processed food applications, with silicon dioxide and calcium phosphate serving as commonly approved anti-caking agents across food categories. Hydrocolloids are becoming increasingly important for texture modification, particularly as manufacturers develop improved mouthfeel and stability in reduced-fat and plant-based products.

Dry form additives hold 62.95% market share in 2025, due to their superior storage stability, transportation efficiency, and ease of handling in industrial food processing operations. Liquid additives show a growth rate of 5.95% CAGR during 2026-2031, driven by applications requiring precise dosing, immediate solubility, and integration into liquid food systems. The dominance of dry additives stems from practical manufacturing considerations, as powder forms provide extended shelf life, lower shipping costs, and simplified inventory man-



agement compared to liquid variants. Anti-caking solutions maintain powder flowability by reducing moisture-induced caking, with calcium carbonate solutions demonstrating potential for reduction in caking under severe conditions.

Liquid additives see increased adoption in beverage applications and specialized food processing, where immediate dispersion and uniform distribution are essential for product quality. The expansion of functional beverages and liquid nutritional products increases demand for liquid additive forms that integrate effectively without impacting taste, appearance, or stability. Emulsifiers such as lecithin play a vital role in combining water and oil-based ingredients, maintaining textural uniformity across products from infant formulas to baked goods and spreads. Advances in encapsulation and controlled-release systems allow dry additives to achieve liquid-like performance while retaining the handling benefits of powder forms, resulting in hybrid solutions that balance functionality and operational efficiency.

The Food Additives Market Report Segments the Industry Into Product Type (Preservatives, Bulk Sweeteners, Sugar Substitutes, Emulsifiers, and More), Form (Dry and Liquid), Source (Natural and Synthetic), Application (Bakery and Confectionery, Dairy and Desserts, Beverages, and More), and Geography (North America, Europe, Asia-Pacific, and More). Market Sizing is Presented in USD Value Terms for all the Abovementioned Segments.



Geography Analysis

North America holds 30.98% market share in 2025, driven by advanced food processing infrastructure, comprehensive safety standards, and consumer acceptance of premium additive solutions. The region's established regulatory framework facilitates product development while encouraging innovation in natural and functional ingredients. The FDA's increased post-market evaluation of food chemicals demonstrates the region's safety commitment, though this may restrict new synthetic additive entries. North American food manufacturers focus on clean label formulations, exemplified by Cargill's high-intensity sweeteners portfolio, including EverSweet®, Truvia®, and ViaTech®. The region›s expertise in biotechnology and precision fermentation enables advanced additive development, despite market entry challenges from high costs and regulatory requirements.

Asia-Pacific shows the highest growth rate at 4.45% CAGR during 2026-2031, supported by urbanization, middle-class expansion, and increased processed food consumption. China's National Health Commission's approval of 30 new food additives in 2024 indicates strong regulatory support in the region's primary market. Japan's food processing sector, valued at USD 190 billion, reflects regional trends toward pre-prepared foods and enhanced safety standards. The region benefits from manufacturing efficiencies and raw material availability, making it a strategic production hub for domestic and international markets.

Europe maintains market distinction through strict regulations, natural ingredient preferences, and sustainable food production practices. The European Commission's support for bio-based innovations, including various fermentation technologies, reinforces the region's sustainable additive development. EU-wide regulatory alignment offers market access benefits, despite rigorous compliance standards. The region's focus on organic and natural products creates opportunities for additives meeting both functional requirements and sustainability standards.

marketresearch.com

Clean-label ingredients: transparency and functionality drive new food formulations

The clean-label paradigm has established itself as one of the key drivers reshaping the food industry, prompting a rethinking of formulations toward greater naturalness, clarity, and transparency. No longer merely a marketing tool, it has become a true competitive standard, supported by growing consumer demand for perceived quality and ingredient awareness.

In this context, clean-label ingredients – defined as additives and functional components of natural origin, minimally processed and free from artificial substances – are playing an increasingly central role in innovation strategies. Natural preservatives, plant-based colors and flavors, and plant-derived emulsifiers now represent the main categories driving technological development, with applications spanning bakery products, beverages, dairy, and packaged foods.

Market dynamics confirm the strength of this trend. According to the **HTF Market** report, the global market is estimated at USD 57.4 billion in 2025 and is projected to reach USD 111.8 billion by 2033, with a compound annual growth rate (CAGR) of 8.7%.

Market drivers

This expansion is primarily driven by demand for "clean" labels featuring recognizable and easily understandable ingredients, perceived as a guarantee of safety and authenticity. At the same time, growing attention to health and wellness is accelerating the gradual elimination of synthetic additives, pushing companies toward increasingly complex reformulation processes. The technological challenge lies in maintaining key functional properties – microbiological stability, shelf life, and sensory characteristics – while relying on natural raw materials, which are often less performant than conventional alternatives.



Technological and innovation trends

Within this scenario, innovation is evolving along multiple directions. On one hand, the development of effective natural preservatives capable of ensuring product safety without compromising shelf life; on the other, the increasing adoption of plant-based ingredients, in line with the broader shift toward sustainable food systems. In addition, traceability technologies are playing an increasingly strategic role, strengthening consumer trust and enhancing the value of ingredient origin across the supply chain.

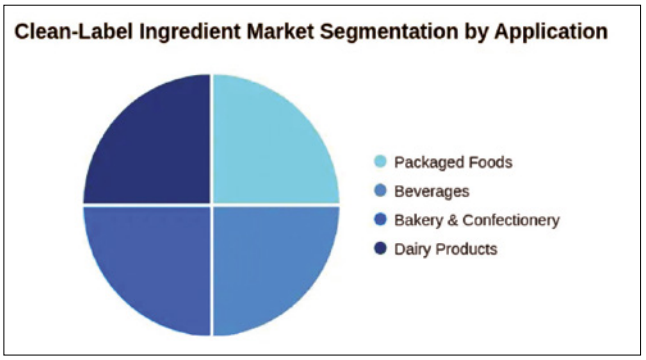
Challenges and constraints

Despite its strong momentum, the sector faces several challenges. Production costs are generally higher, impacting final product pricing, while the lower efficacy of certain natural ingredients may result in reduced shelf life. Further complexity arises from a fragmented regulatory landscape, with varying definitions of "natural" across regions complicating export strategies and standardization efforts.

Growth opportunities

Alongside these challenges, significant opportunities are emerging. Emerging markets are showing increasing sensitivity to transparency and food quality, while clean-label positioning aligns well with premium segments, where perceived value supports higher margins. At the same time, formulation innovation represents a high-potential area, with the development of new natural ingredients capable of replicating the technological performance of conventional additives.



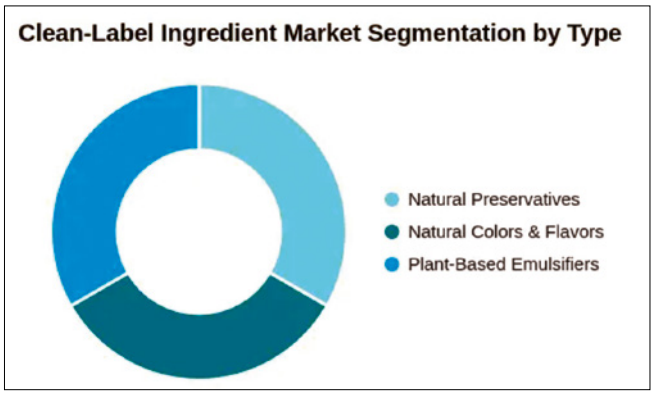


Geographical outlook

From a geographical perspective, North America remains the leading market, supported by strong demand for transparency and high industrial reformulation capabilities. Europe shows steady growth, driven by stringent regulatory frameworks and a well-established focus on sustainability. Meanwhile, Asia-Pacific stands out as the most dynamic region, fueled by urbanization, rising disposable income, and increasing nutritional awareness.

Overall, clean label represents a structural evolution of the food system, where simplified labels are accompanied by growing technological complexity. For industry players, the ability to balance naturalness, safety, and performance will be the key success factor in a market set to consolidate over the medium to long term.

htfmarketreport.com



Frozen Bakery Products: A Market Worth $45 Billion by 2030

The global frozen bakery market continues to show strong growth prospects, driven by increasing demand for convenient foods, the widespread adoption of ready-to-bake and par-baked products, and the need, particularly in foodservice, to standardize quality and production processes. According to Daedal Research's *Global Frozen Bakery Market – 2026 Edition*, the sector reached a value of **$32.1 billion in 2025** and is expected to grow to approximately **$45 billion by 2030**, at a compound annual growth rate of around **7% between 2026 and 2030**. This represents the continuation of an already significant expansion, considering that the market was valued at approximately $23.6 billion in 2021.



Convenience and labour savings drive demand

One of the main drivers of growth is the increasing demand for solutions that reduce preparation times and labour requirements at points of sale. Retailers, bakeries, restaurant chains and quick-service restaurants are increasingly turning to frozen dough, partially baked products and ready-to-bake

items. These solutions make it possible to achieve more consistent quality, extend shelf life and offer consumers freshly baked products without having to manage the entire production process at the point of sale.

Bread and rolls still represent the largest segment, accounting for approximately **34% of the global market**. However, the cakes, pastries and viennoiserie category appears to be more dynamic, with an estimated average annual growth rate of around **8.5%**. Croissants, laminated products and other frozen sweet bakery specialties are increasingly used in cafés, hotels and restaurant chains, where product standardization provides significant operational advantages.

The **ready-to-bake segment** is particularly important, accounting for approximately **52% of the market** and also showing one of the most favourable growth trends, with an expected annual increase of around 8%. The possibility of completing the baking process immediately before sale combines the logistical advantages of frozen products with the sensory characteristics associated with freshly baked goods.



Europe leads, while Asia-Pacific accelerates

From a geographical perspective, **Europe** remains the world's largest market, accounting for approximately **35% of global demand**. Its leading position is supported by a well-established bakery culture, a highly developed industry and the widespread use of bake-off technologies. Germany plays a particularly important role thanks to its extensive baking industry and strong tradition of artisan bakery products.

The most dynamic prospects, however, concern the **Asia-Pacific region**, for which Daedal Research forecasts a CAGR of approximately **9.5%**. The expansion of cold-chain infrastructure, modern retail and foodservice is creating new opportunities, particularly in China and India. The latter is expected to record annual growth of around **12.5%**, the highest among the major markets analysed.

Technology, clean label and new consumption patterns

The evolution of the sector is not limited to volumes. Innovation in freezing technologies is playing an increasingly important role, with greater adoption of **IQF (Individually Quick Frozen)** processes designed to preserve product structure and quality characteristics more effectively.

At the same time, interest is growing in **clean-label formulations**, products with improved nutritional profiles and items capable of meeting consumer demand for healthier foods without sacrificing convenience. The expansion of food e-commerce and delivery services is also contributing to changes in distribution channels. Emerging trends additionally include the development of products and packaging specifically designed for preparation in **air fryers**, appliances that are increasingly used for the home preparation and reheating of frozen foods.

Market growth nevertheless faces several challenges. Investments required for freezing equipment, storage facilities and refrigerated distribution remain substantial, while from a technological perspective, the effects of freezing and thawing cycles on dough structure, texture and sensory properties must be carefully controlled. Other critical factors include price volatility for strategic raw materials such as wheat and dairy ingredients, as well as the need to maintain an efficient cold chain throughout the entire journey from manufacturer to point of sale.

Against this background, competition increasingly depends on the ability to combine **consistent quality, product innovation, production efficiency and extensive refrigerated distribution networks**. Frozen bakery products therefore represent not only a response to growing demand for convenience, but also a strategic tool for streamlining processes in bakeries, retail outlets and foodservice operations while maintaining the image and characteristics of freshly baked products.

daedal-research.com

Global Egg Market Overview

The global egg market was valued at approximately USD 352.17 billion in 2025 and is projected to reach USD 585.37 billion by 2033, with a compound annual growth rate (CAGR) of 6.6% between 2026 and 2033. According to **Market Research** analysts, this growth will be primarily driven by increasing demand for protein- and nutrient-rich foods, as well as the growing use of eggs in the food processing industry, particularly in the bakery, confectionery, and ready-to-eat sectors.

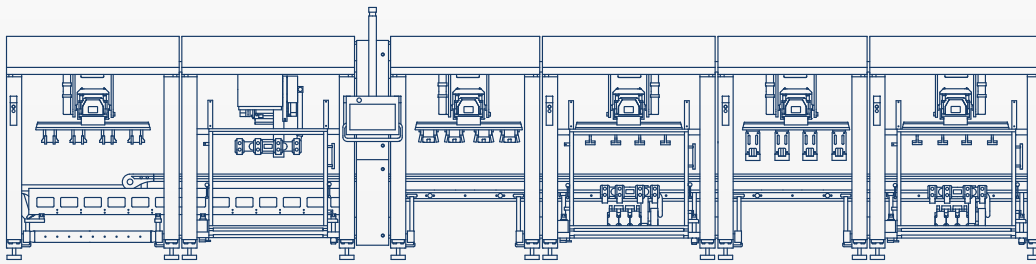
In recent years, consumers have shown a growing preference for convenient and functional protein sources that are easy to incorporate into daily diets. Health awareness, combined with increasingly fast-paced lifestyles, is prompting many people to seek foods that are nutritious, quick to prepare, and versatile. In this context, eggs and egg-based products represent an effective solution, as they provide high-quality, easily digestible proteins along with numerous essential nutrients such as vitamins, minerals, and beneficial fats. Furthermore, the increasing availability of ready meals, protein snacks, and fortified foods has boosted the use of egg-based ingredients in both retail and foodservice, reinforcing their role as a functional and versatile nutritional ingredient.



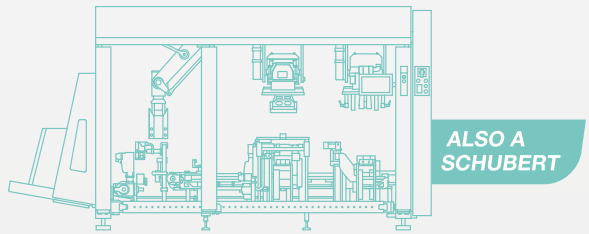
Another key factor supporting market growth is the increasing adoption of processed egg products in the food industry, thanks to their important technological functions as natural emulsifiers, binders, and stabilizers in a wide range of applications, including baked goods, confectionery, sauces, and ready meals. According to the United States Department of Agriculture (USDA), of the 93.1 billion eggs consumed in 2022, approximately 29.7% were processed into liquid, frozen, or powdered forms, widely used in industrial food production. This shift toward processed products helps improve production efficiency, shelf life, and food safety, while ensuring greater consistency in final products and making eggs a fundamental component of large-scale food manufacturing.

The report also analyzes market developments at global, regional, and national levels, forecasting revenue trends and key developments from 2021 to 2033. The analysis considers several industry aspects, including product type (such as white or brown eggs), production methods (e.g., cage-free, organic, or free-range), end-use applications – covering both the business-to-business market, including the food industry and foodservice, and the business-to-consumer market through supermarkets, grocery stores, and e-commerce – and major geographic regions worldwide, including North America, Europe, Asia-Pacific, Latin America, the Middle East, and Africa.
marketresearch.com

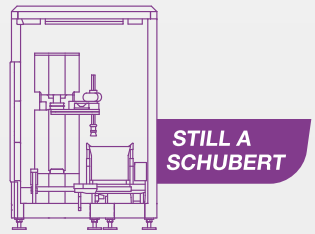
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Smart Packaging for Traceability, Compliance and Consumer Engagement

Packaging for fast-moving consumer goods is becoming a central component of an increasingly complex information ecosystem involving regulators, packaging manufacturers, brand owners and consumers. As smart packaging technologies continue to evolve, the role of the package is expanding far beyond its traditional function of containing and protecting a product.

According to **GlobalData**, regulatory developments such as Extended Producer Responsibility (EPR) schemes and mandatory recycled-content requirements are increasing the need for reliable evidence, traceability and accurate reporting throughout the packaging value chain. Smart packaging can therefore provide important tools for regulatory compliance while simultaneously improving consumer information and product transparency.

Scannable and trackable technologies are particularly relevant in this context. At the same time, active packaging materials and on-pack indicators capable of providing information on freshness, temperature or product condition can offer practical benefits and strengthen consumer confidence in product quality and safety.

From Active Packaging to Connected Solutions

Smart packaging can broadly be divided into two categories: active packaging and digitally connected packaging. Active systems use materials or integrated functions designed to interact with the packaged product or its environment. Their objectives may include extending shelf life, maintaining product stability or monitoring storage conditions. Examples include antimicrobial coatings and chemically activated indicators capable of detecting changes in temperature or freshness.

