

Accepted Manuscript

Micro X-ray computed tomography and image analysis of frozen potatoes subjected to freeze-thaw cycles

Ying Zhao, Pawan S. Takhar



PII: S0023-6438(17)30058-0

DOI: [10.1016/j.lwt.2017.01.051](https://doi.org/10.1016/j.lwt.2017.01.051)

Reference: YFSTL 6003

To appear in: *LWT - Food Science and Technology*

Received Date: 25 October 2016

Revised Date: 17 January 2017

Accepted Date: 17 January 2017

Please cite this article as: Zhao, Y., Takhar, P.S., Micro X-ray computed tomography and image analysis of frozen potatoes subjected to freeze-thaw cycles, *LWT - Food Science and Technology* (2017), doi: 10.1016/j.lwt.2017.01.051.

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1 **Micro X-ray Computed Tomography and Image Analysis of Frozen Potatoes**
2 **Subjected to Freeze-Thaw Cycles**

3 Ying Zhao¹ and Pawan S. Takhar²

4 ¹ Agricultural and Biological Engineering, University of Illinois at Urbana-Champaign, Urbana,
5 IL, 61801, USA

6 ² Food Science and Human Nutrition, University of Illinois at Urbana-Champaign, Urbana, IL,
7 61801, USA

8 **Abstract**

9 Frozen products are subjected to freeze-thaw cycles during storage and shipping. These
10 temperature fluctuations result in ice recrystallization, which causes undesirable quality changes,
11 texture loss, and surface dehydration of frozen foods. The objective of this study was to
12 investigate the effect of temperature fluctuations on ice crystal growth/decay in frozen potatoes.
13 The potatoes, which were in a cuboid French fry shape, were frozen at -80 °C (control group)
14 and fluctuated from -17 and -16 °C, -17 and -11 °C, and -17 and -7 °C for one and two weeks'
15 duration. X-ray micro-computed tomography (CT) was used to observe the three-dimensional
16 (3D) microstructure of frozen potatoes. Image analysis showed significant growth of ice crystals
17 with increases in temperature fluctuations and duration of freezing. The total number of pores
18 was reduced with increases in amplitude and duration of freeze-thaw cycles. These results
19 demonstrate that micro-CT and image analysis can be used to analyze the microstructure of
20 frozen materials and obtain valuable information for designing the freezing process.

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