

1<sup>st</sup> World Congress on Electroporation and Pulsed Electric Fields in Biology,  
Medicine and Food & Environmental Technologies

incorporating

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and

BFE2015 - The 3<sup>rd</sup> International Bio & Food Electrotechnologies Symposium

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## Programme and Book of Abstracts

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Edited by:

**Damijan Miklavčič, Peter Kramar and Tomaž Jarm**

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its ability to alter cell membrane permeability. In wine making PEF has been used to improve the effectiveness of maceration process, however, little is known about how PEF affects the subsequent composition of the wild yeast population. Such information is required as wild yeast growth, during maceration and early stages of fermentation, can modify the flavor profile of wine. This study investigated the impact of PEF on *Saccharomyces cerevisiae*, *Picchia kluyveri* and *Hanseniaspora uvarum*. Each yeast species (4.3-4.8 Log CFU /mL) was suspended in defined grape juice medium (DM) of pH 3.5 and subjected to PEF treatments of either 15, 60 or 160 kJ/kg at a field strength of 1.0-1.1 kV/cm. Yeast cell numbers were estimated immediately after PEF treatment and after 1, 2, 3, or 8 days under simulated maceration conditions. *S. cerevisiae* was the most sensitive species tested, to pH in DM and to the PEF treatments ( $P < 0.05$ ). After an initial decrease in numbers, cells in the control and 15 kJ/kg PEF treatments resumed growth, while 60 or 160 kJ/kg PEF treatments maintained the cell numbers below the initial levels for at least 8 days. PEF treatments and low pH of DM had no effect on *P. kluyveri* numbers or their subsequent growth ( $p > 0.05$ ). The numbers of spoilage yeast *H. uvarum* decreased to below the detection limit of 2.5 log CFU/mL after high PEF treatment and the degree of sub lethal injury was dependent on maceration time and PEF intensity ( $P < 0.05$ ). This study suggests that application of PEF during winemaking can enhance extraction and inhibit spoilage yeast while having a limited effect on the beneficial natural wine yeast.

Thr-D2-P6

#### Improving the extraction yield of juice and bioactive compounds from sweet cherry and their by-products by Pulsed Electric Fields

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Pulsed Electric Fields (PEF) treatment has recently gained interest as a milder and efficient alternative to conventional cell disintegration techniques of plant cell. In this work the influence of PEF pre-treatment on the extraction yield and antioxidant properties of juice obtained after pressing of sweet cherry (*Prunus Avium*) fruits of "Duroi Nero" variety and on the recovery of bioactive compounds from cherry by-products (pressed cakes) were investigated and compared to both untreated and freeze-thawed samples. The cellular disintegration index ( $Z_p$ ) of fruit tissue increased progressively with PEF treatment at field strengths of 0.5, 1 and 3 kV/cm and at a fixed total specific energy input of 10 kJ/kg, up to a maximum value of 0.76. PEF (0.5, 1, and 3 kV/cm at 10 kJ/kg) assisted mechanical pressing (1.64 bar for 5 min) led to significant increase in juice yield (+40%) with respect to the control, showing similar results than freeze-thawed sample. The juice obtained from PEF pre-treated cherries ( $E = 1$  kV/cm) contained significantly higher amounts of anthocyanins (+85%) and antioxidant power (+28%) with respect to untreated samples, while freeze thawed samples showed the highest value only for the anthocyanins. Further increases of the electric field strength ( $E = 3$  kV/cm) did not lead to additional advantages in qualitative characteristics of the juice. Extracts from electroporated pressed cakes led to the highest increase in anthocyanins (+40%) and antioxidant power (+40%) for the lowest electric field strength investigated ( $E = 0.5$  kV/cm). The extractability of bioactive compounds from cherries press cake was not significantly increased by further increasing the field strength applied (1 - 3 kV/cm). The results

obtained from this study demonstrate the possibility to implement a PEF system into a cherry juice production line to increase yield and quality of juice as well as to valorize the cherry by-product.

Thr-D2-P7

#### Improving the extraction of juice and anthocyanin compounds from blueberry fruits and their by-products by pulsed electric fields

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The aim of the study was to investigate the influence of PEF pre-treatment (1, 3, 5 kV/cm and 10 kJ/kg) of blueberry fruits on the extraction yield, anthocyanins content and antioxidant activity of the juice obtained by pressing (1.32 bar for 8 min). Additionally, the extraction with solvent of anthocyanins from the berry by-products (pressed cakes) was also evaluated. Blueberry juice obtained from PEF treated berries at 1 and 3 kV/cm showed the highest increase in juice yield (+32%), total anthocyanins content (+55%) and DPPH-RSC (+40%), compared with the untreated sample. The extracts from press cakes obtained after PEF assisted-pressing of berry fruits showed a significant higher content of total anthocyanins (+95%) and DPPH-RSC (+138%) when compared with the control sample. The higher the field strength applied the greater the recovery of antioxidant compound in the extracts. Significant differences in the contents of anthocyanin glycosides were detected between blueberry juice and press cake extracts. The results obtained from this study demonstrate that PEF-assisted pressing is promising for production of higher quality juices and for the valorization of berry by-products.

Thr-D2-P8

#### Electroeradication of Escherichia Coli is under the control of the conductance of the pulsing buffer

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Bacterial viability can be affected by pulsed electric fields (PEFs) offering a new approach for decontamination of liquids for the food industry and for waste water treatment. The molecular mechanisms remain poorly elucidated. One question is the control by the pulsing solution and the role of its conductance. *Escherichia coli* (*E. coli*) was chosen as a model system. The strain *E. coli* BL21(DE3) was grown to its stationary growth phase, washed and re-suspended in a saline solution at a well-controlled conductivity. Survival was evaluated by plating after a proper dilution. Accumulation of microsecond pulses were efficient for electro-eradication as previously reported but, in most cases a capacitive discharge pulse generator was used where the pulse duration might be affected by the buffer composition and undergo changes during the pulse. This was not the case with our approach using a square wave electropulsator. The main conclusion was that eradication was more efficient in a buffer with a significant conductivity. A tentative explanation taking into ac-