Measurement of olive oil quality

Introduction

Olive oil is used extensively in the food industry and is of significant commercial importance. A range of olive oil grades is available; the grades being classified by several parameters as specified in EEC regulations. Olive oil has an association with healthy eating, as it has very low cholesterol (0.5%) and 77% of its fat content is present as mono-unsaturated fat. It has been linked to the lowering of blood cholesterol, especially the "harmful" low-density lipoproteins, whilst protecting the beneficial high-density lipoproteins.

Measurement of quality and purity

Olive oil is produced by the cold pressing of the olive (pulp, stone and skin) and separating the oil by mechanical means. The highest grade of olive oil is extra virgin, which is produced from a first cold pressing of the fruit. Subsequent extraction and refining leads to other grades of oil, whilst oil produced from the solid mass is obtained using a heat process. It is technically possible to reduce undesirable odours of poor quality oils to obtain neutral oils that can be blended with extra virgin oils. Thus parameters that indicate whether refined oil has been added to the expensive high grade oils are required.

UV spectrophotometric analysis provides an extremely rapid method of showing the presence of refined oil in a sample. The presence of fine detail in the 260 - 280nm region of the spectrum is due to conjugated diene and triene system absorption and is indicative of extra virgin olive oil, whereas this detail is swamped and lost if refined oils are present. The analytical methods described in Regulations EEC/2568/91 (1991) and EEC/2472/97 (1997) are based on measuring absorbance at several wavelengths - using some in a simple equation - to see if certain criteria are met:

Abs 232	Should be less than 2.4
Abs 270	Should be less than 0.2
Abs 270 – (Abs266 + Abs 274) / 2	Should be less than <0.01

Measurements for contamination can also be made in the visible region (413, 454, 482, 631 and 669 nm) but give 10 % of the response from the selected UV wavelengths.

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Note also that new regulations, from 1 November 2002, set out clearer standards for the marketing and labelling of olive oil and products containing the oil, and complements existing rules governing the production of the oil. In practice, this means that if a manufacturer wants to market or label a product as being based on or containing olive oil, in addition to existing regulations governing the labelling of the product, they must either indicate the share of olive oil in the total weight of the product or the percentage of olive oil as percentage of the total fat.

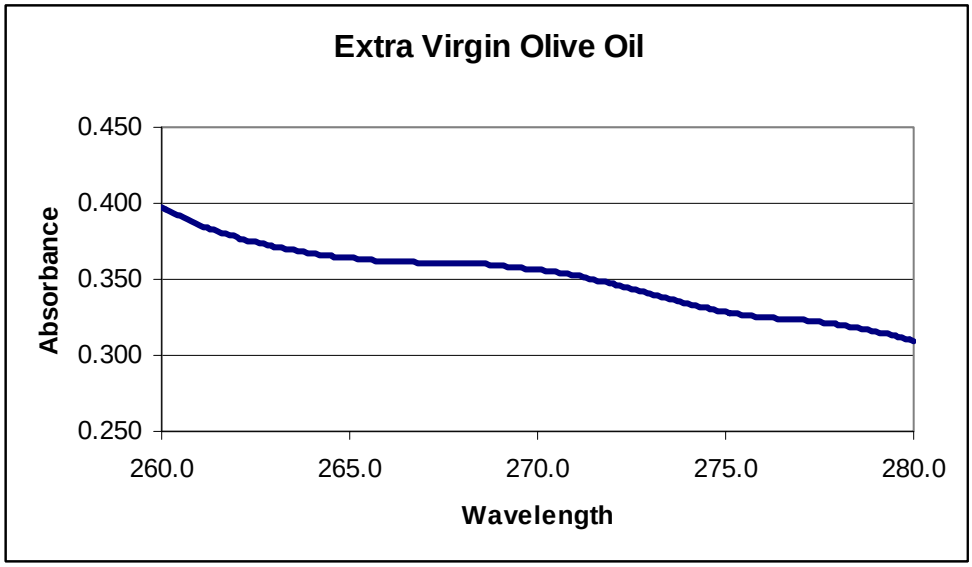
Method

To assess the effects of olive oil contamination, a sample of extra virgin olive oil was measured directly. A further sample was prepared in which the oil was mixed with 10 % refined oil to simulate adulteration or extension of the pure oil. The Libra S22 and S32 UV/Visible spectrophotometers have graphic displays with scanning and multi-wavelength equation entry facilities that make them ideal for this application, since the multi-wavelength measurements can be included as a stored method making them stand alone olive oil analysers for routine use.

Absorbances were measured using 10mm pathlength quartz UV cuvettes in an 8 cell changer on the Libra S32, with reference readings made on spectroscopic grade n-hexane. The oil sample dilution used in this solvent was 1%.

Results

The scan of the extra virgin olive oil shows the detail that is expected (original data exported to Excel for clarity)



The extra virgin olive oil and the deliberately adulterated sample gave the following absorbance readings.

Wavelength, nm	Extra virgin olive oil	Adulterated olive oil	EC criteria
232	1.084	2.750	<2.400
266	0.130	1.100	
270	0.126	0.925	<0.200
274	0.119	0.880	
Equation	0.002	0.065	<0.010

Equation used is Abs 270 – (Abs266 + Abs 274) / 2

Note how the contaminated sample has much higher absorbances in the region of interest and how the stored equation results go outside of the limits imposed by the regulations. The commercial sample of extra virgin oil falls well within the EC criteria.

Discussion and Conclusions

These spectrophotometric tests for olive oil quality can be easily and conveniently performed using the Libra S22 and S32 UV/Visible spectrophotometers in accordance with EC guidelines. User friendly print outs make record keeping very easy; if prefered, results can be readily downloaded to Excel for possible inclusion in a LIMS system.

Ordering details

Libra S32	80-2115-30
Libra S22	80-2115-20