

Title Development of rapid and non-invasive nuclear magnetic resonance method for identifying freeze damaged citrus fruits

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Abstract

Nuclear Magnetic Resonance (NMR) is a versatile technology, which has emerged as a powerful analytical technique that probes the physical state of matter and provides both spatial and chemical information. In the food industry NMR applications appear in examining the physical and chemical characteristics of the products related with important quality parameters. In the present study, low field pulsed NMR was used to determine the spin-spin relaxation time (T₂) of whole navel and Valencia oranges. Navel oranges were exposed to ~ 5 °C and -5 °C and -17 °C. The weight and T₂ values were recorded before and after overnight (~20 h) exposure at each temperature. In navel oranges the exposure to 5 °C did not change the T₂ values compared to those obtained before the exposure but the exposure to -5 °C reduced the T₂ values by ~10%. Whereas, the Valencia oranges did not show any significant reduction in T₂ on exposure to 5 °C and -5 °C, however, exposure to -17 °C caused more than 20% reduction. The small reductions in weights were also observed due to dehydration as a result of exposure at each temperature studied. This suggested that the observed reduction in T₂ cannot be attributed due to dehydration. The possible cause of reduction in T₂ values when exposed to freezing temperature may be due to break down of membranes of juice segments and leakage of juice. The reduction in T₂ values of freeze-affected oranges can be potentially used for fast separation and grading of damaged fruits.