Digitally smart or connected packaging, by contrast, relies on technologies such as QR codes, RFID and NFC tags to exchange information throughout the supply chain and directly with consumers. These



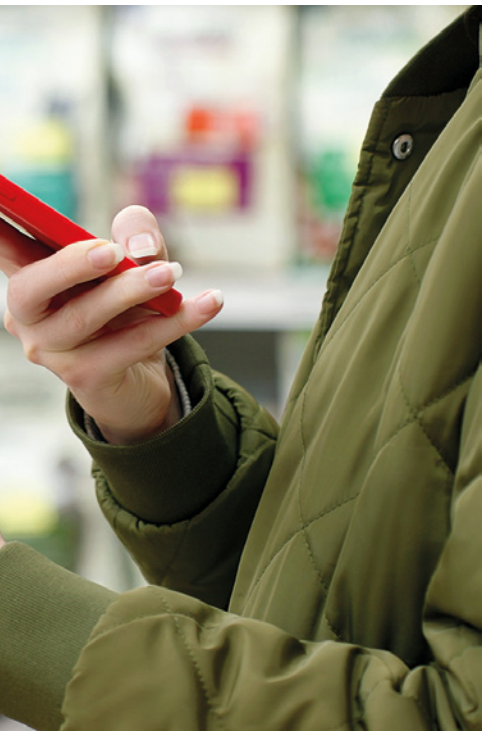
technologies can support traceability and real-time monitoring, which are increasingly important for regulatory compliance in fields including food and pharmaceutical safety and environmental responsibility.

Digital packaging can also become a communication channel between brands and consumers, providing product information, educational content and interactive experiences. However, implementation remains challenging. Upgrading packaging lines and developing the digital infrastructure required to collect, process and manage large quantities of data can involve significant investment.

Consumer acceptance represents another important consideration. Although smart functionality offers numerous technological advantages, consumers generally continue to place greater importance on fundamental factors such as value for money. Smart features must therefore provide a clear and recognizable benefit rather than simply adding technological complexity.

Sustainability Changes Smart Packaging Requirements

The transition towards more sustainable packaging materials also influences the way smart technologies are designed and implemented. As recyclability becomes a central objective, digital codes and information systems may need to be adapted to specific packaging materials and recycling pathways.



Smart packaging can provide consumers with appropriate disposal or recycling instructions while simultaneously carrying data required for EPR reporting and other regulatory obligations. Such information may also need to vary geographically, since packaging and recycling requirements can differ not only between countries but also between regions or individual states within the same market.

This combination of material identification, regulatory information and localized disposal guidance could make connected packaging increasingly important as companies attempt to manage fragmented regulatory systems without excessively complicating physical labels.

Strengthening the Brand-Consumer Relationship

Beyond compliance, connected packaging can generate valuable information for new product development. Data collected through consumer interactions can help manufacturers identify preferences relating to pack sizes, flavours or regional variations in product appeal. QR codes and other scannable elements can also provide access to short surveys, allowing companies to obtain immediate feedback on characteristics such as taste and texture or on consumer reactions to limited-edition products.

Such applications can create a direct communication channel between brands and their customers, but their effectiveness depends on providing genuine added value. Smart packaging should not be perceived as a technological gimmick. Instead, consumers need to recognize connected features as useful tools capable of providing practical information, greater transparency or an improved product experience.

For packaging manufacturers and brand owners, the principal challenge will therefore be finding an appropriate balance between regulatory compliance, cost, technical performance and customer experience. Investments should concentrate on areas where smart technologies deliver measurable benefits, including improved compliance, optimized material selection, effective automation and greater supply-chain transparency.

Consumer-oriented applications should likewise be designed around clearly identified target groups and tangible service benefits. Trust and transparency will be essential, while engagement initiatives must remain relevant to the product and its users. In this context, smart packaging is likely to become an increasingly integrated element of packaging design, combining physical functionality, digital information and regulatory compliance within a single system.

globaldata.com

Global recycled plastic packaging market to reach 6.5 million tonnes

The global market for packaging containing post-consumer recycled plastic (PCR) is expected to increase from 4.9 million tonnes in 2026 to 6.5 million tonnes in 2031, representing an average annual growth rate of 5.7%. The estimates come from **Smithers' study** *The Future of PCR Packaging to 2031*.

Despite the expected growth, market development remains insufficient compared with the volumes required to meet regulatory targets set for 2030. Europe represents the most established and dynamic market, supported by the Packaging and Packaging Waste Regulation (PPWR) and the Single-Use Plastics Directive, which establish minimum recycled-content requirements for different types of packaging. Extended Producer Responsibility (EPR) schemes are also advancing in Asia and North America, although their impact has so far been more limited.

Costs and availability remain key barriers

Cost remains the main obstacle to the wider adoption of secondary raw materials. Recycled PET is currently traded at a price approximately 35% higher than virgin polymer, a difference that many brand owners struggle to absorb. Other challenges include the global shortage of high-quality recycled material, contamination issues in food-contact applications and a fragmented legislative framework, with Extended Producer Responsibility regulations differing between countries and administrative levels.

The competitiveness of recycling facilities in Europe and North America is also under pressure from imports of low-cost recycled material from Asia. According to data reported in the study, growth in European plastics recycling capacity slowed from 17% in 2021 to 6% in 2023, raising concerns about the potential closure of local plants, which could hardly be replaced by imports alone.

New technologies to increase PCR availability

Among the solutions identified to encourage greater use of PCR is investment in mechanical recycling technologies, including AI-based sorting and robotics. The use of robots could increase the availability of clean rPET by up to 25% and reduce contamination by as much as 60%. Closed-loop systems, in which plastic-to-plastic recycling is managed locally

by a limited number of operators, can also improve material traceability and process efficiency.

Chemical or advanced recycling is gaining importance as a complement to mechanical technologies, particularly for difficult-to-process materials such as flexible films and multilayer packaging. A European Commission decision adopted in February 2026 allows content obtained through chemical recycling to be counted towards recycled-content targets for single-use PET bottles. This measure could support the wider commercialization of these technologies, although at least three years will probably be required before a significant increase in supply is achieved.

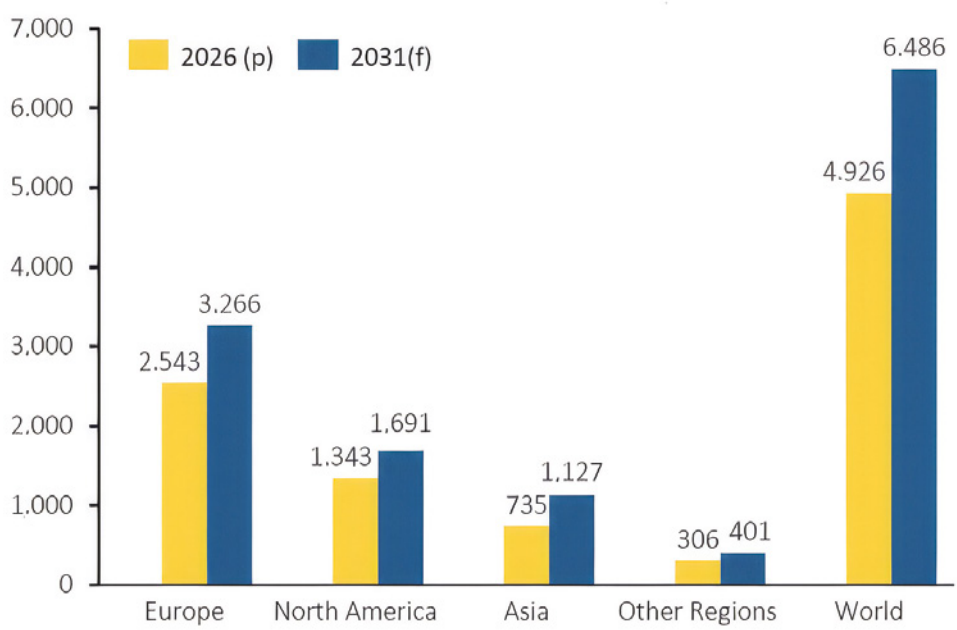
Other measures include extending deposit return schemes to improve collection rates, introducing environmental fees modulated according to the sustainability characteristics of packaging, and greater harmonization of Extended Producer Responsibility regulations.

Recycled PET leads market growth

Recycled PET accounts for the largest share of the market and is also expected to record the strongest growth, with an average annual rate of 6.1% between 2026 and 2031, driven primarily by beverage bottle applications. Polyethylene and polypropylene follow in terms of volume, while polystyrene, PVC and expanded polystyrene are showing negative trends in many regions due to bans and restrictions on their production and use.

The beverage sector accounts for 33.3% of global PCR packaging volumes, followed by other consumer goods at 26.7% and food at 19.1%. Requirements relating to contamination and colour make food and beverage applications particularly challenging from a technical perspective, but these sectors also stand to benefit most from advances in sorting, decontamination and additive technologies.

smithers.com



From spent coffee residues to sustainable packaging

The reuse of residues from the agri-food industry for the development of active food packaging represents a sustainable alternative that has gained increasing attention in recent years.

In this Italian work, published in **Journal of Supercritical Fluids**, active zein films were produced by impregnating them with a multicomponent extract derived from spent coffee grounds – a rich natural source of antioxidants, polyphenols, and other bioactive components – via a sustainable supercritical carbon dioxide technique. This process offers a novel and eco-friendly approach to loading bioactive multicomponent extracts onto biodegradable films.

The extracts were obtained via high-pressure and temperature extraction (HPTE), while the zein films were produced using either solvent casting (ZCAS) or electrospinning (ZELC). Supercritical impregnation was employed to load a multicomponent extract into zein films. Process parameters such as temperature and contact time were optimized to maximize impregnation efficiency. The loading, quantified using caffeine as a reference compound, was 0.64 mg caffeine/g film for ZCAS and 0.93 mg caffeine/g film for ZELC. The impregnated zein films exhibited enhanced light barrier properties and antioxidant activity, as confirmed by 2,2-diphenyl-1-picrylhydrazyl (DPPH) analysis, indicating their potential as sustainable, active, and eco-friendly packaging materials. Moreover, the use of spent coffee grounds as a source of active ingredients, combined with zein as the film matrix, provides a novel upcycling strategy. This dual-function approach aligns with current efforts to enhance food system sustainability through innovations in material science and waste valorisation.



Extending fresh-cut fruit shelf life via novel packaging

Fresh-cut watermelon shelf life is limited by softening, discoloration, and microbial growth, which are partly due to juice leakage. An US study investigated the effects of a novel packaging design featuring a honeycomb-elevated tray base and two-perforation lid on minimizing juice leakage and maintaining fresh-cut watermelon quality using the standard retail packaging as counterpart.



Processed watermelon was stored in both packages for 12 days at 5degreeC, with periodic assessments of physico-chemical and microbiological changes, and consumer preference. The novel package significantly reduced juice leakage and weight loss and preserved firmness and color compared to retail packaging, findings supported by consumers' choices. Microbial counts were similar despite the novel package containing air versus the modified atmosphere (MA) created by retail packaging, suggesting that juice/fruit physical separation controlled microbial growth likewise MA.

This study published in **Food Packaging and Shelf Life** journal pioneers packaging that elevates fresh-cut fruit above its juice to extend shelf life, opening new research and packaging design possibilities.

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Energy Efficiency and Digitalization at the Heart of Food Production

Rising energy costs and decarbonization targets are accelerating the transformation of production processes in the food industry. Among the key topics at **Anuga FoodTec 2027** will be digital energy management, electrification of process heat, high-temperature heat pumps and the modernization of existing plants. The aim is to increase the transparency of energy flows, reduce peak loads and enable production to adapt more flexibly to energy availability and grid conditions.

Decarbonizing process heat

The food industry is characterized by high thermal energy requirements, significant amounts of available waste heat and production processes that often operate continuously. These characteristics make the sector particularly suitable for the use of industrial heat pumps. The latest technologies can recover waste heat and raise it to temperatures of approximately 135°–160°C, allowing it to be reused in thermal processes.

Alongside heat pumps, solutions such as electrode boilers, electric steam generators and power-to-heat systems are expanding the possibilities for progressively replacing fossil fuels in heat generation. Applications including pasteurization, sterilization, drying, and hot water and steam production can therefore be managed more flexibly and efficiently from an energy perspective.

Anuga FoodTec 2027 will also showcase systems for electrified steam generation, hydrogen-ready boilers and hybrid configurations developed according to the production and load profiles of individual plants.

Modernizing existing plants

At the same time, interest is growing in retrofit solutions that can improve energy efficiency without requiring the complete replacement of existing production lines. One example is represented by drying systems based on heat pumps and closed-loop condensation cycles, in which process air is dehumidified, reheated and recirculated.

The use of closed air circuits, heat recovery systems and exhaust-free configurations can reduce energy consumption and CO_2 emissions while keeping existing equipment in operation. These technologies can also be applied to the drying of temperature-sen-



sitive products and the valorization of food industry by-products, such as apple pomace.

The decarbonization of industrial heat is therefore emerging as a multi-technology process. The choice of solutions depends on production characteristics, load profiles and the infrastructure already in place. For this reason, hybrid systems combining electric process heat, heat recovery, energy storage and hydrogen-ready technologies are becoming increasingly important.

Energy monitoring as an efficiency tool

More effective energy management also depends on systematic consumption monitoring. Data collection and analysis make it possible to identify peak loads, assess energy performance trends and create the conditions required for management systems compliant with ISO 50001 and for carrying out energy audits.

Plant digitalization plays a central role in this process. In addition to conventional measuring devices, protection and switching equipment equipped with communication capabilities can also collect energy and operating data. New generations of devices transfer this information to IoT platforms and cloud-based energy management systems, enabling existing infrastructure to be integrated into more advanced digital architectures.

Connected systems to reduce peak loads

The availability of real-time data, intelligent control systems and AI-supported analytical tools makes it possible to measure consumption more accurately and dynamically optimize production processes. Controllers for local energy network management, storage systems and cloud-based monitoring platforms can also automate the distribution of energy flows, reduce pressure on the grid and facilitate the integration of energy from renewable sources.



Artificial intelligence and predictive energy management

One of the most advanced developments concerns predictive energy management. Artificial intelligence-based models can simultaneously analyze production schedules, load profiles, energy prices and weather forecasts to estimate energy requirements in advance and automatically regulate the main energy-consuming systems.

These topics will also be addressed at the new Sustainable Community Hub at Anuga FoodTec 2027, which will focus, among other issues, on increasing the flexibility of industrial energy systems. Particular attention will be devoted to hybrid systems capable of coordinating electricity, heat, refrigeration, storage technologies and, where appropriate, hydrogen.

The aim is to make production processes more adaptable to the availability of renewable energy while maintaining economic efficiency and security of supply.

Growing integration between energy grids and production processes

The increasing share of wind and solar power in the grid will create an ever closer relationship between industrial production and the availability of renewable energy. Refrigeration systems,

electric process heating equipment, energy storage and other high-consumption utilities will increasingly be managed flexibly according to electricity prices and grid conditions.

The challenge is to adapt plants that have been designed for decades around high productivity and continuous operation to a more variable energy system. Hybrid architectures linking electricity, heat, hydrogen and energy storage are therefore becoming increasingly important.
anugafoodtec.com

Beyond stainless steel: designing conveyors for hygiene

In food processing, hygienic design is often associated first and foremost with stainless steel. It is an important material choice, but it is only the beginning. A conveyor can be built entirely in stainless steel and still be difficult to clean if its geometry creates inaccessible areas, horizontal surfaces, hollow sections or points where water and residues can collect.

For this reason, hygienic design should be considered as a design method rather than a material specification. The objective is to make cleaning, inspection and sanitation easier by addressing these requirements from the very first stages of machine development.

Open structures, continuous welds, no horizontal surfaces, drainage and easy access to the conveying components all contribute to this approach. The same applies to the possibility of reaching areas beneath chains and belts without complex disassembly. Cleaning should not be something the machine merely tolerates: the machine should be designed around it.

