Effect of accuracy of thermal diffusivity on the thermal process estimation of meat products

Eszes Ferenc, Zsarnóczay Gabriella, Bencsik Dóra, Csanádi József

Institute of Food Engineering of Faculty of Engineering of the University of Szeged

H-6725 Szeged Moszkvai körút 5-7

eszes@mk.u-szeged.hu, zsargab@mk.u-szeged.hu, bencsikd@mk.u-szeged.hu, csanadi@mk.u-szeged.hu

SUMMARY

The application of the CAD, inverse and reverse engineering and other calculation carried out by computer in the planning and improvement of the technological processes is essential. The elaboration of the planning and modifying variants can be shortened significantly in this way and a lot measuring experiments can be discarded by the application of calculations. The measure of the saving in expenditures depends on the on the parameter accuracy applied in the calculations. In the non-steady state heat transfer processes the thermal diffusivity is one of the key parameters on which a broad range data can be found in the international literatures.

IN our work we have focused on the meat products. Firstly we investigated how high is the range in the literature data and how high temperature estimation differences can be found if we apply different thermal schedule stopping conditions. The infinite series and finite difference solutions of Fourier differential equation are applied to the calculations with 25-100 mm diameter or side length, 1 dimension, and for heat transfer conditions in pasteurising basin, hot smoking and cooking chamber and autoclave. The thermal diffusivity values determined from the chemical composition and its experienced standard deviation of meat products by the equation of Miles et al. (1983) and Choi and Okos (1986), or from the heat penetration measurements carried out in the above mentioned units. In the course of the heat penetration we evaluated the curves having a parameter constellation closest to the least error.

Our results showed that the 10^{-8} m^2/s standard deviation in the literature can be decreased on $5*10^{-9}$ m^2/s by the application of the error analysis resulting the maximal temperature error decrease from ±2°C on ±1°C. In this way small differences could be found at stopping conditions at a definite point (given process time, reaching a core temperature). On the contrary, the difference for stopping conditions of reaching the given equivalent pasteurising time were higher and merely depends on the dynamics of the core temperature development and stepping over the reference temperature.