Chem115 Fall 2023 - Ilana Berlin/Lab6: Copper(II) ions in [Cu(NH3)4]SO4·H2O/LabReport6

Jason Cody - Oct 06, 2023, 9:47 AM CDT

Assignment #12 - LabReport6

You cannot edit this entry after it is graded.

Description	Beer's Law of Cu(II) ions in coordination complex.
I worked in a group with	
The work for this assignment is in	My notebook

Grade **9 / 10**

Graded on Oct 06, 2023, 9:47 AM CDT

Jason Cody - Oct 01, 2021, 10:36 AM CDT

ReportTemplate.docx (15.5 kB)

Ilana Berlin - Oct 02, 2023, 11:29 AM CDT

Date and Title

Ilana Berlin - Oct 02, 2023, 11:39 AM CDT

Purity and concentration of copper(II) ions in copper ammonium coordination compound.

Monday, October 2nd 2023

Jason Cody - Sep 22, 2020, 3:19 PM CDT

Purpose

Jason Cody - Oct 06, 2023, 9:42 AM CDT

By diluting known concentrations of copper ammonium coordination compound and using Beer's Law the concentration (M) of copper in a synthesized copper ammonium coordination compound which complex, specifically? Did you make it last week? can be determined. what will you determine, exactly?

Jason Cody - Sep 22, 2020, 3:19 PM CDT

Reference

Ilana Berlin - Oct 02, 2023, 2:48 PM CDT

Kateley, L. J., *Introduction to Chemistry in the Laboratory, 20th Ed.*, Lake Forest College, 2021, Experiment 6, Appendix B,C.

Jason Cody - Sep 22, 2020, 3:19 PM CDT

Data and Observations

Jason Cody - Oct 06, 2023, 9:45 AM CDT

Mass of dried blue powder copper(II) ammonium coordination compound, weighed using top loading balance, has a mass of 18.628g with the base of the petri dish (17.333g). The total weight of the synthesized compound is 1.295g.

10mL of a pale blue 5.4053g/L Cu(II) solution were added to a 30mL Pyrex beaker. 30mL of a 1M nitric acid solution was prepared using 5mL of a 6M nitric acid solution and 25mL of water. 15mL of water were added to a 50mL Pyrex beaker, then 5mL nitric acid were added, then the remaining 10mL of water. Five samples of varying concentration were prepared (Figure 1). Vial 1, containing just nitric acid solution, is completely clear. Vial 5, containing just $Cu(NO_3)_2$ solution is a pale sky blue liquid. Each sample get progressively more saturated. All samples are transparent.OK

A piece of dark blue/purple hard solid synthesized $[Cu(NH_3)_4]SO_4xH_2O$ was crushed using mortar and pestle. Crushing the compound brought out the purple color. 0.1464g (measure using an analytical balance) of the compound were added to a 10.00mL Kimax volumetric flask. 10mL of 1M nitric acid was added to the flask. The flask was lightly shaken to dissolve the compound. Approximately 3000µm of solution was added to vial 6. The solution in vial 6 is most similar in color to vials 3 and 4. OK

