

Melatonin alleviates pericarp browning in litchi fruit by regulating membrane lipid and energy metabolisms

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Abstract

Melatonin functions as a pivotal bio-active molecule that is involved in diverse physiological processes in plants. This study investigated the effects of exogenous melatonin on browning, membrane phospholipids, membrane fatty acids, energy status, and activities of enzymes associated with lipid and energy metabolisms in harvested litchi (*Litchi chinensis* Sonn. cv. A4Wuhe) fruit during storage at 25 °C. The results exhibited that 0.4 mM melatonin treatment to litchi fruit retarded the development of browning and reduced the changes of cellular membrane permeability during storage. Melatonin treatment suppressed the increment of phospholipase D (PLD), lipase, and lipoxygenase (LOX) activities while prevented the hydrolysis of phosphatidylcholine (PC) into phosphatidic acid (PA). Compared to untreated fruit, higher contents of unsaturated fatty acids (USFA) (oleic acid, linoleic acid and linolenic acid), lower contents of saturated fatty acids (SFA) (palmitic acid and stearic acid) and a higher ratio of USFA to SFA were also found in litchi fruit receiving melatonin. In addition, melatonin treatment maintained the higher energy status, as indicated by the enhanced adenosine triphosphate (ATP) content and energy charge, which could be attributed to the enhanced activities of energy metabolism-related enzymes including H⁺-ATPase, Ca²⁺-ATPase, succinate dehydrogenase (SDH), and cytochrome C oxidase (CCO). These results suggest that melatonin could display a better performance to retard browning and senescence in litchi fruit by modulating membrane lipid and energy metabolisms.