

Enhancing the ascorbate–glutathione cycle reduced fermentation by increasing NAD⁺ levels during broccoli head storage under controlled atmosphere

Liang Wang, Fei Wang, Yuxiao Zhang, Yangli Ma, Yanyin Guo and Xinhua Zhang

Postharvest Biology and Technology, Volume 165, July 2020, 111169

Abstract

Broccoli is prone to adopting fermentation under inappropriate conditions, especially high-CO₂ atmospheres. In this study, broccoli stalks were soaked in 0.4 % reduced glutathione (GSH) for 3 h, before being maintained in 50 % O₂ + 50 % CO₂ or 30 % O₂ + 70 % CO₂ controlled atmosphere. We compared the samples with control broccoli heads soaked in distilled water and maintained in normal atmospheric conditions. Broccoli heads from all treatments were stored at 10 ± 1 °C with 90–95 % relative humidity. Under O₂/CO₂ conditions, GSH pre-soaking of broccoli stimulated the ascorbate–glutathione (AsA–GSH) cycle, elevated nicotinamide adenine dinucleotide (NAD⁺) levels, improved the antioxidant capacity, enhanced the activities of respiratory metabolism enzymes, led to a higher adenosine triphosphate (ATP) status, and efficiently inhibited the accumulation of ethanol and acetaldehyde produced by fermentation, compared with control broccoli. Thus, GSH pre-soaking competitively inhibited fermentation by increasing NAD⁺ levels by promoting the AsA–GSH cycle and electron transfer chain (ETC) pathway. In conclusion, this study provides a potential technology to prevent the occurrence of fermentation in postharvest product.