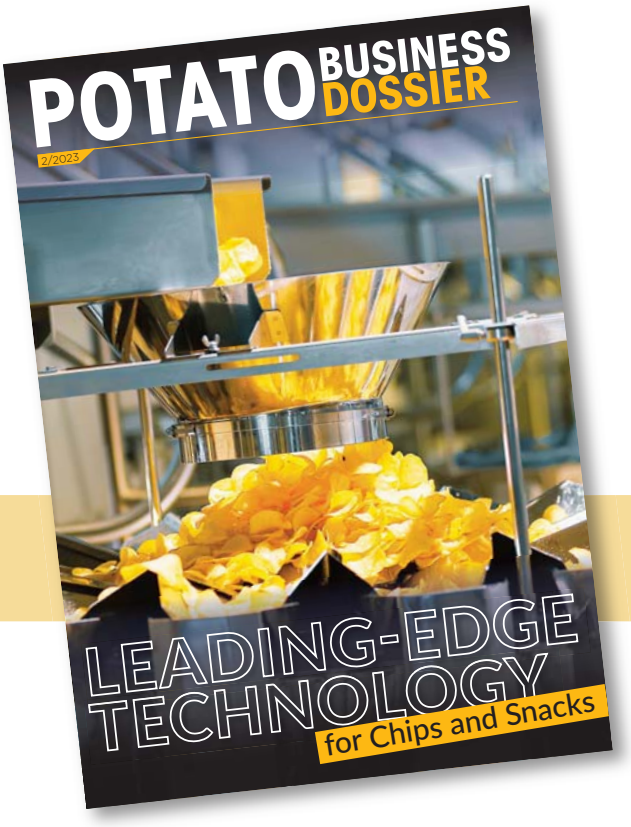
POTATO BUSINESS DOSSIER

2/2023

LEADING-EDGE TECHNOLOGY

for Chips and Snacks



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content

This project is supported by elea URSCHEL HEAT AND CONTROL FAM KEY TECHNOLOGY

Producing Goods with Market Appeal is a Must for Potato Processors

IONEL VĂDUVA
online editor

COMMENT

Potato chips have evolved substantially in recent years, with manufacturers continuing to solve processing challenges to meet – and even surpass – consumer expectations.

Spuds have significant quantities of moisture, amino acids, and reducing sugars, all of which promote acrylamide development when they are traditionally fried. But this is not the only challenge producers have to overcome if they want to grab or hold their market share in this industry. Therefore, they turn to the most advanced pre-processing, frying, and seasoning technology to assist them in producing goods with market appeal while retaining their unique flavor and texture.

Consumer desire alone isn't the only factor influencing how potato chips look. Health groups are focusing more and more on snack foods to lower obesity rates worldwide. For instance, the World Health Organization (WHO) put forth guidelines in 2010 to control portion sizes to alter how people view healthy food options. Similar advice was provided by the British Medical Journal (BMJ), which recommends that product parts be packaged separately.

Expect much more innovation in the future, since people's busy lifestyles mean they're turning to snacking as a replacement for regular mealtimes - and want their potato chip varieties to reflect this. Implementing cutting-edge technology will, as always, be critical to staying ahead of the newest trends and, ultimately, creating products with the 'perfect' bite that will keep consumers guessing for many more years to come. ■

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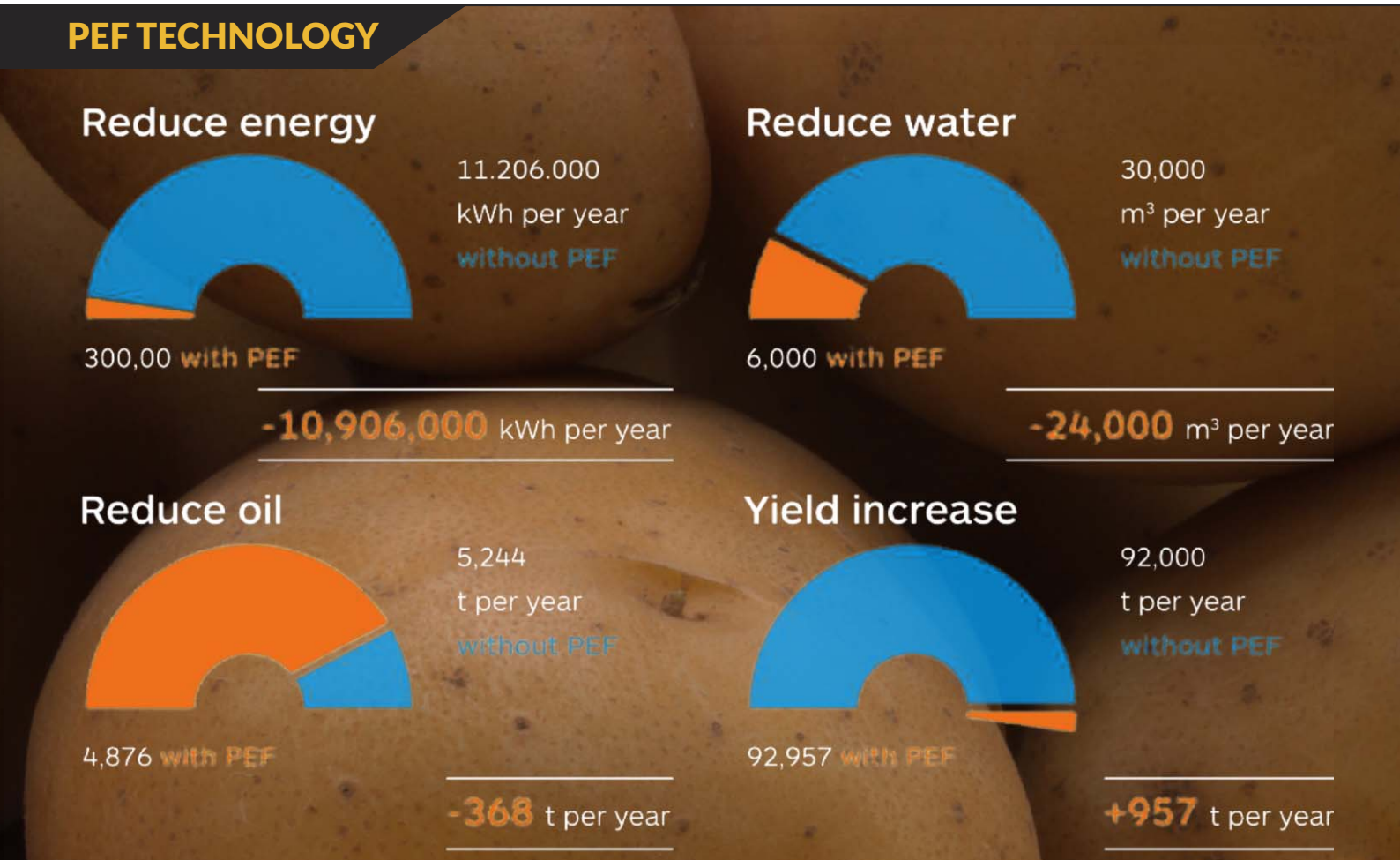

5 PEF sustainability - 26 th raw material French fries line, 7.700 production hours per year

ELECTROPORATION - THE MISSING LINK IN POTATO PROCESSING

Pulse Electric Field (PEF) technology, or electroporation, is a non-thermal effect forming pores in cell membranes. The principle of action is long known, but only in the last decade it has found broad use in vegetable processing industry.

