New laser scanner to zap toxic French fries

Amid growing concern about the discovery of cancer-causing chemicals in crisps and French fries, a young scientist has developed a new laser system that scans peeled potatoes in the factory to detect toxic compounds and prevent them from reaching the consumer.

Earlier this year, the Food Standards Agency (FSA) issued warnings about eating over-fried potatoes, burnt toast and crisps that can contain cancer-causing chemicals such as acrylamide, deeming them a serious health threat to billions of consumers.

At present, raw potatoes that produce an excess of the carcinogenic chemical acrylamide cannot be detected in a fast, sensitive, and non-destructive way.

This new technique developed by Lien Smeesters, 28, at the B-PHOT Brussels Photonics Team at the University of Brussels, in collaboration with Tomra Sorting Solutions, employs a new sensor that scans peeled potatoes, weeding out food that may cause high levels of the toxic chemical.

Currently only general quality tests are available for assessing potatoes with no accurate acrylamide detection. Food safety measures involve a person examining a sample and accepting an entire batch if the small selection passes. However, with this new sensor, every potato or individual French fry can be examined in a rapid, safe and thorough manner for the first time.

Photonics for Factories

It works by scanning the ‘free falling’ food items, such as potatoes, from both the front and back with a laser that employs ‘spatially resolved spectroscopy’, a non-invasive imaging technique using infrared light.

When the laser beam hits a potato, part of the light will be internally scattered during interaction with the tissue. A bad potato produces a deviating internal scattering signal, owing to the high acrylamide precursors, and therefore the system can recognize a 'fingerprint' of the undesirable food'.

This unwanted food item is spotted in mid-air as it begins to fall. Selected by the internal processor, the potato is then ‘knocked out’ of the batch by being blasted with a stream of air and into a reject bin before it hits the conveyor belt below.

The sensor is able to do this with each and every individual potato scanning and rejecting in tiny fractions of a second. Dr Smeesters explains:

“Not all potatoes result in excessive acrylamide formation during frying. We have sought to spot the undesirable potatoes when they are in their raw, peeled stage. After scanning with laser beams, the good potatoes will emit a different light signal than the unsuited ones leading to an unambiguous detection.”

Having filed a patent describing the use of this detection method, the laser scanner will be integrated into one of Tomra's industrial in-line sorting machines, detecting and discarding food items that may contain excessive acrylamide precursors.

Several tons of products could be examined per hour to look for these carcinogenic compounds without using dyes or chemical additives, and without damaging or even touching the food.

Lien Smeesters – Photonics21 Student Award Winner

The driving force behind the detection method, Dr Lien Smeesters, 28, post-doctoral researcher at the University in Brussels in the B-PHOT Brussels Photonics Team and recent winner of the Student Innovation Award at the Photonics Public Private Partnership Annual Meeting, describes the motivation for the project:

"When frying potatoes, acrylamide formation is one of the biggest concerns of the potato-processing agriculture industry. At present raw potatoes that produce an excess of acrylamide cannot be detected in a fast, sensitive and non-destructive way."

"Therefore, we have worked with Tomra Sorting Solutions to develop a spatially-resolved spectroscopic sensor that identifies raw potatoes with high acrylamide precursor concentrations, on basis of their internal scattering properties, in miliseconds."

Smeesters' development comes at a time where tougher acrylamide regulation has been called for by the sustainability group 'Changing Markets Foundation' as well as the recent 'Go for Gold' campaign by the Food Standards Agency, helping people understand how to minimize exposure to acrylamide when cooking at home.

"With so many products containing worrying levels of acrylamide above the EU Indicative Value guidelines, we had to take action. This research and collaboration will hopefully provide unprecedented levels of food safety for millions", Smeesters said.

Future Home Use

Smeesters sees the future benefits of this sensor being more widely available to users in the kitchen:

"Although we are a long way off this yet, the miniaturization of the technology would enable a compact potato quality test tool in your home. A hand-held device indicating whether a potato would be unsuited for frying could reduce our exposure to acrylamide."

"We hope that potatoes unsuited for frying or roasting can be removed from the food chain right up to the end point, at the user level."

"One day we envisage a world where toxic French fries will be a thing of the past!"

About Photonics21

Photonics21 is the European Technology Platform (ETP) for photonics, a technology encompassing all of the products and processes around the emission, manipulation and detection of light. Photonics is integral to a wide range of industries that include the medical, healthcare, transport, manufacturing, and telecommunications sectors.

"Photonics21" was set up in December 2005 to bring the community of photonics researchers and industries together. The European Commission defined photonics as one of five European Key Enabling Technologies (KET's) in September 2009. Shortly after, the European Research & Innovation Program "Horizon 2020" invited Photonics21 to become a "Public Private Partnership" (PPP).

The "Photonics 21 Association", a legal entity under Belgium law, became the private contract partner in November 2013 in a Public Private Partnership (PPP) in conjunction with the EU Commission.

Today Photonics21 represents more than 3000 personal members from across Europe and abroad. Our members are experts in the photonics industry, research organisations and universities who actively engage with us to develop a joint photonics strategy for future research and innovation in Europe.

With the global photonics market growing from €350 Billion in 2011 to €447 Billion in 2015, Photonics remains a strong industry. The European photonics industry, estimated to be worth €70 billion, has considerable global leadership positions and employs over 300,000 people directly.

With positive growth forecast, current industry trends like digitalisation, resource efficiency, individual and zero failure production will drive the photonics industry further.

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About B-PHOT

UB B-PHOT is a leading center of expertise in optics and photonics in domains such as optical fiber sensors, non-linear optics, semiconductor micro-lasers, freeform optics and photonic lab-on-chip.

With over 25 years of experience B-PHOT is internationally recognized for its fundamental and applied research and its industrial innovation that push the boundaries of light technology. A multidisciplinary team of 50 highly skilled researchers and engineers – led by Prof. Dr. Ir. Hugo Thienpont - develops innovative solutions that answer future challenges in domains such as health care, food safety, IoT, telecom, green energy, aerospace, mobility and Industry 4.0.

Companies and partners benefit from its unique Photonics Innovation Center with a clean room facilitating a complete technological value chain from the development of material to

ready-to-market prototypes. B-PHOT supports them with photonics innovation to stay at least one step ahead of fierce competition.

B-PHOT Brussels Photonics is also greatly appreciated by its peers from the European innovation community for its coordinating role in large-scale European projects, for proven add-value to the European photonics research strategy where the valorization of research results and transfer of know-how to SMEs and large-scale companies remains a top priority.

About Tomra

TOMRA Sorting Solutions offers the widest range of food sorting and peeling equipment available in the food industry today, for both fresh and processed food, from farm to fork.

During the past decade, TOMRA bought ODENBERG in 2011 and BEST Sorting in 2012.The acquisition of Odenberg, brought to the table unique, patented technology and leading market positions in several fast-growing segments of the food sorting and processing industry. With the acquisition of BEST Sorting, TOMRA gained a position as one of the world’s leading food sorters and an expanded technology portfolio unrivalled by competitors.

Through a significant number of acquisitions, TOMRA had grown into a considerably global company since the first part of the 2000s.