Abstract

Spectrophotometry is a modern instrument used in chemistry to find the absorbance or how much a solution is concentrated. In this lab we use this to find the absorbance of solutions and from there the concentrations were calculated. Given six different diluted solutions and two unknowns we used the spectrophotometer to help us find the standard curve and then that helped us with finding the unknowns. We found that unknown number 1 is less concentrated then unknown number 2 given all our information. I think spectrophotometry is a great way if not the best way to find and show absorbance and concentrations of solutions. We learned how to use a spectrophotometer to find the standard curve for solutions and finding concentration of solutions given only the absorbance.

Introduction

Spectrophotometry is a quantitative method that is used to determine very low concentrations, usually in the 10-3 to 10-7M ranges. As it implies, spectophotomerty is used to measure the light absorbance in a particular part of the spectrum. Which is based on Beer's Law, which states that for a specific wavelength A=ebC. Where A is absorbance, e is molar absorptivity constant, b is the path length of light , and c is the concentration in mol/L. the more the light-absorbing particles, the greater the concentration, and the more that the light intensity is diminished as it emerges on the other side of a solution when placed in a spectrophotometer. When measuring the "b" (the path length of the light) it is usually measured in centimeters, and in the standard curve. In our experiment today we are going to use the standard curve to find our unknowns after finding all the concentrations of the stock solution and graphing. Some chemical substances that are not colored can often be tagged by reacting them with a dyeing agent and put into a spectrophotometer to measure the absorbance. Spectrophotomerty is probably more widely used than any other analytical technique and is the method of choice in the field of medicine.

Methods

Part A: Preparation of Given Solutions and using the Spectrophotometer

Our first step was collecting six 100-ml volumetric flask and six stoppers to cover them. Then a 1-ml and a 2-ml pipet along wit pipet bulbs was collected with a bottle of deionized water. After that 60-75 ml of our stock $KMnO_4$ was poured into a beaker and covered. Then the spectrophotometer was turned on and set to absorbance, and zeroed out with deionized water. Now we prepared our volumetric flask by labeling them 1 thru 6.

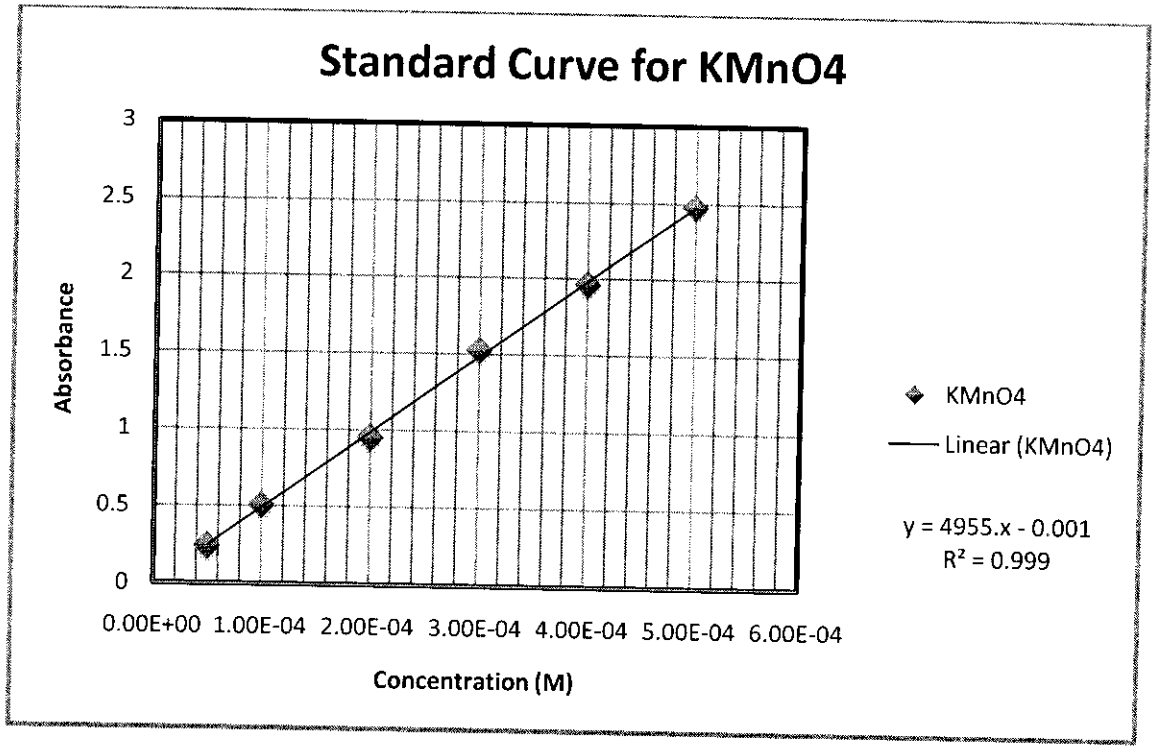
First used was the 1-ml pipet to pipet out exactly 1-ml of our stock $KMnO_4$ solution and transferred to the flask labeled number 1. Then the solution was diluted with deionized water till the