Potato tubers soften after a PEF treatment, as the internal cell pressure (turgor) is lost. Like after preheating, the texture softening improves cutting and results in less feathering and breakage. In comparison to preheating PEF energy and water consumption are reduced by up to 90%. Typical energy input for a PEF processing of potato tubers is 0.3 to 1.5 kJ/kg, corresponding to a temperature increase of 0.01 to 0.4°C. Process intensity is adapted during the season, being highest with fresh from the field crop or harder tuber varieties and lower at the end of the season. Average product length is increased, and the starch loss into cutting and blanching water streams is reduced. That causes an up to 1.5 % yield improvement for a French fries processing line. Due to less tissue breakage the oil uptake during frying is reduced by approximately 10%. As the electric field effect is instant and volumetric, there is no holding time requirement and no start up or shut down time needed. ■

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ADVERTORIAL

PEF-induced product and process improvements in the potato and vegetable chips industry

Pulsed electric field (PEF) processing is now considered a standard process technology in the potato and vegetable processing industry. Applying high voltage pulses opens the cell membrane of roots, tubers, and other fruits and vegetables, allowing quicker and easier water release. This effect, termed electroporation, reduces the turgor pressure and leads to several process, quality and sustainability benefits, including enhanced yield (cutting, slicing and conversion), improved product organoleptic (taste, texture and appearance), and improved nutritional credentials through reduced oil uptake. This article reviews PEF's impact on the different stages in a snacks processing line based on industrial scale experience from Elea PEF users.

Why use PEF?

PEF has been in use at an industrial scale since 2010. To date, Elea has installed over 175 units in the potato and vegetable processing industry worldwide. Whilst many users prefer not to disclose the use of PEF in their production processes, others are openly communicating the use of PEF and its induced product and sustainability benefits for their marketing purposes. Recently published reports included PEF's usage in various countries and companies, e.g. at Amica (Italy), Kanaan (Croatia), Tayto (UK), Pizzoli (Italy) and BemBrasil (Brazil).

Based on electrical energy, the technique allows the replacement of thermal or mechanical cell disintegration techniques or tissue softening with reduced energy input, water and time requirement. PEF uses a non-thermal effect of pulsed power, electroporation. Voltage rectification and pulse modulation use solid-state switching technology allowing high treatment capacity applications. Solid products such as fruits, roots or tubers are treated in belt systems. Elea pulse modulators are designed to allow a large free cross-section for high throughput treatment whilst avoiding product clogging. Elea has developed a range of systems from 1 t/h up to 100 t/h in single lines, which can be operated from 0 to 100 % of their capacity. The PEF treatment is independent of the size and shape of the material being treated, and product segregation by size or shape pre-treatment is not required.

Dependent on product properties such as size and density and throughput of the material, horizontal or vertical electrodes are applied. Energy input levels range from 0.5 to 5 kJ/kg, dependent on type of application. Being a continuous process with a small footprint, PEF integration into existing lines is simple. The process can be applied to products with the peel on or off, and both options are in today in industrial-scale operations, with no impact on PEF efficacy. There are considerations and implications for water utilization and cleaning regimes in the plant if PEF is applied pre-peeling, but the efficacy of the PEF treatment is unaffected. The dwell time of the material from entering to exiting the PEF treatment chamber is approximately 10 seconds. However, the PEF treatment itself happens in fractions of a second as the material passes between the electrodes.

Cutting and slicing

The first and most directly visible PEF effect is observed at the cutting stage. Reduced turgor pressure due to the micro holes created in the cells through the electro-perforation process (PEF), results in a softer and easier-to-cut product matrix. This allows for cleaner and smoother cuts, with less cell damage/disruption and starch loss during slicing (this is true for all types of slicing technologies and different shapes/ cuts). Typically, a cutting force reduction of up to 50 % reduction can be achieved. These slice improvements directly increase yield and product quality. A PEF-treated, softer product will reduce knife wear as the product is easier to cut and will not cause the blades to blunt as quickly.

The cutting improvement will result in less cell damage and reduced starch loss during subsequent washing and processing steps. Typically, a 10 % reduction of starch losses and, in consequence, a 1 to 1.5 % solids yield increase is observed. In addition to a higher yield, the effect will reduce starch loss in process water, reduce starch accumulation in the fryers, reduce water/waste/effluent processing costs and improve product texture.

Washing (continuous frying line)

PEF-induced pores in the cell membrane improve the efficacy of the washing step as more starch is retained inside the cells and not released onto the surface of the slices, thereby requiring less washing. As less starch is carried over, less water will be required. As a result, washing time and water temperature can be reduced, and for most products, a blanching step is no longer required, allowing substantial improvements in product crunch and texture. The washing step will also aid the removal of the liquid components inside the cells, including reducing sugars and amino acids, resulting in less undesirable process by-products (i.e. sugar browning/ defects).

Potato chips frying

Heat and mass transfer are limited by water mobility within the tissue structure. PEF opens the cell membranes, allowing for faster water diffusion and heat transfer rate in the potato slice. In most cases, an increase of production capacity by 5 to 10 % is seen – given sufficient fryer heating and heat transfer power rating is available. Improved heat transport and moisture release allow for a lower frying temperature and/or reduced frying time. Both are critical for operational efficiency, product quality (colour/ texture /nutritional values etc.) and sustainability. The extent of Maillard reactions - typically occurring at temperature levels above 120°C in low moisture environments - can be reduced, resulting in brighter and more consistent product colour.

The potential reduction of frying time and temperature is dependent on the type and design of the fryer used; in most situations, a temperature reduction of 3 – 5°C fryer output temperature and a frying time reduction of up to 10 % has been achieved, maintaining final product moisture levels in the desired range. Due to the increased starch content, achieving the same or crunchier texture with increased moisture content is possible, i.e., instead of a 1.5% aim, a move to 1.8 or even 2.0 % can be achieved.

Besides reducing frying heat load, the smooth cut surface positively affects frying: oil uptake and adhesion on the slice are substantially reduced. Oil influx typically occurs through cracks formed during slicing and washing and tumbling steps. After PEF implementation, a 2 -3 % reduction in oil uptake in absolute numbers or a 10 % reduction in relative numbers is achieved without undesirable effects on product texture and taste. Considering current frying oil pricing, the reduced oil uptake is the single most significant contributor to a fast investment return.

Batch frying

Kettle or hand-cooked chips are produced in batch frying lines, without an intermediate washing step. PEF allows the reduction in frying time and temperature and /or increased batch sizes leading to more consistent product quality and higher yields. Faster moisture release and reduced stickiness due to less free starch on the slices allow up to 10 % increased batch sizes. With optimized conditions final product, shows increased crunchiness as well as improved colour and consistency

Vegetable chips frying

PEF is the perfect solution for vegetable chip processing. High sugar levels of sweet potato, carrot or beetroot and high oil uptake may result in colour and texture problems. PEF treatment and subsequent washing allow for enhanced extraction of reducing sugars, optimization of the frying curves/process and reduced browning during frying. Improved cutting results in less tissue breakage, higher yield and reduced oil uptake. I.e. for sweet potato chips, a yield increase of 2.5 % and a 15 % oil uptake have been observed. PEF performs well with atmospheric frying as well as vacuum frying.

Case study: Savings and sustainability benefits

For a processing line of 1,300 kg/g finished product or 5,400 kg/h raw material and an annual production of 5,200 h, yield increase and oil savings have been monitored compared to investment and operation costs. Yield increase and oil uptake reduction have significantly contributed to the return on investment calculations and deliverables. After PEF implementation, the starch loss has been reduced by 10%, corresponding to an extra yield of 90 t/h, and reduced breakage and fines lead to an additional final product yield of 22 t/year. Oil usage has dropped from 2,350 to 2,120 t/ year, an annual oil saving of 230 t.

elea-technology.com

Prof. Dr. Stefan Toepfl
Managing Director
of Elea Technology

TRENDS AND FUTURE GROWTH

As the #1 Global Leader in Food Cutting Technology, Urschel has manufactured thousands of cutting machines. The form and function of every cutting machine is the sum of both the components and the craftsmanship.

Customers rely on Urschel because they know every machine built is backed by solid, engineered accuracy. Machines manufactured to withstand rugged production environments. Engineers, service, and support partner with customers for the life of their cutting machinery.

POTATO PROCESSING TRENDS

Supplying and keeping up with the everchanging needs of the food processing industry is challenging.

Mike Jacko, Vice President of Applications & Product Development: *"We periodically have customers ask for something new, something unique. We welcome it. Sometimes the request is for a similar product to what's out there already. It could be patented already or exclusive for use by a particular customer or industry".*

Some new cuts are adaptable to current machines and could be relatively easy and inexpensive to make, while others may be very complicated and costly especially with the unknowns.

Small niche products can evolve into big sellers. A processor knows that developing a specific shape gives them an advantage by helping them stand out from the pack.

