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The Feasibility of using Laser Backscattering and Digital Image to Monitor Physico-Chemical Changes of Osmotically Pre-Treated Papaya during Drying

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Abstract

Non-invasive assessments are considered as an alternative method for evaluating quality attributes of agricultural products. This study investigated the feasibility of using the combination of a computer vision system (CVS) with laser diode emitting at 650 nm for predicting moisture content (MC), lightness (L*), hue (h*), chroma (C*), and shrinkage changes of osmotically pre-treated papaya (*Carica papaya* L.) during drying. Convective drying was conducted at four different temperatures (50, 60, 70, and 80°C) and the corresponding air velocity and relative humidity was controlled at 0.5 m/s and 10 g water/kg dry air, respectively. The illuminated area (AI) in pixel numbers and light intensity (IL) measured by grey values were used to monitor the photon migration profiles into the fruit tissue, while the segmented binary image area in pixel numbers (Aimage) was analysed from digital images. As expected, increasing drying temperature resulted to a decrease in MC and C* values, whereas L* and h* values increased as drying proceeded. The results also revealed that for each single AI, IL, and Aimage parameter obtained, can be used to describe all quality changes, except for C*-value. In addition, multiple parameter correlations of backscattering and digital image properties precisely yielded the best fit for MC, h*, and C* predictions because it showed the highest coefficient of determination (R^2>0.94). Therefore, the paper concludes that the use of CVS technique coupled with laser back scattering methods provide useful tools for quality control of fruit during drying. Moreover, they are multipurpose and non-intrusive methods for in-line measurements in food processing industry.

Keywords: Drying, image analysis, laser backscattering, osmotic dehydration, papaya

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