Emission spectrum of Rhodamine B dye

Saravanan Rajendran

October 22, 2020

1 Objective

To study the electronic properties of Rhodamine B dye using spectrofluorometers. The study of emission spectra of a sample helps in determining the optical properties of the sample.

2 Theory: Emission Spectroscopy

Emission spectroscopy is the study of the emission spectrum resulting from the deexcitation of the atoms to its ground state. The emission spectroscopy differs from the absorption spectroscopy that, the measured light is from the sample and has different properties from of the excitation light whereas in absorption, information is extracted from the source. The light is passed through the sample, the atoms are excited and decays to its ground state emitting photon. The measurement is done by the detector from the photovoltage caused by the emitted light. The photovoltage,

$$V = V(\lambda_{ex}, \lambda_{em})$$

is a function of both emission and excitation wavelengths.

3 Spectro fluorometer

The sample is loaded into the sample table using cuvettes. The cuvettes (of length 1 cm) are made of glass or quartz has clear side walls to measure the emission happening from all sides of the sample. The fluorimeter has a source with a spectrum of possible wavelengths and a monochromator to select a particular wavelength. As the light is made to fall on the sample, emitted light resulting from de-excitation of the atom is collected by a collecting mirror and then a photomultiplier and a detector is present to measure the emitted light intensity.

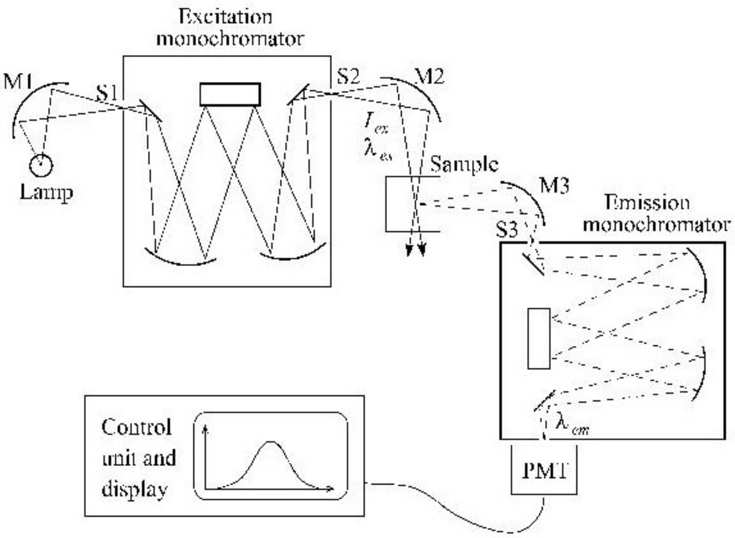

Figure 1: Optical scheme of a fluorimeter.

4 Procedure

The sample preparation is done by diluting the mother sample to get the desired concentration. The baseline correction is done by passing the light through reference sample. Then the sample is loaded and the emission spectrum is calculated for the samples of different concentration keeping the excitation wavelength constant. The emission spectra is a function of excitation wavelength. So a sample is excited with different wavelengths and is measured. The measurements are collected from the computer which is interfaced with the instrument.

Figure 2: Cuvette with four clear side walls used in flourimeter.

5 Results and analysis

- The first plot (Figure 5) shows that highly concentrated sample absorbs more and thereby emits light of higher intensity.
- The second graph (Figure 6)shows that the intensity of the emitted beam depends upon the incident light and are proportional to each other.
- The third graph shows that (Figure 7) the intensity is linearly dependent on the concentration of the sample of given excitation and emission wavelengths. The deviation from the linear fitting may be due to improper dilution.
- The stokes shift of Rhodamine B is 28.2 nm.

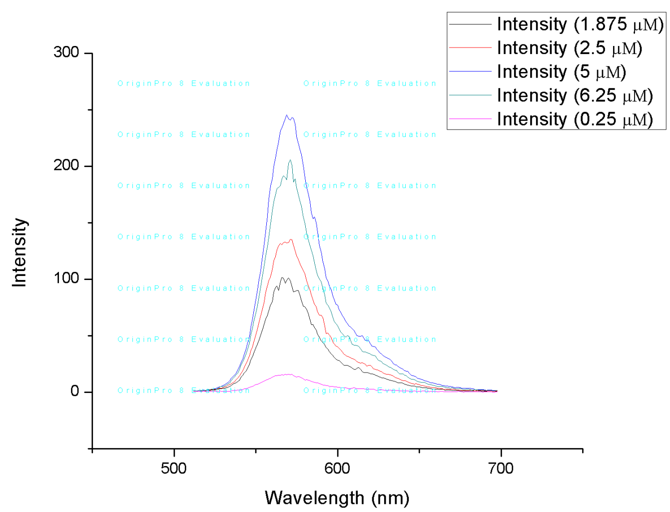

Figure 3: Plot of intensity versus wavelength at different concentration of the sample from the source of excitation wavelength 500 nm.

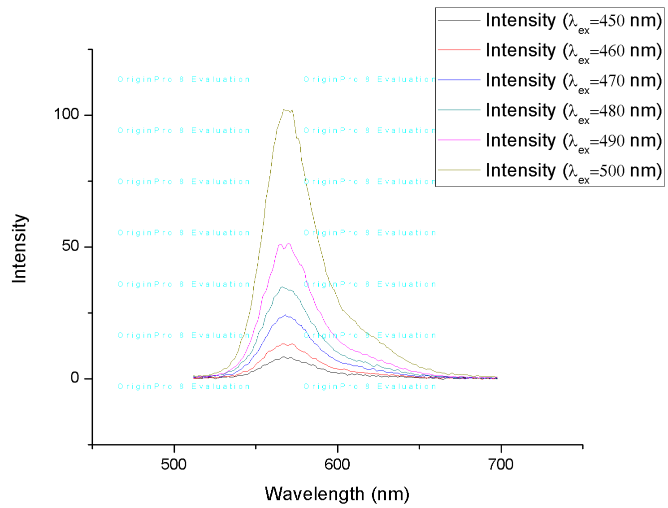

Figure 4: Graph showing that intensity is dependent on the excitation wavelength for a sample of concentration 1.875 μM.

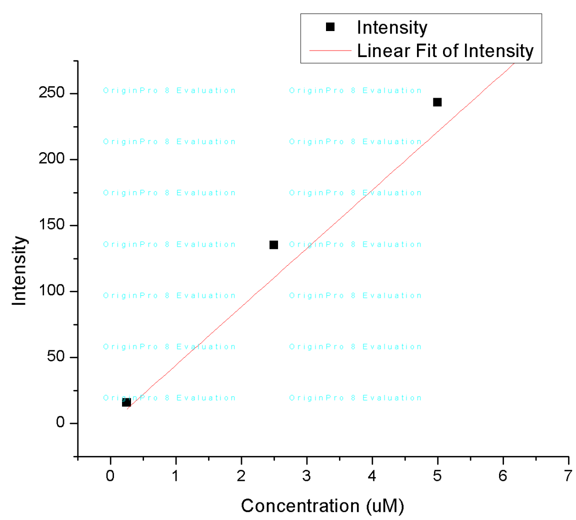

Figure 5: Graph showing the relation between Intensity of the emitted light and concentration of the sample for a given wavelength 570 nm.

References

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[3] Nikolai V Tkachenko. *Optical spectroscopy: methods and instrumentations*. Elsevier, 2006.