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## New generation PEF technology for potato processing

The innovative Dutch company Pulsemaster recently introduced a new generation PEF (pulsed electric field) technology claiming that it can significantly improve potato processing. The Pulsemaster PEF technology induces poration of potato cells, leading to cell disintegration. This makes the pulsed electric field systems an alternative to preheaters in the potato industry.

**T**he PEF treatment – claims Pulsemaster – can improve cut quality and significantly reduce French fry breakage. Water and energy consumption in potato processing are reduced; blanching, drying and pre-frying times are shortened. Furthermore, the leaching of sugars is improved. The treatment can also reduce the frying oil absorption and fat content by up to 50 per cent.

### ENERGY EFFICIENT, COMPACT AND HYGIENIC

Pulsemaster's technical improvement of the PEF concept is based on a more energy efficient process than the previous generation. This means that the new equipment gives better pulse treatment for potatoes with a more compact and modular pulse generator. The generator is combined with a robust and hygienic transport system and a PEF treatment chamber.

PEF processing is a continuous process and the Pulsemaster systems can be implemented in existing processing lines. The new range of industrial-scale equipment – named 'Conditioner' – has treatment capacities from one ton an hour to 50 tons an hour (about 110,000 lb/h) for potato processing systems.

On a commercial-scale, total costs of 1 Euro/ton (0.1 Eurocent per kg / 0.056 US Dollars per lb) can be expected, states Pulsemaster.

Pulsemaster aspires to further growth in the potato, fruit and vegetable industry. The company has rapidly developed its export activities. In Seattle/Bellevue, Washington Pulsemaster has an office for the North-American market at its disposal. "Worldwide the potato industry in particular shows great interest in our new generation PEF technology," said Pulsemaster's Managing Director Mark de Boevere. He also answered a few additional questions from Potato Processing International in order to clarify the PEF process.

**PPI: The pulse generators have a proven track record for industry, research, medical and defense applications. PEF processing is restricted to use on food products with no air bubbles and with low electrical conductivity – how do potatoes fit into that category?**

Mark de Boevere: Potatoes are considered excellent conductors because they are uniformly solid, contain about 80 per cent water and are rich in potassium. By permeabilizing cell membranes, PEF enables tissue softening →



and enhanced mass transport, resulting in the improved cutting of potatoes, higher product quality and increased process capacity. Osmotic pressure or turgor pressure in the cells (turgidity) has been reduced by permeabilizing the cell membranes. Potatoes become more homogeneous with pulsed electric field processing, evening the structure and resulting in the reduction of seasonal variation. PEF technology enables cutting at an optimal product texture. Improved French fries cutting at an optimum product texture results in less breakage and shattering, producing longer, thinner French fries with smooth surfaces, sharp edges and approximately 40 per cent less cutting force for whole potatoes as the main results.

The improved cutting of crisps results in smoother surfaces and less coloration. The subsequent reduced oil uptake and water retention leads to crunchier crisps.

In potato mash production, pulsed electric field processing evens out the structural variations in potatoes, resulting in a large reduction in the number and size of lumps and a smoother mash for a better bite. Depending on the potato variety, appropriate field strengths range from 0.8 to 3.0 kV/cm, and the subsequent energy delivery goes from 0.2 to 1.5 kJ/kg.

In potato processing, for example in French fry production, PEF systems are an excellent alternative for traditional preheaters. PEF technology not only results in superior cut quality and better drying efficiency, but also improves the leaching of sugars. The pulsed electric field causes tiny pores in the potato cell walls, also known as 'cell permeabilization', which facilitates sugar leaching.

*“There are no health risks for operators and other employees.”*

This is good news for public health, because less sugar means less acrylamide formation during the baking or frying of potato products. Furthermore, PEF leads to a significant reduction in the fat content after frying, providing the potential for the production of low-fat French fries and crisps.

### **PPi: Since when can PEF processing be used on non-liquid foods such as – and particularly on – French fries?**

Mark de Boevere: McCain in Bethune (France) was the first industrial potato processing company to start with PEF technology for their French fries, in 2010.

### **PPi: Is there a possibility that, after frying a potato stripe that can be tied into a knot, it will stay elastic like bubble gum?**

Mark de Boevere: No, after blanching, drying and frying you will have a solid end-product, like untreated potato stripes.

### **PPi: How does PEF affect the taste of a potato processed into a French fry?**

Mark de Boevere: In principle, a standard PEF treatment does not affect the taste of the potato relative to an untreated potato. However, a softer tissue structure after PEF treatment allows the use of different potato varieties and cutting technologies to create new product shapes.

### **PPi: Are there any health risks to the PEF operators or other employees at processing facilities?**

Mark de Boevere: There are no health risks for operators and other employees. All our systems are robust with proven solid state components for the pulse generators and a UL- and CE-approved design. For example, the transformer unit can be installed at a maximum of 20 meters from the pulse modulator in the pulse generator unit. This also allows potato processors to install the pulse generator unit outside the actual production hall in a climate-controlled corridor and the transformer unit and treatment tank unit with the transport belt inside the production hall.

Under the brand name 'Conditioner', we manufacture a range of industrial systems to meet our customer's production requirements. These turnkey solutions are fully integrated and modular systems for either the cell disintegration of solids or the microbial inactivation of liquids. As a continuous short-time process with low-space requirements, pulsed electric field processing systems can be easily implemented in existing lines. A patented modular parallel switching technology enables better pulse control and high reliability. The operation principle of parallel switching is charging capacitors in parallel and discharging in parallel, isolated from the load (treatment chamber). This requires a transformer; this split-core transformer is a unique feature of our concept. Pulsemaster's Conditioners are built according to the highest quality engineering standards to withstand 24/7 continuous operation and to deliver optimal performance and energy efficiency. Energy is delivered in the form of rectangular pulses with the highest energy efficiency so as to limit electric power consumption. ●