What we are seeing is a blurring of the lines between what used to be clearly potato slices for crisps/chips and clearly potato fries. We are working under exclusivity agreements to pioneer some great hybrid potato consumer products.

Specific to potato slicing, customers have transitioned to the newer technology of the MicroAdjustable® CC SL-14 Heads. The feedback we are getting is very positive. Faster everything. Sanitation. Adjustments. Blade and head changeovers. Less operator engagement needed. Less labor costs. Increased yield and increased customer satisfaction.

The DiversaCut® Series remains the mainstay making crinkle and deep crinkle fries, skillet dices, halved/quartered baby potatoes, and flat fries.

The Comitrol® Processor Series is used for bits and piece used in tator tots, hash brown patties, and big in dehydrated flakes. The E TranSlicer® Cutter is common also for sliced products, even wedge cuts cut into triangular pieces. All of the above Urschel machines have 'special' set-ups to do oddball unique cuts too. Keep in mind we feel we make the best, least costly watergun knives available.

NEW CONSTRUCTION – NETHERLANDS & U.S.

Urschel B.V., located in the Netherlands, has finalized architectural plans and the construction of their new facility will soon commence. Part of Urschel International, a subsidiary of Urschel U.S.A., the new facility will be comprised of office space, storage, and a test cutting center. The business, currently located at 3961 NL Wijk bij Duurstede in Vogelpoelweg, will move to Morsestraat 1 4004JP Tiel. Construction is scheduled to take several months.

Alan Major, Chief Sales Officer: *"Urschel International was established in the 1970's to supply food cutting solutions and fully support food processors throughout Europe. Building long-standing relationships has allowed our company great success and we are optimistically moving forward with the planning and construction of the new site".*

Urschel U.S.A. Headquarters is in the process of adding 115,000 square feet of manufacturing space to the current 410,000 square-foot facility. This marks the company's third expansion since building the newly constructed plant in 2015. The facility is centrally located in Chesterton, Indiana, U.S.A., one hour outside of Chicago.

Rick Urschel, President/CEO: *"We were basically running out of space. Many of the key departments needed more room to grow. The new manufacturing space will allow more flexibility in order to purchase state-of-the-art production technology".*

The expanded area will positively impact workflow of parts, increase cellular manufacturing, and promote overall productivity throughout the shop. Food processors will benefit by Urschel continuing to grow to meet the industry expectations.

INNOVATIVE THINKING

In 2022, Urschel enabled an offsite development facility. The Innovation & Development Center (I&D) represents a new Urschel investment into the future growth of the food processing industry.

Dustin Gereg, Innovation & Development Manager: *"This allows for the ability to rapidly iterate on new ideas and designs at a rate much faster than normal allowing us to learn and improve on these ideas. This new investment into the future growth of innovation and new product development will lead to newer, more innovation technology offerings to the market at a more rapid rate".*

The ability to work in a very collaborative environment with a group of experts in different disciplines while all maintaining the same focus is a strength of this team.

Urschel's decision to pursue this new endeavor is a commitment to growth of new technology offerings for our customers. It is an investment in future growth in the industry. It demonstrates the commitment to remain the global industry leader in size reduction technology. Even as a more than 110-year-old company we choose to not rest on our successes of the past, but instead show a willingness to grow and change for the betterment of the industry.

TECHNOLOGY

Erik Brown, Electrical Engineering Manager: *"As our customers increase in their processing controls environment, the potential for smart technology within our machines has increased. The investigation of PLC's (programmable logic controller) and HMI's (human machine interface) on our machines started a few years ago when we determined it was time we could benefit from this type of technology on our equipment. Once we finalized on a platform that was most suitable to accommodate our customers, the development started shortly after".*

As engineers, we felt that offering a smart machine was the next step to improve the controls and to gain many benefits. This jump allows us keep up with the ever-growing technology, due to many types of sensors (safety, temperature, detection, etc.) being more efficient when utilized within a PLC system. This flexibility is also paired with many other machine benefits.

BENEFITS OF THE PLC & HMI SYSTEM:

- Ability to quickly identify safety statuses to reduce downtime
- VFD or Soft start faults displayed to reduce troubleshooting time
- Alarms to alert users if a guard has been removed or if an E-Stop has been pressed while the machine is running
- Amperage of the motors are displayed on screen to help determine proper feeding.
- Continuous trending of the machine's amperages
- Customizable maintenance timers
- Datalogging machine information
- Different language options
- Ability to use VNC viewer and watch or control the HMI screen remotely from a control center.
- Ability to remotely start or stop the machine and pull all data from the PLC to a customer's control center
- Recipes for custom speed selections based on the product.

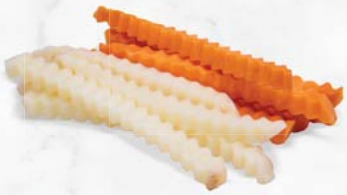
Established in 1910, founded by inventor William E. Urschel, the U.S. manufacturing company continues to grow and develop cutting solutions for the food and allied industries. The company offers free-of-charge test cutting services to showcase the functionality and benefits of Urschel's advanced cutting machinery. This service is available in-person, via video, or live remotely without cost or obligation.

Contact your local Urschel office for more information: www.urschel.com. ■

EXPERT CONTRIBUTORS

Rick Urschel, President/CEO
Alan Major, Chief Sales Officer
Mike Jacko, Vice President of Applications & Product Development
Erik Brown, Electrical Engineering Manager
Dustin Gereg, Innovation & Development Manager







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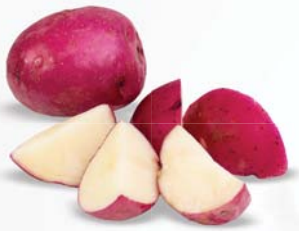



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KEY SELLING POINTS OF POTATO FRYING SYSTEMS

When looking at the distinction between batch fryers versus continuous fryers in potato processing lines, the arguments often revolve around the overall amount of frying oil in the entire frying system compared to yield.

Ionel Vaduva

"Normal continuous potato chips fryers have an Oil-Turn-Over-Rate of less than eight hours whereas, in a traditional batch fryer, it can reach 35 - 40 hours. The Oil-Turn-Over-Rate is defined in hours and calculated as the weight of the vegetable oil in the frying system divided by the weight of oil pick-up in the chips per hour. The longer Turn-Over-Rate, the higher risk for the frying oil to get rancid," Rosenqvists experts explained.

Protecting the vegetable oil in a batch fryer is more difficult because it will not be covered by a steam protection layer during the final two minutes of frying. After all, the frying time is typically five to seven minutes and the water inside the potato slices is evaporated during the first two minutes.

"Most batch fryers are heated by gas. The gas is fired in tubes placed inside the frying pan. The open flames inside the tubes are heating the oil. The flame temperature from the gas can be very high, perhaps even as high as 800–900 degrees Celsius. If the tube system is not properly designed, the heat penetration onto the oil will be too high, resulting in hot-spots film and uneven temperatures causing the vegetable oil to break down faster," the engineers added.

Direct gas-heated fryers are suitable for capacities of up to 150-160 kg/h of finished potato chips. However, for higher capacities (250-300 kg/h), an alternative heating source is recommended to minimize total oil volume and allow for additional technical solutions to the aforementioned issues. This is because the total amount of vegetable oil in the batch fryer system is critical.

One of Rosenqvists Food Technologies' solutions is the patented dual-function fryer. A fryer for true batch fried chips and normal potato chips. All in the same pan.

According to company experts, the market has seen a growing interest in batch-fried chips over the last 7-8 years. So the company designed a pan that has two different systems inside its hood, which can be switched. Each one has the required elements needed to transform the fryer between continuous and batch-style production.

As the potato slices enter the fryer, one or two paddle wagons (agitators) will be moving back and forth in the frying pan separating the individual slices and ensuring that the bed of slices is in motion. The sequence of the action of the paddle wagons is set by the PLC program. The number of trans-movements, the speed of the paddles, the duration of stop and start times at each end, etc. are set in the recipe program for each type of potato chips being produced. The total frying time and requested temperature at the end of the batch cycle can also be set to match the product criteria set by the snack processor. When the chips are done, a

gate opens, and the automatic take-out conveyor transports the chips to de-oiling and toward the seasoning system.

