Title Characterization of radio frequency heating of fresh fruits influenced by dielectric properties

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Abstract

Because of its fast and volumetric nature, radio frequency (RF) heating has been looked upon as a way to overcome the problems associated with conventional heating methods used for disinfestation of fruits. But non-uniform heating within fruits is a major obstacle in adaptation of this technology. In this study, RF heating patterns influenced by dielectric properties (DPs) of fruits were investigated both experimentally and mathematically. A computer simulation model was developed using FEMLAB 3.4, a commercial software for solving Maxwell's electromagnetic and Fourier's heat transfer equations. Orange, apple, grapefruit, peach, and avocado fruits, selected for these studies were subjected to RF heating in a water filled container equipped with a mechanism to keep fruits rotating and moving during RF heating in a 27.12 MHz, 12 kW parallel plate RF unit. DPs of constitutional parts of the selected fruits were measured by open-ended coaxial probe method. The study showed that dissimilarity in peel and pulp DPs greatly influenced the RF heating behavior of the fruits. Core heating was prominent in apple, peeled orange and grapefruit; whereas subsurface/peripheral heating in whole oranges and grapefruit, and avocado. The computer model was an effective tool in characterizing and explaining the heating patterns in the fruits based on DPs. The study helped in better understanding the complex RF heating characteristics of fruits, which may be useful in assessing the design feasibility of product specific RF energy based treatment protocol.