Title Pulsed electric fields-non-thermal technology for cell disintegration and food preservation

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Abstract

Pulsed electric fields (PEF) technology involves the application of short pulses (microseconds) of high voltage (1-50 kV/cm) to affect the integrity of cell membranes by electroporation. This short, non-thermal method can be utilized to improve mass transfer processes, induce stress reactions as well as for liquid food decontamination. Electric field strength, specific energy input and initial treatment temperature have been identified as main processing parameters. The presentation will cover investigation results on the two main application areas of pulsed electric fields in food technology: the disintegration of plant tissue and the inactivation of pathogens and spoilage bacteria in heat sensitive products. The improvement of treatment chamber design was conducted using finite element modeling of field distribution and simulation of different flow properties of co-linear cells. Impact of geometry optimization on effectiveness of microbial inactivation and cell disintegration will be discussed. The impact of PEF-preservation on bioactive food constituents and the consideration of thermal effects occurring in the treatment chamber will be evaluated showing results on PEF-preservation of milk and effect on ß-Lactoglobulin and IgG as well as on natural antimicrobial proteins like Lactoperoxidase, Lysozyme and Lactoferrin. It could be shown, that suitable treatment chamber construction was able to limit the negative impact of locally high temperatures on heat sensitive components by optimization of the flow properties. A model was developed to simulate a temperature-time profile during PEF-treatment and was used to distinguish between pulsed electric field and thermal effects. A short outlook on industrial feasibility of pulsed electric field technology and on regulatory aspects will complete the presentation.