

POTATO BUSINESS DOSSIER

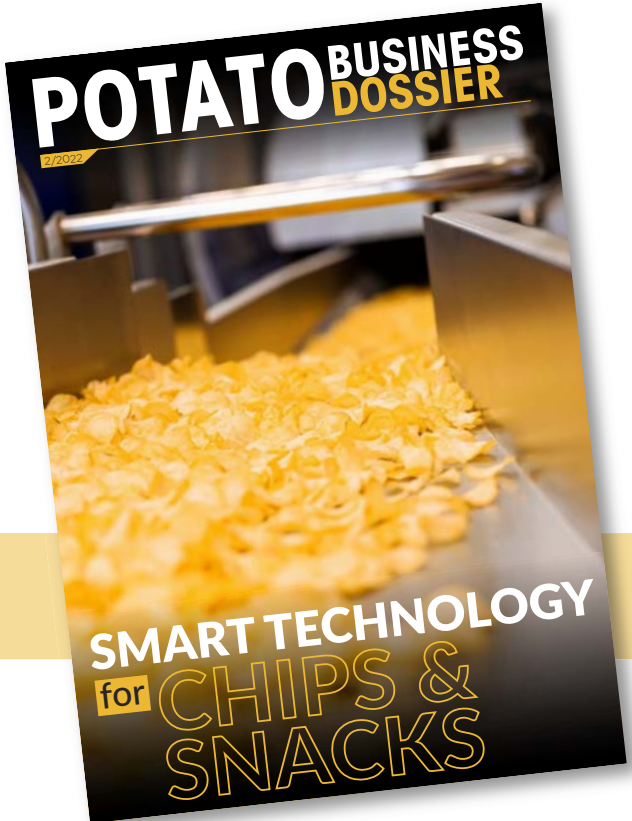
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SMART TECHNOLOGY

for

**CHIPS &
SNACKS**



ISSUE 2 - 2022

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for Chip Slices



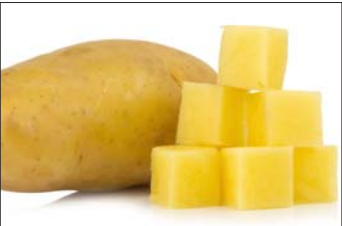
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Uniting Professionals From All Stages of the Snack and Nut Industry

SNACKEX

IONEL VĂDUVA
on-line editor

COMMENT

Ionel Vaduva

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ith a never-ending parade of exciting, great-tasting, and affordable products that provide something for everyone on any occasion, the European savory snacks industry continues to fill people's lives with enjoyment, fun, and pleasure. In this respect, SnackEx is recognized as the industry-defining event that brings together all stages of the demand and supply chain, while providing a unique opportunity to buy, sell, and network with

top industry management, including qualified buyers and key decision-makers.

All the snack consumers expect safe and delicious snacks and treats, good value for money, constantly improving nutritional content, and, of course, the highest quality ingredients and finished products.

Responding to consumer health concerns about their diets, the savory snack sector has continued to engage in activities to assist consumers in adopting a healthy and balanced diet.

Surprisingly or not, over 180 of the industry's leading exhibitors from all over the world exhibit their latest products during SnackEx Hamburg 2022. Organized by the European Snacks Association (ESA), SnackEx 2022 is taking place on 6 – 7 July at Hamburg Messe, Germany. At the Snackex Trade Fair, not only exhibitors but also show attendees will have numerous opportunities to interact with like-minded professionals.

Trade fairs are an enormously important part of the marketing activities of almost every type of business, from the largest multinational corporations to small family businesses. All evidence indicates that the ability to meet with customers and potential future clients in person is still an extremely valuable tool for developing new business. Trade shows provide a one-of-a-kind and unparalleled opportunity for face-to-face interaction.

Meeting potential customers in person results in longer-term relationships and is the most persuasive marketing channel.

Savory snacks have long been a part of our daily diets, and the European savory snacks industry has helped to promote healthy and balanced eating habits. ■

With a never-ending parade of exciting, great-tasting, and affordable products that provide something for everyone on any occasion, the European savory snacks industry continues to fill people's lives with enjoyment, fun, and pleasure.



A 3-step Washing Solution for Chip Slices

The three-step slice washing system is used in the chips production industry to wash away surface starch from potato slices after cutting. With the latest development by Rosenqvists Food Technologies, the system is further developed, offering some unique features.

By Magnus Kalling, R&D manager, Rosenqvists

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he potatoes are sliced to a thickness of between 1.1 and 2 mm, depending on the required product. When cutting, the cell membranes, as well as cells, are opened/damaged.

“The cell fluid containing free amylose and other substances as well as the inner starch granules leaks out as ‘free starch’. This causes a considerable tendency towards stickiness during frying and the slices are thus washed before this operation to eliminate this problem,” Magnus Kalling, the R&D manager at Rosenqvists Food Technologies explained. After potato chips were first manufactured on an industrial scale thirty years ago, several different types of slice washers were developed. Line capacities have increased to over 3,000 kg of finished potato chips per hour, with an estimated hourly input of around 11,000 kg of potato slices. “At this capacity and with a slice thickness of 1.1 mm of the sliced potatoes, it is possible to calculate that a surface area of over fifty square meters (>50 square meters) must be washed every second. Water consumption usually exceeds one cubic meter per tonne of potatoes (>1 cubic meter/ton) and is therefore considerable,” Kalling added.

WASHING PERFORMED IN SEVERAL STEPS

As the lines operate on the three-shift production schedule, with minimal downtime for cleaning, there is a gradual starch build-up on all surfaces of the fryer that in time increases to such an extent that production is disturbed, and cleaning becomes necessary. The cause of this build-up in the fryer is the residual starch granules that float around in the surface water around the chip slice. These are not bound to the potato slice and float with the frying oil; after a few seconds the starch is rendered adhesive, and the water begins to evaporate. The starch granule now undergoes a phase in which it is very sticky and adheres easily to metal surfaces as well as other surfaces.

The slice washing system that Rosenqvists Food Technologies has designed, implies in principle that washing is performed in several steps, where the water is separated and cleaned of particles, to be subsequently pumped back to a preceding stage. In this manner, the slices encounter the cleanest water upon exit and this water is then used in the preceding wash stages.

