50. Inactivation of Listeria Monocitogenes in Milk by Pulsed Electric Field (PEF) and Mild Heating

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Pulsed electric field (PEF) is a nonthermal processing technology that consists of exposing food to pulses of high-voltage electric fields during a short period of time. PEF has been explored as an alternative processing technology to inactivate microorganisms and enzymes without adversely affecting the color, flavor, and nutritional value. Moreover, this technology minimizes the impact on enzymes of technological and safety relevance, proteins, milk fat globules and nutrients (particularly vitamins) causing fewer changes in the original food´s composition.

This study was conducted in milk and using a common pathogenic found in dairy products, Listeria monocytogenes, aiming to assess the use of PEF as a pre-treatment of milk to reduce the temperature and time of its pasteurization, reducing therefore any potential nutritional losses as well as minimal organoleptic quality deployment.

UHT milk (1.5% milk fat) was spiked with a culture of L. monocytogenes ATCC 13932 to get an initial microbial level of approximately 8 log10/mL. The milk was then subjected to pasteurization before and after PEF treatment and the number of viable cells counted after inoculation on TSA and incubation at 37ºC for 48h.

For PEF, a continuous treatment chamber with a collinear structure and an internal diameter and distance of 1.0 cm between electrodes was used. PEF parameters were selected based in previous studies: electric field strength-10 KV/cm, pulse width-50 µs, frequency- 3 Hz and a flow rate of 2.92 L/h. Samples were pasteurized in a FT74XTA HTST/UHT system-Armfield using 62, 64, 68, 70 and 72ºC and a 2 s holder.

PEF treatment by itself is responsible for a reduction of 1,81 log10/mL, but inoculation of cells on a culture medium with 5% NaCl shows that a larger proportion of the cells are fragilized by the PEF treatment as a reduction of 3,31 log10/mL was obtained. That was also confirmed by data obtained from the viable cell count of milk heat treated before and after being subjected to PEF pre-treatment.

At each of the temperatures used to heat-treat the milk we have obtained more than 2,5 times

more reduction in the L. monocytogenes population when the milk was PEF pre-treated. In fact, without PEF pre-treatment we have obtained D72=1,26 s and after PEF pre-treatment the D64=1,1 s.

Results indicate that the combined approach of PEF with mild heating to process milk is a very promising technology for inactivation of pathogens, allowing to reduce the temperature/duration of the pasteurization process to obtain an equivalent reduction of the microbial load, with the potential advantage of keeping some relevant nutritional and sensorial properties of the milk.

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