

Light Absorption of Shifter Dyes

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Absorption spectra of dyes can be measured by a apparatus shown in Fig1. We can represents passed light intensity $I(\lambda)$ as follows.

$$I(\lambda) = I_0(\lambda)10^{-k(\lambda)Cd} \quad (1)$$

where I_0 is reference light intensity dependent on wavelength λ , k is a constant, C is concentration of dye and d is path length. Eq.1 gives the following eq.2.

$$k(\lambda)Cd = \log\{I_0(\lambda) / I(\lambda)\} \equiv ABS \quad (2)$$

The value $\log(I_0/I)$ measured at $d=10\text{mm}$ (path length) is named absorbance.

Table 1 shows the parameters of WLS shifter dyes at peak wavelength of absorption by eq.2. In the table, k_p is the constant at peak wavelength of absorption.

For 200 ppm of Y-11 dye concentration and 1 mm fiber (see Fig.2), $k_p \cdot C \cdot d$ is $0.00638 \cdot 200 \cdot 1 = 1.276$, so you can calculate 1mm passed light intensity as $10^{-1.276} = 0.0529$ by eq.1, showing 94.7% of light of 430nm (peak) wavelength will be absorbed in 1mm fiber path with 200ppm concentration of Y-11 dye.

Fig.3 shows absorbed light $1-I/I_0$ vs. $C \cdot d$. For Y-11 fiber, you can estimate 95% absorption level is $C \cdot d = 200$, and can choice 200ppm concentration and 1.0 mm diameter, for example. And Fig.4 the absorption and emission spectra.

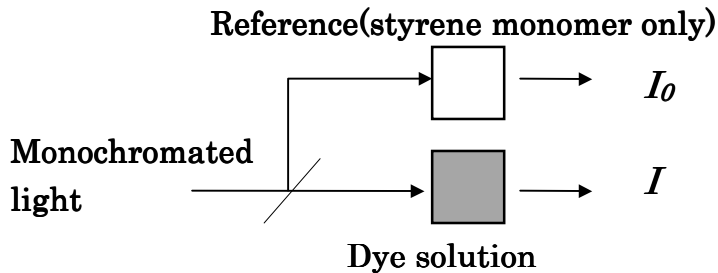


Fig.1 Absorbance measurement
by d=10mm path cell

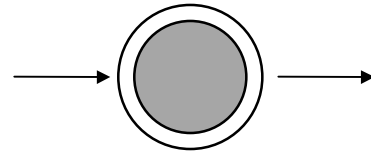
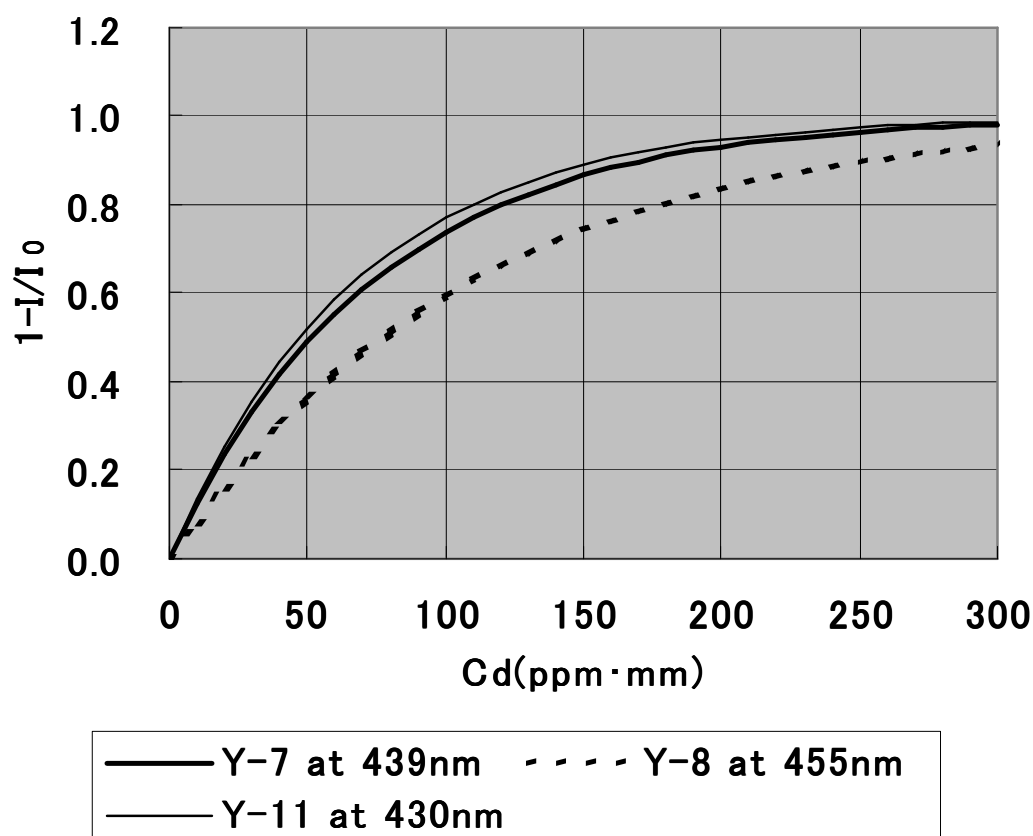


