

Effects of controlled atmosphere on browning, redox metabolism and kernel quality of fresh in-hull walnut (*Juglans regia* L.)

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Abstract

The green hull of fresh walnuts (*Juglans regia* L.) is highly susceptible to browning and accompanied with deterioration of the walnut quality, and the currently available preservation technologies still do not meet the market threshold supply of fresh walnut. This study investigated the effect of controlled atmosphere (CA) storage alone and combination with 1-Methylcyclopropene (1-MCP) on hull browning and kernel quality of fresh in-hull walnut. Fresh in-hull walnuts were treated with air (Control), CA (5% O₂, 7.5% CO₂), 1-MCP (0.5 μL L⁻¹) + CA and stored at 0 ± 0.5 °C for 100 d. Browning incidence, hull redox metabolism, kernel color and walnut oil quality were analyzed. The results showed that CA promoted the activities of superoxide dismutase (SOD), catalase (CAT), and ascorbate peroxidase (APX), maintained total phenol (TP), γ-aminobutyric acid (GABA), ascorbic acid (ASA), and glutathione (GSH) contents, inhibited ethylene production, reduced reactive oxygen species (ROS) accumulation, and delayed the hull browning. Besides, CA attained the highest kernel quality through inhibited the decrease of kernel color value and moisture content, and reduced acid value (AV) and peroxide value (POV) of walnut oil. While 1-MCP + CA treatment increased the activities of antioxidant enzymes, the combination weakened the other positive effects of CA. However, hull browning and kernel deterioration in 1-MCP + CA were less than that observed in air control. Overall, CA was an effective method for the preservation of fresh in-hull walnut at 0 ± 0.5 °C.