Essay on chemistry 4230 laboratory fluorescence spectrometry

Environment, Water

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Fluorescence Analysis of Quinine in Tonic Water

1. Summary

Fluorescence Spectrometry like other spectrometry methods uses absorption to excite fluorescent species so that the difference between the excited-state molecules and the ground state can be measured and used to identify species and measure related concentrations. The instrument used for this experiment is a Cary Eclipse fluorescence spectroscope. The measurements were of the excitation wavelength and emission wavelength. The intensity of an unknown standard solution, the tonic water spiked with standard solution, was measured.

The measurement of the excitation wavelength for the Stock Standard 1 was 345 nm and the emission wavelength was 450 nm. The concentration of

quinine in the unknown sample was measured to be 0. 0714 ppm and the effect of heavy ions in solution was studied.

2. Part 1. Standard Addition

A cuvette with 3 ml of 1: 25 diluted sample of unknown (the tonic water) was prepared and incremental additions of quinine was added. Table 1 shows the intensity response corresponding to standard quinine volume.

Volume(µl)	Intensity (cts)
0	134. 048
30	188. 404
60	235. 865
90	278. 279

Table 1. Standard Quinine Volume (µl)

with corresponding Intensity (a. u)

The intensity is plotted vs. and the volumes of the standard solutions (µl) containing 0. 1 ppm quinine in Figure 1. Volumes of standard additions (µl) were 0 , 30, 60, 90.

Figure 1. Known quinine volume added vs. intensity response

Part 2: Quinine in Tonic Water

The linear regression analyses drawn in excel on data plotted in Figure 1 was used to calculate the equivalent volume of standard added.

I= 1. 6005*Vs + 137. 13 (Eq. 2)

I was the intensity response at 450 nm emission spectroscopy and Vs was volume of standard quinine needed.

The X-intercept of the line was calculated to be -85. 6795µl and corresponds to the equivalent volume of standard added (Vso). This number was then used in the equation,

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(Eq. 1)

Where Cx is the concentration of the unknown, Cs is the concentration of the standard that was spiked, Vx is the initial sample volume, and (Vs)0 is the equivalent volume of standard added.

The measured concentration of the unknown Cx = - (-85. 6795uL) *(10-3 mL/µL)] *(0. 1 ppm)/[3(mL)] =. 0. 00286 ppm = 2. 86 ppb

Accounting for the dilution of the sample that was 1: 25, the concentration of the unknown would be 25 higher or 0. 0714 ppm or 71. 4 ppb.

Part 3: Effect of Heavy Ions

Table 1: Fluorescence Intensity of Standards with Heavy Ions

Intensity (a. u.)

Standard

5. 973

Standard with Cl- 1. 017

Standard with I- 0. 435

Table 1. Intensity Response with heavy ions in quinine

Table 1 presents the changes in measured intensity of the standard due to the addition of heavy ions (Cl-, I-) added into 0. 1ppm quinine. The addition of heavy ions decreased significantly the intensity of the measurement and this can be attributed to the quenching effect and the difference in wavelengths detected by the spectroscope.

Part 4: Error Discussion

Errors involved in the measurements are potentially introduced in the calibration of the instrument (such as inappropriate excitation or emission wavelengths), in the measurement itself (not wiping the cuvette could cause interference in the measurement), in the preparation of the standard additions (low linearity of the curve would result in errors in the intensity of the unknown), and failing to prevent light entering the solution (i. e. wrapping with aluminum foil).

4. References

Skoog, D. A.; Crouch, S. R.; Holler, F. J. Principles of Instrumental Analysis, 6th. ed.; Brooks/Cole, Cengage Learning: Belmont, CA, 2007. pp 399-426.

Harris, C. D. Exploring Chemical Analysis, 4TH. ed; W. H. Freeman and

Company: New York, United States of America, 2009; pp 427-428. n. d. Web. Sept. 2011.

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