IMPROVE PRODUCTIVITY AND QUALITY WITH SPECIALIZED POTATO CHIP FRYER DESIGNS

Batch fryers for kettle-style potato chips are only used for hard-bite, slow-cooked potato chips due to their specific temperature profile, Heat and Control experts say. When it comes to high potato moisture content, a batch fryer is required. Batch fryers for potatoes use a kettle of static, hot oil that is heated either directly by a gas burner burning beneath the fryer pan or indirectly through heat-transfer tubes immersed in the oil. These tubes can be heated using a gas burner, steam, or thermal fluid.

With each batch of potato slices entering the oil, the cooking oil temperature initially drops and then gradually rises as the moisture in the potato slice is cooked off and the burner system regains the ideal frying temperature. Because of the unusual hard-bite texture produced by this "inverted bell curve" temperature profile, these chips are 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

Protecting the delicate vegetable oil in a batch fryer is more difficult because it will not be covered by a steam protection layer during the final two minutes of frying because the frying time is typically five to seven minutes and the water inside the potato slices is evaporated during the first two minutes.

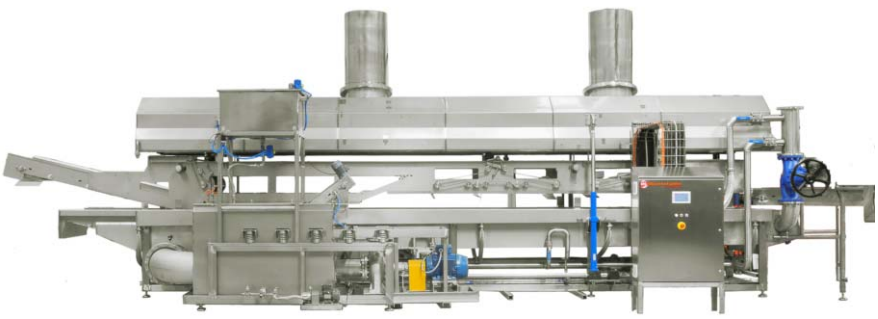
The flame temperature from the gas can be very high, perhaps even as high as **800/900** degrees Celsius.

227 Kilograms of finished potato chips per hour," the company engineers explained.

The designs of continuous fryers differ in terms of heat load, product handling, oil filtration, and production capacity, but they all typically cook food in a continuous flow. The large amount of moisture that must be boiled off during the frying process, as well as factors like responsive, accurate, and consistent temperature control, necessitate an externally-heated continuous fryer design for potato products like chips, sticks, co-products (e.g., tots, patties), French fries, or batter-coated fries.

Continuous fryers with capacities ranging from 91 to 2,948 kg of finished potato chips per hour and up to 22,680 kg of completed French fries per hour are available. External heat exchangers use gas or light fuel oil burners, steam, or thermal fluid to heat cooking oil. These fryers circulate oil constantly through a filter, an external heat exchanger, and single or multiple inlets and exits.

"For a processor who 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 advised.



"A STEP FORWARD IN FRYING"

When it comes to Kiremko's CORDA Invicta, the oil flow was redesigned from the bottom. The belt in the fryer is a completely new closed chain with low maintenance rolling rather than slurring. It also has an embedded control system that leverages data from the processing to improve the fryer's efficiency. The Kiremko CORDA Invicta is a step forward in frying, with 30% less oil content, a 15% smaller manufacturing footprint, a variety of high-tech advances, and a lower Total Cost of Ownership. All the while ensuring a consistent, high-quality result, independent of layer thickness.

The entire metal belt with the integrated chain-link architecture of the CORDA Invicta minimizes plastic pollution while assuring excellent product quality and decreasing wear. The rolling belt support and the one-of-a-kind circulation pump reduce friction and wear, resulting in longer service life.

The Kiremko CORDA Invicta features an integrated dirt removal system, steam blanketing, and automatic fire extinguishing. This keeps your production line, factory, and people safe.

The enclosed system has minimized vapor emissions while maintaining safety. However, the integrated cover and bottom operating system ensure that the interior is secure and simple to access. In comparison to its rivals, the Kiremko CORDA Invicta requires less time and cleaning supplies because of its inside-and-out hygienic design.

"A UNIQUE TREATMENT OF THE OIL"

EFS-Fryers, with its multi-flow continuous frying systems in the limelight, delivers a wealth of expertise and competence to the design and manufacture of fryers.

"Our heating and filtering system guarantees a unique treatment of the oil, the first cause of obtaining the excellence of the product," the company's representatives mentioned.

Batch HE 200 is a new fryer concept, with greater production and better oil treatment that allows the differentiation and quality of the customer's product, and intermittent frying process for productions up to 130/140 kg/h of fries/chips. Its driver and stirrer arm has variable motorization in both speed and direction of rotation, allowing greater product occupation on the frying surface.

The EFISYS range is built with a hygienic design in AISI 304 stainless steel. The product is transported with the help of pallets and immersion mesh, which, together with the different applicable speeds, allow the manufacture of different products. EFISYS incorporates, as an option, the multi-flow oil feed system, improving energy efficiency. It has a system of easy cleaning thanks to its automatic CIP washing system and easy interior access. The oil is continuously filtered, and the filtration equipment (different systems can be chosen) is self-cleaning.

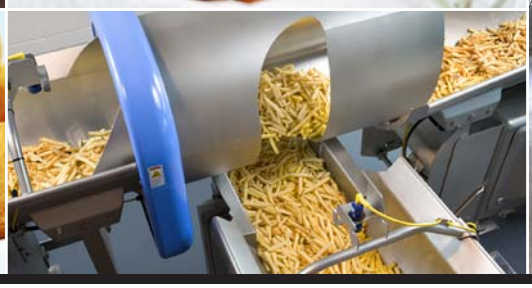
The Efisys Fryer range covers production equipment from 300 kg/h to 1500 kg/h. ■









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INNOVATORS IN CUTTING TECHNOLOGY FOR POTATO CHIPS AND SNACKS PROCESSING

The potato processing market has been steadily increasing in the last few years and this trend is expected to be continued. Following this growth, many companies working in this field have presented different innovations in recent years: new storage options, new pretreatments, new fryers, and new cutting systems.

Emerson Jiménez Barajas, Application Director, FAM STUMABO

One of the most important steps for most potato processing plants is the cutting process. During this step, the shape of the final product is defined. The cutting process in the potato processing market has seen some important innovations in the past years.

QUALITY

The main points that potato processors are looking for are good quality and improved capacity or yield, which are both related. Quality is a somewhat subjective parameter as it depends on the expectations of the processor and the final customer. There are some elements that define if the quality is good, like the slice thickness consistency, and the amount of scrap or off-cuts. It is also a general rule that when the processing line is not producing a good quality product, the capacity of the line is also affected as more scrap or off-cuts are produced and therefore less final product comes out of the line. Therefore, when a potato processor is working on quality, the yield of the line will also be positively affected.

Scrap or off-cuts have a big impact on quality. These are generally small pieces that do not correspond to the quality specifications. They are normally produced because of the shape of the produce. Yet, they also originate when the produce is not stable during cutting, when the knife is not stable or is not sharp anymore. It can also happen when something is obstructing the path between the produce and the knife.