“This concept is logical, but the challenge lies in producing a design that at the same time is hygienic, minimizes foaming effects, efficiently utilizes floor space, and can be practicably adaptable to the layout of different plants.



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Line capacities have increased to over

3k

kg of finished potato chips per hour, with an estimated hourly input of around

11k

kg of potato slices.



The three-step slice washer from Rosenqvists Food Technologies solves all challenges above," the company's expert mentioned.

THE PRINCIPLE OF THE THREE-STEP SLICE WASHING SYSTEM

Wash step one - washing already starts with the slicing operation. This stage is important because the slices are separated from each other together with a liberal amount of circulated water. Slices and water flow over into a rotating tube (one for each slicer). The first section of the tube tapers conically outwards to a larger diameter and then inwards to a smaller one.

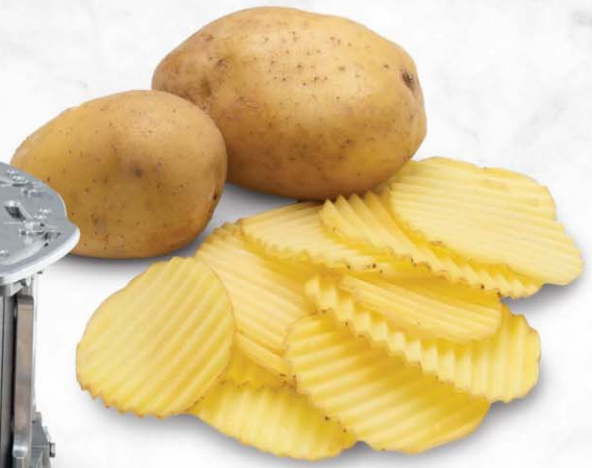
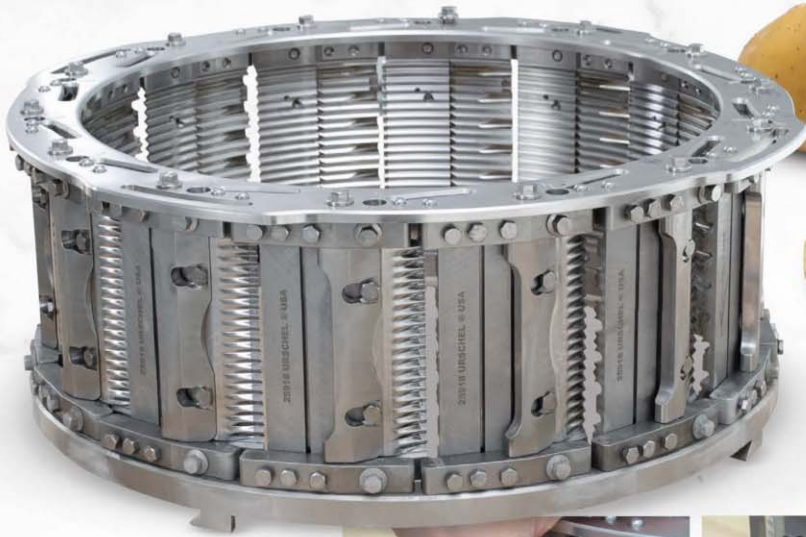
The unit tumbles the slices and water. In this first wash step, the starch concentration in the surface water is reduced to 1:10 and the surface water layer around the slice is now 0.13 mm.

The next section of the tube is a perforated sector where the bulk of the starch-enriched washing water is separated. The free starch content in the surface water is 20-50 ml/kg of slices.

Wash step two - the tube now tapers conically outwards again to a larger diameter and the slices now encounter fresh, cleaner water, while two drivers ensure that the slices and water are tumbled. The tube ends with a cone shape that ensures the water level in the tube. Slices and water flood over the edge into a de-watering shaker. The washing water is separated (free starch content 6-20 ml/kg of slices). After a first de-watering section, further flushing is undertaken with water from step 1.

Wash step three - undertaken after de-watering via spray nozzles above and from below the shaker table. Free starch content in the surface water is now down to a magnitude of 1-3 ml/kg of slices, optimal for smooth frying.

Water handling is done via a pump tank with three sections. The water from step three is strained and collected in section three of the pump tank and pumped to wash step two. The washing water from step two is strained and collected in section two of the pump tank and pumped to wash step one. The washing water from step 1 is strained and evacuated via an overflow. The pump tank is so designed that irrespective of a supply of fresh water, there is always water for the pump circulation in that water can flow backward through an aperture between the sections. Pump tank stage one is provided with an extra pump and two hydro-cyclones to raise the starch concentration in the wastewater and lower than in the circulating water. ■



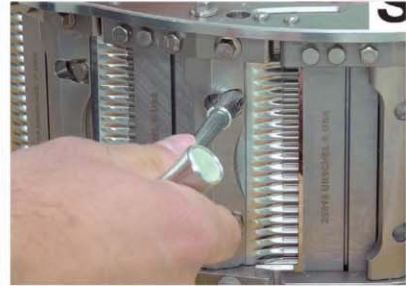
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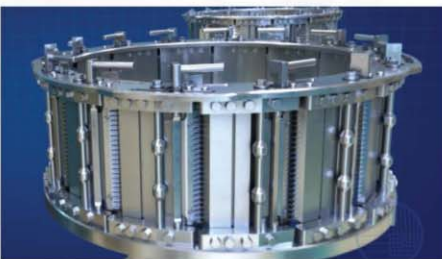
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Improve Productivity and Quality with Specialized Potato Chip Fryer Designs

Many factors go into making the best potato chip, but the fryer is usually at the top of the list. Similarly, determining the best fryer design for a potato chip processor is complicated. Finally, product quality has the greatest influence on the decision; however, floor space, production capacity, acquisition cost, and method of heating cooking oil are all important considerations.

By Heat and Control



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orking with a fryer manufacturer who has extensive experience in custom-designing fryers for each potato chip processor's specific needs ensures that productivity and product quality will meet expectations, laying

the groundwork for future growth.

The first factor to determine the best fryer design is determining the type of potato chip being produced. Does the processor wish to produce a conventional chip or a "hard bite"? Conventional chips are typically produced in a continuous fryer whereas hard bite chips are typically produced in a batch fryer.

