

Impact of electron beam irradiation on the chlorophyll degradation and antioxidant capacity of mango fruit

Truc Trung Nguyen, Apiradee Uthairatanakij, Varit Srilaong, Natta Laohakunjit, Masaya Kato and Pongphen Jitareerat

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Abstract

At the present, the mechanism of chlorophyll degradation in response to ionizing irradiation in harvested fruits have not been examined. To understand the effect of electron beam (E-beam) irradiation on the chlorophyll degrading pathway in relation to chlorophyll degrading enzymes activity, reactive oxygen species (ROS) and antioxidant capacities of harvested mangoes stored at 13 °C for 16 days were studied. E-beam-treated fruit significantly suppressed the activities of chlorophyll degrading enzymes especially pheophytinase (PPH) and chlorophyll degrading peroxidase (Chl-POX) in the late stage of storage. This resulted in the chlorophyll content being maintained. However, E-beam irradiation did not affect the activities of chlorophyllase (Chlase) and magnesium de-chelatase (MD). The respiration rate, ethylene production, ROS accumulation (hydrogen peroxide [H₂O₂] and superoxide radical [O⁻₂]) immediately increased after E-beam treatment, following which they significantly decreased in comparison to the control. E-beam treatment enhanced the fruit's antioxidant capacity by activating the activities of catalase (CAT) and ascorbate peroxidase (APX) and glutathione (GSH) content, and inactivated the activity of superoxide dismutase (SOD). Further, it did not affect the activity of glutathione reductase (GR) and glutathione disulfide (GSSG), vitamin C content, or total phenolic content. These results imply that E-beam treatment has the potential to delay chlorophyll degradation by suppressing the Chl-POX and PPH activities as well as reduce ROS production via CAT, APX, and SOD activities and GSH content.