FAM Centris™ product range for centrifugal slicing and shredding

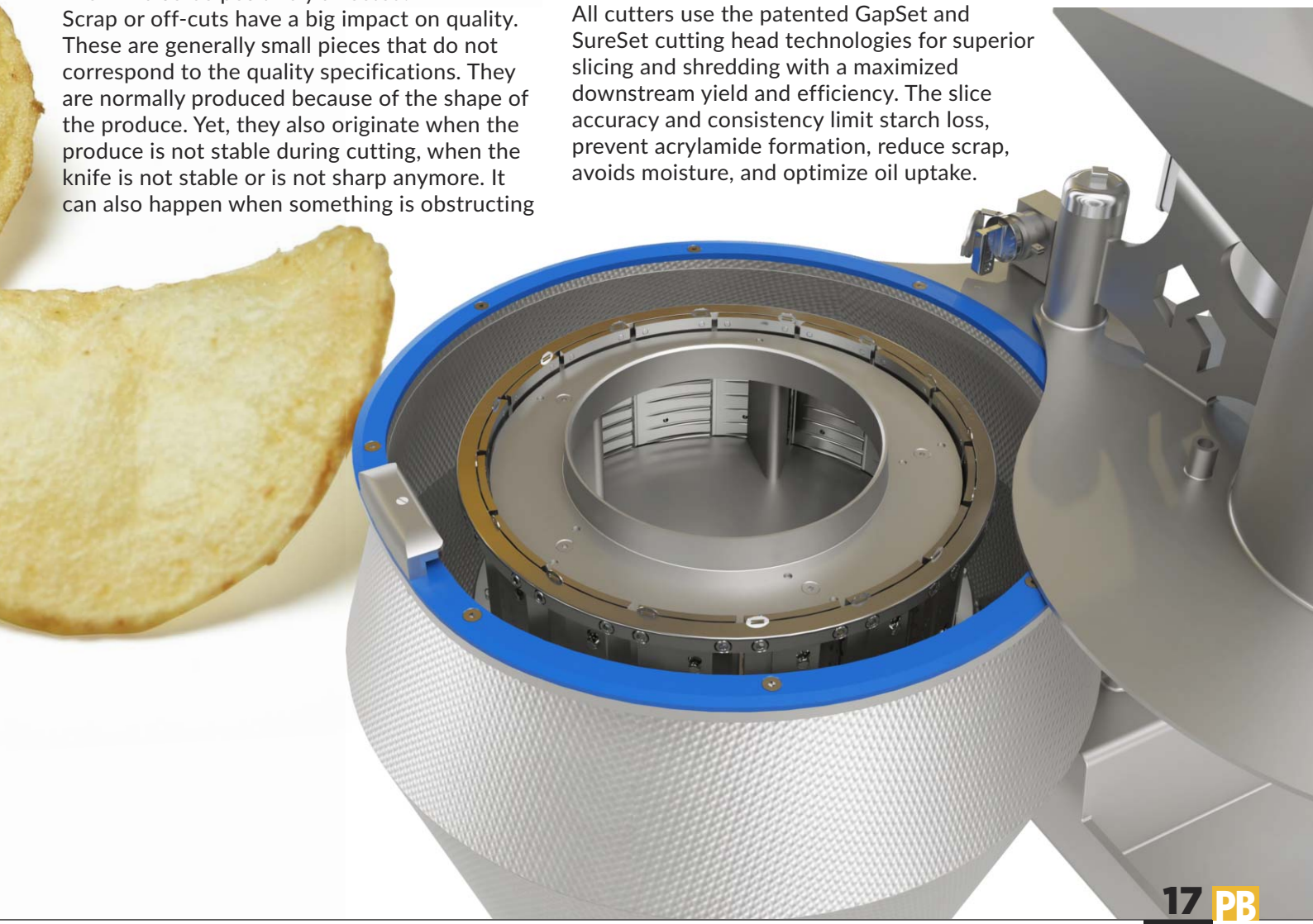
Innovation has always been at the heart of our success. This has been done through listening to the requirements and needs from our customers. We have developed the FAM Centris™ product range for centrifugal slicing and shredding which introduces advanced cutting technology into your potato chips line – being it batch or continuous lines.

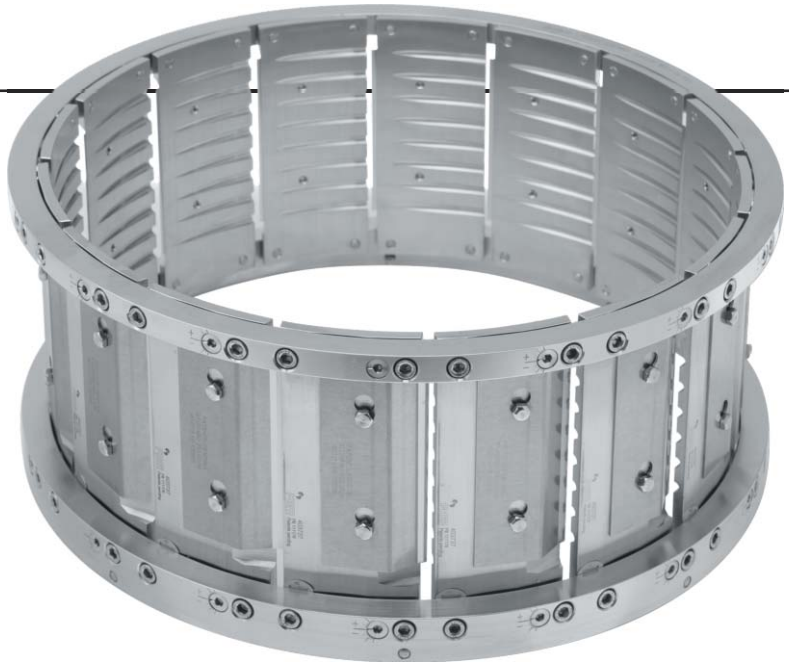
The FAM Centris™ 400P is powered by the SureSet 16P cutting technology guaranteeing consistent slice accuracy throughout the cutting process, for the highest capacities at the highest quality.

The FAM Centris™ 315P uses the GapSet 12 cutting head and is an ideal cutter for low to medium capacities at the highest quality.

Producing vegetable chips brings different challenges, thus solutions, compared to producing potato chips. The FAM Centris™ 400 has specific features to position, cut and handle all kinds of elongated products, with different solid contents to create the perfect slice, both longitudinal and transversal. It's a perfect cutter for all kinds of vegetable chips, where accuracy is crucial.

All cutters use the patented GapSet and SureSet cutting head technologies for superior slicing and shredding with a maximized downstream yield and efficiency. The slice accuracy and consistency limit starch loss, prevent acrylamide formation, reduce scrap, avoids moisture, and optimize oil uptake.





REVOLUTIONARY CUTTING HEADS

Some years ago, FAM started a revolution with the introduction of centrifugal slicing and shredding technology. Following years of continuous improvements, we recently launched the next generation of SureSet cutting heads: the FAM SureSet Stone Defender.
The superiority of this cutting head is the result of continuous improvements carried out by our Food R&D department on existing SureSet technology. The results are higher product quality, less waste, a lower total cost of ownership and more operator-friendliness.
To incorporate the wide-ranging advantages of the SureSet technology into your existing slicer, we offer different conversion kits to upgrade your existing lines with all the benefits of the SureSet technology. The conversion kit comes with the patented DualStage impeller wheel and the support plate to fit the SureSet technology on your existing slicers. The patented DualStage impeller ensures the potato always remains stable during the slicing process. It also maximizes the capacity, as it can slice two potatoes at the same station simultaneously.
The light weight of the cutting heads ensures simplified operations. Their sanitary design avoids starch build-up and reduces the cleaning time.
The 'Set & Forget' feature guarantees a solid cut quality without adjustments. The cutting head will always stay adjusted.

