Measurement of optical rotation of pirarubicin using sodium lamp and halogen lamp

Introduction

An emission line of light source such as a sodium lamp or a mercury lamp is usually used to measure the optical rotation of pharmaceutical products. However, the Japanese Pharmacopeia and the European Pharmacopeia only mention the use of a sodium lamp as the light source.

A polarimeter using a halogen lamp and a band pass filter (BPF) can also be used, as mentioned in the United States Pharmacopeia. However, the measurement error from the transmission property, that is the difference between the center wavelength of the BPF and the wavelength of emission line, cannot be avoided.

Herein, the optical rotation of pirarubicin was measured using a sodium lamp and a halogen lamp, and the measurement error between the results was evaluated.

Keywords: Pirarubicin, Sodium lamp, Halogen lamp, Optical rotation, ORD spectrum

<ORD measurement>

Sample preparation: 10.00 mg of pirarubicin was dissolved in chloroform for final volume of 10 ml.

System

J-815 CD Spectrometer
ORDM-401 ORD attachment

Parameters

Cell pathlength:	20 mm	Temp.:	20ºC	Bandwidth:	1 nm
Data interval:	0.2 nm	Response:	1 sec	Scan speed:	100 nm/min
Wavelength:	700-560 nm	Accumulation:	1		

Results

At first, absorption and ORD spectra of pirarubicin were measured in the region of 700-560 nm to confirm the wavelength dependence of the optical rotation (Fig. 1). The absorbance increased sharply below 600 nm and optical rotation increased gradually as a result of the Cotton effect.

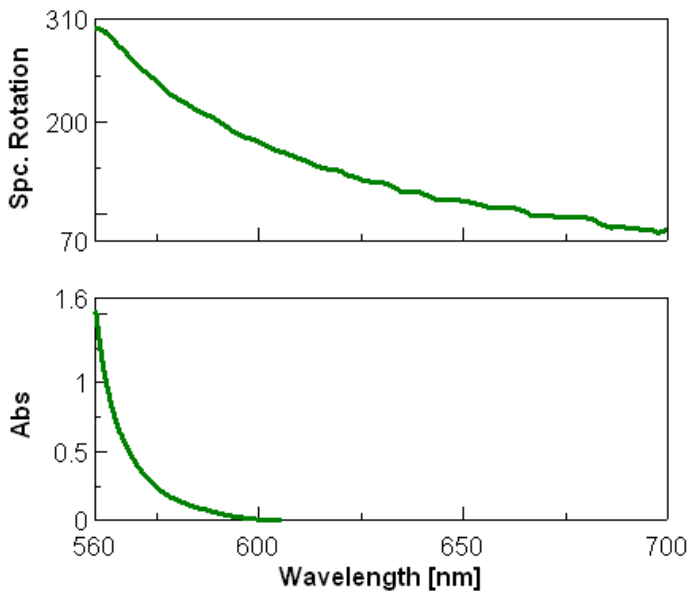

Fig. 1 Absorption and ORD spectra of pirarubicin

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The transmission spectrum of a BPF and the spectrum of the D-line of the sodium lamp, overlapped with ORD spectrum are shown in Fig. 2. It is apparent to see the significant change of the specific rotation in the wavelength region within the BPF.

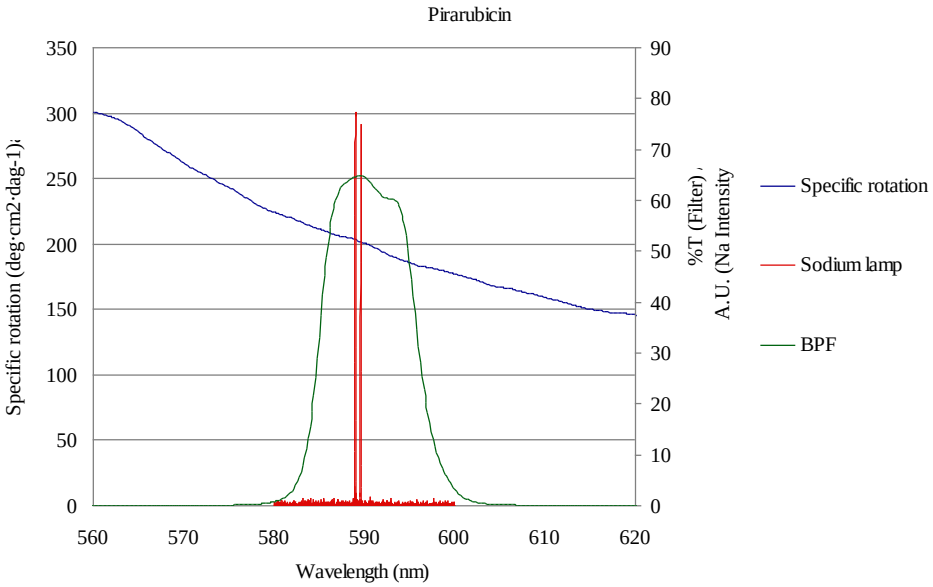

Fig. 2 ORD spectrum of pirarubicin, sodium lamp emission line and the transmission spectrum of the BPF

<Optical rotation>

Sample preparation: Identical sample for ORD measurement.

System

P-2000 Polarimeter
PTC-262 Peltier thermostated cell holder

Parameters

Measurement temp.:	20ºC
Cell pathlength:	100 mm
Wavelength:	589 nm (D-line of sodium and halogen lamp)

Results

Specific rotation of the same sample for the ORD measurement was measured using the polarimeter. When a sodium lamp is used as the light source, the result was $[\alpha]_D^{20}$ = +206.6 [deg·cm^2·dag^{-1}]. This value falls within the range stated in the Japanese Pharmacopeia. ($[\alpha]_D^{20}$ = +195 ~ +215 [deg·cm^2·dag^{-1}]) On the other hand, when using a halogen lamp, the specific rotation was just inside this range ($[\alpha]_{589}^{20}$ = +196.7 [deg·cm^2·dag^{-1}]). These two results clarify the difference in the optical rotations measured at the same wavelength (589 nm) with different lamps.

Table 1 Results of the optical and specific rotation measurements

Light source	Optical rotation [deg]	Specific rotation [deg·cm^2·dag^{-1}]
Sodium lamp	+0.2066	$[a]_D^{20}$: +206.6
Halogen lamp	+0.1967	$[a]_{589}^{20}$: +196.7

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