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APPLICATION NOTE

Olive Oil Quality Assessment with UV-Vis Spectrophotometry

EDINBURGH INSTRUMENTS

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Introduction

Olive oil has been valued for its culinary and cultural significance for millennia. As one of the most widely consumed edible oils globally, quality standards are defined and monitored by regulatory bodies such as the International Olive Council (IOC). The IOC has defined grades for olive oil based on its quality and purity, with three primary classifications: extra virgin, virgin, and olive oil. Extra virgin olive oil is obtained solely by cold mechanical extraction and is prized for its superior taste, characterised by low acidity. Virgin olive oil, while slightly lower in quality than extra virgin, still maintains significant sensory and nutritional qualities. Olive oil, the most widely available grade, may undergo refining processes and often exhibits a milder flavour profile.

Despite extensive countermeasures, several cases of olive oil fraud are reported each year in Europe.[1] These cases commonly involve mixing extra virgin olive oil with a lower-quality edible oil or adding colourants to the olive oil to pass as extra virgin. The integrity of the oil can also be compromised by improper storage and processing. Reliable olive oil analysis methods are essential for ensuring adherence to regulatory standards and gaining consumer trust.

One of the most reliable techniques for assessing the quality of olive oil is UV-visible (UV-Vis) spectrophotometry. This analytical method offers a precise and efficient means of quantifying various compounds present in olive oil, including pigments, phenolic compounds, and oxidation products, by measuring the absorbance of specific wavelengths of light. UV-Vis spectrophotometry only requires a benchtop instrument and almost no sample preparation; therefore, it is an ideal tool for the rapid identification of adulteration or degradation.

In this Application Note, an Edinburgh Instruments DS5 Spectrophotometer is used for the quality assessment of edible oils, including extra virgin, virgin, and lower-grade edible olive oils, following the industry's standard UV-Vis analysis method. Additionally, a method to quantify olive oil adulteration using its visible absorption spectrum is evaluated.

Materials and methods

Commercial edible oils were purchased and used as provided (Figure 1, Table 1). Sample HEVOO was prepared by heating EVOO above its smoke point for a duration of 5 minutes.

Table 1 | Edible oil sample contents and their abbreviation.

Sample	Details
EVOO	Extra virgin olive oil
VOO	Virgin olive oil
PO	Olive pomace oil. Blend of refined olive pomace oil and virgin olive oil
HEVOO	Heated extra virgin olive oil. EVOO sample heated above smoke point for 5 minutes
BO	Blended oil. Commercial blend of 90% refined sunflower oil and 10% extra virgin olive oil
SO	Sunflower oil

Figure 1 | Edible oil sample contents and their abbreviation.

The quality of samples EVOO, VOO, PO, and HEVOO was assessed using the method established by the International Olive Council.[2] The method requires a spectrophotometer which can measure with 1 nm resolution between 220 nm and 360 nm. Linearity, wavelength and photometric accuracy in the UV range must be verified before the measurements. This study employed a DS5 Spectrophotometer (Figure 2), its performance was validated using holmium oxide and potassium dichromate standards. The samples were diluted in isooctane to a concentration of 1% (m/V), transferred to quartz cuvettes and studied in the DS5 Spectrophotometer after performing a baseline correction.

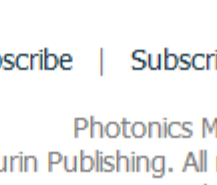

Figure 2 | Edinburgh Instruments DS5 UV-Vis Spectrophotometer.

Olive Oil Quality Assessment with UV-Vis Spectrophotometry

UV-Vis spectrophotometry is a simple and efficient technique for the analysis and evaluation of the quality of olive oil. Extra virgin, virgin, and lower-quality olive oils can be distinguished by measuring their absorbance at four UV wavelengths. The full UV-Vis absorption spectrum provides valuable qualitative and quantitative information when oil adulteration is suspected.

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