BATCH FRYERS

Batch Fryers for Kettle Style Potato Chips - batch fryers are used exclusively for hard-bite, slow-cooked potato chips due to their unique temperature profile. The high-moisture content of potatoes requires a specially designed batch fryer. Potato-specific batch fryers use a kettle of static, hot oil which is directly heated by a gas burner firing under the fryer pan or by heat-transfer tubes immersed in the oil. These tubes can be heated by a gas burner, steam, or thermal fluid. As each batch of potato slices enters the oil, the cooking oil temperature initially drops and then gradually increases as the moisture in the potato slice is boiled off and the burner system regains the proper frying temperature. This "inverted bell curve" temperature profile produces the distinctive hard-bite texture that has made these chips the fastest-growing segment of the potato chip market.

The art of adjusting this oil temperature profile gives processors the ability to create subtle differences in chip texture. Once these cooking parameters are set, sophisticated batch fryers use a programmable logic controller (PLC) to assure repeatable frying of each batch of chips. PLC systems give operators control of multiple machines and process functions, pre-programmed product menus, and complete data management at the touch of a single display screen. Heat and Control Batch Fryer capacities range from 16 to more than 227 Kilograms of finished potato chips per hour.

ADVANTAGES OF BATCH FRYERS

Low cost (compared to continuous fryer systems) and adjustable temperature curve produces chips with unique textures. Multiple batch fryers can be handled by one operator because automatic slice stirring systems perform the cooking and unloading of the finished chips and eliminates the hazardous, labor-intensive task of manual stirring, and assures maximum chip uniformity by stirring

each batch the same way each time.

Although batch fryers give processors several advantages, the production capacity is limited by the fryer's surface area and heat input capability, and due to the large oil volume, the oil turnover rate is relatively slow. Also, operators must periodically stir the product to cook uniformly and to prevent slices from sticking together in clusters. The Heat and Control Chip-Stir system automatically stirs slices during cooking and then directs the finished chips to the discharge/drain conveyor.

CONTINUOUS POTATO CHIP FRYERS

Continuous fryers are available in numerous designs, varying in heat load, product handling, oil filtration, and production capacity; however, all commonly cook a continuous flow of product. Potato products, such as potato chips, sticks, potato co-products (e.g., tots, patties), French fries, or batter-coated fries require an externally-heated continuous fryer design due to the large amount of moisture that must be boiled off during the frying process, as well as factors such as - responsive, accurate, and consistent temperature control; higher thermal efficiency than direct-heating; heat load is not limited by the size of fryer because the fryer and heat exchanger are sized separately; higher capacity production; lower system oil volume (including fryer, heat exchanger, filter, and piping) than direct-heated fryers; continuous removal of product particles; rapid oil turnover rate; oil flow and temperature drop through the fryer are adjustable to match product flow rates; minimal cleaning required as fine particles remain suspended in the circulating oil for more efficient removal.

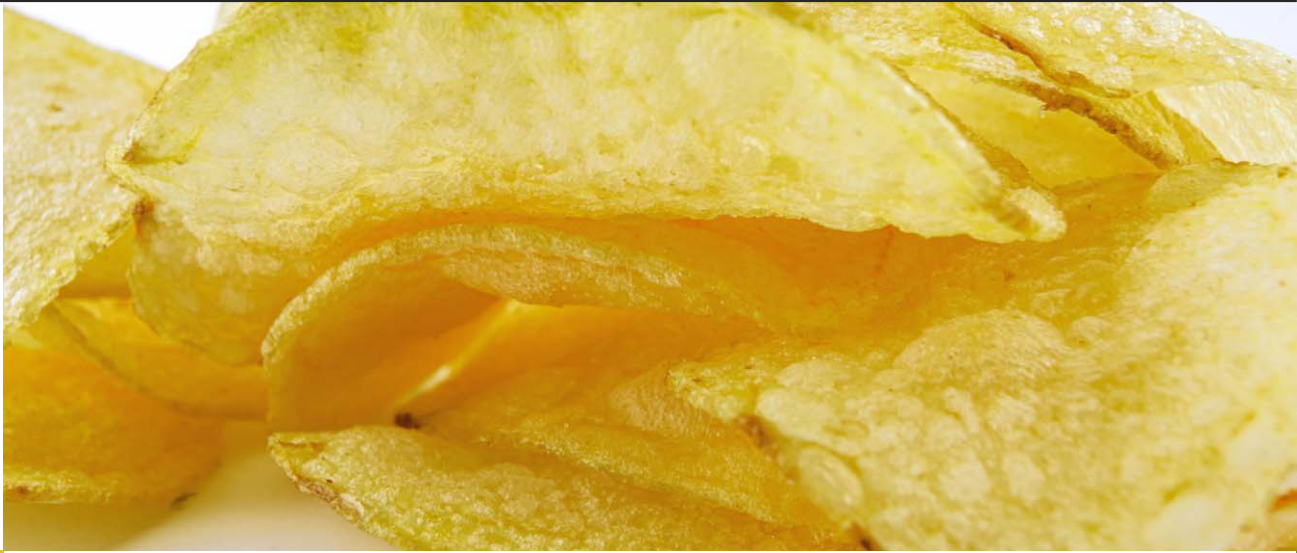
Continuous fryers are available for 91 to 2,948 kg. of finished potato chips per hour and over 22,680 kg. of finished French fries per hour. External-heat exchangers heat cooking oil using gas or light fuel oil burners, steam, or thermal fluid. These fryers continuously circulate oil through a filter, an external heat exchanger, and single or multiple inlets and outlets in the fryer. Continuous oil circulation provides multiple advantages: - maintaining a consistent oil temperature and temperature drop through the fryer; separating and advancing products through the fryer for uniform cooking without clusters; keeping product particles in suspension for more-efficient filtration and a cleaner fryer operation.

CONTINUOUS FRYER DEVELOPMENTS

Unique characteristics and production capacities of different potato products have prompted the development of specially-designed continuous fryer systems, including multi-zone fryers, multi-stage fryers, thermal-fluid-heated fryers, and vacuum fryers.



For a processor that wants the flexibility to cook both hard bite and conventional chips, Heat and Control offers the Universal Product Cooker (UPC).



Continuous fryers are available for

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kg. of finished potato chips per hour and over

22,68

kg. of finished French fries per hour.