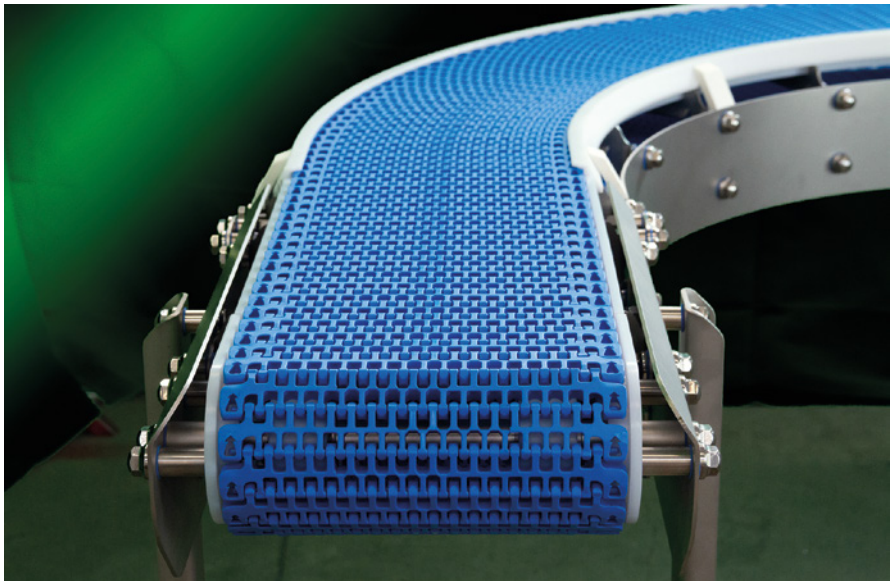
This is the principle behind **Sani-Line**, the range of hygienic conveying solutions developed by **M.H. Material Handling** for food applications.

Within the range, **Sani-Flex** combines an open AISI 304 stainless-steel structure with continuous welds and a modular chain that can be manually lifted to provide easier access during washing and inspection. **Sani-Belt** applies the same principles to belt conveyors, while **Sani-Lift** extends the hygienic concept to applications requiring changes in elevation.

The objective is not to create a single standard conveyor for hygienic environments, but to adapt the same design principles to different product-handling requirements and to the specific area of the production line in which the equipment will operate.

Once cleanability becomes part of the original machine concept, another question naturally follows: can the cleaning technology itself also become part of the conveying system?

This is the direction explored by M.H. Material Handling together with **SteamItaly** through the development of **Steam-Flex**, a solution in which a steam-cleaning chamber is integrated directly onto the conveyor. The aim is not to replace every existing sanitation procedure, but to bring the cleaning process closer to the conveying surface and to consider movement and cleaning as parts of the same system. By integrating the steam unit mechanically with the conveyor, the two technologies can be designed around



The Sani-Flex hygienic conveyor (M.H. Material Handling).

one another rather than treated as separate elements added at different stages of the project.

This evolution from cleanability to cleaning integration reflects a broader principle: in food production, hygiene cannot be separated from machine design.

M.H. Material Handling will bring this approach to **CibusTec 2026**, presenting solutions from the Sani-Line range together with the integrated steam-cleaning concept developed with SteamItaly.

The exhibition will offer an opportunity to see how hygienic design can move beyond the simple choice of materials and become part of the complete architecture of a conveying system.

Sure, stainless steel matters. But designing a conveyor for hygiene means thinking about everything that happens around it: production, cleaning, inspection and the moment the line has to start again.

(M.H. Material Handling - Via G. Di Vittorio, 3 - 20826 Misinto - MB - Italy - Tel. +39 0296720176 - e-mail: info@mhmaterialhandling.com - www.mhmaterialhandling.com)



Steam-Flex, a steam-cleaning chamber integrated onto the conveyor (M.H. Material Handling).

From elderberry to apples: SMI solutions for Holderhof Produkte

Holderhof Produkte AG, a Swiss leading food company in the production of fruit juices, continuously invests in cutting-edge technologies and, three years after the launch of the aseptic juice line in Henau, it has renewed its partnership with SMI by purchasing an LWP 30 ERGON case packer, an APS 620 ERGON palletizer for the new fruit processing center in Sulgen and an APS 620 ERGON palletizer for Henau plant

From elderberry to apples: business success comes from continual investments

Over twenty years ago, Christof Schenk planted the first elderberry trees on his parents' farm in Ufhofen, thus giving rise to the company Holderhof Produkte. Today the company employs around 100 people and produces syrups, beverages, and fruit juices at its three locations in Henau, Ufhofen, and Sulgen. It remains true to the founder's initial vision of transforming its own high-quality, natural raw materials into special beverages without preservatives. Every year, the company markets more than 70 million bottles of over a hundred varieties of beverages and continues to launch innovative products.

SMI solutions for Holderhof Produkte

At the new fruit processing centre in Sulgen, fresh apple sauce is packaged in jars and glass bottles on a newly installed line that can fill up to 2000 jars per hour, depending on the size of the product. The increase in demand has led Holderhof to equip its production plant with extremely flexible and eco-friendly, high-tech secondary and tertiary packaging facilities which are able to quickly switch from one bottle format to another and from one type of packaging to another.



Thanks to the **LWP 30 ERGON wrap-around case packer** supplied by SMI, the 0.36 L / 0.72 L / 0.75 L and 1 L glass bottles are packed in wrap-around trays in a 2x3 format, the 0.25 L and 1 L glass bottles are packed in wrap-around cases in a 2x3 format and the 0.37 L jars are packed in wrap-around trays in a 3x4 format. Downstream of the packer, the **APS 620 ERGON palletizer** creates 800x1200 mm europallets.



LWP 30 ERGON case packer

- SMI case packer quickly adapts to the new package formats required by Holderhof Produkte and offers original and innovative packaging solutions, tailored to the logistical and marketing needs of the Swiss company. With just one machine, it is possible to create various pack configurations both in wrap-around boxes and in tray-only.
- The wrap-around boxes made of corrugated cardboard are very resistant to shocks and are therefore, the ideal solution for preserving the integrity and quality of the products contained within them. The cardboard blank is folded and wrapped around the products simultaneously as they are grouped into the desired format, without stopping the machine, thus ensuring stability for the packages themselves.
- The wrap-around box is a great marketing tool because you can customize the graphics on the packages that grab shoppers' attention at retail locations.



APS 620 ERGON Palletizer

- The palletizing system installed at the production facilities in Sulgen and Henau is a versatile solution that simplifies package handling, reduces changeover times, increases performance, and reduces the footprint within the production line.
- All activities related to installation, management, and maintenance of the system are easily and safely carried out by the operator.
- The product to be palletized arrives on an infeed conveyor and is 'phased' by a rubber conveyor; subsequently, it is brought to the picking position by means of a spacing conveyor, where the picking head picks up the single package or the set of grouped packages and deposits it onto the pallet on the ground. The cyclic repetition of this operation allows various layers of palletization to be formed.

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www.sarp.it

Colloid Mixer for refining nut pastes

The production of nut pastes generally involves several successive grinding and refining stages which, depending on the product and the desired result, can require long processing times, even for relatively small quantities.

The **Fristam** FCM colloid mixer represents a particularly interesting solution for processing these products, where particle size reduction, homogeneity and quality of the final emulsion are key factors in determining product quality and its commercial value.

Thanks to the combined action of high rotational speeds and extremely narrow gaps between rotor and stator, the Fristam colloid mixer forces the product to intense shear forces, promoting particle size reduction and the formation of a finer and more uniform microscopic structure, while ensuring a faster and more reliable process.

Refining, homogenization and emulsification for Premium products

In the production of high-end, premium-quality nut pastes, the Fristam FCM colloid mixer can be successfully used as a final refining stage to achieve a particle size below 20 microns, ensuring superior texture, stability and uniformity, at significantly higher flow rates and in considerably shorter processing times compared to alternative technologies.

The ability to adjust the processing gap conveniently and continuously from the outside, without the need for disassembly or reassembly, gives the FCM exceptional production flexibility, while its extremely compact design allows for quick and easy integration into existing production lines.

Its full CIP compatibility also ensures high hygienic standards and simplifies cleaning procedures between different production batches, without the need to dismantle any mechanical components.



Fristam FCM Colloid Mixer.

Wide Range of Applications

The operating principle of the Fristam colloid mixer makes it suitable for mixing, homogenization and emulsification requirements across a wide range of food applications: from improving the quality and particle size distribution of food creams and pastes, such as pure hazelnut, almond, peanut and pistachio pastes and other nut and seed products, praline fillings and spreadable creams, as well as the preparation of stable emulsions for both fresh and long-life products, including dressings, sauces, mayonnaise, and cereal- or legume-based creams.

To assess and experience the improvements and benefits offered by the FCM Colloid Mixer, Fristam has test machines available for industrial trials.

(Fristam Pumpen - Kurt-A.-Körber-Chaussee 55 - 21033 Hamburg - Germany - Tel. +39 011 4500087- email: sales@fristam.it - www.fristam.com)

VR-L: the new “L”-shaped roasting system that frees up valuable plant space

Tecno 3 introduces the VR-L, a continuous vertical roasting system for cocoa beans and nuts. Drying and roasting take place vertically, while cooling is carried out horizontally. The new roasting system was developed in response to a very real challenge: when designing a new production line, manufacturers almost always face the same constraint — **the amount of floor space available**.

Developed by Tecno 3, the VR-L addresses this challenge with its **“L”-shaped design**. Drying and roasting make use of the vertical space, while cooling takes place horizontally. The result is a compact layout that **minimizes the footprint while maximizing thermal efficiency**.

The process in three steps

The product is continuously fed through the loading hopper and moves down by gravity into the **drying chamber**. Here, it reaches the operating temperature using hot air generated by steam-heated coils. A controlled, adjustable partial air exchange removes moisture.

In the **roasting chamber**, the product is treated using recirculated hot air. This approach **reduces energy consumption** while preserving product quality and its aromatic profile.

The product then moves into the **horizontal cooling section**, where forced ventilation with filtered air brings it down to the correct temperature for subsequent processing. Air discharged from the chambers is conveyed to a cyclone separator, which removes dust and fine particles.

One machine, two applications

Cocoa Beans

The VR-L processes the **whole cocoa bean**, making it suitable for premium varieties. The shell acts as a natural barrier, protecting the aromatic profile during thermal processing. A **microbial reduction cycle** significantly reduces the microbial load.

Nuts

The structural separation between the drying and roasting chambers ensures **optimal texture and extended shelf life**, while helping to prevent lipid oxidation. Here too, the microbial reduction cycle ensures **food safety**.

Maintenance and Hygienic Design

A PLC controls the entire cycle, managing temperatures and residence times, which can be set via a **touch-screen HMI interface**. Sensors continuously monitor the roasting profile, while sampling systems allow samples to be taken directly from the chamber. Guillotine valves between the chambers help optimize the production process from start to finish.

Cleaning is an integral part of the design. The recirculation piping is accessible for inspection and can be dismantled, the conveying hoods open on hinges, and the fans slide out on guide rails. The screens are cleaned automatically, with shells and dust continuously discharged. The entire system is made of **AISI 304 stainless steel**, in compliance with hygiene and sanitation requirements for continuous processing.

An innovative technology designed to **minimize footprint and maximize thermal efficiency** — one system for both cocoa and nuts. The VR-L brings **compact, controlled roasting** to the production plant.

(Tecno 3 - Via Mastri Cestai 2 - 12040 Corneliano d’Alba - CN - Italy - Tel. +39 0173 610564 - e-mail: a.mattis@tecno-3.it - www.tecno-3.it)



VR-L continuous vertical roasting system for cocoa and nuts (Tecno 3).

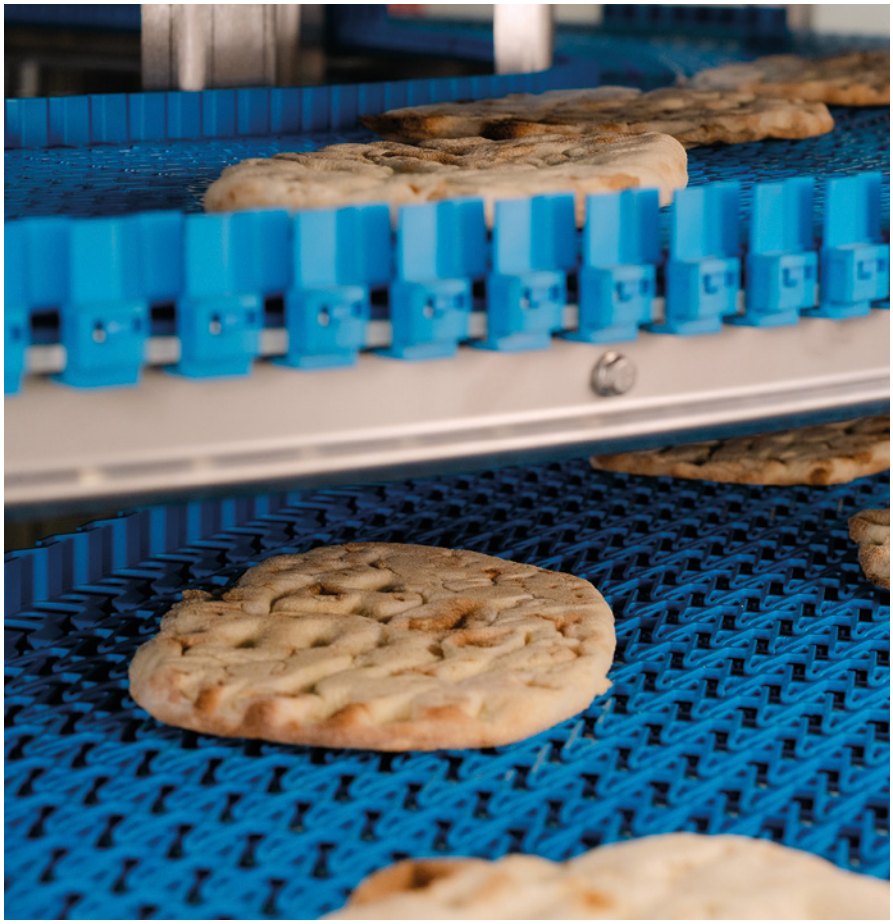
Pinsa romana and pizza when thermal processing becomes part of quality

In the world of pizza and pinsa romana, quality is not defined solely by the dough or the baking stage. In industrial production, the result depends on the continuity of the entire process: controlled times, uniform temperatures, gentle handling and repeatability from one batch to the next.

Pinsa has specific characteristics that require particular care. Its high hydration, open crumb structure and light base must be preserved throughout the line. After baking, uneven cooling can affect texture, encourage condensation inside the packaging and reduce product stability. The same applies to pizza, focaccia and other baked specialities, where correct heat management helps maintain fragrance, structure and perceived quality.

This is where process technology plays a decisive role. Bakeflex, the **SARP** division dedicated to bakery products, develops cooling and freezing systems designed around the product, the required capacity and the available space. Controlling airflow and treatment parameters creates consistent conditions throughout the process, reducing temperature variations while respecting the characteristics of the base.

Each system begins with an analysis of the line as a whole. It is not simply a matter of placing a machine between the oven and packaging, but of coordinating speed, dwell time, temperature, footprint and connections with existing equipment. Conveyors, tunnels and spirals guide the product through the different stages in compact, modular configurations designed for easy cleaning and maintenance.



Pizza cooling process (Sarp).

This approach supports different types of production, from pre-baked retail bases to frozen food-service products, while maintaining a strong focus on efficiency, hygiene and consistent results. Customisation is therefore the starting point for integrating thermal treatment into the customer's actual process.

Bakeflex research is also advancing in the areas of compactness and flexibility. The new spiral in container FlexFreezer, currently on display at SARP's premises, follows this direction: a preview to be presented at Cibus Tec that opens up new possibilities when space, rapid installation and adaptability are decisive factors.

(Sarp - Via Montebelluna di S. Andrea 43 - 31033 Castelfranco Veneto - TV - Italy - Tel. +39 0423 482633 - email: sarp@sarp.it - www.sarp.it)

Easier changeovers, more stable production

A simple tool: what may sound straightforward at first glance isn't always easy to put into practice. This is often the case in packaging machinery engineering, where highly functional but often complex robotic tools dominate the scene

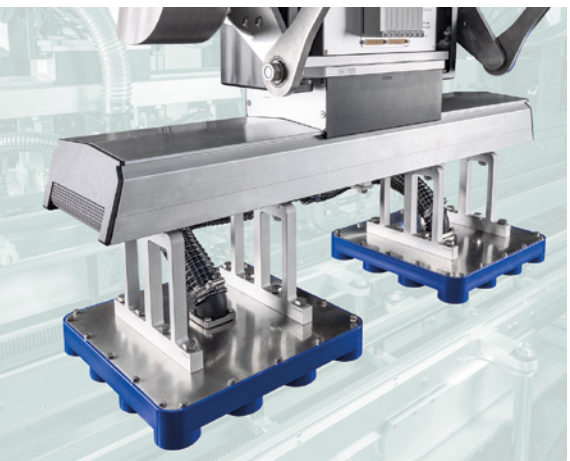


Peter Schubert, Head of Design Engineering at Gerhard Schubert

We spoke with Peter Schubert, Head of Design Engineering at **Gerhard Schubert**, and Wolfgang Sedlak, Technical Manager of Tool Design Engineering, about the status of current designs that are being continuously simplified.

