Synergistic effects of ultraviolet light irradiation and high-oxygen modified atmosphere packaging on physiological quality, microbial growth and lignification metabolism of fresh-cut carrots

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Abstract

The present study investigated influences of ultraviolet light C (UV-C; 2 kJ m^{-2}) irradiation and high-oxygen modified atmosphere packaging (MAP; 80 % O_2, 10 % CO_2 and 10 % N_2) on physiological quality, microbial growth and lignification metabolism of fresh-cut carrots. After 15-d cold storage, comparing with either treatment alone, the combination of UV-C irradiation and high-oxygen MAP (abbr. UV-C + MAP) more obviously inhibited firmness, weight loss, ascorbic acid, total carotenoid and γ-aminobutyric acid declines, reduced respiration and ethylene production rates as well as delayed bacterial growth. UV-C + MAP more strongly restrained whiteness index, total phenolic, lignin and malondialdehyde increases. Furthermore, UV-C + MAP treatment more efficiently retarded lignin synthesis by suppressing phenolic metabolism-related enzyme (phenylalanine ammonialyase, PAL; polyphenoloxidase, PPO; peroxidase, POD) activities and their gene (*DcPAL*; *DcPPO*; *DcPOD*) expressions. Above results indicated that UV-C + MAP exhibited synergistic effects in retaining physiological quality, delayed senescence process, reducing microbial growth, alleviating lignification degree, and lessened surface whitening. Therefore, UV-C + MAP could maintain overall quality and extend shelf-life during storage of fresh-cut carrots.