Multi-zone fryers - in these fryers, oil is introduced and removed at different points along the length of the fryer pan to provide accurate control of the temperature drop that occurs during cooking, known as Delta-T. This enables processors to develop custom color and texture characteristics for different products and also permits frying at lower temperatures, which produces lighter color product and reduces oil degradation.

Multi-stage fryers - these are a variation of the multi-zone design and provide a greater range of frying temperatures. Each fryer stage uses a separate continuous oil filter, oil-circulation pump, and heat exchanger. Multi-stage fryer systems are especially useful for batter-coated fries, french fries, or co-products, such as tater tots and patties.

"For a processor that wants the flexibility to cook both hard bite and conventional chips, Heat and Control offers the Universal Product Cooker (UPC). The UPC is a versatile, economical fryer that utilizes independent fryer modules integrated into one continuous system to produce kettle-style, traditional potato chips, and other types of snacks from the one fryer. It allows an operator to adjust the time, temperature, and oil flow in each module to customize a recipe and to create a variety of styles of chips with a specific texture, moisture, and color," the company's experts explained.

Thermal-Fluid-Heated Batch Fryers - this direct-heated fryer uses a patent-pending thermal-fluid heat exchanger that heats oil uniformly throughout the fryer. A fines removal conveyor and spacing between the heat-transfer tubes prevent product particles from accumulating inside the fryer.

Vacuum Fryers - operating at 10% or less of normal atmospheric pressure, a vacuum fryer boils off product moisture at a lower temperature than traditional fryers. This allows high-sugar content potatoes to be fried without the browning of finished chips. The formation of acrylamide can be controlled because oil temperature can be kept below the 120°C point at which acrylamide forms.

"The Heat and Control Unitized Vacuum Fryer design requires no external-vacuum enclosure and takes the same general amount of floor space as conventional, externally-heated, continuous fryers. This allows processors to get the benefits of vacuum frying without the complexity of an external vacuum chamber," the engineers explained.

When sourcing equipment, potato chip processors should look for equipment that incorporates manufacturing designs that offer benefits for their specific product and delivers product quality and productivity that meets current expectations and allows for future growth. ■

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An Even Flow is Critical for Seasoning Equipment

Coating can be applied before, during, or after frying or freezing. This would be in the form of a starch-based batter, with or without flavor, before frying. In the case of potato chips, seasoning is done after frying and is often quite an expensive process so waste must be kept to a minimum.

By Ionel Văduva



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Seasoning system accuracy is critical to product quality and flavor, and today's equipment manufacturers are eager to provide processors with advanced systems that can aid in this critical process.

Manufacturers are looking for even coverage of the product with the exact amount of seasoning during this step in the process. An accurate seasoning system is not only a guarantee for a great snack product but is also an insurance policy for controlling the production economy.

Consistency is required in a good seasoning solution to ensure an even flow of potato chips, as well as to limit the number of unwanted stops in production. These should be avoided because each stop will result in a different application of seasoning.

Processors strive to always apply seasoning according to their recipe with an even flow of snack product entering the seasoning drum. Manufacturers require a buffer to accumulate product to achieve this flow. The product is then transported on vibratory conveyors to ensure even distribution.

Furthermore, processors should consider the performance of the seasoning drum, as seasoning is typically applied in a rotating drum in which the potato chips are kept in motion and slowly moved forward. It is critical to creating a steady wave of product inside the drum that is not too high. When done correctly, the result is complete seasoning coverage. The seasoning performance of the drum is influenced by factors such as gentle product handling, a steady wave, and an exit where the snack lands smoothly.

Seasoning must be accurately fed because it is fed onto a scarf feeder with a bias-cut exit. Seasoning is slowly shaken forward into the seasoning drum, and the challenge is to achieve a good spread of seasoning and an even forward speed. In addition to the factors mentioned above, several others influence the perfect seasoning of snacks. The ability to glue the seasoning to the snack is affected by the temperature of the product and the amount of oil used. Different seasoning blends have different adhesion properties to the product. Seasoning systems are available in a variety of standard configurations from equipment manufacturers and can be designed and customized to meet any coating requirement. Slow speed, gentle action, and uniform product depth prevent product breakage and ensure optimal coverage with all types of seasoning.

All seasoning systems are built on a single skid for ease of installation, and the design includes a retractable scarf feeder, drum/swivel, and 90-degree rotating seasoning feeder. The seasoning drum's design allows the product to be gently treated/tumbled, ensuring that all of the product in the drum receives the same level of seasoning coverage. As a result, the product will be evenly seasoned with no wasted ingredients.

DIFFERENCES BETWEEN POWDERED, OIL-BASED, AND WATER-BASED SEASONINGS

The requirements of every customer are different and so Fabcon's engineers ensured that they could offer a range of options and technology for manufacturers. The company's range includes dry seasoning screw feeders, which come in volumetric and gravimetric options. Gravimetric technology provides top accuracy when it comes to dry seasoning feed and compensates for variations in powder characteristics, including bulk density.

Vibratory scarf edge feeders are also a key part of Fabcon's portfolio. These receive the seasoning from the screw feeders and feed an even curtain onto the product in the seasoning drum. Alongside the scarf, edge feeders are the vibratory drum feed conveyors which provide a regular flow of product to the seasoning drum, and our innovative space-saving Vibraweigh technology which accurately weighs the product and proportions the amount of seasoning accordingly.

"We also offer a wide range of stainless steel seasoning drums in different sizes. These have adjustable rotation speeds and angles, as well as specially designed flights to ensure consistent product coverage and vitally, which keep breakage to a minimum, overcoming any quality control issues," Trevor Howard, managing director – of Fabcon Food Systems said.

DIFFERENT OPERATIONAL STYLES

Fabcon's seasoning systems can be operated in a conventional "kitchen" style or the increasingly popular On-Machine Seasoning option, which is mounted on a platform and where each weighing and bagging station has its seasoning system. This allows for different flavors to be applied simultaneously and eliminates the need to clean elevators when a flavor change takes place. This helps greatly when manufacturers require short production runs, often at short notice, particularly to satisfy hard discount retailers.

Through Fabcon's partnership with Northern Ireland-based Snack Engineering Ltd, the



Processors can always apply seasoning according to their recipe with an even flow of snack product entering the seasoning drum. An even flow is required if they want to apply 6% seasoning.



