

Application News

No. A571

Spectrophotometric Analysis

Quality Control of Film and Filter – Application of Spectra Evaluation Function of LabSolutions™ UV-Vis –

A Fourier transform infrared spectrophotometer (FTIR) is often used for the material identification and the contaminant analysis of a film and a filter. On the other hand, a UV-Visible spectrophotometer is used to examine their optical properties such as transmittance and reflectance. Its example is the examination of transmittance of a long-pass filter which is an optical element and transmits light in longer wavelength range than a specific wavelength. Films and filters are utilized in many fields based on their properties.

This report demonstrates pass/fail judgments of a band-pass filter and a long-pass filter using the spectra evaluation function of LabSolutions™ UV-Vis and the color measurement of color cellophane films using the color analysis function of LabSolutions UV-Vis.

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Transmittance Measurement of Filter

The external appearance of the UV-1900 is shown in Fig. 1. A band-pass filter and a long-pass filter were measured with the UV-1900 after mounting a film holder in its sample compartment. Fig. 2 shows their transmittance spectra. The band-pass filter transmits light only in the wavelength range near a specific wavelength and the long-pass filter transmits light in longer wavelength range than a specific wavelength.



Fig. 1 External Appearance of UV-1900

Table 1 Measurement Conditions

Instrument	: UV-1900, Film holder
Wavelength Range	: 190 to 1100 nm
Scan Speed	: Medium
Sampling Pitch	: 1.0 nm
Lamp Interchange Wavelength	: 323 nm

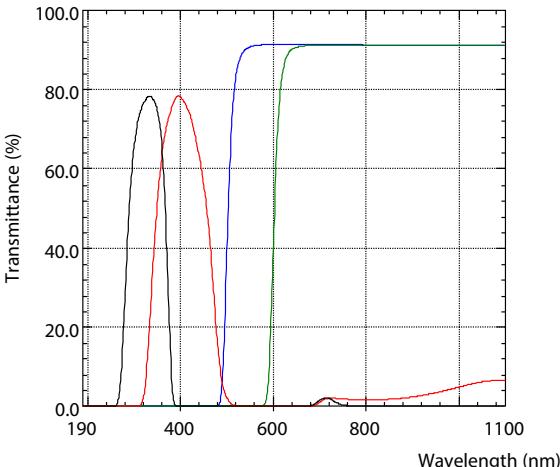


Fig. 2 Transmittance Spectra of Filters
Black: U-340, Red: B390, Blue: Y50, Green: R60

Spectra Evaluation Function of LabSolutions UV-Vis

The quantitative evaluation of the band-pass filter and the long-pass filter was performed using the spectra evaluation function of LabSolutions UV-Vis. It consists of eight items ; Photometric Value, Maximum Value, Minimum Value, Peak, Valley, Area, Statistics and Cutoff. A total of 33 subfunctions are included in them. It shows a pass/fail judgment for a measurement result according to the conditions determined preliminarily.

The setting of conditions shown in Table 2 was done assuming that a UV-340 filter was used in the wavelength range from 300 nm through 370 nm. Minimum Value/Single Point compares the minimum transmittance in the evaluated wavelength range with the threshold to judge the pass/fail. The conditions of Table 2 examine whether the minimum transmittance in the wavelength ranges both from 300 nm through 340 nm and from 341 nm through 370 nm is over 40 %. Statistics/Average Value compares the average of transmittance in the evaluated wavelength range with the threshold to judge the pass/fail. The conditions of Table 2 examine whether the average of transmittance in the wavelength ranges from 300 nm through 370 nm is over 60 %. The results are shown in Fig. 3. Not only pass/fail judgments for each item but also the comprehensive judgement are shown as the results.

Table 2 Evaluation Conditions

Name	Kind	Parameter	Threshold
Minimum Value (Short Wavelength)	Minimum Single Point	W.R 300 to 340 nm	Over 40 %T
Minimum Value (Long Wavelength)	Minimum Single Point	W.R 341 to 370 nm	Over 40 %T
Average Value	Statistics Average Value	W.R 300 to 370 nm	Over 60 %T

