

The role of melatonin in alleviating the postharvest browning of lotus seeds through energy metabolism and membrane lipid metabolism

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Abstract

To investigate the underlying mechanism of melatonin (MT) involvement in the browning of lotus pods and seeds, the samples were immersed in 100 $\mu\text{mol L}^{-1}$ MT and 10 $\mu\text{mol L}^{-1}$ luzindole, a nonselective MT1/MT2 receptor antagonist. The energy and membrane lipid metabolisms of lotus seeds during 8 d at 25 ± 1 °C were evaluated. The results indicated that MT treatment suppressed the browning of lotus seeds through enhancing the endogenous MT content, while luzindole demonstrated an opposite effect. Compared with the control, the MT treatment ensured the energy status of lotus seeds, as the ATP content and energy charge were promoted. The activities of cytochrome C oxidase (CCO), succinate dehydrogenase (SDH), and ATPases were enhanced by the treatment, which might contributed to the ATP production. Additionally, the cell membrane integrity of lotus seeds was maintained by MT treatment through reducing the cell membrane permeability, $\text{O}_2^{\bullet-}$ production rate, and malondialdehyde and H_2O_2 contents, as well as enhancing the unsaturated-to-saturated fatty acids ratio, which could be explained by inhibited lipoxygenase (LOX), lipase (LPS) and phospholipase D (PLD) activities. Thus, the sufficient energy supply and normal cell membrane function may be responsible for the attenuated browning of lotus pods and seeds by MT treatment.