

NUMERICAL AND EXPERIMENTAL ANALYSIS OF ULTRASOUND ASSISTED FREEZING OF POTATO SPHERES

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Abstract

In the present study, ultrasound assisted immersion freezing process (in 1:1 ethylene glycol-water solution at 253.15 K) of potato spheres (0.02 m diameter) was evaluated using experimental, numerical and analytical approaches. Ultrasound was irradiated for different intensities (190, 890, 2400 W m⁻²). A finite volume based enthalpy method was used in the numerical model, based on which temperature and liquid fraction profiles were simulated by a program developed using OpenFOAM® CFD software. Euler and Gauss methods were used for time and space discretization. The results showed that ultrasound irradiation could decrease the characteristic freezing time of potatoes. The numerical model predicted the characteristic freezing time in accordance with the experimental results. The model can be used to study and control different operation situations, and to improve the understanding of the freezing process.

Keywords: Ultrasound assisted freezing, Potato, Phase change, Finite Volume Method, OpenFOAM®, CFD



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