

Integration of PEF in food processing for improving food, quality safety and competitiveness

FieldFOOD newsletter no. 1

February 2016

Welcome to the first FieldFOOD Newsletter

Welcome to the first edition of the FieldFOOD newsletter. The aim of newsletter is to provide regularly with a brief update of the progress in this Innovation Action within the topic "Innovative solution for sustainable novel food processing" (SFS-17-2014) of the work program "Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bio-economy". FieldFOOD is coordinated by the University of Zaragoza (Spain) and have a total eligible cost of €2.3M receiving a contribution of €2.0M from the EC Horizon 2020 research and innovation program under grant agreement n° 635632. We hope that newsletters serve as a valuable communication and reliable information platform to ensure that end users and beneficiaries of the PEF technology are fully aware and updated with respect to the advances of the project address to application of PEF to the food and drink industries.

The Challenge

Pulsed electric fields (PEF) is an innovative, non-thermal food processing technology that causes electroporation of cytoplasmic membranes of microorganisms and eukaryotic cells of plant and animal tissues using low energy requirements whilst minimizing quality deterioration of the food compounds. In the last decades, intense fundamental and applied efforts have been addressed to demonstrate the capability of PEF to inactivate vegetative cells of microorganisms at lower temperatures than those used in thermal processing, to enhance mass transfer in different operations of the food industry (e.g., extraction of intracellular components of interest, dehydration, infusion of compounds into the cells, etc.), and to modify food structure.

Effects deriving from PEF processing are extremely attractive for the food industry in terms of combating pathogens, reducing spoilage and waste, improving food quality and optimising process efficiency. However, in spite of the many advantages that can be derived from the introduction of the PEF technology in the food industry, applications of PEF is still small, owing to significant bottlenecks that prevent the introduction of the technology, such as the following:

- Until now, PEF processing has been intended to be used to supersede, rather than complement, existing food processing technologies.
- There is a lack of a systematic approach based on process analysis of the specific application of interest for the successful integration of the PEF technology, either in replacing or complementing the traditional food processing technologies.
- Industrial systems have not been adapted to the end-user requirements to obtain the best performance.
- There are high costs associated with existing PEF generators.



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The FieldFOOD project

Until now the lack of industrial-scale equipment and the high costs have limited the commercial use of PEF technology in the food industry. The FieldFOOD project aims to develop flexible low-cost technology and methods. FieldFOOD started in April 2015 and lasts three years. Three universities, a research institute, a federation of food science and technology societies, a manufacturer of pulse power generators and several food processing companies are involved. You can find the results on our website and in our newsletters.



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Universidad Zaragoza



ARAGONESA RODEGAS/WINERY



ENERGY PULSE SYSTEMS DESIGNING ENERGY FOR LIFE

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The Objectives

The overall objective of the FieldFOOD is to overcome the main technological and industrial hurdles to implement PEF in the food industry by addressing successful, real-scale demonstrations of the viability of the introduction of the Pulsed Electric Field (PEF) technology as a strategy to improve the competitiveness of the European food industry by improving food quality (safety, nutritional, and sensorial properties), optimizing process efficiency, reducing energetic costs, and introducing new foods in the market.

This broad objective will be achieved by:

- Conducting a systematic process analysis of different specific applications (e.g., fruit juice processing, tomato product processing, winemaking, olive oil extraction and cider-making) for a successful integration of the PEF technology in order to replace or complement existing traditional food processing technologies. This process analysis will facilitate the accomplishment of the following:
 - Identification of the specific requirements of each application for designing tailored PEF equipment (e.g., generator, treatment chamber, and transport system of material).
 - Make adaptations and/or modifications of the current processing steps and processing parameters as a consequence of the introduction of the PEF technology in the processing line.
- Design modular, portable, low-cost pulse generators with the possibility of connecting several modulators and transducers in series, according to the production capacity of the companies.

The Approach

FieldFOOD is focused in application of PEF in processing of plant based foods (wine, olive oil, tomato, cider, fruit juices). These raw materials are seasonal products whose physicochemical composition may vary significantly from one year to other. Therefore, to have detailed physicochemical characterization of this raw material is essential to understand potential variability in results observed in different campaigns or when working with different varieties of the same raw material. The project is 36 months in duration and cover three harvesting seasons. The 3-year duration will facilitate pilot plant scale studies aimed at defining PEF processing conditions and optimal treatment conditions of the related processing steps during the first year of the project and on-site studies in the plants of the SME companies in the following 2 years. Repetition of the industrial test for two successive years in the SMEs is required to evaluate the influence of the yearly variation in the raw material, to modify the tailored PEF prototype and processing conditions annually, if necessary and to derive reliable conclusions on the benefits /drawbacks of the introduction of the PEF technology.

