EU cofin Project Final Report 2018
The EU projects that receive co-finance from the top sectors must submit a technical and financial final report. This format is to be used for reporting the technical results. The report must be submitted before 15 February 2019 to Hans van der Kolk

General information	
TKI Number of the project	AF-EU-15009
Title	I3-Food
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Address project website	http://i3food.eu/
Start date	1 April 2015
End date	28 February 2018

Short description/aim project (this information can be published on a website of the TKI/Topsectors)

The main objective of i³-Food is the implementation of 3 prioritised innovative food processing technologies by validation of optimum process control under industrial conditions: 1. Pulsed Electric Field preservation (PEF-P) of liquid food products(TRL 7-8); 2.High pressure thermal sterilization (HPTS) (TRL 6-7) and 3. Low shear extrusion of cold food products (TRL 6).

A congeneric set of both technical (missing online sensors) and process conditioned bottlenecks (missing application of HACCP concept) does exist which hinders their uptake by industry and in the market. Therefore, optimum process control will be achieved in i³-Food leading to application under real life operating conditions by demonstrating and piloting in a near to operational environment of applicable validation systems for each technology.
Six well selected industry partners, thereof four SMEs, strongly support the approach and contribute as technology provider or technology applicant.

Project partners: DIL (DE), WFBR (NL), Fraunhofer ISI (DE), IRTA (ES), Foodcase (NL), Hoogesteger (NL), Erdbär (DE), DMK Eis (DE), ENTEX (DE)

Description highlights and results (this information can be published on a website of the TKI/Topsectors)

Novel food processing technologies have been further developed in recent years and decades. Although technical advantages have been made in terms of time savings, energy savings, extending of shelf life for retailers and 'ready to use' products, the implementation of these technologies in industrial food production is often still rather limited. Taking the risk and investing in an improvement of their processing lines is one of the main hurdles for the industry, especially for small and medium-sized enterprises (SME) in food processing. There is neither the time nor the available resources needed for the implementation of new non-standard processes.

Therefore, the main objective of i³-food is the implementation of three innovative food processing technologies under industrial conditions, ensuring rapid and maximum market uptake:
1. Pulsed Electric Field Preservation (PEF-P) for liquid food products, using short electric pulses to assure microbial inactivation while preserving the fresh characteristics
2. High Pressure Thermal Sterilization (HPTS) using high pressure to reduce the thermal impact on the products, as compared to other thermal sterilisation processes
3. Low Shear Extrusion (LSE) for cold food products like ice cream at low temperature based on planetary roller extruder improving sensory quality

As for all 3 technologies, the evaluation of the industrial application of process validation for PEF-P processing of fruit juices has been implemented. The sensor for HPTS evaluated in realistic food products in an (semi-) industrial scale using RTE meals and the sensors for LSE of ice cream were successfully validated at industrial scale with upscaling of the process, to pilot scale (up to 200 l/h). The project represents fully innovative approach towards foods that already exists on the market but manufactured by novel technological solutions. The technologies have the potential to generate significant benefits along the value chain, in particular decreased growth of microorganisms, better textural and sensory properties and could result in lower costs, thereby creating competitive advantage. Furthermore, the production of juices (PEF) and ice creams (LSE) has strong industrial potential on account of shortening of time treatment coupled with significant inactivation of unwanted microorganisms. In addition, many benefits are also achieved for the snacks using HPTS as well.

The work carried out can be responsible to enhance innovation capacity of the food companies by introducing the innovative technologies for food processing, create new market opportunities by introducing more healthy and attractive foods thus strengthening the competitiveness and growth of the relevant companies. In addition, the introduced technologies are eco-friendly and there are no doubts how those represent environmental, technological, social and health aspects as well.

In a fully innovative approach, the i3-food project has identified the barriers for the industrial uptake of these technologies and designed a plan to help in a wider implementation. The barriers are manifold and vary from low acceptance or rejection by consumers to non-open market access or lack of knowledge and information among food producers on how to integrate novel technologies.