PRECISION BLADES

Improvements were made in the materials of the blades to have a more resistant cutting edge that keeps it sharpness longer or that resists better the impact of foreign objects. It was also important to consider that a stable product and a sharp knife could not work properly if there is something in between affecting the cutting process. Therefore, some features were added to the cutting systems to allow any foreign element to exit the cutting area and reduce any interference between the potato and the blade.
Scrap, off-cuts, and slice thickness consistency are also a nuisance for any post-treatment done after cutting. They can block systems, affect fryer stability, and oil quality, interfere with heat exchange, reduce hygiene conditions, etc. So, minimizing its production has also benefits for the rest of the processing line, including energy consumption as some of these post-treatments require a lot of energy, and having a good cutting quality helps to reduce the amount of energy required to achieve the process.
Together we cut your product to perfection.■

INNOVATORS IN CUTTING TECHNOLOGY FOR **POTATO CHIPS AND SNACKS** PROCESSING

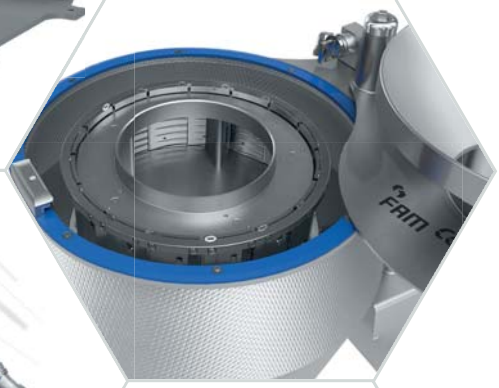
Centris 315P & 400P powered by patented GapSet and SureSet cutting head technologies

For superior slicing and shredding with maximized downstream yield and efficiency:

- Slice accuracy and consistency limits starch loss, prevents acrylamide formation, reduces scrap, avoids excess moisture and optimizes oil uptake

Up to double the capacity without compromising on quality:

- Unique, pantented 12 or 16-station cutting heads
- Dual stage impeller
- Premium precision blades designed and manufactured in-house



Simplified operations:

- Light weight cutting heads
- Sanitary cutting head design avoids starch build-up and reduces cleaning time
- 'Set & Forget' GapSet slice thickness mechanism
- Easy-dial SureSet high precision slice thickness adjustment

Reduced TCO thanks to Stone Defender technology with active crash protection

Can be integrated into all leading snack processing lines

Dedicated solutions for both batch and continuous processing lines with the choice for low, medium or high capacity

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INDUSTRIAL FOOD CUTTING SOLUTIONS

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brochure

EFFECTIVE METHODS USED IN FRIED POTATO PRODUCTS COATING

In potato chips and French fries production, the industry's key players are looking at coating agents as an effective way to satisfy consumer preferences as well as tackle health concerns.

Ionel Vaduva

When it comes to giving a product more texture or crunch, breadcrumbs are one example of a popular coating agent. Breadcrumbs can be used to coat potato pancakes or croquettes for a crisp, golden-brown exterior. Cornmeal is another favorite potato coating. Besides giving the product more texture or crunch, coating agents also prevent potatoes from clinging to one another, which can be an issue in the potato frying industry. Flour is another typical coating used in potato processing. Flour can be used to coat potatoes before frying or baking to create a crisp exterior and prevent sticking.

THE FLAVOR APPLICATION SOLUTION

Another important aspect of meeting customer expectations is flavor application. Experts say that electrostatic outperforms more conventional tumbling drum methods of flavor application because a high degree of consistency of coating is necessary to produce good taste and flavor. This type of application ensures minimal product waste and fall-off, making it a win-win situation. Electrostatics produces a 'wraparound' effect, which ensures that every part of the product is coated uniformly. This allows customers to taste flavor throughout the product rather than discovering that half of the coating has fallen off to the bottom of the packet.

"Electrostatics is already well-established but there is huge potential for it to grow still further. Over the last two decades, we have seen market demand increase as more and more people recognize the benefits it can deliver, but there are more opportunities. As manufacturers and food processors continue to look for cost savings and efficiencies combined with an improved customer experience, we believe electrostatics will take its rightful place at the table as the go-to system for flavor application," according to Peter King, founder of Spice Application Systems.

ADDRESSING THE FAT CONTENT AND THE SHELF LIFE DECREASE

Deep-frying is used in the industrial processing of potato goods such as potato chips and French fries, resulting in delightful crispy treats. However, depending on the potato variety and processing method, frying can result in an increase in fat content and a decrease in shelf life. To address these issues, researchers and food technologists have created functional coatings that can prevent these issues while also improving overall product quality.

These coatings serve as barriers that stop oil from entering the potato matrix, so lowering oil uptake without sacrificing the desirable texture and flavor. One such coating is based on modified starches, which, when applied to the potato surface during frying, form a thin film and prevent the potato from absorbing oil.

French fries that have been frozen or par-fried frequently use coatings to give them their signature color and texture. However, the application of these coatings also affects the uptake of oil and the accumulation of acrylamide. Since oil uptake has a direct impact on the overall quality and flavor of the finished product, it is a crucial factor to take into account when producing French fries. Fries fried in oil have a higher overall fat content because the starch in the potatoes absorbs the oil. By acting as a barrier that delays oil absorption, batter coatings,

Since oil uptake has a direct impact on the overall quality and flavor of the finished product, it is a crucial factor to take into account when making French fries.

Using **1%** CMC as an edible coating material was more effective in reducing oil uptake and improving the sensory qualities of fried potato chips.

for example, can help reduce the amount of oil that fries absorb. Utilizing specific starches, like pre-gelatinized starches, processors can successfully lower the oil uptake.

USING PROTEIN- AND POLYSACCHARIDE-BASED COATINGS

As a result of the water in the raw potato material evaporating during frying and being partially replaced by oil, which makes up 40% of the completed product, its qualities are impacted. consequently, eating fried items in deep oil has been linked to obesity, type 2 diabetes, and coronary heart disease. Before frying, choosing the right food coating may prevent moisture loss, and also lower the amount of fat that is absorbed.

Recent research has demonstrated the viability of using coating materials such as protein- and polysaccharide-based coatings as foundation ingredients in food items. These materials have qualities that can thicken, gel, stabilize, form films, disperse, and change textures.

The mechanical and barrier qualities of a coating material, which are influenced by its composition and micro-structure, as well as the properties of the food product it binds to, determine how effective it is. To minimize water loss from the coat, hydrophilic bio-polymers can be employed as water binders in coatings. Oil uptake would be decreased if water loss could be decreased.

The majority of commercial bio-polymer coatings that make this claim about how they prevent fat absorption are made of polysaccharides. The surface tension between the oil and the food might also be decreased by using coating materials as emulsifiers in composite films, which would help to reduce oil uptake.

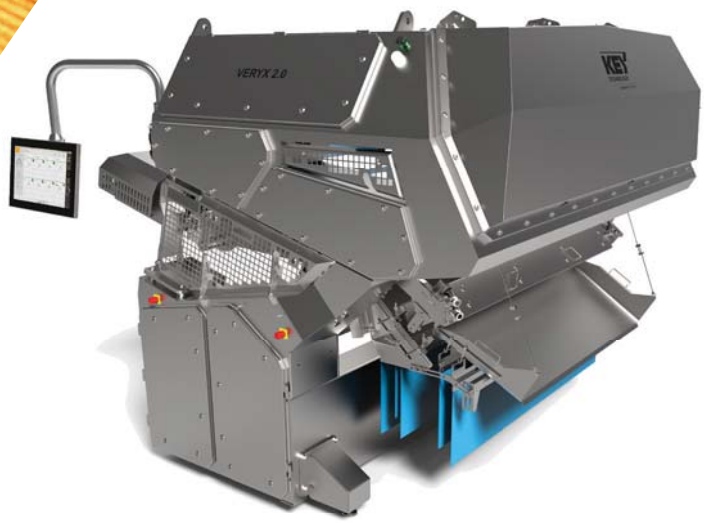
"The effect of coating materials on moisture content and oil uptake of potato chips after being fried in sunflower oil at 180±5°C and data indicated that potato chips immersed in 1% carboxy methyl cellulose (CMC) as edible coating material had the highest reduction rate in oil absorption followed by potato chips treated with 1% xanthan gum (XG) and those treated with 10% soya protein isolate (SPI); 35.20, 30.32 and 24.72%, respectively. Results [...] revealed that increasing CMC, XG, and SPI concentrations were accompanied by decreasing the oil content of fried-coated potato chips. The thermal gelation properties of coating materials led to the formation of a small number of wide punctures with low capillary pressures, which resulted in less oil entrance to the pores", the 'Coating Materials as a Potential Pre-treatment for Reducing Oil Uptake of Fried Potato Chips authors wrote.

To reduce the amount of oil that fried potato chips absorb, the coating was crucial as a pre-treatment process. The moisture content maintained in the fried potato chips and the oil uptake were inversely correlated. The authors said that using 1% CMC as an edible coating material was more effective in reducing oil uptake and improving the sensory qualities of fried potato chips. It also had a minor impact on the physical and chemical characteristics of the oil used for frying at 180°C for 24 hours.

SPI was efficient at reducing oil uptake, and as its concentration rose, so did its effectiveness at reducing the rate at which oil was taken in, but it had several adverse effects on the physical and chemical properties of the oils used in frying, making it impractical to use on a large scale.