Why is your tooling strategy currently shifting into greater focus?

Peter Schubert: Whether we're talking about bakery, confectionery or pet food manufacturers, there is a widespread trend towards greater variety in product ranges. On the production side, this translates into frequent changes, notably in packaging formats. To prevent unnecessary downtime or waste, manufacturers need easy-to-handle tools that don't require time-consuming readjustment. Stop the machine, swap the tools, resume production without errors – this is what it's all about.



New design methods for transfer (image) and other tools also result in lower costs, among other benefits.

And at present, does this work without any issues?

Wolfgang Sedlak: Not always. German mechanical engineering has a reputation for building systems that are brimming with features; people often talk about 'German overengineering'. But complicated solutions are impractical. At Schubert, we have always focused on practical solutions that make production as easy as possible for our customers.

What sets Schubert's tools apart?

Peter Schubert: Highly functional tools usually involve many parts, high costs and weight. This is precisely where we are aiming to counteract the trend with simple, lightweight and, above all, quick-to-set-up tools for our robots. 'Ramp-up Zero' is the goal: after a format change, the first packaged unit must come off the line error-free. These tools are recognised automatically via code-based systems, meaning the machines handle the adjustment themselves. This reduces manual intervention and error rates.

Wolfgang Sedlak: Our tools are still highly functional. It's just that we make a stricter distinction between primary and secondary functions: primary functions remain in the tool, secondary functions are transferred to the machine. This makes the tools simpler and lighter.

Do tool adjustments impact the machine design?

Peter Schubert: Definitely. Optimising our tools means that we work with new carrier and connecting elements for the machine frames. Among other things, this has a positive impact on the repeatability of robotic movements. Consistently optimised tools are also more lightweight and consist of fewer individual parts. That is why we are fully committed to 3D printing.



Wolfgang Sedlak, Technical Manager of Tool Design Engineering, Gerhard Schubert GmbH

Wolfgang Sedlak: Thanks to lower tool weight, robots can achieve higher cycle rates, so they can pack more in the same amount of time and ensure a higher performance density for the respective systems. This saves a considerable amount of work – both for our customers and in our design engineering department.

(Gerhard Schubert - Industriegebiet Südost - Hofäckerstraße 7 - 74564 Crailsheim - Stuttgart - Tel. +49 7951400-0 - E-mail: info@gerhard-schubert.de - www.schubert.group)

Food Safety and Reliable Performance in VFFS Packaging Lines

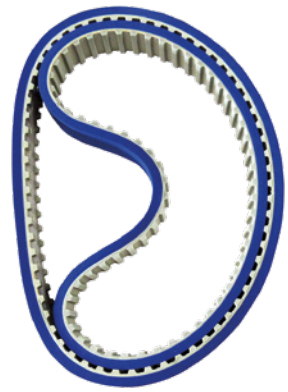
In Vertical Form Fill Seal (VFFS) packaging lines, accurate film tracking is essential to ensure productivity, packaging quality, and operational continuity. That's why the choice of timing belt can make a significant difference in terms of reliability, efficiency, and food safety.

To help manufacturers meet these demands, **Megadyne** developed **MEGAPOWER Silcoat**, a polyurethane endless timing belt featuring a durable silicone coating specifically designed for food packaging applications.

Engineered with advanced cast technology

What differentiates **MEGAPOWER Silcoat** from conventional silicone-coated belts is its manufacturing process. Instead of applying the silicone cover during a separate production phase, Megadyne uses advanced cast technology to form the silicone directly within the mould.

This integrated construction provides high resistance to delamination and delivers performance advantages compared to standard solutions.



MEGAPOWER Silcoat belt for food packaging machines (Megadyne).

Built for VFFS packaging

In VFFS machines, Megadyne's Pull Down synchronous belts help maintain constant speed and continuous vacuum between the belts and the packaging film, supporting precise and efficient product movement throughout the packaging process.

The solution is suitable for packaging a wide range of food products, including confectionery, chips, tea, coffee, biscuits, and pasta. The silicone coating combines excellent grip on packaging film with abrasion resistance, allowing secure film handling without damaging the material.

MEGAPOWER Silcoat also delivers consistent performance in humid environments and across a wide range of operating temperatures, making it suitable for challenging packaging conditions. Its distinctive blue silicone cover is certified for food industry applications, providing an additional safety and hygiene benefit for food manufacturers.

MEGAPOWER Silcoat is available in 2 versions:

Glossy, a standard non-reworked version for applications that do not require extreme performance.

Grinded, a high-performance version that can be customised with holes, slots, rough surfaces and vacuum features.

Ready when production cannot stop

As part of Megadyne's **MTS (Made to Stock)** range, MEGAPOWER Silcoat is stocked for immediate delivery. This helps reduce machine downtime and supports continuous production when replacement belts are required.

Combining cast silicone technology, food-industry-certified materials, customisation possibilities, and immediate availability, MEGAPOWER Silcoat offers a dedicated solution for VFFS food packaging applications where reliability, grip, and consistent performance are essential.

Download the technical handbook dbook to explore the benefits and technical specifications of MEGAPOWER Silcoat.

(Ammega Italia - Via S. Lucia 114 - 10075 Mathi - TO - Italy - Tel. +39 011 9268052 - email: info@megadynegroup.com - info@ammeraalbeltech.it - www.ammega.com)

More uniform microwave pasteurization for foods with different viscosities

Microwave technology, thanks to its rapid heating capability, represents a promising alternative to conventional thermal pasteurization systems. However, its industrial application is limited by



non-uniform temperature distribution, a problem that is particularly relevant in high-viscosity foods. A Chinese study published in **Food Research International** developed a strategy to improve heating uniformity by combining eccentric rotation and bubbling.

The researchers used *Escherichia coli* as an indicator microorganism to quantitatively assess heating non-uniformity in a small-scale single-mode microwave system. To obtain a more uniform thermal field, a combined perturbation approach based on eccentric rotation and bubbling was applied, and optimal parameters were identified for foods with viscosities ranging from 1 to 1,500 mPa·s.

The eccentric rotation-bubbling-assisted microwave treatment (MRW-UH) significantly improved heating uniformity in products with different viscosities. The effectiveness of the system was subsequently validated in three representative food matrices: raw milk, blueberry jam, and sesame paste.

Compared with conventional microwave treatment and conductive heating, the new technology showed greater stability in microbial control during storage. At the same time, it more effectively preserved important quality parameters, including pH, titratable acidity, alkaline phosphatase activity, antioxidant capacity, and color.

The combination of eccentric rotation and bubbling may therefore represent an effective technological approach to overcoming one of the main limitations of microwave pasteurization, enabling more uniform and efficient processing while improving quality preservation in foods covering a wide range of viscosities.

Innovative Air-Jet Impingement Cooking: Improved Meat Quality, Safety and Efficiency

The use of air jet impingement technology is emerging as a promising alternative to conventional ovens for cooking beef and poultry, thanks to its ability to improve energy efficiency, preserve product quality and ensure high standards of microbiological safety.

A Turkish study published in the **Journal of Food Measurement and Characterization** compared this technology with conventional cooking, optimizing the main process parameters using response surface methodology.

The researchers evaluated the effects of oven temperature, air velocity, tray position and cooking time on meat quality characteristics. For beef, the optimal conditions were 175°C, an air velocity of 15 m/s, a cooking time of 19 minutes and a central tray position. For whole chicken, the best combination was 200°C, the same air velocity of 15 m/s, a cooking time of 20 minutes and a central tray position.

In both applications, core temperatures exceeded microbiological safety limits, reaching at least 72°C for beef and 82°C for chicken, thus exceeding the minimum threshold of 75°C required for the latter. At the same time, the system maintained high water-holding capacity, reduced meat hardness and limited the formation of undesirable compounds such as heterocyclic amines (HCAs), which can be generated during more intense heat treatments.



One of the most significant findings concerned energy efficiency. Compared with conventional ovens, air jet impingement technology reduced energy consumption by 54.41% for beef and 31.19% for whole chicken, thanks to shorter processing times and more effective heat transfer. Although a slight increase in aerobic bacterial counts was observed due to the shorter heat exposure time, the products still maintained fully compliant microbiological safety levels.

The study therefore highlights the potential of air jet impingement technology as a promising solution for improving sustainability, product quality and productivity in industrial meat-cooking processes.

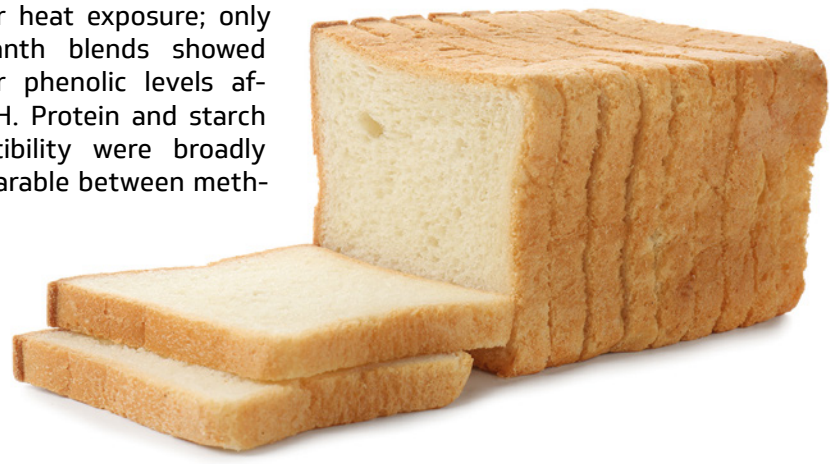
Innovative cooking with air jet impingement: Enhancing beef and chicken quality, safety, and efficiency.

Effect of ohmic baking on the quality of breads made from different cereals

An Austrian study compared conventional baking (CV) with ohmic heating (OH) to assess how reduced baking times influence the physical and nutritional quality of sandwich breads made from cereal blends.

Wheat flour was partially replaced (25%, 50%) by amaranth, buckwheat, sorghum, or quinoa flour. Breads were baked conventionally (200°C, 40 min) or using a tailored OH protocol (2 kW/kg for 120 s, 0.6 kW/kg for 30 s), achieving a 94% reduction in baking time. Purpose-built tins ensured comparable baking conditions across methods. Physical properties (baking loss, volume, colour, texture) and nutritional attributes (phenolic acids, antioxidant capacity, *in vitro* digestibility) were evaluated. OH breads had comparable or superior physical quality compared to CV breads, showing higher specific volume and softer crumb in formulations containing 50 % alternative grains. Chemical analyses indicated higher total phenolic content and antioxidant capacity in CV breads, despite their longer heat exposure; only amaranth blends showed higher phenolic levels after OH. Protein and starch digestibility were broadly comparable between methods, with some grain-dependent variations.

This study published in **LWT - Food Science and Technology** journal demonstrated strong potential of ohmic heating as an alternative baking technology for cereal-blend sandwich breads.



More Stable UHT Milk with Improved Quality Characteristics

Extending the shelf life of UHT milk while preserving its nutritional and sensory characteristics is one of the main challenges facing the dairy industry. A recent German study published in **Innovative Food Science and Emerging Technologies** developed an innovative process called Customized Phase Treatment (CPT), which combines microfiltration, microwave heating and indirect UHT treatment to produce whole milk with improved storage stability without resorting to excessively intense heat treatments.

The process involves separating raw milk into cream and skim milk, which are then pasteurized independently. The skim milk is subjected to microfiltration through 0.1 µm membranes, allowing heat-sensitive whey proteins to pass through while retaining bacteria, spores and plasmin, which are responsible for reducing shelf life, in the concentrate. The permeate is then treated by microwave heating at 120°C for 4 seconds, thereby limiting the denaturation of the most heat-sensitive proteins.

The concentrated fraction is standardized to a fat content of 9%, homogenized and preheated at 95°C for 128 seconds, followed by indirect UHT treatment at 140°C for 4 seconds. Milk produced using this technology was compared with products subjected to conventional direct and indirect UHT treatments. The results showed that the degree of whey protein denaturation was intermediate between that observed with the two conventional technologies, helping to better preserve the nutritional quality of the product.

During 24 weeks of storage at 20°C and 30°C, CPT-treated milk maintained good physical stability, with no increase in viscosity, fat destabilization or development of rancid flavours. In contrast, directly treated UHT milk showed an increase in particle size and viscosity, attributed to greater proteolytic activity. According to the authors, the CPT process therefore represents a promising alternative to conventional UHT treatments, allowing the production of long-life milk with improved quality characteristics and high storage stability.



Microwave cooking for more sustainable and safe bread

The use of microwave technology in industrial breadmaking could represent a practical solution for reducing energy consumption and limiting the formation of process contaminants without compromising the quality of the final product. A UK study published in the **Journal of Food Engineering** compared four different bread baking technologies: conventional baking, domestic microwave baking, industrial solid-state microwave baking, and hybrid systems combining conventional and microwave heating.



Over an eight-day storage period, breads produced using the industrial microwave system retained the highest moisture content, significantly slowing the staling process and exhibiting the lowest hardness values. In contrast, domestic microwave treatment resulted in greater moisture loss and more rapid crumb firming.

The baking technology also affected the appearance of the bread. Conventional baking produced a darker crust due to more intense Maillard reactions, whereas microwave-based technologies generated lighter crusts. Specific volume was highest in conventionally baked bread, although the hybrid baking systems recovered much of the volume loss observed in breads baked exclusively with microwave technology.

One of the most significant findings concerned food safety. All microwave-based baking technologies resulted in significantly lower acrylamide concentrations than conventional baking, owing to shorter processing times and lower surface temperatures. At the same time, the industrial solid-state microwave system demonstrated lower energy consumption and a superior environmental sustainability profile, confirming its potential as one of the most promising technologies for the future of industrial bread production.

Influence of Forming Methods on Ground Beef Patties Quality

The quality of a burger depends not only on the raw material used, but also on the method by which it is formed before cooking. A recent US study published in **Foods** investigated the influence of four different ground beef patty-forming systems on the technological, structural and sensory characteristics of the cooked product. The results highlight how the choice of processing technology can significantly affect consumers' final perception.

The experiment involved 333 burgers for each treatment, produced using four different forming systems: mold-pressed, extrusion, hand-formed and guillotine. The samples underwent a number of evaluations, including cooking loss, cooking time, patty shrinkage, texture profile analysis, Allo-Kramer shear force, internal color and sensory analysis conducted by a consumer panel.

