

Quality grade identification of essential oil. "A compact near infrared spectrometer for efficient field measurement of liquid sample"

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Introduction

Recently, the demand for essential oils has been increasing in medical treatment, as well as in aromatherapy treatment. Accordingly, the quality assurance matter has become more imperative. The aim of this research was to develop a method for identifying the quality grade of essential oils easily, with a compact near-infrared (NIR) spectrometer.

Materials and methods

Figure 1. shows a comparison of three Lavender-essential oils, delivered from different dealers, and a genuine Lavender-essential oil as reference.

Figure 2 (Photograph.1). shows the AOTF (Acousto-Optic Tunable Filter) NIR spectrometer used in this research.

Main specifications of the instrument:

Model OptScan-C

Wavelength range 1250–2500 nm (800–4000 cm⁻¹)

Resolution 1 nm

Scan rate 4000 points/sec.

PC interface USB-2 (Wireless option)

Dimensions 55–100–230 mm, 1.2 kg

Figure 3. shows a drawing of the measurement module to hold a liquid drop (10 micro L) for measurement.

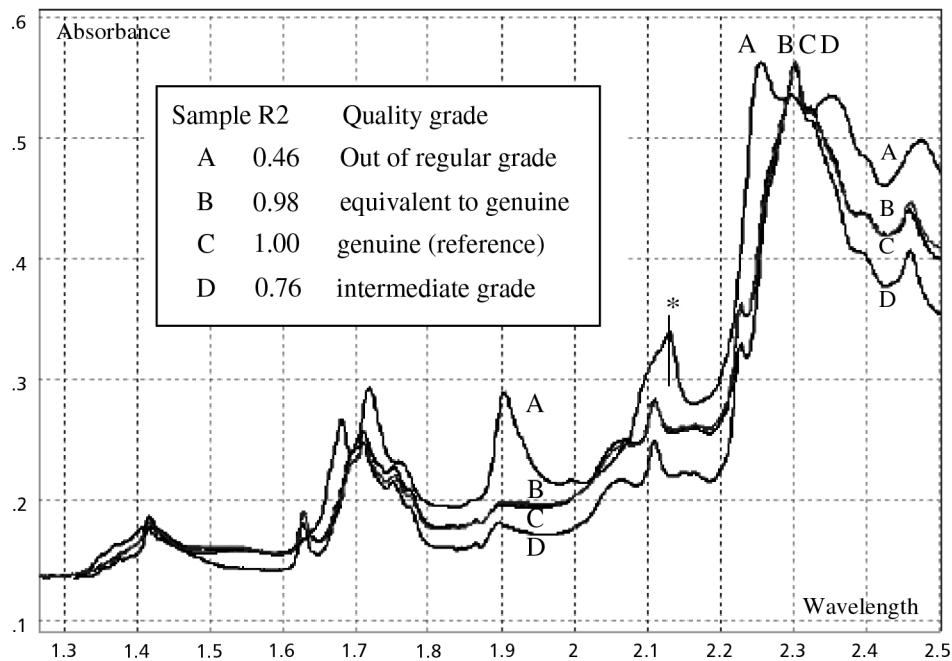


Figure 1. Comparisons of spectra.



Figure 2. The AOTF (Acousto-Optic Tunable Filter) instrument.

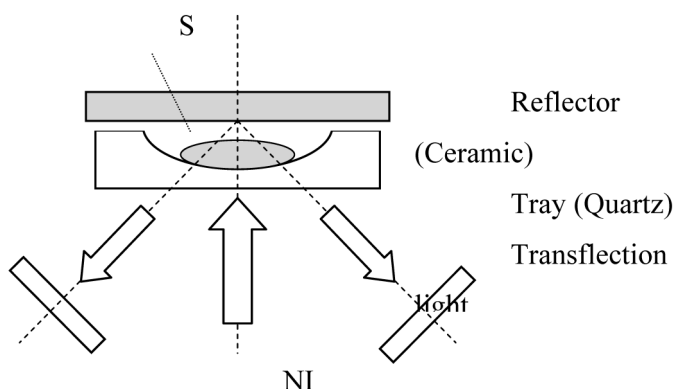


Figure 3. The measurement module.

Spectra acquisition

The spectra were acquired in diffuse-reflectance mode over the wavelength region of 1250–2500 nm at 1 nm resolution and 15 scans per sample, within 6 sec.

Data analysis

To define the quality grade of each sample a Goodness to Fit Analysis software (Digital Data Management Corp. Japan) was applied.

Results and discussions

The main causes of changes in the quality of essential oils are inclusions of water and other impurities. For example, in Figure 1 the spectrum of Sample A. has a water absorbance peak and fossil oil peak*, and is obviously recognised as being out of regular quality grade by the Fitting ratio of $R^2=0.42$. Sample B in Figure 3 is recognised as having almost same quality as genuine Lavender essential oil C, by having a Fitting ratio of $R=0.98$.

We have applied this technique to several kinds of essential oils and verified their quality grades.

Conclusion

We believe that this method is able to identify the quality grade of essential oils in terms of a numerical value, and could be applicable, not only to essential oils, but also to food (edible) oils, drug solutions, and other agricultural chemicals, including fuels.