

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

FieldFOOD newsletter no. 2

December 2016

Welcome to the second FieldFOOD Newsletter

Welcome to the second edition of the FieldFOOD newsletter. The aim of newsletter is to provide regularly with a brief update of the progress of the FieldFOOD project. We hope that these 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.

First Annual progress meeting - Summary

First annual progress meeting organized by UCD Dublin was held in Dublin, Ireland on 22-23 March 2016 coinciding with the celebration of the "3rd School on Pulsed Electric Fields (PEF) Processing of Food" in the framework of the COST action TD1104 "European network for development of electroporation-based technologies". The meeting was attended by Brian McKenna and Damijan Miklavcic, members of the Scientific Advisory Board of FieldFOOD, in addition of the delegates of the different partners involved in the project.

This meeting presented the activities conducted for the partners during the first year of FieldFOOD. Studies conducted at lab and pilot plant scale have permitted establishing the processing conditions to be used during the second year of the project in the industrial test. The design of the treatment chambers for application of the treatment in the companies was advanced. Numerical simulation showed that the electric field distribution in the treatment chambers was good enough to ensure a correct PEF treatment and permitted ensuring a correct performance of the PEF generators, minimizing the electrical current required to generate the necessary electric field strength. This is of great relevance in order to define the requirements of the PEF modulators for scaling up the technology for the next years of the project.

Progress on the development of the pulsed electric fields generators was also presented by EPS. Two modulators are being constructed for the treatment of solid and liquid matrices. EPS confirmed the availability of the modulators for conducting industrial test in the second year of the project. A schedule for the delivery of the modulator prototypes according to the availability of raw material in the different companies was established.



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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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New partner in FieldFOOD

CIRCE Foundation (Centre of Research for Energy Resources and Consumption) was established in 1993 as an independent Research Centre with the aim to create and develop innovative solutions and scientific/technical knowledge, as well as to transfer them to the society, especially to the industry.



CIRCE's mission is to drive forward improvements in energy efficiency by means of the development of R+D+i activities and formative actions, thereby contributing to a sustainable development and improving the competitiveness of companies.

Over 190 professionals with a broad variety of profiles compose the team of people working at CIRCE. Since 1993, CIRCE has participated in more than 2.500 R&D&I projects at national and international level and has trained more than 1.850 professionals from 47 countries within the postgraduate courses CIRCE promotes.

In year 2001, CIRCE was recognized as National Centre of Innovation and Technology. The main research topics in CIRCE are: energy efficiency, wind and solar power, natural resources, biomass, electrical substations, smart-grids and storage, thermal power systems and emissions reduction, sustainable mobility and energy socioeconomics.

One of the key objectives of FieldFOOD is to perform successful, real-scale demonstrations of the viability of the introduction of the PEF technology in the food industry for different applications. The activities of CIRCE in the project will especially be focused on supporting sustainability of the food processing line derived for the introduction of the PEF technology, mainly from to environmental effects.. Additionally, due its experience in process engineering and optimization, CIRCE will coordinate the WP dealing with the industrial demonstration.

FieldFOOD at Researchers' Night 2016 of Zaragoza (Spain)

The last Friday of September has been designated European Researchers' Night by the European Commission. Over 250 cities of Europe hundreds of activities were organised to show people how exciting research can be and how relevant science actually is to our daily lives. These activities allow for public engagement and meetings with researchers in relaxed and festive environments. This year the Zaragoza the event was celebrated in the cultural centre Caixa Forum. Objectives of FieldFOOD were presented in a posters and researchers of the FieldFOOD belonging to the University of Zaragoza performed demonstrations of the capacity of pulsed electric fields for improving extraction of intracellular components and for modify food structure of plant based foods. Finally, attendants had the opportunity of taste red wine elaborated from grapes treated by pulsed electric fields.

Work packages

WP1- Characterization of the raw material
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WP2- Process Design at Pilot Plant Scale
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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
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WP5- Industrial Validation
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WP6- Dissemination, Technology Transfer and Communication
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WP7- Project Management
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Researchers' Night 2016 of Zaragoza (Spain).

Modulator and transducers constructed by EPS for mass transfer

The FieldFOOD project presented a main technological challenge for EnergyPulse Systems: the construction of a high-voltage pulsed power modulator and associated transducers for mass transfer processes in different food applications, such as tomato, cider, red fruits, grapes and olive olives. These materials present a wide range of electrical conductivities and field intensity needs in order to get electroporated. Considering this, EnergyPulse Systems, decided to build a direct capacitor discharge Marx generator solid-state based transform less modulator to guarantee an almost square pulse independent of the product conductivity variations. The Marx topology, charging capacitors in parallel from a relatively low voltage power supply following by their connection in series with the load, allows a modularity assembling concept that reduce the cost of the equipment, supported also by the utilization of standard 1200V off-the-shelf components. This type of technique to generate high voltage pulses enables high flexibility in the pulse parameters, allowing for pulse width and frequency variations, which in addition with the semiconductors used prove high efficiency operation. The modulator is capable of 10kV and 240A pulses, from 5 μ s to 200 μ s and up to 200Hz, limited by the 3.5kW input power, inside an IP54 enclosure with 800x600x400mm³ volume, 80kg, which permits an easy portability inside an industrial installation. Thinking of industry operation, a simple touch screen interface was implemented for defining and reading the parameters. Also, a complete interlock system for operator safety was introduced giving the complete system, including modulator and transducer, a CE conformity. Finally, a set of co-field transducers with various gaps, for applying different electric fields, was develop, being separated from the modulator enclosure, by wire connection, in order to limit the modifications introduced to the industrial lines and to increase the flexibility in setting the transducer physical orientation in the factory.

