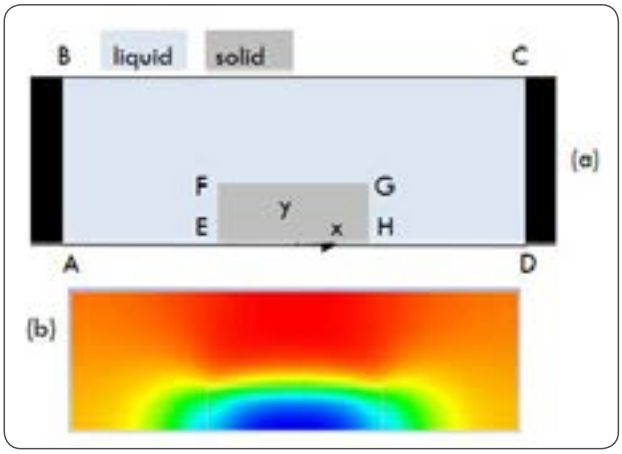
Farshad Bolourchifard et al., J Food Process Technol 2018, Volume 9
DOI: 10.4172/2157-7110-C8-098

Impact of preheating on solid-liquid food temperature distribution after ohmic sterilization process and multi-objective optimization

Farshad Bolourchifard, Saeid Movahed and **Mohammad Mehdi Torkzadeh**
Politecnico di Milano, Italy

The ohmic heating is a non-traditional process of food sterilization; application of an external electric field through the target medium can raise its temperature to the desired sterilizing value. Unlike its traditional counterparts, the result is a remarkably efficient process due to the fact that the energy is released directly through the body of the product (fruits, vegetables, foods, mixtures etc.) rather than at its surface. Industrial applications of the process are particularly advanced in the food, pharmaceutical and biotechnological sectors, where remarkable results have been obtained for a wide variety of products. However, non-homogeneity and variation of local electrical conductivity may cause hot and cold spots inside the sterilizing food product. Since, the cold and hot spots can affect the final quality of the sterilized product as well; the non-uniform temperature gradient is the main short-comings of the ohmic heating food sterilization. In the current study, a combination of preheating and ohmic heating techniques is used as an effective hybrid sterilization method to make the temperature profile inside the product more uniform and eventually to prevent the occurrence of the hot and cold spots as much as possible. Without loss of generality, the proposed method is applied to two specific case studies to prove its effectiveness. The results show that the regulated preheating by applying a quality based optimization will substantially reduce the required voltage of ohmic heating and also the temperature difference between the hot and cold spot so that can satisfy the sterilization temperature limits and guarantee more acceptable quality and safety of sterilized product.



(a) This figure schematically illustrates the assumed axisymmetric model of this study. The cylindrical container filled with aqueous solution (water). The suspending solid phase is assumed at the center of the liquid (fruit pulp or meat). Two electrodes located at the ends of the container apply the required electric potential. **(b)** This figure shows the generated temperature field inside the sterilization domain before using the presented method.

Recent Publications

1. Cho W I, Kim E J, Hwang H J, Cha Y H, Cheon H S, Choi J B and Chung M S (2017) Continuous ohmic heating system for the pasteurization of fermented red pepper paste. Innovative Food Science & Emerging Technologies 42:190-196.

2. Hradecky J, Kludska E, Belkova B, Wagner M and Hajslova J (2017) Ohmic heating: a promising technology to reduce furan formation in sterilized vegetable and vegetable/meat baby foods. Innovative Food Science & Emerging Technologies 43:1-6.
3. Kim N, Ryang J, Lee B, Kim C and Rhee M (2017) Continuous ohmic heating of commercially processed apple juice using five sequential electric fields results in rapid inactivation of *Alicyclobacillus acidoterrestris* spores. International Journal of Food Microbiology 246:80-84.
4. Lyng J G, McKenna B M and Arroyo C (2018) Ohmic heating of foods. In: Alternatives to Conventional Food Processing, ISBN 978-1-84973-037-2.
5. Sivashankari M and Pare A (2018) Ohmic heating: thermal processing of fruits and vegetables. In: Technological Interventions in the Processing of Fruits and Vegetables. Apple Academic Press, 121-138.

Biography

Farshad Bolourchifard has his expertise in Energy Systems and Computational Fluid Dynamics, improving the efficiency using multi-objective optimization methods. He did several simulations and experiments to improve the systems operation and also the final quality of the output.

farshad.bolourchifard@mail.polimi.it

Notes: