Discrimination between virgin olive oils from Crete, the Peloponese and other Greek islands using near infrared transflectance spectroscopy

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Food adulteration is a serious consumer fraud and a potentially dangerous practice. Regulatory authorities and food processors require a rapid, non-destructive test to accurately confirm authenticity in a range of food products and raw materials. Olive oil is a prime target for adulteration either on the basis of the processing treatments used for its extraction (extra virgin vs virgin vs refined oil) or its geographical origin (for example, Greek vs Italian vs Spanish). As part of an investigation into this problem, some preliminary work focused on the ability of near infrared spectroscopy to discriminate between virgin olive oils from geographically-close regions of the Mediterranean, i.e., Crete, the Peloponese and other Greek islands.

A total of 64 oils were collected: 18 from Crete, 28 from the Peloponese and 18 from other Greek islands. Oils were stored at 20°C prior to spectral collection at room temperature (15–18°C). Spectra

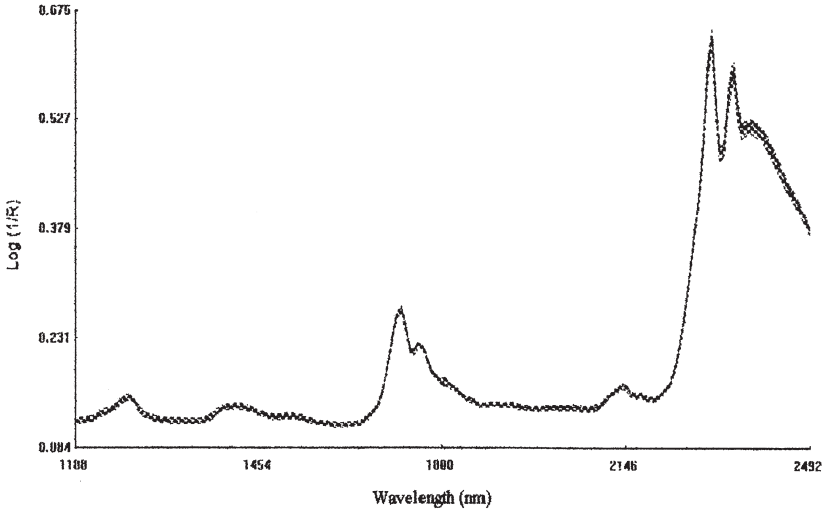

Figure 1. Transflectance spectra of 64 virgin olive oils from Crete (18), the Peloponese (28) and other islands (18).

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Figure 2. Camlock cell with gold-plated disc

were recorded between 400 and 2498 nm at 2 nm intervals on a NIRSystems 6500 scanning monochromator (Figure 1). Samples (approximately 0.5 mL) were placed in a camlock reflectance cell with a gold-plated backing plate (Figure 2), producing a sample thickness of 0.1 mm.

Classification into three categories (**C**rete, **P**eloponese and **O**ther) was investigated using factorial discriminant analysis and separate calibration and prediction sample sets (50% of samples in each). Results obtained are shown in Table 1. Best results used spectral data in both the visible and near infrared ranges. Sample scores (Figure 3) reveal the clustering achieved with the best model while the relevant discriminant profiles are shown in Figure 4.

Table 1. Classification results using factorial discriminant analysis.

		% Correct classification	
Spectral range (nm)	Principal components	Calibration set	Prediction set
400–2498	1,3,7,12	96.9	93.9
1100–2498	2,4,5,6	84.4	72.7
400–750	1,3,4	78.1	72.7
1800–2200	4,3,2,13,5,9	96.9	93.9

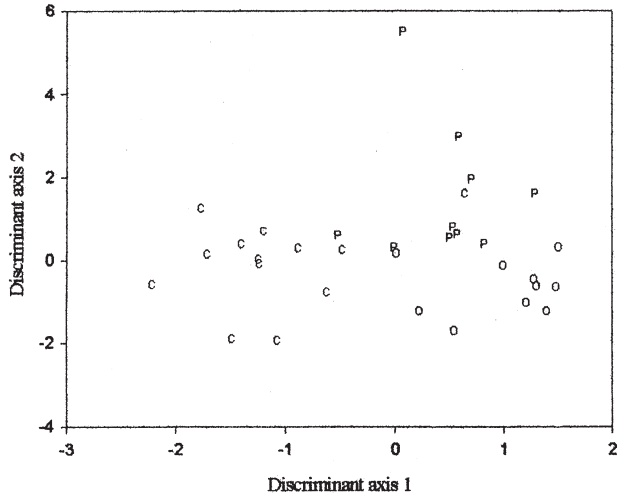

Figure 3. Discriminant scores plot (400–2498 nm).

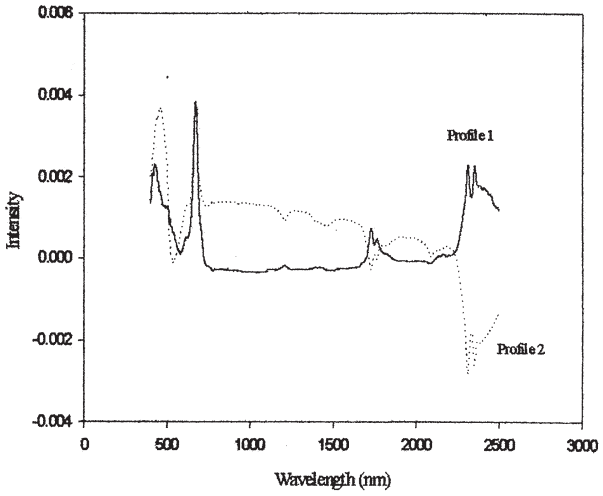

Figure 4. Discriminant profiles.