Overcoming the technological bottleneck:

To resolve the lack of continuous process control on line in these novel technologies, validated sensors where developed at industrial scale, somewhat important when a little difference in temperature can suppose a great energy save or a safer and/or better product e.g. by avoiding under or overtreatment.

Developing an optimum process control:

A fully and evaluated HACCP (Hazard Analysis and Critical Control Points) concept has been developed for each technology, providing to interested stakeholders with a systematic preventive approach to food safety from biological, chemical, and physical hazards in production processes, and design measurements to reduce these risks to a safe level.

Achieving a strategy for application and market up-taking:

For application of each technology under real life operation conditions. market barriers and market entrance hurdles (as user demands, or consumer acceptance) have been analyzed. Application opportunities beyond known use cases, taking into account economical, ecological and social aspects, have been explored to achieve an innovative strategy for overcoming the market barriers and ensure a maximum market uptake. For a fast and easy market penetration, an analysis of the innovation environment and identification of opportunities have been performed, leading to one roadmap per technology for market uptake.

On 26 January 2018, a i³-FOOD Demonstration workshop was organized at Wageningen Food & Biobased Research. The title of the workshop was high pressure mild preservation, and insights were shared from the i3-Food project relating to high pressure processing. This included effects on inactivation of microbial spores, effects on product quality, temperature validation and the sensor developed in i3-Food and HPP and legislation. A demonstration was given on HP sterilisation. The workshops attracted 25 participants, of which 20 from industry.

Number of delivered products (with WFBR involvement) (in an appendix, please provide the titles and/or description of the products or a link to the products on public websites)			
Academic articles	Reports	Articles in journals	Introductions/workshops
1	-	2	6 Presentations 1 Workshop

Appendix: Names of the products or a link to the products on a public website

http://i3food.eu/

https://www.wur.nl/nl/Onderzoek-Resultaten/Topsectoren/show/i3-Food-implementation-of-innovative-food-processing-1.htm

https://topsectoragrifood.nl/project/i3-food/

This appendix summarises the outcome were WUR is involved in.

Scientific papers:

High pressure processing combined with heat for fruit and vegetable preservation. Ariette Matser, Martijntje Vollebregt. 2016 In: High pressure processing of fruit and vegetable products. Eds. M. Houska, F.V.M. Silva.

Papers in professional journals:

Milde conservering. Stand van zaken. Voedingsmiddelentechnologie, 29 May 2015, nr. 7., p 30-31.

Mild conserveren met hogedruk en koud plasma. Doet uw bedrijf mee aan een praktijkproef bij de WUR? Annemarie Barbier- Schenk. Voedingsmiddelentechnologie. September 2017

Pesentations:

H.M. Vollebregt and A.M. Matser, Hurdle technology to improve organoleptic aspects of broccoli in pressure assisted thermal sterilisation, 19th EFFoST Conference, Athens Greece, 2015

A.M. Matser, M. Nierop Groot, H. Mastwijk, R. Timmermans and H. Bokhorst van de Veen, Mild preservation, could it be beter than heat pasteurisation?, FIMM conference, Wageningen The Netherlands, 2016

A. Matser and M. Vollebregt, High pressure high temperature processing. Potential applications for preservation of food products, with special focus on tomato products, Fruit & Veg Processing, Avignon France, 2016, https://colloque.inra.fr/fruitvegprocessing2016

A.M. Matser, Longer fresh with mild preservation (in Dutch), Conference Changes in the chain, novel technologies and future of cooling, Wageningen The Netherlands, 2016

M. Vollebregt, K. Aganovic, A. Matser, S. Toelpf, Optimal process control for high pressure thermal sterilisation of food products, Effost Conference, Sitges, Spain, 2017

M. Vollebregt, M. Helmond, K. van Kekem, A. Matser, Possibilities of high pressure thermal sterilisation for preservation of cauliflower, Effost Conference, Sitges, Spain, 2017

Workshop:

High pressure mild preservation, i³-FOOD Demonstration workshop
Wageningen Food & Biobased Research, 26 January 2018