Title Dehydration reduces crack development in IQF “baby carrots”

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Abstract

Crack development and enhancement in Individually Quick Frozen (IQF) “Baby carrots” are major problems since they lower product quality, profitability and consumer preference. Studies were initiated to determine crack morphology, crack development physiology, and the effects of moisture status on crack development. Experiments were conducted to test the hypothesis that partial dehydration of carrots prior to quick freezing reduced cracking. Carrot samples were collected before being transported to freezing tunnels and divided into two treatments; controls and air-heated to partially dry the hydro-transported carrot Electrolyte leakage (EC/g), crack percentage, crack morphology, membrane injury indices (MII), and relative water content (RWC) were measured immediately after IQF processing and again after 8 weeks of frozen storage. RWC of the air-dried samples were significantly lower than the control (90% and 99%, respectively). Cracks decreased significantly in samples with low RWC (35% in control to 28% air-dried). Week 8 control samples also had a higher percentage of cracking (34% in week 8 to 30% initially). Electrolyte loss was significantly higher in air-dried samples both prior to and after 8 weeks of storage implying that hot-air drying and freezer storage damaged membranes to a greater extent than in controls. Electrolyte leakage however, did not translate into membrane injury since no significant differences were found in MII between treatments. Freezer storage significantly enhanced MII (23% in week 8 to 18% initially). Air-drying prior to quick freezing lead to a significant reduction in the dimensional morphology of cracks. Length decreased from 24.0 mm to 17.1 mm while crack width and depth decreased from 2.2 mm to 1.54 mm and 2.68 mm to 1.64 mm, respectively. Removing moisture (9%) from the product prior to quick freezing reduces cracks and seems to be a viable option to produce quality IQF “Baby carrots”.