

Development of an artificial fruit prototype for monitoring mango skin and flesh temperatures during storage and transportation

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Abstract

Postharvest losses in the mango global market may be as high as 30%, affecting the cost of production, which is passed on to the consumer. Lack of homogeneous air temperature in refrigerated containers, packages, pallets and difficulty of inserting temperature sensors in fruit are issues in addressing losses during transport. This study aimed to develop an artificial fruit with skin and flesh thermal behavior equivalent to those of 'Tommy Atkins' mangoes at different maturity stages, which could be used to monitor fruit temperature during storage, transportation and marketing. The materials used to simulate mango skin were white acrylonitrile butadiene styrene (ABS), crystal ABS, and poly lactic acid with wood powder (PLA Wood). Mango flesh was simulated using three agar concentrations, 5, 10 and 15%. A temperature sensor was inserted in the middle of each artificial fruit (42.5 mm deep into the agar-gel flesh) and another was inserted under the skin (1 mm deep), both in the center and equatorial region to monitor the fruit thermal behavior. Skin and flesh temperature changes were monitored during refrigerated storage with or without hydrothermal treatment. The thermal behaviors of White ABS and Crystal ABS skins were different from those of the mangoes, and it was not possible to simultaneously obtain high correlation with fruit at different maturity stages. Artificial fruit with PLA Wood skin and flesh containing 15% agar showed skin and flesh thermal behavior similar to that of mangoes at different maturity stages defined through the quality attributes skin and flesh color, soluble solids, citric acid, pH and firmness, with $R^2 = 97\%$, coefficient of variation between 7 and 17% and $P > F$ at 99% confidence level. Artificial fruit with PLA Wood skin and flesh containing 15% agar can be used for real-time monitoring of skin and flesh temperatures of 'Tommy Atkins' mangoes at different maturity stages after harvest.