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EFFECTS OF DRYING AIR TEMPERATURE ON THE STRUCTURAL PROPERTIES OF GARLIC EVALUATED DURING DRYING

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Second order phase transitions may occur in foodstuffs during the convective drying process. These transitions involve physicochemical changes, which influence both structural properties and drying behavior. The aim of this study was to examine the effects of drying air temperature and the second order phase transition of garlic on the changes in particle density, apparent density, apparent porosity, effective diffusivity, and cracking produced during drying. Garlic slices were dehydrated at three air temperatures (40, 50, and 60°C). The moisture content (X), inside temperature (T_i), surface temperature (T_s), apparent (ρ_b) and particle (ρ_p) densities of garlic slices were measured during drying. Porosity (ε) was calculated based on the data collected for ρ_p and ρ_b. Glass transition temperatures (T_g) and micrographs were obtained for both raw and dehydrated garlic. A critical point in the intersection of T_i, T_s, and T_g was found; this point was identified as a second order phase transition. Diffusivity and slope changes in ρ_b, ρ_p, and ε with respect to moisture content were found to be related to this critical point. Experimental data for ρ_b, ρ_p, and ε was fitted to a nonlinear equation with three exponential terms with respect to moisture content, with an $R^2 > 0.85$. Less dense products were found to be more porous, with more cracking, higher moisture diffusivity, and lower T_g at the end of the drying process.

Keywords: ***Particle density, Apparent density, Apparent porosity, Glass transition temperature, Microstructure.***

INTRODUCTION

New, unconventional drying methods, such as infrared-convective, convective-frying, convective-lyophilization, and non-isothermal[1] drying processes have shown promising results for minimizing loss of quality in dried foodstuffs. Nevertheless, the effects of the most widely used drying method, convective drying, on the properties of foodstuffs are still not sufficiently understood. Before exploring new, alternative drying methods, it is necessary to fully understand the effects of the most common drying method on certain structural properties that are key in preserving the quality of dried foodstuffs and in minimizing deterioration both during and after processing.

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