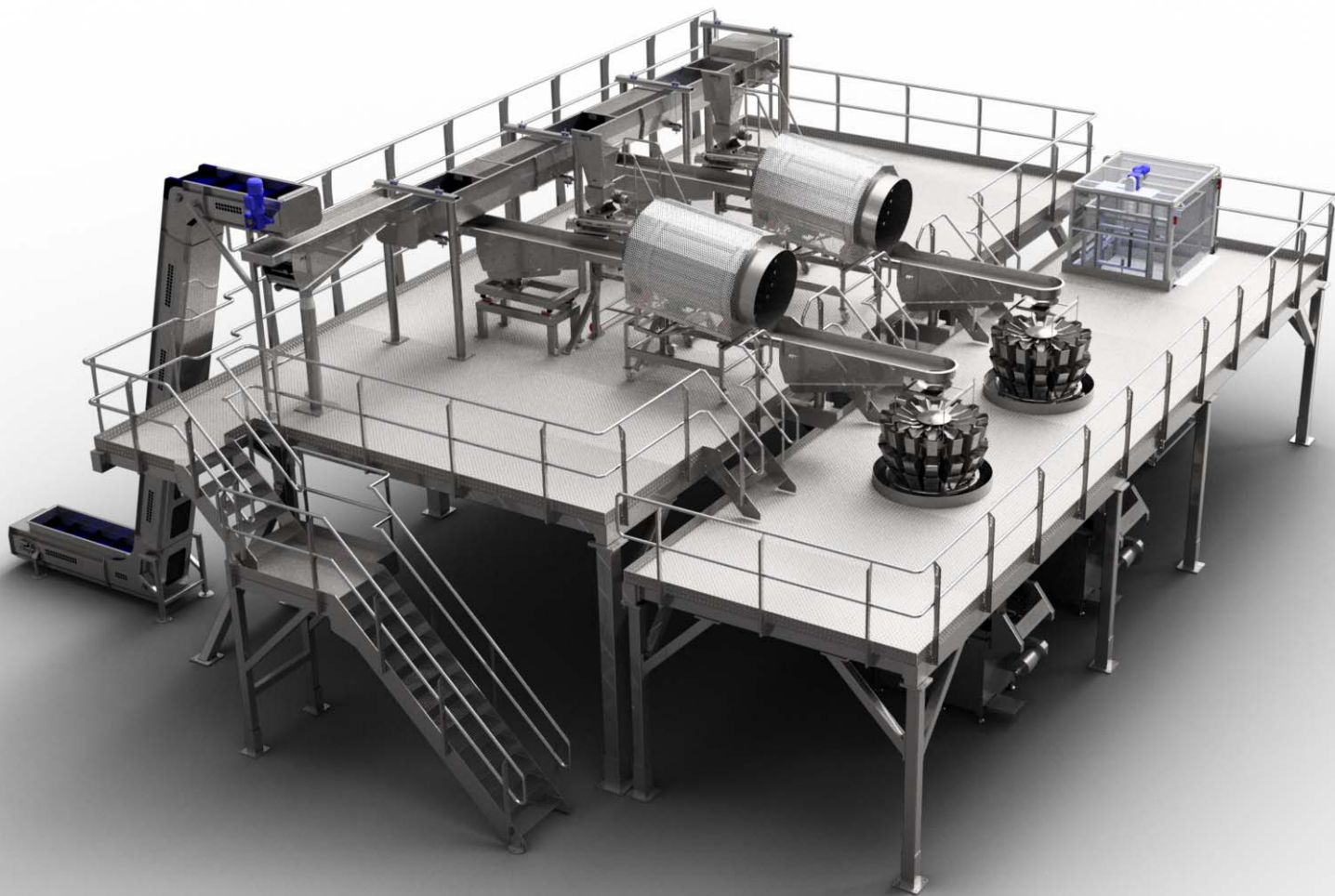
All Fabcon's design work is done in **3D**.

company also supplies high-accuracy oil and other liquid applicators, which require no air atomization and eliminate mist formation. "Our partnership also brings a closed-loop kettle slurry system to the market which gives the option of a highly accurate application of a premixed combination of seasoning and oil or other fats, using a closed-loop control system," Howard added.

One of Fabcon's key Unique Selling Propositions is that the company's equipment is custom-made and sized to suit throughputs, space availability, and any other criteria. All Fabcon's design work is done in 3D and the company's experts can design lines either to take account of current product and seasoning flexibility requirements or to provide adaptability for possible future layout changes.

"Our HM range of conveyors can be supplied as multi-lane systems which offer complete flexibility and allow any product and any flavor to be fed to any packaging station," Trevor Howard mentioned.

A properly designed coating equipment will include accurate dosing, chilled water mixing, tanks, and transfers to the application system, which must be designed to allow complete coating of all products, as well as excellent removal of excess and carry-over batter during transfer to different parts of the entire system. Good quality systems are not cheap, but the impact on the product is critical, and processors should always look for good quality equipment that ensures good effective coating and batter management, mixing, applying, and excess removal. ■





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Stephan Töpfl: "PEF is Seen as Standard in the French fry Industry"



Pulsed Electric Fields (PEF) process is increasingly being used in the production of potato and vegetable snacks. The benefits of the process are based on an effect known as electroporation, which has the cell membrane as its target.

By Ionel Văduva

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membrane engulfs all cells, separating them from their surroundings. When an external voltage is applied, a charge accumulates at the membrane, causing the potential to rise. This causes an electrical

compression of the cell membrane, resulting in the formation of a pore.

Plant cells, such as potato cells, soften when exposed to PEF because their internal cell pressure decreases (turgor). Cutting is improved as a result of controlled texture softening of tubers, resulting in less starch loss and thus increased product yield. Reduced feathering also decreases oil uptake during frying. Facilitated moisture release allows reduced frying time and temperature, which can lead to increased production capacity and improved product appearance.

Potato Business: How can the potato processors who adopt PEF technology make significant cost savings?

Stephan Töpfl, ELEA: PEF triggers tissue softening, which improves cutting and reduces tissue breakage, increases yield, and reduces oil uptake.

Can you give us more details about the benefits the improved cutting achieved by using PEF delivers? Please touch upon yield, blade wear, and oil uptake.

