CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Isaac W. Chizhik

Project Number

36273

Project Title

Mixing Up a Better Lab: Wavelength Choice Affects Accuracy and Consistency of the UV-Vis Spectroscopy Analysis

Abstract

Objectives/Goals

For this study, I moved to scientifically ascertain the source of the inconsistencies in the results of the students who performed the UV-Vis Spectroscopy Lab as as part of their Analytical Chemistry 251 lab at SDSU, and then to remedy it. Thus, I asked the question, #what causes unreliable results when using spectrophotometry to find the concentration of Iron (II) and how does one overcome such obstacles?#

Methods/Materials

I predicted that the wavelength used by the original lab procedure, 562nm, was not best for detecting the iron in the solution and was, thus, the source of the inconsistencies reported by the students. I thought that changing the wavelength to one that can detect a higher absorbance would negate such unfortunate effects by rendering any error insignificant. I first measured the absorbances of a single solution of Iron (II) marked with 1, 10 phenanthroline in a spectrophotometer at different wavelengths to find the one with the highest results. I then measured the absorbances of solutions with a constant amount of unknown and varying amounts of standard at the original wavelength and the new one to find the concentration of the unknown (absorbance is directly proportional to concentration).

Results

The wavelength with the maximum absorbance was found to be 512nm. After using the relative absorbances for the known concentrations of the standards to to derive the concentration of the unknown at both 512nm (experimental) and 562nm (control), I found that the error of the experimental wavelength was 3 times smaller than that of the control. Its results were also reproducible, falling consistently within an error of 10%.

Conclusions/Discussion

the experiment concluded that the wavelength that was used by the students before this study, 562nm, was too high and not as sensitive to the particular shade of green that was absorbed by the solution. Meanwhile, 512nm was an excellent wavelength that allowed for optimal measurements to be made under the circumstances and the skills being used.

Summary Statement

I found that the source of the inconsistencies in the UV-Vis Spectroscopy Analysis were due to the wavelength being too high at 562nm, with the lower wavelength at 512nm being optimal for detecting Iron (II).

Help Received

I performed the lab and did all of the math myself. The project was given to me by Dr. Harrison of the Chem department of SDSU and the hypothesis came out of a discussion that we had. He also provided me with all of my equipment. However, everything else was of my own doing.