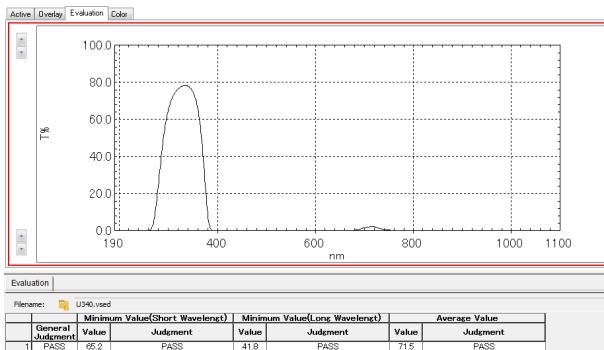


Fig. 3 Pass/Fail Judgements for U-340 Filter

In a similar way, a Y50 filter was examined based on the conditions shown in Table 3 and its results are shown in Fig. 4. Cutoff/Over compares the wavelength at which the transmittance is over the threshold in the evaluated wavelength range with the threshold wavelength. The conditions shown in Table 3 examine the followings; 1) whether the wavelength at which transmittance is 50 % in the wavelength range from 450 nm through 550 nm exists in the shorter wavelength range than 510 nm when the wavelength is scanned from the shorter side and it exists in the longer wavelength range than 500 nm when the wavelength is scanned from the longer side. 2) whether the wavelength range from 550 nm through 1100 nm transmits light and the minimum transmittance in the range is over 90 %. 3) whether the wavelength range from 190 nm through 450 nm doesn't transmit light and the minimum transmittance in the range is less than 1 %.

Table 3 Evaluation Conditions

Name	Kind	Parameter	Threshold
Rise (Short wavelength)	Cutoff Over	W.R. 450 to 550 nm Threshold 50 % From short wavelength	Over 510 nm
Rise (Long wavelength)	Cutoff Over	W.R. 450 to 550 nm Threshold 50 % From long wavelength	Over 500 nm
Minimum Value Transmission Range	Min. value Point	W.R. 550 to 1100 nm	Over 90 %T
Maximum Value Non-transmission Range	Max. Value Point	W.R. 190 to 450 nm	Less than 1 %T

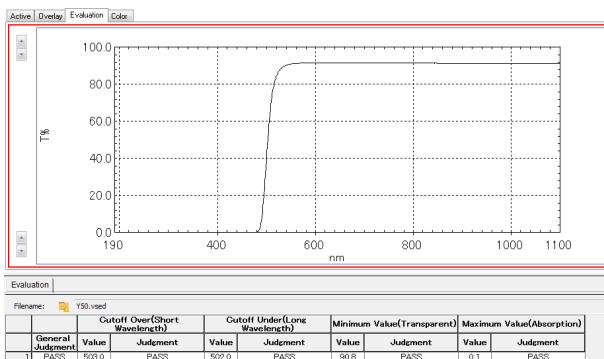


Fig. 4 Pass/Fail Judgements for Y50 Filter

Color Analysis Function of LabSolutions UV-Vis

Color cellophane films shown in Fig. 5 were measured based on the conditions of Table 4. Their results obtained with the color analysis function of LabSolutions UV-Vis are shown in Fig. 6. They are coincident with their visual color. The other color specification systems are also available.

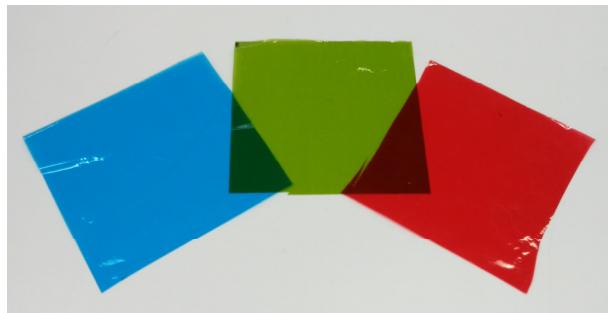


Fig. 5 Color Cellophane Films

Table 4 Measurement Conditions

Instrument	: UV-1900, Film Holder
Software	: Color Analysis
Wavelength Range	: 380 to 780 nm
Scan Speed	: Medium
Sampling Pitch	: 1.0 nm

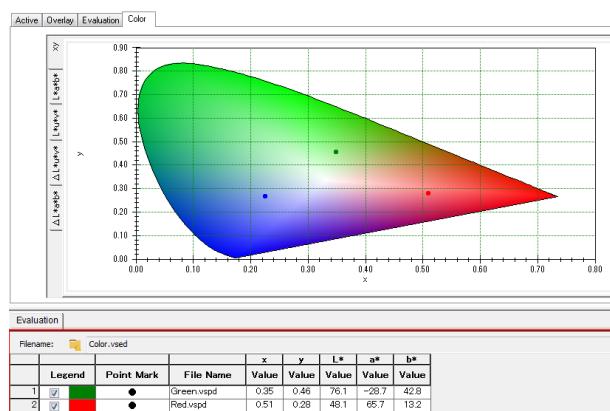


Fig. 6 XYZ Color System

Conclusion

A band-pass filter and a long-pass filter were measured with the UV-1900 and their pass/fail judgments were conducted with the spectra evaluation functions of LabSolutions UV-Vis. The items which were individually examined for a spectrum could be evaluated with the functions simultaneously and quantitatively.

The results of color cellophane films obtained with the color analysis function of LabSolutions UV-Vis were coincident with their visual color.