The research on these experimental coatings has shown some encouraging results, but more research is still required to discover the best concentrations, application techniques, and compatibility with the sensory qualities of potato chips. The actual application of such coatings in the food sector is heavily influenced by regulatory considerations as well as customer approval. ■

Optimize Yield, Quality & Productivity



INTEGRATED SORTING, CONVEYING AND PROCESSING SOLUTIONS

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- **Improves process efficiency** – through smart system connectivity and access to a rich set of digital data about your product and sort operation

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PRESERVING PRODUCT QUALITIES THROUGH PRECISE REGULATION OF PROCESS HUMIDITY

Potatoes have a lot of water when they are harvested. In the production of snacks, value-added foods, and byproducts, moisture is gently removed. The formation or preservation of desired features, such as maintaining taste, color, and texture, is made possible by precise regulation of drying and process humidity.

Ionel Vaduva

Dehydration can provide a long shelf-life, for dehydrated potato slices, dices, and shreds, while retaining fresh potato flavor and texture when reconstituted.

"For pre-form product and retrogradation, drying with integrated cooling can achieve the perfect surface texture for the forming of co-product for hash brown-type products. For convenience and frozen food processors, a dehydro-frozen dryer can effectively process value-added potatoes and vegetables, often diced for soups and stews," Ron Walunas, Senior Applications Engineer at Buhler Aeroglide Corporation mentioned.

A multi-stage, single-pass conveyor dryer can effectively handle potatoes for any application, including drying, roasting, and dehydration. As the product goes through various zones with individually controlled temperature, humidity, and airflow, processing uses air to transmit heat and remove moisture.

Impingement processing provides a homogeneous airflow across the whole conveyor for roasting and color development, ensuring consistent color at high volumes. The oven edge effect is eliminated by the quick, uniform high-heat transmission provided by high-velocity impingement air tubes over the conveyor bed. Through high-speed pinging against the surfaces, impingement systems remove the boundary layer surrounding the product.

When compared to lower velocity convection or via air systems, this significantly accelerates heat transfer, cutting the time required for the operation by at least 50%. Airflow and temperature from above and below the conveyor are accurately controlled by dual impingement systems, which are designed for this purpose.

To ensure a uniform drying process at each stage of processing during dehydration, a multi-stage drier with transfer sections between stages will gently reposition goods. The multi-stage processing method for pre-formed products offers flexibility in cases when additional cooling time is required for starch gelatinization. A multi-stage setup provides the operational flexibility required to adjust process air, humidity, airflow rate, and retention time at different phases of processing for dehydro-frozen products, where the focus is on flavor concentration and water removal.

MANAGING EMISSIONS COMING FROM THE DRUM DRYERS

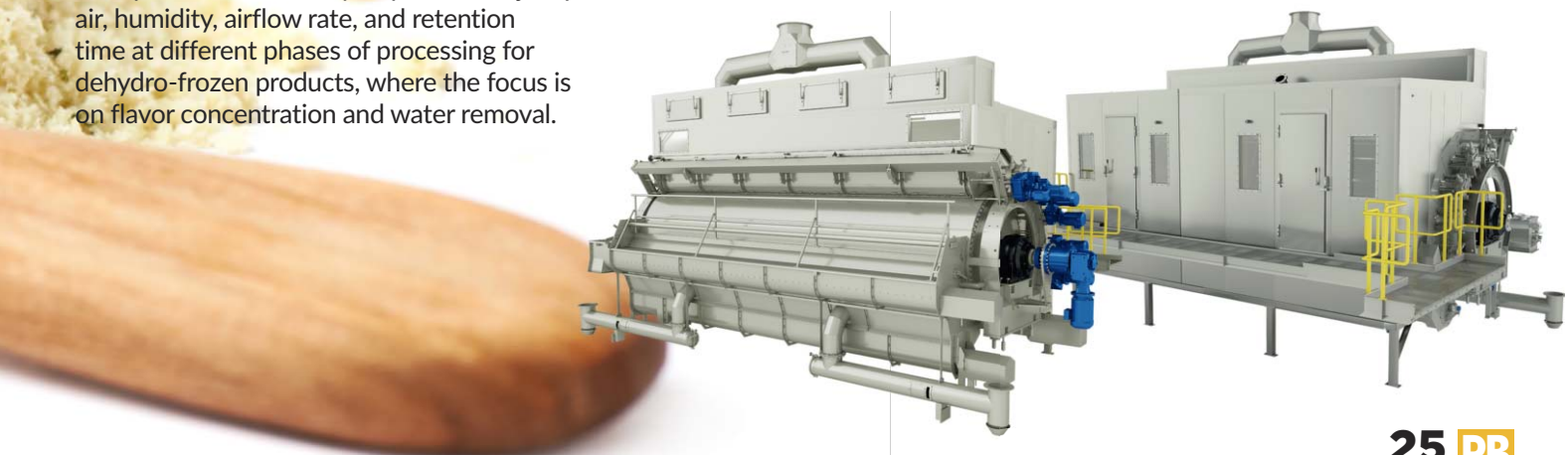
With the inclusion of the Steamclosure Extraction System, Tummers is advancing the Emission to Energy (E^2E) idea in collaboration with its partner, Solutherm.

This concept employs novel ways to convert pollutants to energy, allowing customers to develop a future-proof, sustainable, and cost-effective manufacturing process. Another step closer to the emission-free industry of the future.

"The process of drying out potato puree to make flakes produces a lot of emissions in the form of steam. Until recently, this steam was still being released into the outside world through flues, wasting energy and polluting the landscape with visible and smellable emissions. Now, however, the introduction of the E^2E SteamClosure means those days are over," according to a recent press release.

The process of making flake entails transferring puree over a hot drum dryer, which removes moisture and leaves behind a thin layer of potato. Then, this is mashed up to the required size of potato flakes. During the process, a significant amount of steam is released and needs to be removed. Due to the clever construction of the recently created and patented Tummers E2E SteamClosure, which is installed hermetically over the drum dryer, all the steam is caught in its purest form. ■

When compared to lower velocity convection or via air systems, this significantly accelerates heat transfer, cutting the time required for the operation by at least **50%**



THE VALUE OF QUALITY FRYING OILS

Oil seed crops are planted throughout the world to produce cooking oil. The seeds are washed and crushed before oil is removed using an extraction process. The oil is then refined to remove any unwanted taste, smell, color, or impurities. Frying oils are a critical component of the food processing industry, especially in the production of French fries, potato chips, and other deep-fried snacks.

Tudor Vintiloiu

Different types of frying oils exist, with each offering varying levels of quality, stability, and health benefits. The choice of oil used in large fryers within the potato processing industry is a critical factor that affects the quality and taste of the final product, as well as production costs. Some oils, such as virgin olive oil, walnut oil, and grapeseed oil, are pressed straight from the seed or fruit without further refining.

Some other sources of frying oil include sunflower, canola, palm, and soybean. Most vegetable oils are liquid at room temperature. When oils are heated, unsaturated fatty acids, which are the building blocks of triglycerides, are degraded. Monounsaturated-rich oils, such as olive oil or peanut oil, are more stable and can be re-used much more than polyunsaturated-rich oils like corn oil or soybean oil. For this reason, when deep-frying foods, it is important not to overheat the oil and to change it frequently.

BEST OPTIONS FOR THE POTATO PROCESSING INDUSTRY

The potato processing industry requires frying oils that can withstand high frying temperatures and offer excellent stability, flavor, and shelf life. Based on these requirements, vegetable oils, such as canola, soybean, and sunflower oils, are the best options for use in large fryers. These oils are readily available, cost-effective, and have high smoke points, making them ideal for use in the potato processing industry. In addition, the use of high oleic versions of these oils can further enhance their stability and prolong their life.

Proper filtration and temperature control, as well as the judicious use of antioxidants, can also help extend the life of frying oils, reducing production costs and improving the quality of the final product.

DEGRADATION OF FRYING OILS

Frying oils undergo various forms of degradation during use. The most common types of oil degradation include oxidation, hydrolysis, and polymerization. Oxidation occurs when the oil reacts with oxygen, leading to the formation of free radicals that cause the oil to become rancid. Hydrolysis occurs when the oil reacts with water, leading to the breakdown of the oil into fatty acids and glycerol. Polymerization occurs when the oil's fatty acids react with each other, leading to the formation of polymerized compounds that can cause the oil to darken and form deposits.