meniscus reached the 100-ml line. The flask with the prepared dilution was covered with a stopper and set aside. For the second flask the 2-ml pipet was used to measure out exactly 2-mls of the stock solution and emptied into the flask labeled number two. Then that flask was diluted with deionized water till the meniscus reached the 100-ml line, and covered with stopper. Then 4-ml, 6-ml, 8-ml, and 10-ml was measured out using the 2-ml pipet and placed into flask labeled 3, 4, 5, and 6 respectively. All was diluted with deionized water until they reached the 100-ml line and capped off then set aside.

Then the spectrophotometer was set to absorbance and zeroed with deionized water. Then starting with the most diluted solution rinsed the capsule and then poured into a capsule and measured the absorbance. We repeated these steps and recorded all our results.

Part B: Finding the Standard Curve and the Unknowns

After recording all our results for our known dilutions we was given two unknown concentrations. The unknowns where then rinsed in the capsule and then measured in the spectrophotometer. From there we got there absorbance then a graph was made from our previous data to show the curve of the information collected and from that the slope and the R squared value was found. Then the absorbance of our unknowns was plugged into the slope equation and solved for X. that gave us the concentrations of our unknowns.



Results

After making the solutions and using the Spec-20 spectrophotometer to measure the absorbance of our standards, it was determined that 1 mL stock solution had an absorbance of 0.242 with a molar concentration of .00005. The 2 mL stock solution had an absorbance of 0.509 with a molar

concentration of .0001. The 4 mL stock solution had an absorbance of 0.954 with a molar concentration of .0002. The 6 mL stock solution had an absorbance of 1.525 with a molar concentration of .0003. The 8 mL stock solution had an absorbance of 1.962 with a molar concentration of .0004. The 10 mL stock solution had an absorbance of 2.478 with a molar concentration of .0005. The first unknown solution had an absorbance of .727 with a molar concentration of 1.46922E-4. The second unknown solution had an absorbance of 1.226 with a molar concentration of 2.47628E-4.

Discussion

It was determined that when the amount of stock solution was increased the absorbance was also increased. Using the Spec-20 spectrophotometer was the most sufficient way to obtain an accurate absorbance. The concentration also increased as the amount of stock solution increased. The equation used to determine this is 0.0050M x 1 mL/100mL. The molar concentration of the stock solution was 0.0050M. This was then multiplied by 1 mL (2,4,6,8,10) and then divided by 100 mL because this is what the solution was diluted to. After obtaining these figures, a standard curve was constructed. After constructing the standard curve and placing a line of best fit, the y=4955.x-0.001 value was obtained which made it possible to solve the concentration of the unknowns. The absorbance of the unknown was determined by the Spec-20 spectrophotometer. To find the concentration of the unknown the absorbance is simply plugged in for y and then solved for x.

Conclusion

By doing this laboratory experiment we learned how to test the concentrations and absorbencies of liquids using the Spec-20 spectrophotometer. From our observations, it was determined that when one increases the amount of stock solution added to the mixture, then the absorbency is going to be higher.