The final product yield is increasing, as less starch is lost in processing water streams. How much is dependent on product shape, for French fries typical yield increase is 1% and for potato chips 1 to 2%. Blade lifetime is multiplied by a factor of up to three. Oil uptake is reduced by up to 10% for French Fries and up to 18% for potato chips. E.g, on a 1,500 kg/h potato chips line oil savings of up to 175 tons per year have been achieved.

Why is PEF a superior process to regular blanching or traditional preheating?

PEF is using electric energy; its major benefit is the volumetric and instant effect. Small and large tubers are treated the same, without the need for residence time. In comparison to thermal treatment very little energy is required, as a ballpark number of 1 kWh per ton of product is applied. Hence PEF contributes to using less thermal energy and reducing fossil fuels use.

Please tell us more about the current state of market demand for PEF systems, and what are some of the trends you are observing.

PEF is already seen as a standard technique in the French fries industry. Recent developments aim at larger scale processing and further

improving energy efficiency by optimizing system performance. In the potato snacks industry PEF use is growing fast, and developments aim upon doing new product shapes and textures for fried and dried products. Other growing areas of PEF use are the potato flakes industry as well as its use for reducing blanching, drying, and freezing times in the vegetable processing industry.

What is the environmental impact of a PEF system?

A PEF system has a very low energy requirement, so its environmental impact is very small. But, looking at the overall line and product environmental footprint drastic improvements can be achieved. Replacing standard preheating



Whilst the success story of PEF has started with some of the global players small and mid-scale processors are very open and very active in that field.



Oil uptake is reduced by up to **10%** for French Fries and up to **18%** for potato chips.



by PEF saves up to 90% of water and energy and increases product yield. On a medium-size French fries line of 8 tons/h finished up to 10m kWh of energy and 25,000 cubic meters of water are saved per year. We are tracing the environmental impact of our installed base, so far Elea PEF systems have reduced potato industry CO₂ emissions by 5m tons.

Do PEF systems integrate easily with an existing processing line?

PEF is continuously operable and requires a small footprint, so yes. Typical projects require a few days for installation and commissioning. PEF systems are implemented before cutting or slicing and are available with a capacity range from 1 to 100 t/h. Elea PEF systems can be used from 0 to 100 % of the design capacity and are fully integrated into central process control systems.

How do you support your customers post-installation, and what are some of the more common challenges?

The most common task is line optimizing to make use of the full potential of PEF. With more than 200 industrial-scale systems at Elea, we have collected a wealth of knowledge on PEF's impact on subsequent processing steps. We support our partners by making use of our R&D and engineering team and network technology partners and regional agents. To fully use optimization potential for cutting, blanching, and frying we not only provide PEF but also process optimization tools such as Cut Control and PEF Control.

How open are small to mid-scale processors to investing in this technology?

Whilst the success story of PEF has started with some of the global players small and mid-scale processors are very open and very active in that field. We have developed a range of smaller-scale, compact systems for the potato snacks industry with great interest and market feedback. Given current challenges of energy and edible oil pricing that is the fastest growth area. ■

RESEARCH & DEVELOPMENT

ELEA's team of experts is currently working on making use of PEF-enhanced product development opportunities such as new product shapes and raw materials. Improved cutting but also the option to extract and infuse allows making use of so far underused crops. A pre-treatment e.g. allows washing out undesired or antinutritive substances from tubers or vegetables. On the other hand, PEF-enhanced uptake of color, flavors, or minerals is gaining importance and can be used to impact product taste, texture, and appearance. Last but not least, combinations of PEF and upcoming vacuum frying or drying techniques allow the creation of novel, tasty and crunchy product textures.



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DRYING



Achieving the Desired Sensory Outcome Through Drying

Drying is the process of reducing moisture, increasing shelf life, and potentially combating pathogens by using time and temperature. The drying process is also important for achieving the desired product characteristics and sensory combinations.

By Ionel Văduva

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historically, dehydration has been used on potato tubers in the form of cubes, in order to boost preservation and shelf life - something that is still applied today. When it comes to technology, the multiple-stage dryer

has been the standard technology for hot air convection drying cut, non-pulp forms of a wide variety of vegetables. This equipment provides maximum process flexibility because the drying air temperature, velocity, and humidity are variable throughout the drying cycle. Multi-stage machines provide the best process control, are the easiest to clean, and allow for the greatest bed width, but at the same time have the largest footprint and the highest capital cost. With entry cost being a major consideration for a new processor, multiple-pass and single-stage arrangements are options, particularly for dedicated product and/or low-capacity lines.

A multi-stage, single-pass conveyor dryer can efficiently process potatoes for every application imaginable for drying, roasting, and dehydration. As the product moves through multiple temperature zones with individually controlled temperature, humidity, and airflow, the air is used to transfer heat and remove moisture.

A multi-stage dryer with transfer sections between stages will gently reorient the product during dehydration to provide a uniform drying process at each stage of processing. The multi-stage processing of the pre-formed product allows flexibility where extended cooling time is required for starch gelatinization. A multi-stage configuration provides the operating flexibility required to control process air, humidity, airflow rate, and retention time at different stages of processing for dehydro-frozen products where the focus is on flavor concentration and water removal.

Impingement processing ensures consistent color at high capacities by delivering uniform airflow across the entire conveyor during roasting and color development. High-velocity impingement air tubes transfer high heat quickly and uniformly across the conveyor bed, eliminating the oven edge effect. Impingement systems remove the boundary layer around the product by pinging at high speeds against the surfaces. When compared to lower velocity convection or air systems, this greatly accelerates heat transfer, reducing process time by at least 50%. Airflow and temperature from above and below the conveyor are precisely controlled by dual impingement systems. Single impingement systems only supply air from above the conveyor.

DRYING/DEHYDRATING TECHNOLOGIES

Microwave and vacuum/freeze-drying, at the laboratory level, show superior results in maintaining product quality and nutrition, according to Bühler Aeroglide Corporation experts. However, due to technical and, most importantly, cost constraints, they are not widely viable for commercial, high-volume purposes. A puree slurry's quality and nutrition are also improved by contact drum drying and spray drying. However, capacity limits the acceptance of contact drum drying, and the high capital and energy costs limit spray drying as a cost-effective solution.