SOLUTIONS TO PROLONG THE LIFE OF FRYING OILS

Filtering

Filtering the frying oil is an effective way to remove food debris and contaminants that can accelerate oil degradation. Filter systems can be installed in large fryers to remove impurities, thereby extending the life of the frying oil.

Reducing Frying Temperature

Frying oils degrade faster at high temperatures. Reducing the frying temperature to the recommended range (320-375°F) can help prolong the life of the frying oil.

Using Antioxidants

Antioxidants, such as butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT), can be added to frying oils to reduce oxidation and extend the oil's shelf life. However, the use of these additives must be limited to approved levels as they may have adverse health effects.

Using High Oleic Oils

High oleic oils, such as high oleic canola oil, are more stable than regular vegetable oils due to their high levels of monounsaturated fatty acids. They have a longer shelf life and are less prone to oxidation.

Chemical Reactions

Many chemical reactions take place during frying and affect the quality and storage time of the oil. Several of these reactions lead to spoilage of the oil. Hydrolysis is the major chemical reaction that occurs during frying. As the food product is heated, water in the food evaporates and the water vapor diffuses into the oil. The water molecules cause hydrolysis in the oil, resulting in the formation of free fatty acids, reduction of the smoke point of the oil, and unpleasant flavors in both the oil and the food.

The smoke point, or the burning point, of an oil or fat is the temperature at which it begins to produce a continuous bluish smoke that becomes clearly. For high temperature cooking (160– 190°C), an oil with a low smoke point, such as unrefined sunflower oil and unrefined corn oil, may not be suitable.

PROCESS

Repeated frying (using the same oil several times) increases the viscosity and darkens the color of the cooking oil. If the physio-chemical properties of cooking oil deteriorate, the oil must be discarded because it can prove to be harmful for human consumption. Antioxidants, such as Vitamin E, added during frying are extremely effective in decreasing the rate of lipid oxidation, while enzymes such as superoxide dismutase, catalase, and peroxidase are also beneficial. Nonetheless, Vitamin E effectiveness decreases with increasing temperature.

During frying, the water loss process passes three different steps. The first step corresponds to potato heating, involving mainly the loss of water

Oil absorption is influenced by a variety of factors; oil quality, product and frying temperature, oil degradation, frying time, frying duration, initial moisture content of food ingredients, product shape and content, porosity of coating, and the method of frying.

Oil fried potato chips contain up to **39%** oil, which accounts for **60%** of their calories. Fat and calorie contents of these chips are of concern to health conscious consumers.

at the cutting surfaces. During the second step, an intense formation of water bubbles and an exponential decrease of water content with time are occurring. The third step occurs after the formation of the crust, hindering the movement of the vapor bubbles, created by the internal gas pressure. Physical changes induced by frying process such as crust formation have been closely correlated to oil penetration, and this imparts the characteristic appetizing nature of the food. Also fried foods develop desirable organoleptic properties such as color, crispiness, texture, and fried flavor resulting in popularity among consumers.

OIL ABSORPTION REDUCTION

Oil absorption is influenced by a variety of factors; oil quality, product and frying temperature, oil degradation, frying time, frying duration, initial moisture content of food ingredients, product shape and content, porosity of coating, and the method of frying.

Oil fried potato chips contain up to 39% oil, which accounts for 60% of their calories. Fat and calorie contents of these chips are of concern to health conscious consumers. In many countries, medical authorities have implicated a high fat diet as being one of the major factors causing increased incidence of cardiovascular disease. Fats (lipids) are implicated in cardiovascular disease due to the fact that the fats are a major source of energy supplying about 9 kcal/g, whereas proteins and carbohydrates each supply about 4 kcal/g; eating a high-fat diet is conducive to obesity.

High oil content is therefore a major factor affecting consumer acceptance of oil-fried products today and the low fat food products are becoming more popular. In particular, during the past years, the American Heart Association and other health organizations have encouraged reduction of fats in foods to less than 30% of calories for most people. Saturated fat and trans-fat are the undesirable fats. Reducing oil content in potato chips is motivated by other reasons also; oil is a costly raw material and is an important determinant of the cost of a product. A high oil content often makes the chips greasy or oily. On the other hand, it is possible to make chips so low in fat content that they lack flavor and seem harsh in texture. ■

POTATO PROCESSING
INTERNATIONAL

2023 Feature Planning

1 JANUARY/FEBRUARY
Ad closing 16.01/Publishing 27.01

Key Exhibitors Road Map and Event Agenda

Processes
- Sorting, Pre-cleaning, Washing, De-stoning
- Energy and Water Saving

Expert View
- Cutting/Slicing/Dicing
- Sustainability in Production

Spotlight
- Cleaning and Sanitation

Markets
- Western Europe

Products
- French Fries in Retail and Foodservice

Ingredients
- Batters, Coatings

Storage Special
- Refrigeration and Long-term Storage
- Sprout Suppressants in Storage

Trade shows: Potato Expo 2023, Fruit Logistica 2023

2 MARCH/APRIL
Ad closing 13.03/Publishing 22.03

Key Exhibitors Road Map and Event Agenda

Processes
- Conveying Systems and Belts
- Process Monitoring

Expert View
- Automation - Ensuring a Reliable and Flexible Production Flow
- Drying - Innovation in Belt and Drum Dryers

Spotlight
- Smart Production/IoT/Industry 4.0

Markets
- North America

Products
- Chips and Potato-based Snacks

Ingredients
- Established vs. New Flavors

Storage Special
- Storage Challenges and Cost-saving Solutions
- Storage Design and Construction

Trade shows: World Potato Congress, Interpack 2023

3 MAY/JUNE
Ad closing 08.05/Publishing 19.05

Key Exhibitors Road Map and Event Agenda

Processes
- Cutting, Peeling, Slicing
- Seasoning & Coating

Expert View
- PEF Applications and Advantages
- Frying Tehnologies and Advancements
- Optical Sorting - Increasing Yelds, Reducing Waste

Spotlight
- Alternative Energy & Increasing Efficiency

Markets
- Eastern Europe

Products
- Hash Browns and Croquettes

Ingredients
- Frying Oils

Storage Special
- Power Saving and Sustainability
- Sensors and Data Gathering

Trade shows: Europatat 2023

4 JULY/AUGUST
Ad closing 17.07/Publishing 28.07

Processes
- Blanching, Frying
- PEF Systems

Expert View
- Cutting Accuracy and Equipment Reliability
- IQF Freezing for French Fries

Spotlight
- Supply Chain Management & Logistics

Markets
- South America

Products
- Flakes & Mashed Potatoes

Ingredients
- Seasonings for Chips and Fries

Storage Special
- Automated Climate Control
- Potato Monitoring & Quality Assurance

Trade shows: Potato Association of America Annual Meeting

5 SEPTEMBER/OCTOBER
Ad closing 04.09/Publishing 15.09

Processes
- Oil Filtration Systems & De-fattening
- Cooling and Freezing
- Starch and By-products Processing

Expert View
- Remote Maintenance and Customer Service
- Complete Lines for Processing
- Conveying And Product Transport

Spotlight
- The Road to Sustainability

Markets
- APAC/ANZAC

Products
- Extruded Potato Products

Ingredients
- Salt

Storage Special
- Disease Management
- Handling Potatoes to & from Storage

Trade shows: Potato Europe 2023

6 NOVEMBER/DECEMBER
Ad closing 07.11/Publishing 18.11

Processes
- "Forming and Extruding"
- Turnkey Projects
- Waste Management/Upscaling

Expert View
- Batch vs. Continuous Frying
- Cutting vs. Hydrocutting
- Pulsed Electric Field (PEF) Processing

Spotlight
- Increasing Production Capacity

Markets
- Global Market Predictions for 2024

Products
- Seasoning Trends

Ingredients
- Better for you/Clean Label

Storage Special
- Store Preparation and Hygiene
- Bulk vs. Boxed Storage

Trade shows: British Potato 2023

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