Refrigerated-moderate electric fields promotes E. coli death at ambient temperatures

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Heat is a well known agent of microbial inactivation. It has been previously reported that the effect of heat is enhanced by the presence of an electric field. Herein, we report a study on the feaseability of using refrigerated-moderate electric fields (R-MEF) on the inactivation of Escherichia coli ATCC 25952, in comparison to the most common treatments (pasteurization and ohmic heating - OH). Experiments were performed on a concentrical batch refrigerated cylindrical glass tube of 30cm total length and 2.3cm inside diameter with two titanium electrodes at each edge. The temperature was always kept below 30 ºC by means of a refrigeration system. MEF ranged between 50-288.5V.cm-1 (6 levels), being E. coli suspension samples collected during the time of the experiment to record the death curves. Pasteurizations were performed by the classical isothermal bath methodology at temperatures ranging from 55-75 ºC, and OH was performed on the same cylindrical glass tube (in the absence of refrigeration), at temperatures ranging from 55-65 ºC; in both cases samples were collected during 10 min (1 sample/min). In both OH and R-MEF, temperature was recorded with the objective of isolating its effect during statistical analysis. Results show significant differences between the effects of temperature and electric field on the E. coli death curves ($p<0.01$). By isolating the effect of temperature, it was possible to conclude that electric fields effect on death curves becomes very significant above 160V.cm-1. Furthermore, the use of R-MEF with fields above 220V.cm-1, promotes death rates of 3 Log10 cycles of E. coli in less than 6 min, and even higher rates at greater electric fields. Therefore, R-MEF shows great potential as a complement of traditional thermal processing in both food and drug manufacture to help ensuring sterility without the need of very large electric fields (such as e.g. in pulsed electric fields technology).