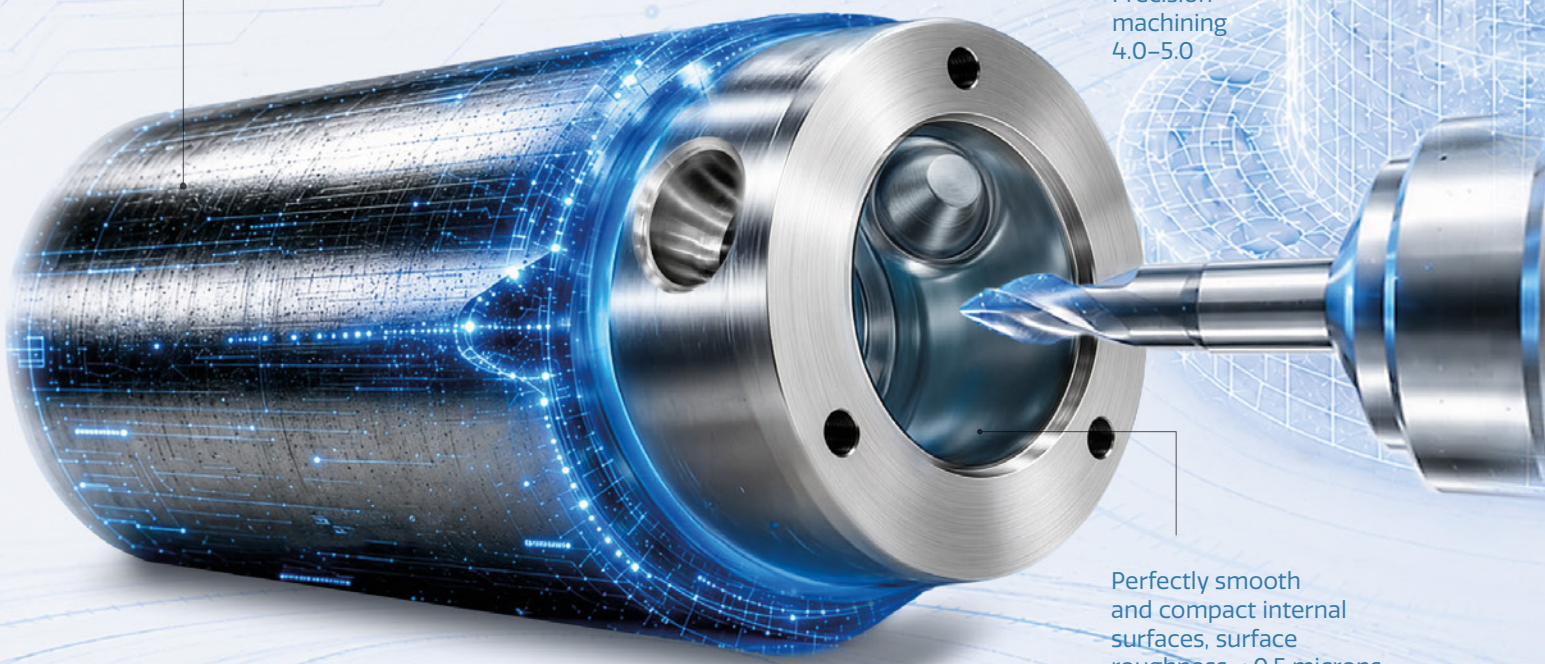
The results showed that the forming method significantly affected cooking time and patty shrinkage ($p < 0.0001$), while no appreciable differences were observed in cooking loss ($p = 0.8116$). Instrumental analysis showed that mold-pressed burgers had the highest hardness values compared with the other forming methods, indicating a more compact structure. In contrast, the forming method did not significantly affect the internal color of the cooked meat, either in terms of redness or yellowness.

The most interesting differences emerged during sensory evaluation. Although most of the attributes assessed did not vary significantly, tenderness perceived by consumers was affected by the production method ($p < 0.0020$). In particular, extrusion-formed burgers required the shortest cooking time, exhibited the lowest mechanical resistance and shear force, and were also rated as the most tender by the consumer panel. According to the authors, the choice of forming system therefore represents an often underestimated technological factor that can play a key role in optimizing the sensory quality of burgers and improving consumer acceptance.



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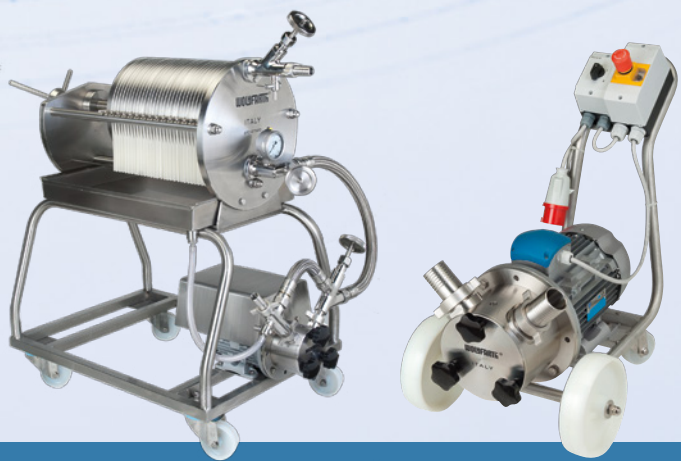


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Enzyme-based CIP systems for the removal of milk deposits

Cleaning-in-place (CIP) is the most common method of cleaning in dairy processing, predominantly using sodium hydroxide (caustic) based nonbiodegradable detergents frequently followed by nitric acid to remove milk residues deposited during heating at high temperatures. While highly effective, this process presents sustainability challenges. Enzymes have emerged as a sustainable alternative due to lower energy and water demands and biodegradability.

An Irish study published in the **International Journal of Dairy Technology** explores the feasibility of using commercial enzymes as sustainable alternatives to traditional caustic detergents in removing milk fouling deposits from stainless steel surfaces under cheesemilk pasteurisation conditions.

Stainless steel surfaces were fouled under simulated pasteurisation conditions and cleaned using caustic and enzymatic cleaners. Enzyme stability, reusability and deactivation were assessed using an activity assay kit. Analyses included three independent trials, each with three replicate coupons. A cost analysis was applied to compare enzymatic and caustic CIP. Protease-based CIP can achieve statistically similar CIP results at 50°C (0.74% residual fouling) compared with caustic at 75°C (0.1% residual fouling). Protease showed stable and active enzyme activity throughout CIP and retained an average of 93.66% activity after a CIP cycle and storage studies revealed 85.1% enzyme activity after 24 h of storage under refrigeration. Ninety-eight per cent of the enzyme was removed from the test bed system with a cold-water rinse post-CIP, and complete deactivation was achieved with a nitric acid treatment (65°C) similar to a traditional caustic and acid-based CIP protocol. Cost analysis showed that although protease procurement is slightly more expensive than caustic detergent, energy and water savings at lower operating temperatures offset this difference, confirming the economic feasibility of enzymatic CIP for fouling removal.



Protease-based enzymatic CIP supports sustainability goals by reducing energy use, chemical waste and emissions, while maintaining cleaning effectiveness supported by a cost analysis.

Non-thermal milk decontamination by ionic modulation



The dairy industry requires effective non-thermal processing strategies capable of ensuring microbial safety while preserving the nutritional and bioactive quality of milk. A Spanish study describes a novel milk decontamination approach based on selective ionic removal by dialysis, resulting in a controlled reduction in ionic strength.

Milk deionization significantly reduced the microbial load in raw bovine milk to levels comparable to those achieved by conventional thermal pasteurization, while largely preserving its physicochemical composition. Ionic depletion enhanced the antimicrobial effectiveness of endogenous milk components; this effect was abolished when native salt concentrations were maintained, highlighting the key role of ionic modulation in microbial control. Major milk constituents, including proteins, fat, and solids-not-fat, were not substantially affected by deionization, whereas low-molecular-weight solutes such as lactose and urea were partially removed. Deionized milk also exhibited improved stability during refrigerated storage, as evidenced by delayed acidification compared with raw and pasteurized milk.

Overall, these results published in **Foods** journal demonstrate that milk deionization represents a feasible proof-of-concept non-thermal alternative to pasteurization based on ionic modulation, with potential applications in dairy processing and human milk preservation, where maintenance of bioactive components is particularly desirable.

Non-thermal reduction of aflatoxin M1 in milk

Milk is an essential part of the human diet but is highly susceptible to aflatoxin M1 (AFM1) contamination and this heat-stable toxin cannot be eliminated by conventional thermal pasteurization.

An Iranian study introduces a continuous non-thermal system combining Venturi tube hydrodynamic cavitation and liquid-phase plasma for AFM1 reduction while preserving milk quality. Using response surface methodology, parameters voltage (10-20 kV), flow rate (2-8 l/min), temperature (30°-50°C), and time (1-5 min) were optimized to maximize degradation. Results showed 52.1 ±1.1% AFM1 reduction in spiked milk (0.2 mug/kg initial) to 0.096 ±0.002 mug/kg in under 5 min. This meets Iranian standards (<0.1 mug/kg). The quadratic model (R^2 = 0.9811) confirmed high accuracy. Milk quality remained stable with pH 6.69 ±0.04, fat 3.68 ±0.06%, color DELTAE 0.92, and TBARS 0.20 mg MDA/kg. This energy-efficient technology outperforms batch plasma and thermal methods. The treatment preserves milk quality with minimal oxidative impact, as evidenced by low TBARS levels, and preliminary safety assessments suggest non-toxic degradation products, though further toxicological studies are recommended.



This study, published in **LWT - Food Science and Technology** journal, offers a scalable solution for producing milk with reduced AFM1 while preserving quality.

Disinfection of contact surfaces in beef processing plants

Contamination of food-contact surfaces represents an important microbiological risk in meat processing plants. A Chinese study published in **Food Control** compared the effectiveness of four disinfectants – peroxyacetic acid, quaternary ammonium salt, sodium hypochlorite and lactic acid – applied to cutting boards and conveyor belts in a beef cutting room.

In addition to evaluating microbial reduction, the researchers used high-throughput sequencing to investigate the effects of the treatments on microbial diversity and community structure. Disinfectant spraying significantly reduced total viable counts, Pseudomonas, lactic acid bacteria and total coliforms on both types of contact surface.

Among the products tested, peroxyacetic acid showed the highest efficacy, reducing microbial counts by 4.2–5.0 log10 CFU/cm². On cutting boards, it reduced the relative abundance of



Acinetobacter and *Pseudomonas* to below 19.3% and 6.0%, respectively. On conveyor belts, it also significantly decreased the relative abundance of *Acinetobacter* and *Psychrobacter*, while modifying the overall microbial community structure.

Functional prediction analysis also suggested potential changes in microbial pathways associated with carbohydrate, amino acid and lipid metabolism following peroxyacetic acid treatment. Overall, the study identified this disinfectant as the most effective among those tested and provides useful information for optimizing sanitation protocols for contact surfaces in beef processing plants.



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Pectin-low-density lipoprotein oleogels as techno-functional ingredients for gluten-free bread



The development of high-quality gluten-free bread remains a major challenge due to the absence of gluten, which is related to poor texture and oxidative instability. An US study explores the utilization of pectin (PE) and low-density lipoprotein (LDL)-based oleogels as fat replacers in gluten-free bread, comparing them with soybean oil, butter, and wheat bread control.

The incorporation of PE/LDL oleogels significantly enhanced dough microstructure and viscoelasticity, yielding breads with greater specific volume (1.99 mL/g), more uniform crumb structure, and improved moisture retention. The oleogel-based breads exhibited lower hardness (179.44 g) and chewiness (129.65) than others, indicating superior softness and elasticity. Moreover, the oleogel-based breads preserved the unsaturated fatty acid profile of soybean oil, reduced lipid oxidation (TBARS values <0.04225 mg/kg), and achieved superior sensory acceptance.

These findings publisged in **Food Chemistry** journal indicated that PE/LDL-based oleogels effectively mimic gluten functionality, offering a promising strategy for producing high-quality, nutritionally improved gluten-free bread.

Oat okara flour for nutritional enhancement of cookies

Oat okara, a protein and fiber-rich by-product of oat milk production, remains underutilized due to its high moisture content and spoilage risk. An Australian study characterized the nutritional composition, functional properties, and phytochemical profile of dried oat okara flour (OOF) and evaluated its application in cookies at 10%-30 % wheat flour substitution.



OOF contained 50.51 % carbohydrates, of which 40.80% is dietary fiber, 28.44% protein, 14.68% fat, 5.04% ash, and 36.11 ppm avenanthramides. It exhibited low solubility (27%) but strong water (2.00 g/g) and oil absorption capacity (1.13 g/g). Cookies enriched with OOF improved dietary fiber (up to 7.25%) and protein content (up to 14.24%) while maintaining similar energy values (528.66-538.92 kcal/100 g). In vitro starch digestibility decreased with higher OOF levels, lowering the predicted glycemic index by approximately 14%. At the highest substitution level, antioxidant stability was maintained through Day 14, phytochemical retention through Day 21, and texture through Day 28.

These findings published in **Food Frontiers** journal highlight the potential of OOF as a functional ingredient to improve nutritional value and reduce glycemic response in baked products. This work supports the valorization of plant-based by-products within circular food systems.

Tannin-rich extracts to preserve beef patties quality during cold storage

Increasing consumer demand for healthier and clean-label meat products, together with health concerns over synthetic antioxidants, has driven interest in natural alternatives. In this context, tannin-rich extracts were evaluated by Italian Researchers as functional ingredients to improve the quality and shelf life of beef patties.

The effect of two different tannin-rich extracts, each tested at three different concentrations (0.005%, 0.02%, and 0.04% *w*/*w*), was investigated in beef patties. Obtained results were compared with a commercial rosemary extract (0.2% *w*/*w*) and an untreated control. Natural antioxidant supplementation significantly reduced lipid oxidation during refrigerated storage, limiting malondialdehyde (MDA) formation. At the end of the 7-day storage period, the control sample exhibited the highest thiobarbituric acid reactive substance (TBARS) value of 2.99 ±0.01 mg MDA/kg, whereas treated samples showed markedly reduced oxidation (0.34-0.97 mg MDA/kg), with tannin-rich extracts presenting greater antioxidant efficacy with respect to rosemary extract (p < 0.001). The natural compounds also effectively inhibited hexanal formation and delayed the accumulation of 1-octen-3-ol compared with the control (p <0.001). Moreover, all extracts enhanced meat redness, as indicated by higher CIELAB a^* values, while no significant effects (p >0.05) were observed on texture, microbial growth, or overall sensory acceptance.



These results published in **Antioxidants** journal highlight tannin-rich extracts as promising natural antioxidants for improving oxidative stability and extending the shelf life of beef patties.

Enhancing low-fat frankfurter with almond protein emulsion gels

Reducing saturated fat content in meat products remains one of the main technological challenges for the processed meat industry. Replacing animal fat with liquid vegetable oils often leads to problems related to texture, stability, and processing performance. A study published in **Food Chemistry: X** evaluated the use of emulsion gels formulated with almond protein isolate (API) and kappa-carrageenan (KC) as pork fat replacers in low-fat frankfurters.

The emulsion gels were prepared using 6% almond protein isolate, 20% sunflower oil, and different concentrations of carrageenan. The formulation containing 6% KC (AEG6) showed the best technological properties, displaying a denser microstructure, greater gel strength, enhanced thermal stability, and improved oil-binding capacity.

AEG6 was then used to replace 50% of pork fat in frankfurter



production. Results showed that the instrumental texture of the final products remained comparable to conventional frankfurters, without significant negative effects on sensory quality. Texture, juiciness, and overall acceptability achieved scores similar to those of traditional products.

According to the authors, almond protein/carrageenan emulsion gels represent a promising solution for the development of reduced-fat meat products, thanks to their ability to mimic the technological behavior of animal fat while maintaining stability and sensory quality.

Development of a functional fermented dairy beverage from buttermilk

The aim of a Brazilian study was to develop a fermented dairy beverage based on buttermilk, enriched with prebiotic fibre and supplemented with protein, and to evaluate its physicochemical and microbiological properties.

Four treatments were formulated: control (T1), inulin (T2), whey protein (T3), and inulin plus whey protein (T4). During 36 days of refrigerated storage, pH, titratable acidity, syneresis, protein content, lactic acid bacteria count, and rheological behaviour were evaluated. Treatments T1 and T2 exhibited minimal differences across all parameters, confirming the feasibility of adding inulin to dairy beverages without altering their characteristics. Treatments T3 and T4 showed significant differences in all parameters except microbial counts, displaying higher pH, titratable acidity, protein content, and viscosity, and lower syneresis, highlighting the influence of protein supplementation on product properties.

Overall, the results published in **Journal of Dairy Research** demonstrated that the use of buttermilk to produce dairy beverages is promising and may lead to a new variety of healthy products for consumption.



Characterisation of fibre-enriched pasta from wet milled quinoa

Quinoa fibre-rich fraction (QFi), obtained through wet milling, represents an innovative approach to improving the nutritional and functional quality of cereal-based products. Unlike conventional whole quinoa flour (WhQF), wet milling induces phytate losses during steeping, generating ingredients with enhanced mineral bioavailability.



A Spanish study evaluated the incorporation of QFi into wheat pasta, assessing dietary fibre contribution, mineral bioavailability, cooking behaviour, and colour. Six fortified formulations were prepared by partially replacing wheat flour with WQF (white, red, or black) or QFi from the same varieties, with inclusion levels adjusted to provide equivalent dietary fibre across formulations. All quinoa-enriched pastas raised dietary fibre contribution compared with the control. Mineral contents also incremented, with the greatest values observed in formulations containing black quinoa ingredients. Fe and Zn contents were greatest in pastas with black WhQF, while Ca concentration was richer in formulations containing black QFi. Mineral absorption may be partially inhibited in pastas with WhQF, particularly in those containing the red quinoa. In contrast, QFi showed reduced phytate levels, highlighting the nutritional advantage of wet milling. Technologically, quinoa ingredients increased water absorption during pasta cooking.

According to this work, published in **Foods** journal, wet milled QFi provides a novel alternative to WhQF, combining improved mineral bioavailability with suitable technological properties for pasta processing.