Solar drying is another accepted conventional drying method, most common in third-world sources. Solar drying results in the lowest price point per kg of the finished product due to the lowest investment and energy costs but lacks product uniformity, quality, and sanitation and does not lend itself to continuous commercial processing.

In the particular instance of rotary drying, convection rotary dryers have been used for over 50 years primarily for drying waste and spoiled product directly from the field. The potatoes that were usually found near the fields, were crudely shredded, dried, and used as animal feed. Drying the pulp after juicing is one of the rotary niches being explored today. The pulp that remains after the extraction of the high-value juice contains enough nutrients to be used in flour production. This method is commonly used in the dehydration of fruit and vegetable pulps, and as with other pulps, a significant fry mix-back will be required for flowability through the dryer.

Idaho Steel introduced the first stainless steel drum dryer in 1993 and a super drum dryer in 1995. Larger, more productive drums were developed in the following decades, with increasing global demand. The latest megadrum, produced by Idaho Steel, has a guaranteed capacity of 1,250 kg per hour and can - depending on the dry matter content of the potatoes used - even deliver up to 1,500 kg per hour.

Kiremko and Idaho Steel, as strategic partners, have now placed more than 200 "drum dryers" around the world. These drums are the heart of the flake line, a heated round "drum" on which the mashed potato is dried. With this rich experience, Idaho Steel and Kiremko say they can offer the most effective and high-capacity flake process in the world.

THE NEED FOR LOWER FAT SNACK OPTIONS MAKES THE DRYING STEP INCREDIBLY IMPORTANT

EnWave Corporation's Radiant Energy Vacuum Dehydration (REV) is a rapid, low-temperature



The need for lower-fat snack options makes the drying step incredibly important in potato processing when vacuum-frying is one of the main processing techniques.



products, vacuum frying has been the go-to choice of technology. This results in a tasty – but high-fat option for consumers. As healthier options become more commonplace, this leaves much room for improvement on the nutrition label: - vacuum frying - commonly used for potato processing but results in a high-fat potato product (about 40% fat); frying - high

The latest megadrum, produced by Idaho Steel, has a guaranteed capacity of **1,250** kg per hour and can - depending on the dry matter content of the potatoes used - even deliver up to **1,500** kg per hour.

drying method that maintains the product's color and flavor. According to the company's experts, non-fried vegetable chips are on the rise, as consumers become more conscious of what they are eating. The need for lower-fat snack options makes the drying step incredibly important in potato processing when vacuum-frying is one of the main processing techniques. REV technology is well-positioned to help Consumer Packaged Goods (CPG) companies, brands, and snack manufacturers create better-for-you alternatives for traditional favorites. "For the traditional white potato – foods have commonly included the French fry, the tater tot, and the potato chip. For these



temperature frying for the white potato has proven successful, but problematic for naturally-high-in-sugar products such as the sweet potato where burning is more likely to occur at higher temperatures; REV Drying – Gentle, low or no-fat alternative for potato processing, able to create a crunchy texture without the use of oil. Also able to retain enzymes, colors, and nutrients during a low-temperature drying process," the company's representatives mentioned. ■



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Balancing Frying Process Efficiency and Product Stability

The fat uptake and texture of fried potato products such as French fries and potato chips are affected by the quality of frying oils, fatty acid composition, and degree of degradation. Oil content is an important quality attribute in fried foods. Low-fat fried potato products have a hard and unpleasant texture. High oil utilization, on the other hand, is not cost-effective.

By Ionel Văduva

T

he choice of frying oil depends on many factors such as availability, price, frying performance, flavor, and stability of the product during storage. The most popular oil used for frying products is palm oil or its fraction,

followed by soybean oil (SB), canola oil (CA), and lard (LA). Hydrogenated vegetable oils such as sunflower and rapeseed oil are also widespread. With economic development and a shift in eating habits, regular consumption of deep-fried foods such as French fries has recently increased. Deep frying is a food processing operation that involves simultaneous heat and mass transfers by immersing the food in hot oil at temperatures of 180 degrees Celsius or higher.

Parameters such as oil quality, frying temperature, and time - all influence oil absorption during deep-fat frying. The high temperature causes some of the water to evaporate, which then moves away from the food and through the surrounding oil. The food absorbs the oil, which replaces some of the lost water.

Since moisture removal during frying is a key factor for oil uptake of fried products, low temperature have significantly lower oil uptake than high temperatures. The determination of the exact instant the frying oil must be replenished is also a major concern for avoiding possible health risks.

During the frying process, oil is often recycled in several batches, allowing moisture and air to be mixed into the hot oil. As a result, these oils undergo thermal and oxidative decomposition, and polymers formed under these conditions are harmful to health. Spent frying oils may contain harmful concentrations of degradation products, and so, frying oil quality is key to food safety and consumers' health.

Some of the current frying technologies incorporate continuous oil filtration systems to aid in the removal of particulate material left behind from sliced products during cooking. The oil is typically passed through a filtering system to remove both large and fine particles. If these particles are left in the oil, they continuously produce polymers and other polar compounds that cause an off-taste in the product and degrade the frying oil, affecting organoleptic properties such as crunchiness. The sooner and more accurately the particles are removed, the better the oil quality will be.

PRESERVING THE STABILITY OF FRYING OIL

Frying oil undergoes tremendous stress during the frying process. Fried food processors and

snack manufacturers are presented with the challenge of balancing the health demands of consumers with frying process efficiency and finished product stability. Dalsorb Oil Purifier, manufactured by The Dallas Group of America, helps to preserve the stability of frying oil to reduce or even prevent oil discards while maintaining finished product quality.

"Instead of replacing frying oil frequently, we maintain the oil quality for a more consistent food product. Our clients save 4-8 times of their oil costs with our highly effective powder-based solutions," Kevin Ryan, director of US Sales at The Dallas Group said.

Dalsorb removes undesirable compounds like off-flavors, odors, off-colors, free fatty acids, and polar contaminants from edible oils to reduce or eliminate oil discard while improving overall product quality. Dalsorb particles act as a magnet to attract and remove the dissolved tastes and odors that can spoil fried foods, and it can be applied in either batch or continuous form in an industrial application. The batch system is separate from the frying system and is completed during the time a facility shuts down its frying lines for cleaning.