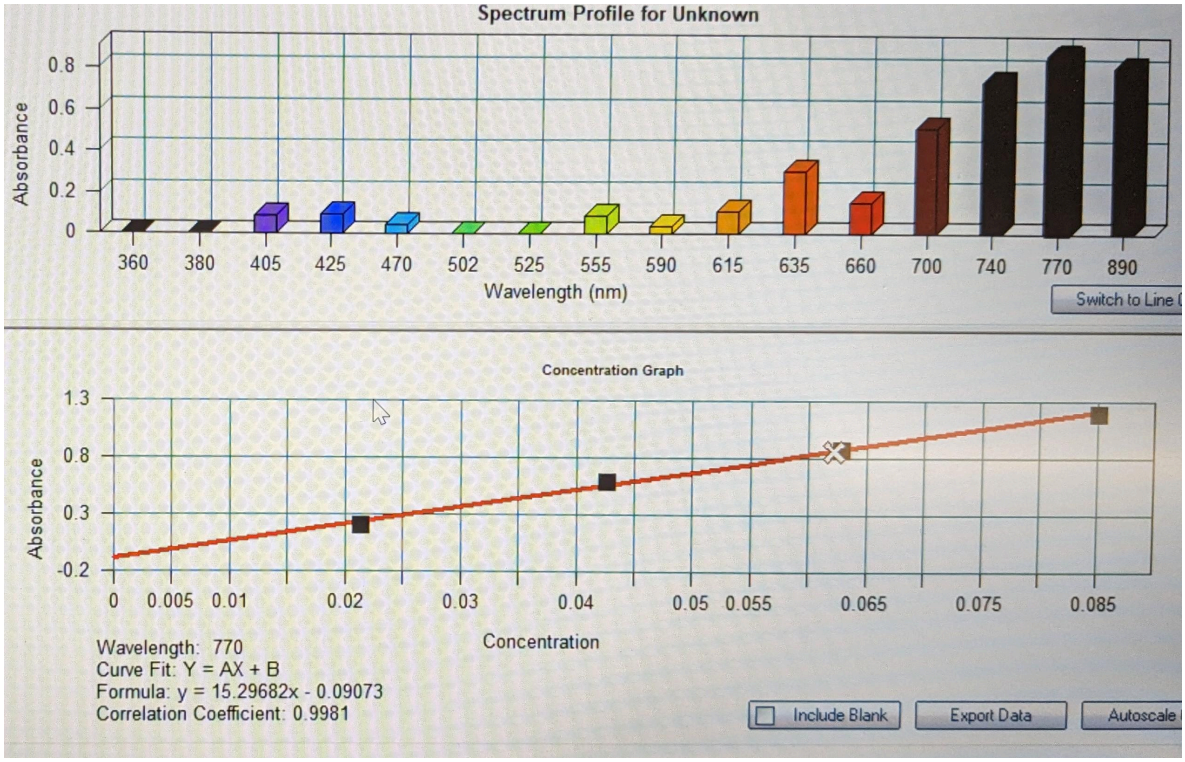
A microLAB spectrometer, model FS-528, was used to scan samples (Figure 2). The λ_{max} for Cu(II) is 770nm. The Beer's Law equation given by the samples is 15.29682x - 0.09073 OK

Figure 1. Preliminary Data still preliminary?

Vial Number	Volume of $Cu(NO_3)_2$ solution (µL)	Volume of HNO_3 (µL)	Concentration (M)	Absorbance (A)
1 (Blank)	0	3000	0	N/A

2	750	2250	0.0213	0.2108
3	1500	1500	0.04253	0.5928
4	2250	750	0.0628	0.8763
5	3000	0	0.08506	1.1952
6 (Unknown)	N/A	N/A	0.0621	0.8597

Figure 2. Spectrometer Data



Jason Cody - Sep 22, 2020, 3:19 PM CDT

Calculations

Jason Cody - Oct 06, 2023, 9:46 AM CDT

1.295g (1000mg/1g)(1mmol/245.7mg) = 5.271 mmol of $[Cu(NH_3)_4]SO_4 \cdot H_2O$

Percent yield = 100 x (5.271/6.00) = 87.9% OK. Very reasonable.

5.4053g/L Cu(II) (1 mol Cu(II)/63.546g Cu(II)) = 0.085061 mol/L = 8.5061×10^{-2} M

1M(30mL) x 6M(xmL) = 5 mL

30mL - 5mL = 25mL

8.5061×10^{-2} M(750µm) = xM(3000µm) = 2.1265×10^{-2}M

8.5061×10^{-2} M(1500µm) = xM(3000µm) = 4.2531×10^{-2}M

8.5061×10^{-2} M(2250µm) = xM(3000µm) = 6.2796×10^{-2}M

0.1464g (1mol/245.7g)(1 mol Cu/1 mol $[Cu(NH_3)_4]SO_4xH_2O$) = $5.958x10^{-4}$ mol of Cu/0.01000L = 0.05958M = $5.958x10^{-2}$M

Percent error - 100x (0.0621-0.05958)/0.05958 = 4.4% OK; comparison of calculated concentration from line equation?

Jason Cody - Sep 22, 2020, 3:19 PM CDT

Conclusions

Jason Cody - Oct 06, 2023, 9:47 AM CDT

The compound was relatively pure since the concentration was close to the highest known concentration solution. ?? how does this indicate purity? There may be unused reactants that contribute to the diminished purity. There may have also been moisture remaining in the sample and NH_3 lost in the Cu(II) complex.

The b value (0.09073) in the Beer's law equation shows how far off the entire line is from the y intercept being 0. Since this number is close to zero, my plot was close to ideal. R^2 is also a measure of the quality of your line (and, therefore, pipet technique). There may have been operative errors in measurement. OK, based on what?