Applications of ultraviolet light–emitting diode technology in horticultural produce: a systematic review and meta-analysis

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Abstract

Essential factor influencing the growth of plants is quality and type of light, development, and accumulation of phytochemicals, especially those grown in controlled conditions. Light is essential source for photosynthesis in higher plants, whereas light signalling is important in plant morphogenesis. The development of LED technologies enables for the optimization of photosynthetic processes and the regulation of plant physiology through the manipulation of light parameters. The plant morphology and functioning are influenced by the LED light quality, duration, and intensity producing responses at biochemical, physiological, and anatomical levels. LEDs also improve the nutritional profile of fruits and vegetables by inducing resistance to abiotic and biotic stress, as well as their effect on bioactive compounds, physiological properties, and ripening process. This paper reviews the role of LEDs in pre-harvest and post-harvest storage of fresh produce, including the effects on physiological characteristics, secondary metabolites, nutritional properties, ripening process, resistance to biotic and abiotic stress, and post-harvest disease occurrence. This review also focuses on the role of LEDs and the impact of their various bandwidths on the preservation of horticultural produce pre- and post-harvest. LED treatment can enhance several phytochemicals such as phenolic compounds, carotenoids, and vitamins. It has a significant impact on antioxidant capacity and anthocyanin content. LED was seen to be an efficient lighting source for delaying or accelerating ripening of fruits, and as well as delaying senescence. Therefore, LED lighting is an promising technology for enhancing the shelf life of vegetables by increasing disease resistance.