"The process itself is straightforward and effective", the company expert explained. The oil is initially removed from the fryer and sent to a holding tank, to which a mixer can be installed. Dalsorb is then added to the oil at 2% of the total weight and is mixed into the oil for approximately 10 minutes. It is then passed through a Star (plate and paper) filter.

The cake formed in the filter unit forms the depth filter and removes particulate less than one micron in size. The oil can then be returned to the fryer for the next production run. For applications where there is either a rapid degradation of the oil or the fryers operate 24 hours a day, a batch continuous system can be used.

TAILOR-MADE SUNFLOWER-BASED SOFT SEED OIL BLENDS VS. PALM OIL

In the potato par-frying industry, Cargill GEOS Europe primarily provides customers with sunflower-based soft seed oil blends. Soft seed oils have a relatively low content of saturated fat (SFA) and because of that have a healthy image. Thanks to the inclusion of high oleic oils in soft seed oil blends, the stability of the oil is ensured. "Our customers in the potato snack industry also have a choice between tailor-made sunflower-based soft seed oil blends and palm oil. In this application, the choice of oil will depend on company policy, consumer trends, and/or retail requirements," Nicolette Drieduitte, Technical Business Development manager Foodservice, Cargill GEOS Europe. According to Drieduitte, in par-frying, the oil



We expect to see a continued move from palm oil to soft seed oils. This continued change will be in function of choosing healthier, lower SFA oils (soft seed oils) or a more price-competitive solution (palm oil).



Instead of replacing frying oil frequently, we maintain the oil quality for a more consistent food product. Our clients save 4-8 times of their oil costs with our highly effective powder-based solutions.

itself is just one of many factors that determine oil longevity: - the quality of the fried product, the equipment, and the process also impact how long oil can be used. To achieve the best results, it is important to minimize the 'oil enemies' like carbon (food particles) and air through oil filtration and steam blanketing.

The design of the fryer also plays an important role. It should be easy to remove crumbs and clean. Also, the temperature of the oil heating system should be as low as possible, minimizing oil exposure to excessive heat.

In continuous frying, oil performance is determined by turnover. The higher the turnover, the more the fresh oil is topped and the longer the oil's longevity will be. Oil turnover is determined by the oil volume in the fryer and the amount of oil absorbed by the fried food.

With continuous frying, oil replacement will

mostly be applicable when switching to another oil. Oil discard is only rarely needed if for some reason the oil quality is below standard. In kettle frying (batch process for snack products), oils will need to be changed when predefined discard levels are reached.

"We expect to see a continued move from palm oil to soft seed oils. This continued change will be in function of choosing healthier, lower SFA oils (soft seed oils) or a more price-competitive solution (palm oil). Other changes we expect to see on the horizon include the global phase-out of partially hydrogenated oils by 2023 and the development of alternative frying methods like air or turbo frying, which will drive fried product innovation. These developments may lead to increased use of more stable oils, such as high oleic sunflower oil," Nicolette Drieduitte concluded. ■



POTATO PROCESSING

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

2022 Feature Planning

1 JANUARY/FEBRUARY

Ad closing 17.01/Publishing 28.01



Key Exhibitors Road Map and Event Agenda

Processes

Conveying systems and belts
Pre-cleaning, washing, de-stoning

Expert View

Conveyors and the transfer of potato products
Remote maintenance and customer service
Cutting technology advancements

Spotlight

Cleaning and sanitation

Markets

Western Europe

Products

Better for You potato products

Ingredients

Lowering salt content

Storage Special

Handling potatoes to & from storage
Bulk vs. boxed storage

Trade shows: Potato Expo | Jan 6-7, Fruit Logistica | Feb 9-11,
International Potato Technology Expo | 24-25 Feb

2 MARCH/APRIL

Ad closing 14.03/Publishing 25.03



Key Exhibitors Road Map and Event Agenda

Processes

Sorting
Process monitoring
Seasoning & coating

Expert View

Optical sorting - increasing yields
Automation - ensuring a reliable and flexible production flow

Spotlight

Smart production & Industry 4.0

Markets

Eastern Europe

Products

Potato-based snacks, drinks and innovations

Ingredients

Flavors and seasonings for chips and fries

Storage Special

Automated climate control
Potato monitoring & quality assurance

Trade shows: Anuga FoodTec | 26-29 Apr

3 MAY/JUNE

Ad closing 09.05/Publishing 20.05



Key Exhibitors Road Map and Event Agenda

Processes

Cutting, peeling, slicing
Energy and water saving
Oil filtration systems & de-fattening

Expert View

Precision in cutting equipment
Sustainability in production

Spotlight

Waste management

Markets

North America

Products

Local vs. international tastes in potato snacks

Ingredients

Frying oils

Storage Special

Power saving and sustainability
Storage design and construction

Trade shows: WPC | May 30-June 02, Europatat Congress | 29 - 30 May,
Snackex | 06-07 June

4 JULY/AUGUST

Ad closing 18.07/Publishing 29.07

Processes

Blanching, frying
Forming and extruding

Expert View

Latest frying technology developments
PEF applications and advantages

Spotlight

Increasing efficiency in potato processing

Markets

South America

Products

Potato chips flavors, textures and trends

Ingredients

Batters, coatings

Storage Special

Sprout suppressants in storage
Sensors and data gathering

Trade shows: Potato Association of America Annual Meeting | July,
Potato Europe | 6-8 September

5 SEPTEMBER/OCTOBER

Ad closing 05.09/Publishing 16.09

Processes

Cooling and freezing
Dehydrating

Expert View

IQF freezing for French fries
Drying - innovation in selt and drum dryers

Spotlight

Traceability along the potato value chain

Markets

APAC/ANZAC

Products

Frozen French fries in retail & foodservice

Storage Special

Refrigeration and long-term storage
Disease Management

6 NOVEMBER/DECEMBER

Ad closing 07.11/Publishing 18.11

Processes

Turnkey projects
PEF technology

Expert View

Complete lines for processing
Conveying systems & inspection tables
Batch vs. continuous frying

Spotlight

Increasing production capacity/Future-proofing processing operation

Markets

Global market predictions for 2023

Products

Flakes, pellets and mashed potatoes

Ingredients

The future of potato snacks 2023

Storage Special

Storage challenges and cost-saving solutions
Store preparation and hygiene

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