

Applicability of X-ray microtomography for Characterizing the Microstructure of Frozen Apple during Storage

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Abstract

X-ray microtomography (X-ray micro-CT) was applied to visualise the change of 3D microstructure during freezing of 'Jonagold' apple at a pixel resolution of 3.83 μm . To better understand the microstructure evolution during freezing, pore size distributions were carefully analysed. This work highlighted the applicability of X-ray micro-CT to visualise the microstructure evolution in frozen apple samples subjected to three different freezing protocols (at -6 °C, -12 °C, -20 °C). Freezing process was done directly on cooling stage mounted on micro-CT system that allows one to follow the structure of the materials in frozen state.

It was observed that slow rate of heat removal at -6 °C damages cellular tissue of apple considerably as noted on the spatial irregularity of pores. Instead; slightly damaging of apple tissues was observed for the latter two freezing protocols (i.e. at -12 °C and -20 °C). From this study, we manage to show the application of X-ray micro-CT to reveal and quantify the 3D microstructure of frozen apple tissue during freezing.

Keywords