

Title Quantification of cell membrane integrity and its relevance to texture quality of onions: Effects of high hydrostatic pressure and thermal processes

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Abstract

Different methods were assessed in order to obtain information on onion cell membrane integrity after high pressure and thermal processing and to study the impact of these treatments on cell compartmentalization and texture quality. To determine changes in cell membrane permeability and/or cell integrity the methodologies evaluated were: cell viability determination (light microscopy and neutral red staining), ¹H-NMR (T₂ and diffusion), biochemical products formed as a result of enzymatic activity (pyruvate content) and electrolyte leakage.

High pressure treatments consisted of 5 minute hold times at 50, 100, 200, 300 or 600 MPa. Thermal treatments consisted of 30 minute water bath exposure to 40, 50, 60, 70 or 90 °C. A comparison of all methods was done to determine changes in membrane permeability and integrity. There was strong agreement between the various methods in the determination of the ranges of high pressure and temperature that induce changes at the cell plasmalemma and tonoplast level. Membrane rupture could clearly be identified at 300 MPa and above in high pressure treatments and at 60 °C and above in thermal treatments. Membrane destabilization effects could already be visualized at 200 MPa and 50 °C treatments. The texture of onions was influenced by the state of the membranes and was abruptly modified once membrane integrity was lost.

The quantification of degree of cell membrane disruption imparted by preparation and processing food operations will allow for comparison and optimization of food processes