Roles of antioxidant capacity and energy metabolism in the maturity-dependent chilling tolerance of postharvest kiwifruit

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Postharvest Biology and Technology, Volume 168, October 2020, 111281

Abstract

To investigate the effects of fruit maturity on chilling injury, antioxidative capacity, and energy metabolism, 'Hongyang' kiwifruit were harvested at three stages of maturity (I, II, and III), based on soluble solid content (4.5–5.5 %, 6.5–7.5 %, and 8.5–9.5 %, respectively). The fruit were cold-stored at 0 °C for 100 d and then subjected to various analyses. Among the three fruit stages, stage II and III fruit were less susceptible to chilling injury and exhibited a higher abundance of antioxidant enzymes (superoxide dismutase, catalase, ascorbate peroxidase, and glutathione reductase) and energy and metabolism-related enzymes (H^+-adenosine triphosphatase, Ca^{2+}-adenosine triphosphatase, cytochrome C oxidase, and succinic dehydrogenase). Moreover, we observed lower levels of super oxide anion, H_2O_2, malondialdehyde content, and relative membrane permeability, and higher levels of ATP and energy charge. These results indicated that the higher resistance of stage II and III 'Hongyang' kiwifruit against chilling injury could be correlated to higher antioxidant and energy metabolism-related enzyme activities, ATP levels, and energy charges. However, the stage III fruit decayed faster than stage II fruit. The results indicate that the postharvest life of 'Hongyang' kiwifruit can be maximized by harvesting and storing kiwifruit at a soluble solids content of 6.5–7.5 %.