Work packages

WP1 – Characterization of the raw material
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Ireland
Nigel Brunt on
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WP2– Process Design at Pilot Plant Scale
Technische Universität Berlin
Germany
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WP3– PEF Equipment Development
Energy Pulse Systems,
Portugal
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WP4– Integration of PEF in the Current Processing Lines
ProdAl scarl,
Italy
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WP5– Industrial Validation
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Spain
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WP6– Dissemination, Technology Transfer and Communication
EFFoST,
The Netherlands
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WP7– Project Management
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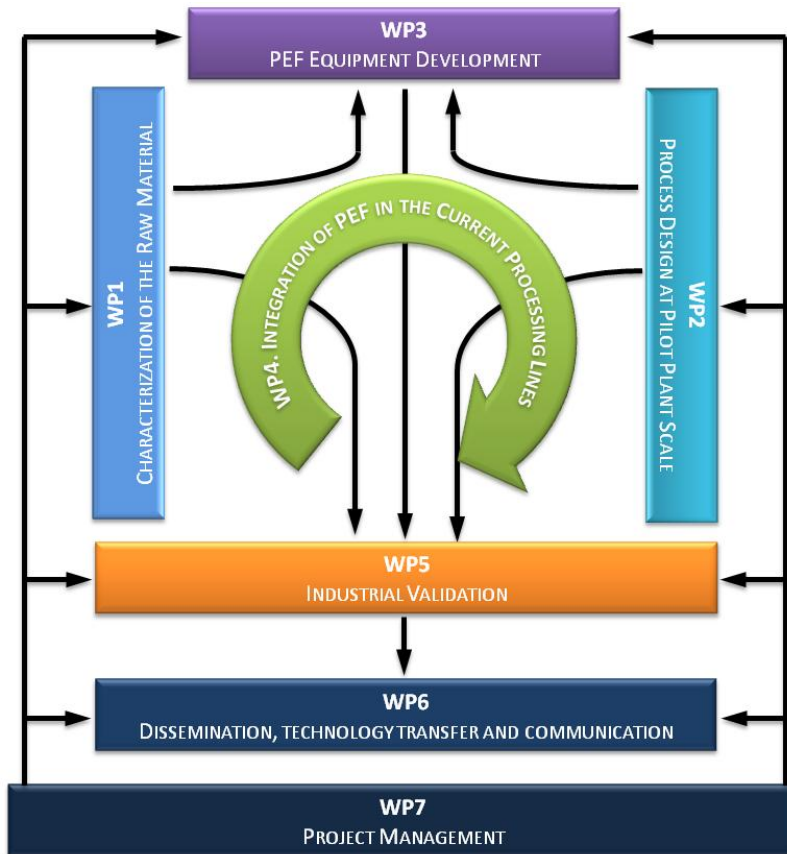


Figure 1 Graphical presentation of FieldFOOD work packages and their interactions.

The Consortium

The project represents an integrated interdisciplinary approach to the implementation of PEF technology in the food industry, involving four research institutions (University of Zaragoza, Technical University of Berlin, ProDAI scarl, University College of Dublin), one manufacturer of PEF generators (Energy Pulse Systems), five food companies representing different production sectors in which exist clear benefits of the implementation of the PEF technology, including fruit juice producer (Diesdorfer Süßmost-, Weinkelterei & Edeldestille), winemakers (Bodegas Aragonesas), olive oil producer (Agrinarsa), tomato product producer (F.P.D. S.r.l. Industria Conserve Alimentari) and cider-makers (the Apple Farm). The project will also address the economic feasibility and opportunities to improve the process sustainability in the SME's derived from the introduction of the PEF technology (CIRCE) and EFFoST will be involved in dissemination activities and exploitation of the project results and setting up a business plan.

Scientific Advisory Board



Nuria Mª Arribas
Head of Research, Development and Innovation at FIAB and Secretary General at Spanish Technology Platform Food for Life



Dietrich Knorr
Emeritus Professor at the Department of Food Biotechnology and Food Process Engineering at the Technische Universität Berlin



Damijan Miklavcic
Professor at the Department of Biomedical Engineering at the University of Ljubljana



Brian McKenna
Emeritus Professor of Food Science at University College Dublin and Fellow International Academy of Food Science and Technology (IAFoST)



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Upcoming events

18th IUFOST - World Congress of Food Science and Technology, Dublin, Ireland

18th IUFOST – World Congress of Food Science and Technology will take place between 21st – 25th August 2016 in Dublin, Ireland. The theme of the congress is “Greening the Global Food Supply Chain – through Innovation in Food Science and Technology”

The work carried out in the FieldFOOD project will be highlighted in the session “Integration of pulsed electric fields for improving processing of plant based foods”.



Date: **Wednesday August 24th 2016**

Time: **11:30 – 12:55**

Preliminary program:

11:30 – 11:55 – FieldFOOD: a H2020 innovation action for improving food processing by PEF – Javier Raso

11:55 – 12:10 – Numerical simulations for designing PEF treatment chambers – Cornelia Rauh

12:10 – 12:25 – Apple juice, cider and PEF – Nigel Brunton

12:25 – 12:40 – Tomato products and PEF – Giovanna Ferrari

12:40 – 12:55 – PEF equipment for industrial applications – Luis Redondo

More information about the 18th IUFOST - World Congress of Food Science and Technology can be found at www.iufost2016.com

4th School on Pulsed Electric Field Applications in Food and Biotechnology

8 - 11 May 2017, Vienna, Austria

The 4th PEF School will be organized by the BOKU Institute of Food Technology and the BOKU Institute for Synthetic Bioarchitectures.

The objective of the 4th PEF School is to offer to students, academic and industrial researchers the opportunity to improve their knowledge of the fundamentals of pulsed electric fields (PEF) and electroporation and to get an insight into the variety of food and bioprocessing applications.

More information about the 4th PEF School can be found at <http://pefschool2017.boku.ac.at>



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