MONITORING FRUIT OPTICAL PARAMETERS USING LASER LIGHT BACKSCATTERING IMAGING TECHNIQUE DURING DRYING

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ABSTRACT

The moisture content of fruits is one of the most important quality parameters that requires monitoring during the drying process, because it directly affects the storability and market potential. Thus, the main objective of the presented work was to evaluate the laser light backscattering imaging (LLBI) technique for monitoring the moisture content of banana fruit during drying. In a nondestructive manner, laser diodes with wavelengths of 532 nm, 635 nm, 780 nm, 808 nm, 850 nm, and 1064 nm were used to investigate the optical properties of the banana. Scattering images have been taken before and after the samples were exposed to hot air drying of 60 °C. Experiment was repeated 4 times. The grey level intensity and the size of the backscattering area were extracted from the images. The scattering profiles were characterized by the Gaussian- Lorentzian cross product (GL) distribution function with five parameters and absorption, reduced scattering, and effective attenuation coefficient from Farrell's diffusion theory models. Both models are based on radial intensity profiles. The wavelengths of 780, 808, and 850 nm achieved good fit with $R2 > 0.993$ for Gaussian-Lorentzian cross product (GL) model and $R2 > 0.951$ for Farrell's diffusion model. The maximum value of scattering and the minimum value of absorption and effective attenuation coefficients have been observed at 532 nm, with $R2 > 0.997$ for both models. In contrast, higher absorption and effective attenuation and lower scattering coefficient values were obtained at wavelengths of 635 nm and 1065 nm with $R2 < 0.98$ for both models. Significant change was observed for all optical properties of the tissue in response to drying ($p < 0.05$). This is the result of the degradation of pigments, cellular structures, and moisture content. The moisture content of bananas was successfully monitored in a non-destructive way using LLBI technique during the drying process.

Keywords: Laser backscattering Imaging, Drying, Optical properties