Effects of biofortification on dough properties for bread making

Micronutrient deficiencies, or hidden hunger, remain a critical global nutritional challenge. Agronomic biofortification of staple crops like wheat with iodine (I), selenium (Se), and zinc (Zn) represents a promising solution to address this issue.

A Belgian study published in **LWT - Food Science and Technology** journal assessed the impact of foliar-applied I, Se, and Zn, individually and in combination, on flour and bread quality in two wheat cultivars. In Bezostaja-1, biofortified whole wheat flour reached 619 µg/kg I, 623 µg/kg Se, and 75 mg/kg Zn, with white flour retaining 32%, 74%, and 23%, respectively. Co-application of nutrients reduced protein content by ~10% and slightly decreased dough gas retention (77%-75%) yet had minimal effect on bread volume. Individually, Zn biofortification reduced loaf volume, whereas Se and I treatments maintained it. Moreover, pan loaf bread preserved more micronutrient concentrations than flatbread.

Despite variations in micronutrient retention among bread types, biofortified wheat presents a sustainable approach to enhancing dietary micronutrient intake without compromising bread-making quality.



White chocolate enriched with barley powder

The enrichment of chocolate with healthy ingredients represents an effective strategy to create functional food with high nutritional and bioactive potential. In this context, a group of Romanian researchers evaluated the use of green barley powder in the formulation of white chocolate, analyzing its effects on the chemical, physical, colorimetric, antioxidant, mineral and sensory characteristics of the final product.

The study, published in **Foods** journal, compared eight different formulations obtained from the factorial combination of two types of fat – milk butter and cocoa butter – with four levels of added green barley powder (1%, 3%, 5% and 7%). Two untreated controls, free of green barley, were added to these samples.

Increasing addition of green barley to both milk and cocoa butter led to the decrease in dry matter, soluble solids, pH and fat in the produced chocolate, with the untreated controls always showing the highest values. Opposite trends



were recorded for proteins, fiber, ash and mineral substances. The 'L', 'a' and 'b' color components gradually decreased from the untreated control to the highest concentration of barley powder addition both to milk and cocoa butter. The increasing integration of barley powder either into milk or cocoa butter resulted in the gradual decrease in F max compression and F max cutting of the chocolate manufactured, compared to the untreated control. The addition of barley powder to milk and cocoa butter elicited a gradual increase in all the antioxidants analyzed, i.e., vitamin C, carotenes, lycopene and xanthophylls, and of chlorophyll a and b, compared to the untreated control. Vegetal flavor attributes were enhanced by the increasing addition of green barley powder. The latter incorporation into milk and cocoa butter sheds light on the interesting topic of conceiving and applying the manufacture of innovative functional chocolate with high content of fiber, nutrients and antioxidants.

Comparison of fresh and dehydrated spirulina ice creams

Spirulina (*Limnospira platensis*) is a cyanobacterium that is widely recognized for its sustainability and nutritional value. With approximately 70 % protein content on a dry mass basis and a diversity of essential nutrients including vitamins A, B12, and beta-carotene, spirulina holds significant promise for enhancing human health.

A Spanish study evaluates the properties of fresh and dehydrated spirulina, comparing hand-produced and industrial powder forms. Key analyses included C-phycocyanin concentration *via* UV-Vis spectrophotometry and antioxidant activity using the ABTS method. Our findings demonstrate that temperatures above 50°C reduced C-phycocyanin stability and antioxidant activity. Dehydrated spirulina exhibited superior properties compared to fresh forms, while sugar addition further enhanced antioxidant activity. To broaden consumer appeal, Spirulina was incorporated into ice cream, chosen for its ability to preserve antioxidant properties due to its sugar content. Melting rate analysis revealed that no Spirulina form fully replaced the need for stabilizing gums, though ice creams with dehydrated Spirulina exhibited better water-holding capacity. Sensory analysis indicated consumer preference for fresh Spirulina ice cream over other forms.



This study, published in **International Journal of Gastronomy and Food Science**, highlights spirulina's versatility, emphasizing its potential as a functional food ingredient while also addressing challenges related to processing and product development.

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Biotransformation of pea whey into pea-based alcoholic beverages



The liquid byproduct from pea protein extraction processes represents a significant waste management challenge for the food processing industry, typically requiring costly disposal through wastewater treatment systems. A study conducted by Researchers from Singapore explored a biovalorization approach that would transform this underutilized pea whey into fermented alcoholic beverages.

Three distinct commercial yeast strains of *Saccharomyces cerevisiae* were employed to evaluate the biotechnological potential of pea whey conversion into alcoholic beverages as part of a valorization strategy. Fermentation trials demonstrated robust microbial proliferation with increases of approximately 2 log CFU/mL, while ethanol production reached concentrations between 5.5 and 6.5% (v/v) at 10% added sucrose. The fermentation resulted in the formation of higher alcohols and esters, including isoamyl alcohol (650.55-727.16 mug/L), 2-phenylethyl alcohol (248.26-315.15 mug/L), isoamyl acetate (42.71-108.00 mug/L), and ethyl octanoate (163.62-578.75 mug/L), while simultaneously reducing hexanal, a major beany off-flavor compound in pea whey, from 2.33 mug/L to below the detection limit in EC1118 and 71B fermentations.

These findings published in **Food Bioscience** journal establish alcoholic fermentation as a viable biotechnological solution for sustainable waste management, enabling the biotransformation of pea whey into novel alcoholic beverages with improved sensory properties.

The use of beet stalk powder in developing of nutrient-rich pasta

The valorization of agricultural by-products such as beetroot stalks (BSs) offers a sustainable strategy for reducing food waste while enhancing nutritional value of staple foods. A Greek study published in **Recycling** journal investigates the incorporation of BS powder, an agricultural waste rich in phenolics, betalains, and dietary fibers, into durum wheat semolina pasta.



Pasta containing 5-20% BS were evaluated for bioactive compounds, cooking performance parameters, texture, color, and sensory acceptance. Enrichment increased total phenolics, antioxidant activity, and betalain concentration in a dose-dependent manner, with 20% BS pasta reaching 2.24 mg gallic acid equivalents/g phenolics and 1.53 mg/g betalains. Although drying and boiling reduced bioactive retention, enriched pasta maintained up to eightfold higher antioxidant activity than the control. Cooking performance showed increased water uptake and swelling index at higher substitution levels, while texture analysis revealed reduced hardness and cohesiveness above 15% BS substitution. Color analysis confirmed intense red hues from betalain pigments, enhancing consumer perception. Sensory evaluation indicated that control pasta was preferred for flavor and texture, but 10-15% BS samples were well accepted for their appealing color and mild vegetal notes.

Overall, BS powder demonstrates strong potential for upcycling agricultural waste into functional, sustainable pasta with enhanced nutritional quality and alignment with circular economy practices.

Influence of high-amylose wheat on functional properties of pasta



The integration of high-amylose wheat (HAW) into pasta offers promising nutritional benefits due to its high resistant starch content. However, its impact on pasta quality and molecular structure remains insufficiently understood.

An Australian study systematically evaluated the influence of increasing HAW content (0-100%) on the cooking quality, texture, thermal properties of starch, protein secondary structure, intermolecular interaction forces, and water molecular states of cooked pasta. Results showed that higher HAW proportions enhanced ionic interactions within the starch-protein matrix, reduced water mobility, and delayed protein secondary structural transitions during cooking. These modifications corresponded with longer optimal cooking times leading to elevated cooking loss, and distinct molecular rearrangements (such as reorganization of hydrogen bonds and hydrophobic interactions in protein, reduced enthalpy in starch), particularly at substitution levels more than 50%. The light microscopy images showed a discontinued protein structure and less homogeneous matrix in 80% and 100% HAW pasta.

The findings, published in **Food Hydrocolloids** journal underscore the critical role of HAW incorporation in modulating pasta quality attributes and provide a foundation for developing functional pasta products with improved health-promoting properties.

Gluten-free flatbread with carob flour and sourdough

The growing demand for clean-label foods has stimulated interest in minimally processed ingredients capable of improving the nutritional and technological quality of gluten-free bakery products. Carob (*Ceratonia siliqua* L.) is an underutilized Mediterranean crop whose seeds are mainly used for locust bean gum production, while other fractions of the fruit remain insufficiently valorized.

A Croatian study published in **Foods** journal investigated the potential of carob seed flour (CSF) and the whole carob fruit flour (pods and seeds; CSPF) as natural structuring ingredients in gluten-free flatbread (GFFB), combined with sourdough fermentation. The initial technological properties (pasting profile, baking loss, specific volume, color, and texture profile) and nutritional composition were evaluated, alongside storage stability, through textural and sensory changes during 72 h. The incorporation of carob ingredients improved the nutritional profile of GFFB, nearly doubling total dietary fiber and iron content without compromising sensory acceptance. CSF use resulted in an improved pasting profile and a 50% softer crumb structure. Sourdough fermentation successfully mitigated the increased hardness and lower sensory freshness perception in CSPF formulations.

Carob seed flour, as well as whole carob fruit flour combined with sourdough, represent effective natural strategies for improving the technological properties, nutritional quality, texture profile, and freshness perception of gluten-free flatbread without compromising sensory acceptability.



Omega-3 oleogels from flaxseed oil as fat replacers in cookies



An Indian study aimed to assess the functional properties of omega-3-rich blended oil-based oleogel and its application in cookies as a solid fat substitute.

Blended oil with balanced fatty acids was developed with a saturated (SFA): monounsaturated (MUFA): polyunsaturated fatty acids (PUFA) ratio of 1:1.3:1 using flaxseed oil and palm olein (40:60), incorporated with 1500 parts per million of moringa leaves extract as a natural antioxidant. Soy wax and beeswax at 5% (w/w) concentration were used as oleogelators in different oleogel formulations. The oil-binding capacity of the bee wax-based oleogels (BWO) and soy wax oleogels (SWO) was higher than 99%. Peroxide values of omega-3 rich oleogel, butter, and blend were within the permissible limit (< 2 mEq O_2/kg). The induction period of oil blend, SWO, and BWO was found to be 7.1h, and the induction periods of SWO (6.95h) and BWO (6.5h). The textural properties analysis revealed that the hardness of BWO (2.2N) and SWO (4.3N) was lower than that of butter (5.1N). Rheological properties revealed that SWO and BWO have higher storage modulus (G') than the loss modulus (G). A stronger gel network was found in the SWO than in the BWO. Cookies made with butter, SWO, and BWO showed a similarly higher spread ratio, along with lower hardness and fracturability, compared to those made with the oil blend.

According to the work published in **Discover Food** journal, these formulated oleogels offer a promising novel fat substitute in bakery products, offering an ideal fatty acid profile and potential health benefits.

Unveiling the functional potential of fava bean pod powder

Fava bean (*Vicia faba* L.) pods, a by-product of agri-food processing, were studied by Spanish Researchers as powdered ingredients by freeze-drying and milling to two particle sizes (200 and 45 µm).

The powders were characterized for their main bioactive compounds (free and bound phenolics, vitamin C, and chlorophylls) and evaluated for bioaccessibility after *in vitro* digestion. Functional properties, including antioxidant and anti-inflammatory activity, and estimated glycemic index (GI), were assessed. Free phenolics accounted for over 93% of total phenolics, and vitamin C content was higher in the coarser sample. Although the highest overall bioaccessibility was observed in the coarser powder, the finer sample exhibited significantly higher total phenolic compounds, antioxidant and anti-inflammatory activity. Notably, the antioxidant effect was attributed mainly to the water-soluble fraction. Both powders showed low GI values, indicating slow carbohydrate digestion.

Results, published in **LWT - Food Science and Technology** journal, support the potential of fava bean pod powder (particularly the finer form) as a sustainable functional ingredient for health-oriented foods.



Potential of adzuki bean for plant-based meat



The search for sustainable and multifunctional protein ingredients has driven interest in underutilized legumes such as adzuki bean, a crop rich in protein, polyphenols, and bioactive compounds yet underexplored in modern food applications.

A Singapore study published in **Sustainable Food Proteins** journal developed adzuki bean protein (ABP) via alkaline extraction (pH 8-10) and isoelectric precipitation (pH 4.0-4.5), evaluating process efficiency, nutritional attributes, and multifunctionality potential. Notably, the natural low-fat content of adzuki bean enabled protein extraction without defatting or organic solvents, featuring a more sustainable process.

Extraction at pH 9.0 with precipitation at pH 4.5 achieved the most favorable balance of protein content (84.5%), yield (75%), and recovery (62%). Amino acid analysis confirmed a balanced profile with high levels of essential amino acids, including branched-chain amino acids, lysine, methionine, and tryptophan, comparable to soy protein. Additionally, ABP exhibited a natural red hue and significant antioxidant activity (TPC up to 222.6 µmol GAE/g; DPPH up to 110.3 µmol TE/g), highlighting its dual nutritional and functional value. Techno-functional analyses demonstrated strong oil-holding capacity, emulsification, gelation, and foam stability, positioning ABP as a clean-label alternative to conventional proteins. Sensory evaluation indicated neutral taste and umami-enhancing potential. Application in a plant-based jerky prototype delivering comparable protein to meat jerky but reduced sodium and cholesterol, and high dietary fiber, demonstrated practical feasibility.

Further supported by intrinsic color and oxidative stability over 1 year storage at 25°C, ABP emerges as a scalable, value-added ingredient with distinctive multifunctional properties that enable clean-label innovation and supply chain diversification to advance health-conscious product development.

Sustainable egg replacers in dried wheat noodles

Eggs are one of the basic ingredients of noodles, providing unique technological and sensory features. Also, eggs are important sources of proteins, vitamins and minerals. Despite excellent technological and nutritional features of eggs, they contain high amounts of saturated and *trans* fatty acids, which are thought to be responsible for some health problems, such as cardiovascular diseases and hypercholesterolemia.

In a Turkish study, eggs in the formulation of dried wheat noodles were replaced by two types of flaxseed mucilage extracted from meal using conventional method and ultrasound-assisted



extraction. The results illustrated that color *L** and *a** values of noodle samples increased, but *b** values decreased when fully replacing eggs with flaxseed mucilage. The use of sonicated mucilage resulted in higher DELTAE (4.20), water uptake (195.5%), volume increase (238.1%) and firmness (5.09 N) values in noodles compared to conventionally extracted ones (3.88%, 193.1%, 217.5%, and 4.85 N, respectively). On the other hand, noodles made with 100% flaxseed mucilage had lower cooking loss (4.42%) and higher firmness (5.82 N) than 100% egg noodles (5.32% and 4.30 N, respectively). Mucilage type had no notable impact on the moisture, ash, protein and carbohydrate contents. Replacing 100% of eggs with flaxseed mucilage decreased the fat content (~84.5%) and energy value and increased carbohydrate content of noodles. Although the protein content of noodles decreased by replacing eggs with mucilage, all noodle samples still had a protein content above 13.5%. Replacing 100% of eggs with mucilage reduced the total phenolic content of samples from 0.43 to 0.39 g GAE/kg. Besides that, both mucilage types demonstrated similar antioxidant properties in noodles. Compared to conventional mucilage (7.39), sonicated mucilage revealed greater overall acceptability scores (7.68). However, replacing 100% of eggs with mucilage slightly reduced the overall acceptability of noodles.

The findings published in **Food Science & Nutrition** journal suggest that flaxseed mucilage, especially extracted by ultrasonication, is a promising replacer for eggs in the production of acceptable energy-reduced wheat noodles.

Development of bioresidue apple flour with potential application in the food industry

Food loss and residues have attracted the attention of many sectors around the world due to negative environmental and economic effects. Several studies identify this bioresidue with potential to be explored and used as natural ingredients, benefiting environment and economy, and producing functionalized products.



A Portuguese study published in **Measurement: Food** journal aimed at the nutritional, chemical and bioactive evaluation of flours obtained from apples discarded as bioresidue due to their low caliber or non-standard format. The nutritional evaluation of the flour highlighted an interesting protein and ash content.

Three free sugars were identified in the analyzed flour, with fructose being the main sugar and five organic acids, with malic acid being the most prevalent. Regarding fatty acids, monounsaturated fatty acids predominated, with oleic and linoleic acids being the major components. Seven phenolic compounds were identified by HPLC-DAD-ESI/MS, divided into three different families: phenolic acids, flavan-3-ols, and dihydrochalcone, with phenolic acids predominating, which may justify the antioxidant and antimicrobial potential evidenced by the flour. After characterization, flour was incorporated into two types of bread and the effect of this incorporation over the shelf life was evaluated.

