Quantification of Pyropheophytins in Extra Virgin Olive Oils Using Portable Mid-Infrared Spectroscopy and Multivariate Analysis

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Extra virgin olive oil (EVOO) is a major increasing component of the American diet, consuming 300,00 tons of EVOO in 2012. The EVOO consists of distinctive sensory and nutritional characteristics. The chlorophyll pigment gives the deep green color to the EVOO, which is pleasing to consumers. Thermal degradation, blanching, light, oxygen, enzymes, and weak acids will cause the chlorophyll degradation to advance to pyropheophytins. The pyropheophytins will occur as a yellow-brown pigment from the degradation of chlorophyll over time. Pyropheophytins are one of the most important indicators of overall oil quality and freshness, identifying the storage mishandling of EVOO. According to Edwin Frankel, pyropheophytins content should not be exceeding 15% in EVOO. Current analytical techniques use chromatographic methods that are time-consuming, expensive, and labor-intensive. The objective of this study was to develop a rapid and robust technique for rapid (1min) quantification of pyropheophytins in EVOO using a portable Fourier Transform infrared spectrometer (FT-IR) combined with a multivariate analysis. EVOO samples (n=114) were kindly provided by Borsa Laboratories, a Turkish contract laboratory that tests the quality of exported EVOO. The spectra of a drop of EVOO oil were directly collected using a portable FT-IR with a temperature controlled (65°C) crystal and analyzed by partial least squares regression (PLSR). High-performance liquid chromatography (HPLC) was used as a reference analysis technique to determine pyropheophytins content in EVOOs. Pyropheophytins content of the samples ranged from 1.3–31.7, and 31% of the samples were exceeding the limit of 15%. The predicted pyropheophytins content showed good correlation between reference tests and FT-IR spectra (Rval≥0.90) and gave low standard error of predictions (SEP≤1.7) that would allow the olive oil industry could use this technique for quality control applications. Portable FT-IR enables portability and ease-of-use, making it a great alternative to traditional methods.