

Determination of free fatty acids in crude palm oil and refined-bleached-deodorized palm olein using Fourier transform infrared spectroscopy

ABSTRACT

A rapid direct Fourier transform infrared (FTIR) spectroscopic method using a 100 μ BaF₂ transmission cell was developed for the determination of free fatty acid (FFA) in crude palm oil (CPO) and refined-bleached-deodorized (RBD) palm olein, covering an analytical range of 3.066.5% and 0.0760.6% FFA, respectively. The samples were prepared by hydrolyzing oil with enzyme in an incubator. The optimal calibration models were constructed based on partial least squares (PLS) analysis using the FTIR carboxyl region (C=O) from 1722 to 1690 cm^{-1} . The resulting PLS calibrations were linear over the range tested. The standard errors of calibration (SEC) obtained were 0.08% FFA for CPO with correlation coefficient (R²) of 0.992 and 0.01% FFA for RBD palm olein with R² of 0.994. The standard errors of performance (SEP) were 0.04% FFA for CPO with R² of 0.998 and 0.006% FFA for RBD palm olein with R² of 0.998, respectively. In terms of reproducibility (r) and accuracy (a), both FTIR and chemical methods showed comparable results. Because of its simpler and more rapid analysis, which is less than 2 min per sample, as well as the minimum use of solvents and labor, FTIR has an advantage over the wet chemical method.

Keyword: FTIR; Free fatty acids; Palm oil; Palm olein; Partial least squares analysis; Spectroscopy