

Title Combination treatment of alkaline electrolyzed water and citric acid with mild heat to ensure microbial safety, shelf-life and sensory quality of shredded carrots

Author S.M.E. Rahman, Yong-Guo Jin and Deog-Hwan Oh

Citation Food Microbiology, Volume 28, Issue 3, May 2011, Pages 484-491

Keywords Alkaline electrolyzed water; Citric acid; Mild heat; Combination treatment; Microbial safety; Shelf-life and sensory quality; Shredded carrots

Abstract

The objective of this study was to determine the synergistic effect of alkaline electrolyzed water and citric acid with mild heat against background and pathogenic microorganisms on carrots. Shredded carrots were inoculated with approximately 6–7 log CFU/g of *Escherichia coli* O157:H7 (932, and 933) and *Listeria monocytogenes* (ATCC 19116, and 19111) and then dip treated with alkaline electrolyzed water (AIEW), acidic electrolyzed water (AcEW), 100 ppm sodium hypochlorite (NaOCl), deionized water (DaIW), or 1% citric acid (CA) alone or with combinations of AIEW and 1% CA (AIEW + CA). The populations of spoilage bacteria on the carrots were investigated after various exposure times (1, 3, and 5 min) and treatment at different dipping temperatures (1, 20, 40, and 50 °C) and then optimal condition (3 min at 50 °C) was applied against foodborne pathogens on the carrots. When compared to the untreated control, treatment AcEW most effectively reduced the numbers of total bacteria, yeast and fungi, followed by AIEW and 100 ppm NaOCl. Exposure to all treatments for 3 min significantly reduced the numbers of total bacteria, yeast and fungi on the carrots. As the dipping temperature increased from 1 °C to 50 °C, the reductions of total bacteria, yeast and fungi increased significantly from 0.22 to 2.67 log CFU/g during the wash treatment ($p \leq 0.05$). The combined 1% citric acid and AIEW treatment at 50 °C showed a reduction of the total bacterial count and the yeast and fungi of around 3.7 log CFU/g, as well as effective reduction of *L. monocytogenes* (3.97 log CFU/g), and *E. Coli* O157:H7 (4 log CFU/g). Combinations of alkaline electrolyzed water and citric acid better maintained the sensory and microbial quality of the fresh-cut carrots and enhanced the overall shelf-life of the produce.