E2-36 A low-cost device to teach colorimetry in a chemical laboratory

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Colorimetry is widely used for estimation of concentration of coloured substances. In conventional colorimetry, a tungsten lamp is used as a radiation source and different filters are selected to cut down the unnecessary radiation prior to its interaction with the analyte.

The performance of the radiation sources and filters are not taught in undergraduate or graduate teaching programmes in Sri Lanka. We have developed a simple unit which can be used to observe the performance of radiation sources (tungsten lamp and LEDs) and filters.

A low-cost cell compartment was designed to monitor the performance of radiation sources and various filters, using the emission mode of a spectrofluorimeter. The radiation source is connected to one side of this device and it can be linked to the constructed DC power supply. This unit can be inserted into the cell compartment of the fluorimeter and all the spectra can be recorded; emission spectra of tungsten lamp with or without filters, any relevant coloured solutions and LEDs.

The performance characteristics of various filters and LEDs have been compared in table 1. The LEDs are found to have a lower narrow bandwidth. Figure 1 illustrates the data for calculating Absorbance (A) and Transmittance (T) from spectral data.

When a relevant coloured solution is placed in the cell holder the magnitude of I_0 proportionally decreased to I_1. The magnitudes of I_0 and I_1 can be measured and A (or T) can be calculated.

This device can be successfully used in laboratories to teach the basics of colorimetry and it can also be applied to select wavelength of radiation source and relavant optimum filter necessary. Nominal cost of this device is approximately Rs. 600 and a conventional fluorimeter is required to achieve these objectives. A monochromatic device and a detector can also be fabricated locally.

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Table 1: Emission spectral data of tungsten lamp with filters and LED's

Item #	Figure	LED Colour	Maximum wavelength (nm)		Band width (nm)		
Tungsten lamp	3.1 a				515		150
Filter #		LED	Filter		LED	Filter	LED
420	3.1b	Blue	450	480	60	60	
470	3.1c	Green	475	570	60	25	
530	3.1d	Yellow		530	595	55	30
620	3.1e	Orange		605	610	50	30
660	3.1f	Red	610	645	45	40	