

**Title** Evaluation of alternative sanitizers to chlorine disinfection for reducing foodborne pathogens in fresh-cut apple

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**Citation** Postharvest Biology and Technology, Volume 59, Issue 3, March 2011, Pages 289-297

**Keywords** *Escherichia coli* O157:H7; *Salmonella*; *Listeria*; Fruit disinfection; Antimicrobial substances

### Abstract

The risk of undesirable by-products from chlorine disinfection in fresh-cut industries, together with its limited efficacy, has led to a search for alternative agents. The aim of this study was to test several alternative putative antimicrobial substances to reduce *Escherichia coli* O157:H7, *Salmonella* spp. and *Listeria* spp. populations on fresh-cut apple. Carvacrol, vanillin, peroxyacetic acid, hydrogen peroxide, N-acetyl-L-cysteine and Citrox were selected for their results in *in vitro* assays against *E. coli* O157:H7 and *Listeria* spp., to be tested on fresh-cut apple plugs. Apple flesh was inoculated by dipping in a suspension of a mix of the studied pathogens at  $10^6$  cfu mL<sup>-1</sup>, and then treated with the antimicrobial substances. All treatments were compared to deionized water and a standard sodium hypochlorite treatment (SH, 100 mg L<sup>-1</sup>, pH 6.5). Pathogen population on apple plugs was monitored for up to 6 days at 10 °C. Bacterial reductions obtained by peroxyacetic acid (80 and 120 mg L<sup>-1</sup>), vanillin (12 g L<sup>-1</sup>), hydrogen peroxide (5, 10, 20 mL L<sup>-1</sup>) and N-acetyl-L-cysteine (5 and 10 g L<sup>-1</sup>) were similar or higher than reduction obtained by SH. In addition, bacterial populations were maintained at low levels throughout storage. No cells of any of the pathogens were detected in the peroxyacetic acid, hydrogen peroxide, Citrox and SH washing solutions after apple treatment. Peroxyacetic acid, hydrogen peroxide and N-acetyl-L-cysteine could be potential disinfectants for the fresh-cut industry as an alternative to chlorine disinfection. However, their effect on sensory quality and effectiveness under commercial processing conditions should be evaluated.