REAL-TIME MONITORING OF ORGANIC APPLE (VAR. GALA) DURING HOT-AIR DRYING USING NEAR-INFRINGEMENT SPECTROSCOPY

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ABSTRACT

Dried apple (Malus domestica B.) shows a growing trend to its worldwide consumption as raw material to produce organic snacks, integral breakfast foods, chips, etc. Apple is often dried by conventional methods (e.g. hot-air drying, freeze-drying, etc.), which are usually uncontrolled and then prone to product quality deterioration. Thus, there is a need for the development of new drying systems able to guarantee high-value end products. In this study, the feasibility of NIR spectroscopy as smart drying technology to non-destructively detect and monitor physicochemical changes in organic apples wedges during 8-h hot-air drying at 60°C has been investigated. Moreover, the impact of microwave heating pre-treatment (at 850W for 45 sec) as enzyme inactivators on model performances was also evaluated. Partial least squares (PLS) regression models were successfully
developed to monitor changes in water activity ($R^2 = 0.97\div0.98$), moisture content ($R^2 = 0.97\div0.98$), SSC ($R^2 = 0.96\div0.97$) and chroma ($R^2 = 0.77\div0.86$) during drying. Classification analysis was performed for the development of discriminant models able to recognise dehydration phases of apple wedges 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 a very-good (>0.90) or excellent (>0.95) sensitivity and specificity for the predefined drying phases. Feature selection procedures allowed to obtain both regression and classification models with performances very similar to models computed from the full spectrum. Results suggest that effect of microwave heating on both water loss and microstructure of apple tissue was pronounced, mainly affecting the features selection procedure in terms of selected wavelengths.

**Keywords:** *Malus domestica* B., smart drying, apple wedges, convective air drying, chemometrics, feature selection

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