Overall, the nutritional and chemical composition of the apple flour obtained in this study makes it a viable alternative for application in the bakery and pastry industry, thus creating alternative products and health promoters for the consumer. Additionally, the reuse of apple bioresidue will allow the recovery of waste discarded annually without added value, in addition to contributing to a positive impact on the economy and the environment.

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Carbohydrate Composition and Frozen Bread Quality

The effect of altered starch and fibre composition on the quality of frozen bakery products has only been partially studied. Additionally, results are difficult to compare without standardized methodology and experimental conditions. A Hungarian study published in **Journal of Cereal Science** investigated the rheological properties of wheat dough made from varieties with different starch (waxy wheat flour (WWF)) and fibre composition (aleurone rich flour (ARF)). This effect was also investigated on the quality of frozen and prolonged frozen storage part-baked breads.



A standardized method for comparing part-baked breads with different composition was successfully developed. Baking loss and specific volume decreased due to freezing. Additionally, wheat flour breads consistently showed higher parameter values than composite flour breads during frozen storage. Crumb hardness was also affected by flour composition: WF hardened during storage; after an initial decrease ARF composite became the hardest; following a brief increase, WWF softened during storage and showed the most favourable behaviour. Unlike flour type, the length of frozen storage had a negligible impact on certain parameters.

The favourable behaviour of WWF composite samples and the lack of differences in sensory properties suggest that, even with altered starch and fibre composition, part-baked breads with suitable quality and improved nutritional value can be produced.

Enhancing the quality stability of frozen precooked chicken breast

The industrial application of precooked poultry is hindered by quality deterioration during short-term frozen storage (up to 30 days), while high-efficiency cryogenic methods like liquid nitrogen freezing remain costly.

A Chinese study compared four freezing methods, air freezing (AF), -80°C freezing (UF), ternary immersion freezing (IF, consisting of ethanol, 10% glucose solution and distilled water), and



liquid nitrogen freezing (NF), to identify a sustainable approach for maintaining the quality stability of frozen precooked chicken breast. IF and NF produced smaller and more uniformly distributed ice crystals, effectively preserving sarcomere integrity and water-holding capacity while suppressing protein aggregation and lipid oxidation. After 30 days of frozen storage, IF maintained similar physicochemical stability as NF but with substantially lower operational costs. These findings published in **LWT - Food Science and Technology** journal demonstrate that IF provides a cost- and energy-efficient alternative to cryogenic freezing, offering new insights into the sustainable processing of high-quality precooked poultry products.

Improving Frozen Lamb Quality by Ultrasonic Pre-Chilling

Improper pre-chilling prior to freezing often leads to significant quality deterioration, while existing quality preservation strategies overlook the importance of controlling the pre-chilling stage.

Chinese study investigated the effects of ultrasonic immersion assisted pre-chilling on the quality and microstructure of cooked lamb with vacuum packaging (VPU) during frozen storage. The results indicated that VPU reduced ice crystal size in lamb by up to 25% and promoted a more uniform ice crystal distribution, thereby decreasing thawing loss and cooking loss by up to 21% and 65%, respectively. LF-NMR analysis further demonstrated that VPU inhibited the conversion of bound and immobilized water into free water, thereby improving the water holding capacity (WHC) of lamb. Moreover, VPU reduced TBARS values by up to 28% and maintained texture stability, as evidenced by a 5.87 times lower coefficient of variation (CV) in hardness throughout the storage period compared with the control group. VPU also better preserved lamb color (maintained the highest a* (3.77) at 30 d) and extended shelf life by 4.29 times.

Therefore, this study published in **Food Research International** journal provides novel insights into addressing the issue of freezing quality deterioration in cooked meat products.



Antibacterial Effects of Nisin and Chive Seed Extract on *Staphylococcus aureus*

The growing demand for natural preservatives is driving research toward the use of bioactive compounds capable of replacing or complementing synthetic antimicrobials. Among these, nisin is one of the most widely used antimicrobial peptides in the food industry, while numerous plant extracts have demonstrated promising antibacterial properties.

A Chinese study evaluated the effectiveness of combining nisin with Chinese chive (*Allium tuberosum*) seed extract to control *Staphylococcus aureus*, also assessing its impact on the shelf life of pasteurized milk and fresh strawberries.

The results, published in **Science and Technology of Food Industry**, demonstrated a pronounced synergistic effect between the two compounds. The combination of nisin and the plant extract significantly reduced intracellular reactive oxygen species (ROS) levels and decreased extracellular polymeric substance (EPS) production compared with treatments using the individual antimicrobials. This combined action impaired the microorganism's ability to adapt to environmental stress and to develop protective structures, thereby enhancing the overall antimicrobial efficacy.

The study also investigated the practical application of the mixture in two highly perishable food matrices. During eight days of storage, both at room temperature and under refrigeration, pasteurized milk and strawberries treated with the combined formulation exhibited a marked delay in spoilage. In milk, compositional quality was better preserved, while treated strawberries showed lower weight loss, higher antioxidant capacity, and a slower increase in acidity.

The combined use of nisin and Chinese chive seed extract therefore represents a promising strategy for improving the microbiological safety of foods while reducing reliance on conventional preservatives. The use of natural ingredients with complementary antimicrobial activities could support the development of new clean-label formulations capable of meeting consumer expectations while maintaining high standards of quality and food safety.



Freezing and Freeze-Drying to Preserve Cheese Microflora

Preserving the microbial communities typical of traditional cheeses is essential for maintaining their biodiversity and ensuring the continuity of their characteristic flavour and quality. A French study evaluated the effectiveness of freezing and freeze-drying as strategies to stabilize the entire microbial community of a smear-ripened cheese without isolating or propagating individual microorganisms.



The researchers used a simplified microbial community capable of reproducing the metabolic processes involved in cheese ripening. Samples were subjected to different preservation treatments, including freezing at -80°C, freezing at -20°C, and freeze-drying, followed by one month of storage. Microbial survival was assessed by colony-forming unit (CFU) counts, while differential scanning calorimetry (DSC) was used to correlate the physical changes occurring in the samples with microbial stability.

Freezing at -80°C proved to be the most effective preservation method, with a loss of viability of less than 0.8 log units, followed by freezing at -20°C and freeze-drying. The bacteria involved in cheese ripening were found to be the most sensitive microorganisms to the preservation treatments. The study, published in **Foods** journal, also demonstrated that the best-preserved microbial community could be successfully reused in a new cheesemaking process, confirming the feasibility of preserving and reusing entire microbial ecosystems of technological interest. This approach offers a valuable strategy for safeguarding the microbiological heritage of traditional cheeses while ensuring the reproducibility of their quality characteristics over time.

Improving the Texturization of Upcycled Durum Wheat Proteins



The valorization of milling by-products is one of the major challenges of the circular economy in the cereal sector. An Italian study published in **Applied Food Research** optimized the extrusion process of a defatted durum wheat meal protein (DWMP), an ingredient obtained from semolina production side-streams and intended for the manufacture of texturized plant-based foods.

The researchers formulated a blend consisting of 75% pea protein isolate and 25% recovered durum wheat proteins, evaluating the effects of three extrusion parameters: pH (6.9 and 7.5), screw speed (400 and 600 rpm), and moisture content (28% and 32%). The objective was to obtain a more fibrous structure and sensory characteristics closer to those of meat analogues. Increasing the screw speed improved the water-holding capacity, which increased on average from 2.7 to 3.4 g H_2O/g, and enhanced the specific volume of the extrudates, while reducing both hardness and the water solubility index. Conversely, a higher moisture content produced denser and firmer products with lower elasticity but a slightly greater sensory perception of fibrousness. Raising the pH to 7.5 proved particularly effective in improving the quality of the final product.

The extrudates exhibited higher water-holding capacity, a softer texture, and greater perceived juiciness, together with reduced sensory hardness.

According to the authors, the appropriate combination of extrusion parameters can significantly improve the physicochemical and sensory properties of proteins recovered from durum wheat milling by-products. The findings confirm the potential of these upcycled ingredients for the production of high-value plant-based foods, contributing to waste reduction and the development of more sustainable food supply chains.

Enhancing Quality and Stability of Dried Blood Orange Slices

The choice of time/temperature combination is critical for ensuring microbiological stability and retaining the characteristic taste of dried blood orange slices. The aim of an Italian study was to investigate the capability of hot air-drying technique to maintain the quality characteristic of dried blood orange slices stored in modified atmosphere packaging (MAP).

Hot air-drying at 70°C for 12 h preserved shrinkage without altering the longitudinal diameter, though thickness was significantly reduced, especially in samples with passive MAP. Increased hardness and chewiness were noted due to water removal, with active MAP maintaining high hardness and colour integrity up to 100 days of storage (D100). Sensory analysis revealed differences in colour intensity and flavour between active and passive MAP-stored slices. Headspace solid-phase microextraction (HS-SPME) chromatography identified key chemical compounds contributing to aroma and flavour, highlighting the complex interplay between temperature, storage conditions, and volatile organic compounds production.



The study, published in **Horticulturae** journal, demonstrates that drying combined with MAP storage enhances organoleptic qualities and nutritional value, offering a method to produce a healthy, tasty, and visually appealing snack.

Enzymatic extraction to enhance the value of corn fiber gum

Corn germ meal is an important by-product of corn processing, often used as animal feed or otherwise underutilized. One of its potentially valuable components is corn fiber gum (CFG), a natural polysaccharide with emulsifying, thickening and antioxidant properties. A Chinese study published in **Transactions of the Chinese Society of Agricultural Engineering** compared different extraction techniques to assess their effects on CFG structural and functional characteristics.



After removing fat and starch, CFG was obtained using three procedures: alkaline, xylanase-assisted enzymatic and acidic extraction. The resulting products were compared for yield, purity, molecular weight, particle size, solubility, rheological behaviour, emulsion stability and antioxidant activity.

Alkaline extraction provided the highest yield, at 19.2%, but with relatively low purity (64%) and high molecular weight. Enzymatic extraction, on the other hand, produced CFG with the highest purity (68%), the lowest molecular weight (169 kDa), smaller particles and the highest solubility, at 91.37%. It also showed superior gel-forming capacity and typical shear-thinning behaviour, making it particularly interesting for sauces and dressings.

Enzyme-extracted CFG also provided greater emulsion stability and stronger antioxidant activity, associated with its higher phenolic content. According to the authors, these properties suggest potential applications as a natural emulsifier in yogurt, a stabilizer in ice cream and an antioxidant ingredient in baked products. Enzymatic extraction could therefore help transform a corn-processing by-product into a high-value functional food ingredient.

Ultrasound improves whole wheat dough and noodle quality

The use of whole wheat flour makes it possible to produce foods with a higher content of fibre and bioactive compounds, although the presence of the different grain components can make gluten network formation and dough processing more challenging. A Chinese study published in the **Journal of Cereal Science** proposed a novel strategy based on direct-contact ultrasonic pretreatment of a whole wheat flour-water mixture, with the aim of improving dough processability and the properties of the resulting noodles.

Unlike previous applications of ultrasound to fully formed dough or refined wheat flour suspensions treated in ultrasonic baths, the researchers used a direct-contact device capable of treating the high-viscosity whole wheat flour-water mixture. The treatment was applied at powers of 0, 50, 100, 150 and 200 W before the remaining flour was added and the dough subsequently formed.

The results identified the intermediate power of 100 W as the most effective condition. At this level, the β-sheet content of gluten proteins increased from 22.99 to 27.21%, while free sulfhydryl groups decreased by 9.61%, promoting the formation of disulfide bonds. Hydrogen bonds and hydrophobic interactions also increased, together with the viscoelastic moduli of gluten proteins. Overall, these modifications resulted in a stronger and more ordered gluten network, also characterized by a higher bound water content.

The positive effects were also reflected in noodle quality. Pretreatment at 100 W reduced cooking loss by 23.81% and increased polyphenol and flavonoid contents. At the same time, antioxidant activity improved: the DPPH radical scavenging rate increased from 56.5 to 63.9%, while ABTS radical scavenging increased from 42.2 to 51.4%. Significant improvements in the textural properties of the final product were also observed.

Treatment intensity, however, proved to be a critical parameter. At the highest power of 200 W, ultrasound caused protein degradation and disruption of the gluten network, resulting in deterioration of both dough and noodle quality. The study therefore indicates that appropriately controlled ultrasonic treatment could represent an interesting technology for simultaneously improving the processability, structure and antioxidant properties of whole wheat flour products.



Pulsed electric fields to improve the properties of nonfat dry milk

Pulsed electric field (PEF) technology is a non-thermal treatment of growing interest in the dairy industry due to its potential to modify selected functional properties without significantly altering protein structure. A US study published in the **International Journal of Molecular Sciences** evaluated the effects of PEF treatment on evaporated skim milk (ESM) and nonfat dry milk (NFDM) subsequently produced by spray drying.

A 48% (w/w) ESM solution was continuously treated at a field strength of 20 kV/cm and specific energy of 15 kJ/L, with a flow rate of 150 L/h. PEF treatment reduced particle size by 8.4% for whey proteins and 11.1% for casein micelles, while conductivity increased by 10.6%. PEF-treated evaporated milk also showed 14.5% lower viscosity than the untreated control and a 40% reduction in sedimentation.

After spray drying, the resulting NFDM showed improved technological properties, with increases of 1.9% in tapped density, 4.7% in solubility and 60% in emulsification stability.



Protein analysis revealed no modification of the secondary structure, while minor changes in tertiary structure were observed, including increased fluorescence intensity and decreased transition temperatures. The reduction in casein micelle size may be associated with the movement of minerals into the aqueous phase.

As the first study to apply PEF technology to highly concentrated evaporated skim milk using a commercial continuous-flow system, the results indicate that this technology could improve dairy processing efficiency as well as selected quality characteristics of nonfat dry milk.

Steam-vacuum treatment for pig carcass decontamination

Surface contamination of carcasses during slaughtering represents an important issue for the microbiological safety of meat. A German study published in the **Journal of Food Protection** evaluated the effectiveness of a combined steam-vacuum treatment applied to the surface of industrially slaughtered pig carcasses after evisceration and before chilling, assessing both microbial reduction and possible effects on surface color.

Trials were conducted under regular slaughterhouse conditions on carcass surfaces contaminated with stomach contents, bile, or tubular rail fat. Steam-vacuum treatment was applied for periods ranging from 2 to 8 seconds to approximately 30 cm-long sections of carcass rind.

The procedure produced a statistically significant reduction in total bacterial counts, reaching approximately 2 log10 and bringing microbial levels close to or below the detection limit. More specifically, reductions of 1.2 log CFU/cm² were obtained for stomach-content contamination, 1.6 log CFU/cm² for bile, and 2.2 log CFU/cm² for tubular rail fat.

The treatment also caused no significant color differences compared with untreated carcasses after 24 and 48 hours of storage at 2°C. Stomach contents could be completely removed without significant color changes compared with the control. In contrast, discoloration caused by bile and tubular rail fat could not be completely reversed: after decontamination, differences remained particularly in the yellowness component for bile and across the different color parameters for tubular rail fat.

Overall, steam-vacuum treatment proved to be an effective method for microbiological decontamination of pig carcass surfaces, reducing bacterial loads to levels below the detection limit while generally having limited effects on surface color.



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FoodTech Village: The Digital Ecosystem Connecting Innovation, Technology and the Food Industry

A platform for the future of Food & Beverage

Digital transformation and the accelerating pace of innovation are profoundly reshaping the food industry. Against this background, **FoodTech Village** was created as an international platform developed by Chiriotti Editori with the aim of establishing a permanent meeting point for companies, startups, researchers, technology suppliers and professionals from the food and beverage industry. The project is designed as a digital ecosystem dedicated to knowledge sharing, professional networking and the promotion of innovations that are redefining the future of the Food & Beverage sector.

