Microbial decontamination system combining antimicrobial solution washing and atmospheric dielectric barrier discharge cold plasma treatment for preservation of mandarins

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Abstract

The effect of a microbial decontamination system that integrates antimicrobial washing and in-package atmospheric dielectric barrier discharge cold plasma (ADCP) treatment on mandarin preservation was studied. A 0.2 % highly activated calcium oxide (CaO) aqueous solution and slightly acidic electrolyzed water containing 0.5 % fumaric acid (FS solution) were tested as antimicrobial washing solutions. ADCP treatment was applied to mandarins packaged in commercial polyethylene terephthalate (PET) containers at 26 or 27 kV for 1, 2, 3, or 4 min. *Penicillium digitatum* disease incidence on mandarins was lowest (77.1 %) after ADCP treatment at 27 kV for 2 min. *P. digitatum* disease incidence on untreated mandarins or those treated with ADCP after washing with CaO solution, FS solution, or CaO solution and FS solution consecutively was 97.3 %, 64.3 %, 87.1 %, or 80.0 %, respectively. ADCP treatment after washing with CaO solution (CaO-ADCP treatment) did not affect the appearance of mandarins, but altered the glossiness of the sensory attributes of mandarins ($p < 0.05$). CaO-ADCP treatment retarded increases in the respiration of the fruit and total soluble solid content of the flesh during storage at 4 °C, as well as the total polyphenol contents of mandarin peel at 4 °C and 25 °C. Neither ADCP treatment with nor without washing affected the pH of the flesh, ascorbic acid concentration of the flesh, antioxidant capacity of the peel, or color of the peel during storage at 4 °C and 25 °C. The results of this study demonstrated the potential of CaO-ADCP treatment for enhancing the storability of mandarins in plastic packages by inhibiting the growth of *P. digitatum* on fruit while minimizing changes to fruit quality during storage.