

Title Hyperbaric treatment to enhance quality attributes of fresh horticultural produce
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Abstract

An experimental hyperbaric system was conceptualized, designed and built to explore the effect of hyperbaric treatment on the respiration rate (RR), respiratory quotient (RQ) and quality attributes of tomato. Housing five containers that could be individually pressurized from 1 to 9 atm_{abs}, the respirometer was equipped with a flow meter, control valve, pressure transducer; CO₂ and O₂ gas analyzer and type T thermocouples, all connected to a data acquisition and control card. A software interface was programmed to allow control of the air flow rate through the proportional valve of the flow meter, based on a PID (Proportional, Integral, and Derivative) algorithm.

Hyperbaric treatments on tomato fruit showed RR to be inversely proportional to the pressure applied: RR was reduced by 20% at 9 atm_{abs} compared to the control (1 atm_{abs}). At the onset of pressure application the RQ was low and increased to reach a value of approximately 1 within 120 hours. Low RQ values were caused by solubilization of CO₂ in the tomato cells at the beginning of the process.

Early breaker stage tomatoes were subjected to hyperbaric pressures of 1, 3, 5, 7 or 9 atm_{abs} for different durations (5, 10 or 15 days) at 13°C, followed by a storage period of 12 days at 20°C. The effect of hyperbaric treatment on postharvest quality of tomato fruits was evaluated with an emphasis on weight loss, firmness, color, lycopene content, titratable acidity (TA) and total soluble solids (TSS). Based on firmness values, control tomatoes were no longer acceptable for consumption after 12 days of post-treatment storage. Being subjected to hyperbaric pressures of 7 and 9 atm_{abs} for 15 days caused irreversible physiological damage to the tomatoes.

Treatments of 3, 5 or 7 atm_{abs} applied over 10 days, or 5 atm_{abs} applied over 5 days maintained marketable firmness. The lowest weight loss occurred with treatments of 3 or 5 atm_{abs} for 5 days, or 5 atm_{abs} for 10 days.

Lycopene content of the tomatoes was improved by hyperbaric pressure followed by 12 days of maturation. The greatest lycopene content--28% more than in the control--was obtained for tomatoes subjected to 5 atm_{abs} over 10 or 15 days.