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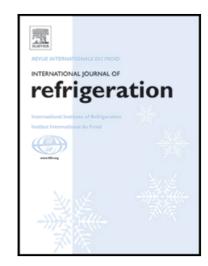
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ACCEPTED MANUSCRIPT

ANALYSIS OF THE FREEZING TIME OF CHICKEN BREAST FINITE CYLINDERS

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ABSTRACT

Chicken meat is among the most largely consumed meat worldwide. The shelf life of chicken meat is rather short so freezing is largely used to reduce water activity and stop the microorganism proliferation. In this paper experimental data available in the literature for food freezing, including poultry products, are briefly reviewed. Then, some new experimental measurements are presented for freezing of packed cylindrical chicken breast samples in air. The experimental freezing times were compared with the estimations of several semi-empirical or approximate models in the literature. Furthermore, by means of User Defined Functions for the implementation of the temperature-dependent thermophysical properties of chicken meat, the commercial CFD software package STAR-CCM+ was used for analyzing the freezing process and estimating the freezing times of the tested specimens. For engineering purposes, it was decided to follow a simplified approach, by using an average value of the overall airside heat transfer coefficient. The numerical estimations were rather good (mean relative error -1.4 % and mean absolute error 2.4 %).

HIGHLIGHTS

- Experiments on total freezing time of poultry samples were performed
- The variability of the predictions of some semi-empirical models was tested and critically discussed.
- STAR-CCM+ CFD package was used for the implementation of a 3D finite volume numerical model of meat freezing.
- Experimental measurements, results of semi-empirical models, and outputs of the numerical tool were compared.

KEYWORDS

Chicken breast, freezing time, experimental data, semi-empirical models, CFD, STAR-CCM+.

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