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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PEF wine tasting @ meeting of Research Groups of Agri-Food Institute from Aragón

On Monday June 6th 2016 wine treated by PEF during the first year of the FieldFood project it was presented during the celebration of the “First Meeting of Research Groups of Agri-Food Institute from Aragón” in the Mediterranean Agronomic Institute of Zaragoza. The wine was elaborated with Grenache grapes and treated by PEF. Maceration-fermentation was conducted at 18°C. The PEF treatment permitted reduce the maceration time for 5 days. In a blind sensorial test in which four different wines were compared the 65% of the testers preferred this wine over a wine macerated-fermented at 18°C (8%) obtained from untreated grapes or that two wines macerated-fermented at 25°C obtained from untreated (38%) and PEF (0%) treated grapes.



1st Workshop on Advances in Food Science and Technology

Javier Raso, coordinator of the FieldFOOD project was invited by Prof. Mario Pérez Won and Prof. Gypsy Tabilo from the Department of Food Engineering of the University de La Serena and Bio Bio respectively to visit Chile during the first week of July 2016. During his stay in Chile Javier Raso taught a seminar on the Department of Food Engineering of the University de la Serena and participated as speaker in the 1st Workshop on Advances in Food Science and Technology organized by SOCHITAL (Chilean Society of Food Science and Technology) and held in Santiago de Chile. During these events last advances conducted in Europe on the PEF technology for food and biotechnological applications and the FieldFOOD project were presented. The technology raised many expectations between the Chilean researchers that are focusing their investigations in increasing the added value of farm products. On the other hand, Javier Raso also visited the company Capel that produce grape juice, wine and pisco, typical liquor from Chile obtained from distillation of white wine. PEF also resulted very attractive to the technicians for the possibility of to be used in different processes of the company.



FieldFOOD workshop @ IUFoST2016

The first FieldFOOD workshop was being held the August 24th at the 18th IUFoST – World Congress of Food Science and Technology, Dublin, Ireland. The congress theme was “Greening the Global Food Supply Chain – through Innovation in Food Science and Technology”. Over 5 exciting days, there were 80 sessions planned, in which over 250 scientific, industry and policy experts shared new findings, practical experiences and lessons learned in their respective fields. One of the parallel sessions was dedicated to the FieldFOOD workshop entitled “Integration of Pulsed Electric Fields (PEF) for improving processing of plant based foods”. The workshop provided the participants with the state of the art of PEF and its application. A total of 50 people attended the workshop



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Wine treated by PEF at Bodegas Aragonesas

In October 2016 Unizar and Bodegas Aragonesas started the activities involved in the FieldFOOD project. The objective of these activities was to scale up the technology from lab-pilot plant scale to industrial scale. This procedure follows the validation of the results obtained previously at lab scale.

In the installations of the winery Bodegas Aragonesas, 6 deposits of 5000 kg were filled with grapes of the local variety Garnacha. The grapes of 3 of those deposits were treated by pulsed electric fields directly after the destemming step and immediately before the maceration. Based on the experience of the precedent year, the PEF parameters were adjusted to apply the treatment at 2200 kg/h. The other 3 deposits were filled with untreated grapes in order to compare the results with the PEF treated grapes. During the maceration, the total polyphenol index (TPI) and the colour index (CI) were monitored, showing that the colour and polyphenol release from the grape skin was accelerated after a PEF treatment of the grapes in comparison to the untreated grapes.

First experiments at Diesdorfer

The Diesdorfer Süssmost, Weinkellerei & Edeldestille GmbH (short Diesdorfer) is a SME-member of the FieldFOOD consortium. It has been producing fruit juices and fruit wines from local orchards since 1935. Besides the traditional production of beverages and spirits, Diesdorfer closely collaborates with the department of Biotechnology and Process Engineering of TU Berlin in FieldFOOD project. Thus, first pilot plant trials with PEF technology were successfully undertaken in spring 2016 at their facilities. Liquid mash from warehouse-apples was treated with short pulses in a small de-juicing unit for characterising its impact on the juice yield after pressing..



After a few trials and processing some 100 kg of apples with the handy but continuously working pressing plant, results showed a significant yield increase up to 3 percent. In the following months, a technical upscaling will take place to suit larger processing plants with capacities up to 5 or more tons per hour. Company owner Stefan Schulz: "I'm optimistic that we will gain interesting results with the large plant and the new technique in the next months."

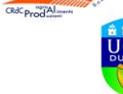
Industrial scale experiments are planned in the summer season. Then, they are processing strawberries, cherries and colourful berries.



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