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REAL-TIME MONITORING OF ORGANIC CARROT (VAR. *ROMANCE*) DURING HOT-AIR DRYING USING NEAR-INFRARED SPECTROSCOPY

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ABSTRACT

The worldwide consumption of dried carrot (*Daucus carota L.*) is on a growing trend due to its increasing use as a raw material for organic snacks, integral breakfast foods, chips, etc. Conventional methods for drying carrots include hot-air drying and freeze-drying, which are usually uncontrolled and therefore prone to product quality deterioration. Thus, there is a need for innovative drying systems that yield high-value end products. In this study, the efficacy of NIR spectroscopy for the non-destructive monitoring of physicochemical changes in organic carrot slices during 8-h hot-

air drying at 40°C was demonstrated and the impact of hot-water blanching pre-treatment (at 95°C for 1.45 min) for enzyme inactivation on model performances was evaluated. Partial least squares (PLS) regression models based on NIR reflection spectra were developed to monitor changes in water activity (R^2 = 0.91-0.96), moisture content (R^2 = 0.97-0.98), total carotenoids content (R^2 = 0.92-0.96), lightness for unblanched carrots (R^2 = 0.80-0.83) and hue angle for blanched samples (R^2 = 0.85-0.87). Soluble solids content prediction was poor for both treatments (RMSEP = 3.43-4.40). Classification analysis was performed for the development of discriminant models able to recognise dehydration phases of carrot slices on the basis of their spectral profile. The classification models were computed using K-means and Partial Least Squares Discriminant Analysis (PLS-DA) algorithms in sequence. The performance of each PLS-DA model was defined based on its accuracy, sensitivity and specificity rates. All of the selected models provided from good (>0.85) to excellent (>0.95) sensitivity and specificity for the predefined drying phases. Feature selection procedures yielded both regression and classification models with performances very similar to models computed from the full spectrum. Results suggest that hot-water blanching negatively impacted the feature selection procedure in terms of selected wavelengths due to pronounced effects on both water loss and the microstructure of carrot tissue.

Keywords: *Daucus carota L.*, smart drying, carrot slices, convective air drying, chemometrics, feature selection

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