Developing and modelling of ohmic heating for solid food products

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Publication date:
2014

Document Version
Peer reviewed version

Innovations in Attractive and Sustainable Food for Health
28th EFFoST Conference | 7th Food Factory for the Future Conference
25-28 November 2014 • Uppsala Konsert and Kongress, Uppsala, Sweden
EFFoST
FOOD FACTORY

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Title:

Developing and modelling of ohmic heating for solid food products

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Heating of solid foods using the conventional technologies is time-consuming due to the fact that heat transfer is limited by internal conduction within the product. This is a big challenge to food manufactures who wish to heat the product faster to the desired core temperature and to ensure more uniform quality across the product. Ohmic heating is one of the novel technologies potentially solving this problem by allowing volumetric heating of the product and thereby reducing or eliminating temperature gradients within the product. However, the application of ohmic heating for solid food products such as meat and seafood is not industrially utilized yet. Therefore, the aim of the current work is to model and develop the ohmic heating technology for heating of solid meat and seafood.

A 3D mathematical model of coupled heat transfer and electric field during ohmic heating of meat products has been developed. The resulting coupled model equations were solved using the Finite Element Method (COMSOL Multi-physics® version 4.2). The experiments were carried out using a newly developed laboratory-scale ohmic heater with different setups e.g., different applied voltages. The temperature profiles and current were continuously measured inside the product. The model has been validated using the experimental data. Good agreement was achieved between model predictions and the experimental values. The model has been utilized to predict the temperature distribution and to control the process by tracking the cold spot and hot spot within meat products during the ohmic heating process. The conclusion is that Ohmic heating is a promising technology for heating of solid meat and seafood, and the developed model can be used in the design and optimization of the ohmic heating processes for the meat and seafood products.