Detection of Adulteration of Olive Oil with Fourier Transform Infrared Spectroscopy and Chemometrics

Gozde Gurdeniz, Figen Tokatli, Banu Ozen
Izmir Institute of Technology
Urla-Izmir, Turkey

High economic value olive oils have often been adulterated with other oils. Adulteration does not have only economical implications but also have toxicological consequences. Although the analytical methods improve with technological advances, adulteration methods also become more difficult to detect. Several chemical analysis methods are available for detection of the purity of olive oils. Use of Fourier transform infrared (FTIR) spectroscopy in authentication of oils has the advantages of minimum sample preparation and quick analysis.

Detection of several ways of adulteration of extra-virgin olive oils was studied with analysis of FTIR spectra with chemometric techniques such as principal component (PCA) and partial least square (PLS) analysis. Extra-virgin olive oil was adulterated with hazelnut oil and binary mixtures of other edible oils. Mixtures of two different monovarietal olive oils were also prepared and analyzed. Ease of discrimination of olive oil and the adulterated sample depends on the type of the adulterant. Discrimination of mixtures of two monovarietal olive oils was successfully achieved with PCA. PCA also correctly classified hazelnut oil adulterated olive oils and pure olive oils even at low concentrations. In addition, FTIR analysis in combination with chemometric techniques was effective in detection of binary mixtures of other edible oils in olive oil at concentrations as low as 5%. PLS accurately predicted the adulterant concentrations in olive oil in all three cases.

These results indicate that mid-infrared analysis and chemometric techniques are effective ways of detecting adulteration of extra-virgin olive oil with different edible oils.