Non-destructive quantitative analysis of carotene content in carrots using Raman spectroscopy

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European Food Research and Technology 247: 2299–2307. (2021)

Abstract

Carotene is the main source of vitamin A in the body, which has anti-oxidative, immune-regulatory, anti-cancer and anti-aging effects. The aim of this study was to develop a non-destructive method for the determination of carotene content in carrots using Raman spectroscopy combined with chemometrics. Raman spectra of carotene and carrot were collected to determine the Raman peaks of carotene in the carrot's Raman spectrum. According to the Raman peaks of carotene, the distribution of carotene content in carrots was discussed. The average Raman spectra of different parts of carrot were used to represent the carrot sample. Quantitative models of principal component regression, partial least squares (PLS) and least squares support vector machine were established using the all-band spectra of carrots and the characteristic band spectra of carotene in carrots. The results showed that the modeling results of characteristic band spectra of carotene in carrots are better than that of all-band spectra of carrots. Among them, the PLS model has good prediction accuracy, the RMSE of the prediction set samples is 4.660 mg/kg, and the coefficient of determination is 0.950. Raman spectra of five carrots were used to verify the prediction ability of the model, there was no significant difference between the predicted value and the true value. The research results provided a method support for the quantitative analysis of carotene content in carrots.