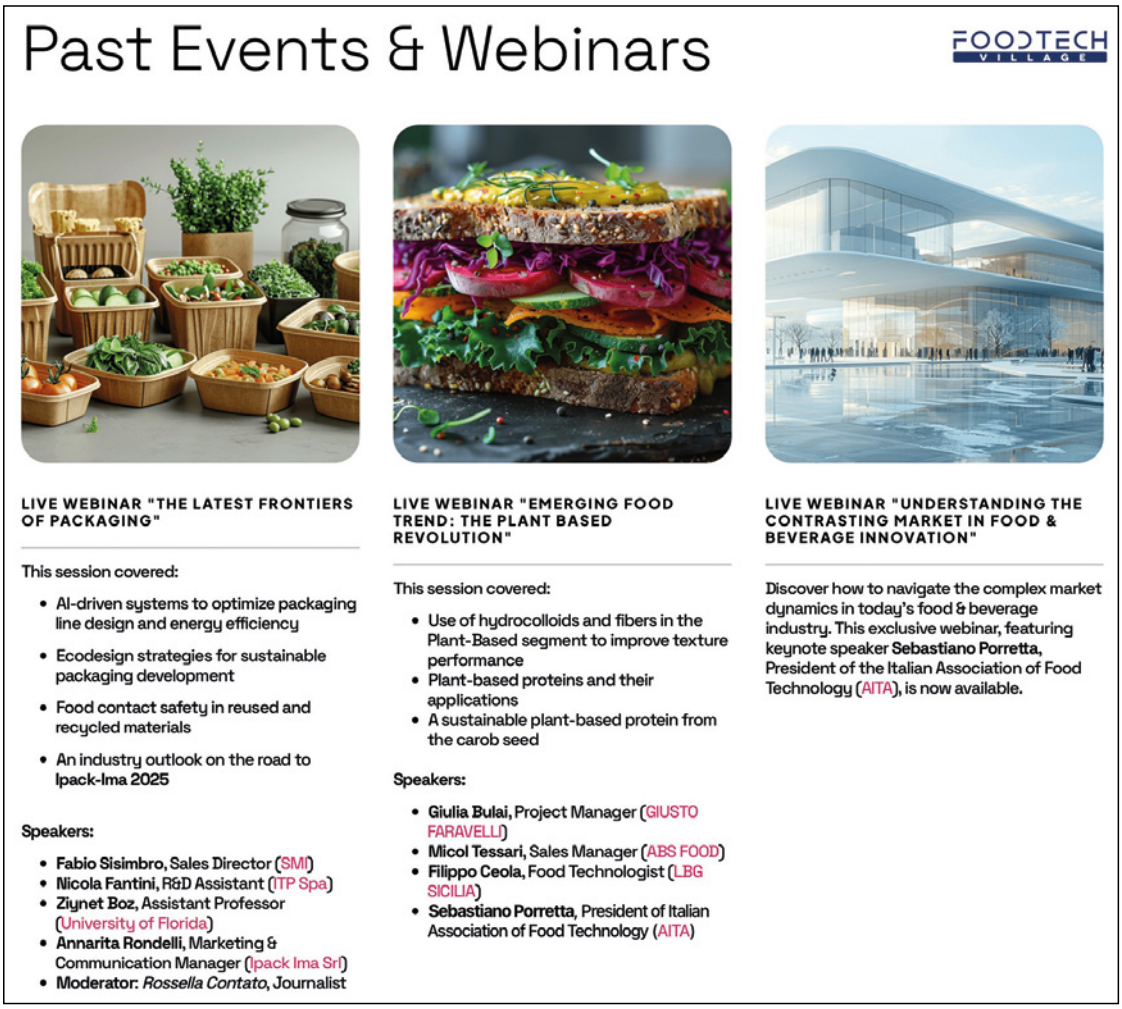
Unlike traditional trade fairs, which are limited in time and space, FoodTech Village operates as a year-round platform, enabling companies to showcase products, technologies, services and expertise to an international community of industry professionals. Its main objective is to connect the supply and demand for innovation, creating tangible opportunities for collaboration and business development.

The scientific direction of the project is entrusted to Professor Sebastiano Porretta, President of the Italian Association of Food Technology (AITA), whose expertise helps ensure the technical and scientific rigor of the content provided.



Specialist content and continuous professional updating

One of FoodTech Village's distinctive features is the wide range of content available. The platform covers numerous areas of the food industry, including bakery and confectionery, beverages, cereals and pasta, ingredients, milk and dairy products, meat and fish, as well as fruit and vegetables and processing technologies.



Particular attention is devoted to the issues driving the evolution of the sector, including industrial automation, robotics, artificial intelligence, sustainable packaging, food safety, quality control, process digitalization, nutrition and health. Through articles, technical insights, application case studies and presentations of new technological solutions, FoodTech Village aims to provide food industry professionals with a continuously updated source of specialist information.

The platform also offers a comprehensive programme of specialist webinars and workshops. These events address highly topical subjects such as the gluten-free market, new generations of non-alcoholic beers, advanced packaging, innovative ingredients and emerging trends in the food industry. Content is developed with contributions from experts from industry, academia and applied research, providing participants with a multidisciplinary perspective on market challenges and opportunities.

Workshops are designed around an interactive approach and include discussion sessions, case studies and practical insights, facilitating the transfer of knowledge that can be directly applied in production environments.

Networking, visibility and innovation growth

In addition to its information and educational role, FoodTech Village serves as a strategic networking platform. The project was created to facilitate interaction between innovators, startups, technology suppliers and established companies,



providing a digital environment capable of accelerating the adoption of innovation and encouraging new industrial collaborations.

Companies can use the platform to increase their international visibility and showcase machinery, raw materials, ingredients, specialist services and technological solutions to a highly qualified audience. At the same time, industry professionals gain access to a network of expertise and knowledge that facilitates the identification of technology partners and new business opportunities. Further value is provided by networking activities organized through webinars, virtual round tables, thematic events and online meetings. These tools make it possible to establish professional relationships that extend beyond traditional geographical boundaries and contribute to building an international innovation-oriented community.

In a context characterized by increasingly complex challenges – from environmental sustainability and digitalization to food safety and evolving consumer demands – FoodTech Village is positioned as a digital hub integrating information, education and networking. Its mission is to contribute to the development of a more innovative, sustainable and competitive food ecosystem by connecting expertise, technologies and ideas capable of transforming the future of the Food & Beverage industry.
foodtechvillage.com

SIMEI 2026: Innovation and Technology for Wine and Beverage Production

SIMEI, the international trade fair dedicated to technologies for winemaking and bottling, will return to Fiera Milano from 17 to 20 November 2026. Organised by Unione Italiana Vini (UIV), the event will celebrate its 31st edition, confirming its role as a reference point for technological innovation throughout the production chain, from the vineyard to the finished beverage.

For more than 60 years, SIMEI has provided an international showcase for machinery, equipment and technological solutions for the wine industry. The 2026 edition will further broaden this scope, covering not only wine but also beer, oil, spirits, liquid food and other beverages, reflecting the increasing technological integration taking place across these sectors.

A broader platform for the beverage industry

The expansion into liquid food and beverages will be strengthened by the debut of Bevertech, a new initiative designed to extend SIMEI's technological expertise to a wider range of production applications.

According to Paolo Castelletti, CEO of Unione Italiana Vini Servizi, the exhibition aims to reinforce its role as a strategic innovation platform in an increasingly complex and dynamic market. Particular attention will be paid to technological progress, process rationalisation and solutions capable of helping companies increase efficiency and diversify their production.

The objective is therefore not limited to creating business opportunities. SIMEI also aims to provide an international meeting and discussion platform for companies, technology suppliers and professionals throughout the supply chain, with an increasingly advanced approach to partnerships, content and technological integration. The launch of Bevertech will be accompanied by collaboration with Luigi Caricato's "L'Oleoteca di Olio Officina", while a new partnership with Consorzio Birra Italiana will strengthen the exhibition's presence in the brewing sector. The collaboration with Distillo, the exhibition dedicated to equipment for micro-distilleries, has also been renewed.

Partnerships and technological innovation

Distillo will hold its fourth edition within SIMEI. Ahead of the November exhibition, the two organisations will also collaborate on a conference scheduled for 28 April at Cantine Astoria in Crevada, Treviso, focusing on tourism in distilleries and liqueur production facilities and on the opportunities offered by hospitality and experiential travel. The meeting, organised by Distillo in collaboration with SIMEI and Unione Italiana Vini, will bring together industry operators, producers, professionals and the specialised press to examine the potential of tourism linked to the distilling sector.

Another confirmed feature of SIMEI 2026 is the traditional Innovation Challenge, the competition dedicated to recognising technological innovations developed for the sector. The initiative reflects the exhibition's focus on new solutions capable of improving production processes and supporting the technological evolution of the wine and beverage industries.

An international showcase for the entire supply chain

The figures from the previous edition highlight SIMEI's international dimension. In 2024, the exhibition featured 578 companies and brands across more than 30,000 square metres of exhibition space, with foreign delegations from 32 countries. More than 33,000 professional visitors from 90 countries attended the event. Building on these results, the 2026 edition will showcase the latest trends and technological developments across all stages of the wine and beverage production chain. Alongside its traditional focus on oenology and bottling machinery, SIMEI will increasingly address technologies and solutions for liquid food, beer, oil and spirits.

This broader approach reflects the convergence taking place across beverage production technologies and the growing demand for flexible, integrated and efficient processing and packaging solutions. SIMEI 2026 will therefore provide an international platform where technological innovation, production expertise and new market opportunities can come together.

simei.it

SIGEP World 2027 Strengthens Its International Reach

SIGEP World will return to Rimini Expo Centre from 23 to 27 January 2027 for its 48th edition, strengthening its position as an international meeting point for the gelato, pastry, bakery, pizza, chocolate and coffee industries. Organised by Italian Exhibition Group (IEG), the event aims to double the number of top international buyers, from 502 in 2026 to around 1,000.

The 2027 edition will build on the results achieved in 2026, when SIGEP World hosted 1,300 brands across 138,000 m² and 30 halls, attracting professionals from 160 countries. Almost one visitor in four came from abroad, while the number of international exhibitors increased by 33%. The 502 top buyers from 74 countries generated 5,851 business meetings. For 2027, particular attention will be devoted to retail chains, travel catering and luxury hospitality, alongside an International Pavilion, foreign delegations and an expanded business matchmaking programme.

From Rimini to a global network

SIGEP is increasingly evolving from a traditional trade show into an international network operating throughout the year. SIGEP Asia returned to Singapore in July with the Gelato World Cup – Asia Selection, while SIGEP USA is scheduled for April 2027 and SIGEP China will take place in Shanghai in June. The SIGEP Meets the World programme is also expanding, with international stops designed to connect potential exhibitors, buyers and the media.

Vietnam will be the Guest Country for the 2027 edition. The country represents one of the most dynamic foodservice markets worldwide, with the out-of-home sector expected to grow from $24.8 billion in 2025 to $45.2 billion by 2031. Vietnam is also the world's second-largest coffee producer and the leading exporter of Robusta coffee. The initiative, developed with the Italian Trade Agency and ICHAM, will bring a government delegation and new qualified buyers to Rimini.

Gelato remains one of the core sectors of SIGEP World. According to the Italian Gelato-makers' Association (AIG), Italian gelato consumption increased by an es-

INTERNATIONAL EVENTS IN ITALY

17-20 November 2026 - Milano: Simei, beverage and wine industry show - www.simei.it
13-14 January 2027 - Bologna: Marca, private label food show - www.marca.bolognafiere.it
23-27 January 2027 - Rimini: Sigep, confectionery, pastry and ice cream show - www.sigep.it
21-23 February 2027 - Rimini: BBTech, beer technology show - www.bbtechexpo.com
21-23 February 2027 - Bologna: Sana Food, organic food show – www.sana.it
28 February - 2 March 2027 - Verona: Sol2Expo, olive oil show - www.solverona.com
11-14 April 2027 - Verona: Vinitaly, Italian wine show - www.vinitaly.com
15-17 April 2027 - Bologna: Cosmofarma, functional and nutraceutical show - www.cosmofarma.com
20 - 22 April 2027 - Rimini: Macfrut, fruit and vegetable processing show – www.macfrut.com
4-7 May 2027 - Parma: Cibus, food show - www.cibus.it
18-20 May 2027 – Milano: Packaging Première – luxury packaging show - www.packagingpremiere.it
25-27 May 2027 – Parma: SPS Italia – automation and digital show - www.spsitalia.it
23-26 October 2027 – Milano: Host, foodservice show – host.fieramilano.it/
10-12 November 2027 – Bologna: Refrigera, freezing and refrigeration show - www.refrigera.show
2-5 February 2028 - Verona: Fieragricola, agricultural technologies show - www.fieragricola.it
16-17 February 2028 - Parma: Solids, powder and bulk processing show - www.solids-parma.de
8-11 May 2028 – Milano: Tuttofood, food show – www.tuttofood.it
29 May – 1 June 2028 - Milano: Ipack-Ima, packaging, food processing and pasta show - www.ipackima.com

timated 2% in volume during the 2026 tourist season compared with 2025. Growth reached 12% in seaside resorts and around 8% in residential areas, while major cities recorded an increase of approximately 1%. High summer temperatures also boosted demand for granitas and sorbets, although gelato parlour profitability fell by 6% due to higher electricity, refrigeration and skilled labour costs.

Technology, equipment and digital innovation

Technology will play an increasingly important role at SIGEP World 2027. The exhibition will include the Kitchen Equipment Hub, dedicated to foodservice technologies, and the Digital District, focusing on robotics, artificial intelligence and digital services.

Among the new projects will be "The Orbital Kitchen", developed with BEX – Beyond Exploration Expo. The concept will feature an AI-powered kitchen incorporating smart solutions originally conceived for extreme environments but potentially applicable on Earth. Water purification systems and pasta-making machinery will also be presented, while an EFCEM-ANIMA advisory board will bring together European industry associations to discuss technological developments affecting the foodservice equipment sector.

These initiatives reflect the increasingly close relationship between food production, automation and digital technologies. SIGEP World is therefore extending its scope beyond ingredients and finished products to embrace equipment and technological solutions covering the entire supply chain.

New experiences for pastry, bakery, coffee and gelato

The 2027 programme will also introduce a new concept dedicated to fine pastry and coffee for luxury hospitality, involving international executives and pastry chefs. Vision Plaza will host the SIGEP Vision think tank, while the Sustainability District will feature a symposium and a dedicated cupping area.

International competitions will continue to play a central role. The Gelato World Cup – Europe Selection will bring together eight countries competing for a place in the 2028 final, while *Bread in the City – Bakery World Cup* will be organised with the Richemont Club. Seven Italian Barista Championships, organised with the Specialty Coffee Association and qualifying for the World Coffee Events, will also take place.

The Pizza Club will host leading professionals and events including 50TOP Pizza, while training and younger generations will be addressed through SIGEP Academy, Discover Gelato and the SIGEP Youth Competition. Together, these initiatives reinforce SIGEP World's ambition to combine business, technology, professional training and international networking within a single platform for the global foodservice industry.

sigep.it

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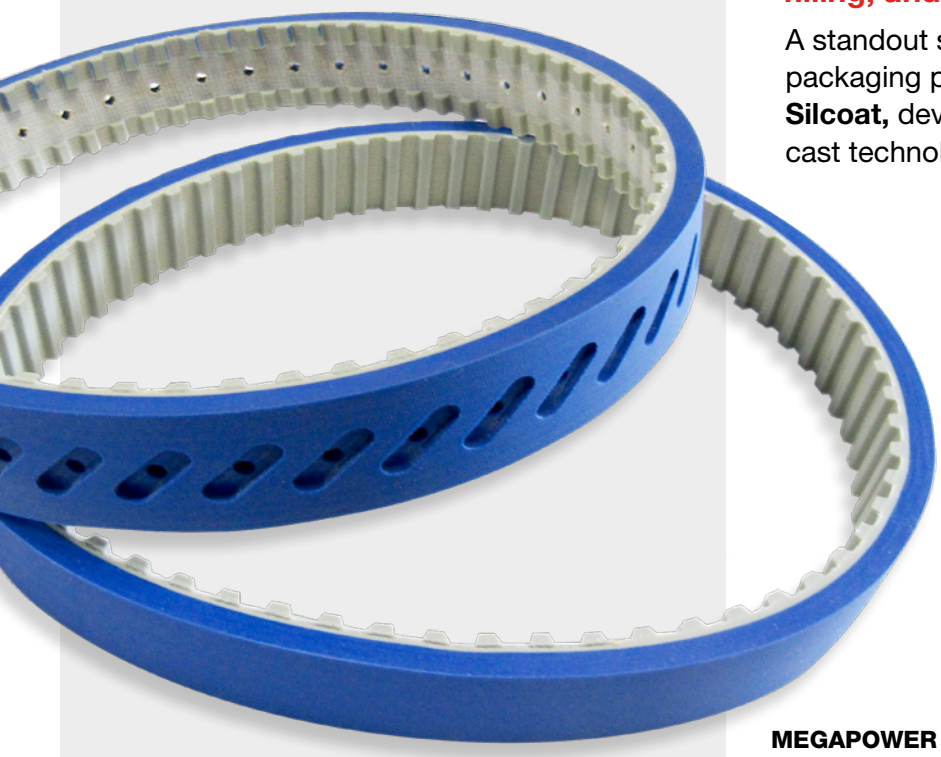
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