Fig.2 WLS fiber

Table 1 Parameters of WLS dyes

		Y-7	Y-8	Y-11
C	ppm	24.8	34.5	18.2
d	mm	10.0	10.0	10.0
peak wavelength	nm	439	455	430
Absorbance	—	1.443	1.348	1.162
k_p	$\text{ppm}^{-1} \cdot \text{mm}^{-1}$	0.00582	0.00391	0.00638



Absorption Curve at peak wavelength

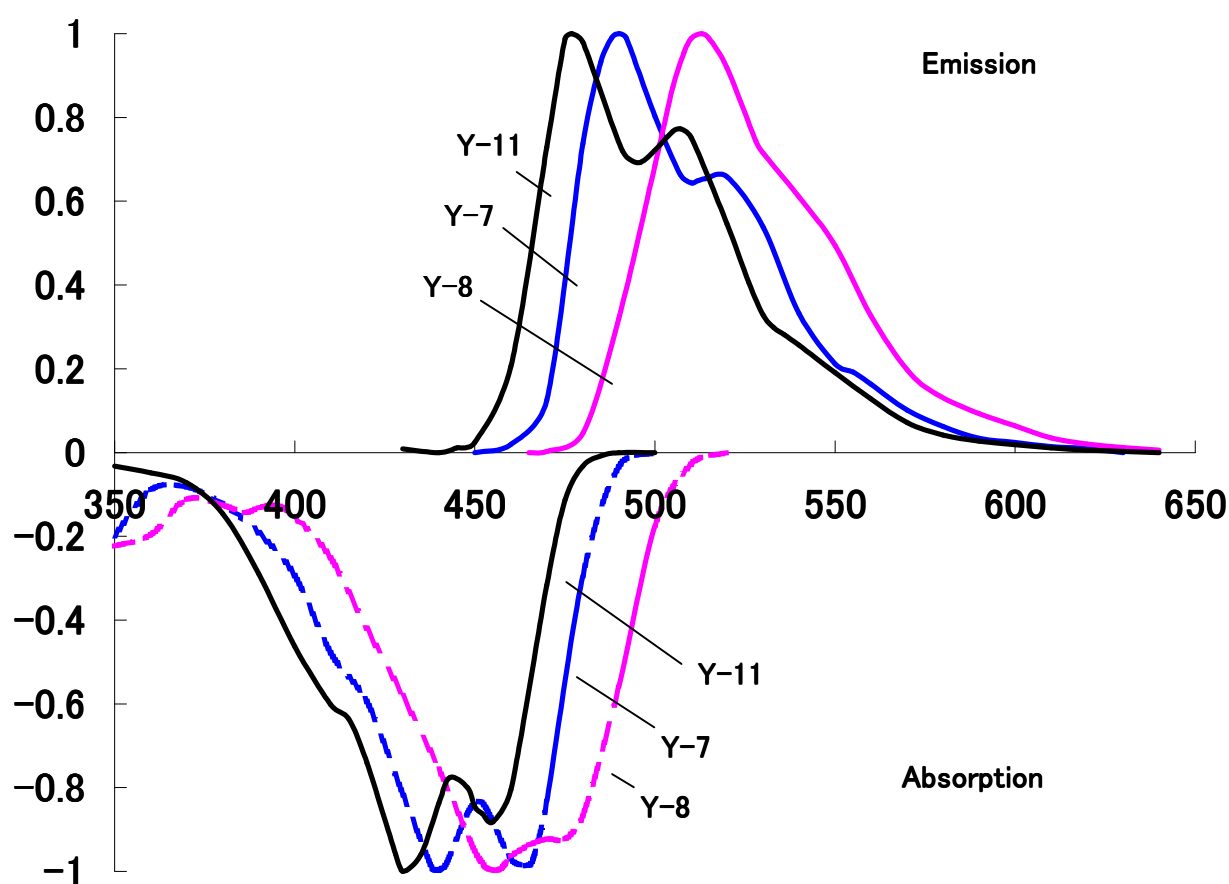


Fig.4 Absorption and Emission Spectra
(normalized the peak values)