APPLICATION NOTE

UV/VIS SPECTROSCOPY

Determination of olive oil purity and degree of oxidation using the LAMBDA XLS

Introduction

Olive oil is well established in the food industry. Demand continues to grow not only because of its distinct flavor, but also because of an increased awareness of its health benefits. In fact, the FDA allows producers of olive oil to place a health claim on their products because there is some scientific evidence to support a risk reduction of coronary heart disease by consuming a higher proportion of monounsaturated fat in one's diet. This is significant because olive oil is considerably rich in monounsaturated fats, most notably oleic acid. It is therefore of interest to producers to know the quality of the oil, its state of preservation and changes brought about in it by technological processes. EEC Regulation 2568/91 (1991) outlines the method for measuring olive oil purity, using a UV spectrophotometric technique.

The quality of the olive oil is studied by measuring the characteristics of the absorption bands between 200 and 300 nm. These are frequencies related to conjugated diene and triene systems. A low absorption in this region is indicative of a high quality extra virgin olive oil, whereas adulterated/refined oils show a greater level of absorptions in this region.

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Instrument

The PerkinElmer® LAMBDA™ XLS UV/Vis spectrophotometer, shown in Figure 1, is a stand-alone, robust scanning spectrophotometer with no moving parts and a unique Xenon Lamp Source (XLS) with a typical lifetime of 5 years. The system produces reliable and accurate oil purity results in relation to EEC Regulation 2568/91 (1991) in seconds.

The LAMBDA XLS is equipped with a large LCD screen making running methods and viewing data easier. Results can be printed, stored, or exported into Microsoft® Excel® for use on your personal computer.

Method

Olive oil samples were diluted in iso-octane (2,2,4- trimethylpentane). All samples were measured in matched, synthetic fused silica cuvettes (10 mm is the recommended pathlength) running a solvent blank as a reference.

Absorption measurements for purity determination were made at 232, 266, 270 and 274 nm. K values were calculated according to the equation shown in Figure 2.

The purity of olive oil can be determined from three parameters:

- **K_{232}** Absorbance at 232 nm
- **K_{270}** Absorbance at 270 nm
- **Delta K** (Figure 3)

The LAMBDA XLS was used to collect UV data from 4 x different label graded commercial olive oil samples.

Results

The results collected using the LAMBDA XLS for the 4 x different graded olive oils showed correct alignment with the EEC Regulation limits (Table 1).

Conclusion

The LAMBDA XLS is a reliable and cost effective system appropriate for compliance with EEC Regulation 2568/91 (1991); the standard method for measuring olive oil purity, using a UV spectrophotometric technique.

Table 1. Measured and Permitted K Values of Commercial Olive Oils.

	Measured K values				
Olive oil sample type	**K232**	**K266**	**K270**	**K274**	**Delta K**
'Extra virgin' sample 1	1,897	0,151	0,148	0,135	0,005
'Extra virgin' sample 2	1,717	0,201	0,189	0,173	0,002
'Virgin' sample 3	1,436	0,240	0,248	0,223	0,016
'Olive oil' sample 4	3,000	0,640	0,832	0,458	0,283
Maximum Permitted Values (EEC Commission number 2568/91)					
Extra virgin olive oil	≤ 2,4		≤ 0,20		≤ 0,01
Virgin olive oil	≤ 2,5		≤ 0,25		≤ 0,01
Olive oil	≤3.3		≤ 1,0		≤ 0,13

Figure 1. LAMBDA XLS UV/Vis Spectrophotometer.

$$K\lambda = \frac{\text{Abs } \lambda}{D \times L}$$

D = Dilution gr/L

L = cuvette pathlength

Figure 2. K equation for λ nm.

$$\text{Delta K} = K_{270} - \frac{K_{266} + K_{274}}{2}$$

Figure 3. Delta K equation.

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