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SPECTROPHOTOMETRIC STUDY ON THE STABILITY CONSTANT OF COMPLEX Cu^{+2} – ARSENAZO-III

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ABSTRACT

The interaction of copper ion (Cu^{+2}) with arsenazo-III has been investigated by specrophotometric technique.Cu^{+2} ion forms a light reddish water soluble complex with arsenazo-III having 1:1 metal to ligand ratio with maximum absorbance at 610 nm. The pH range of constant maximum absorbance is between 2.0 and 4.5. Their stability constants have been determined by applying mole ratio method, Job's method of continues variation and Dey and coworkers' method. The value of log K for Cu^{+2} was found to be 5.48. The analytical applications of the colour reaction have also been investigated.

KeyWords: Cu^{+2}, Chelate, Arsenazo-III, Stability constant.

INTRODUCTION

From the survey of literature [1-9], it has been found that there are very few references regarding spectrophotometric studies on the stability of Cu^{+2}-Arsenazo-III complex. As no data are available in the literature on the above complex , the nature and composition of the complex have been determined spectrophotometrically. In this communication the composition and stability of the chelate formed by arsenazo-III with Cu^{+2} have been reported.

EXPERIMENTAL

An ECIL made PC based double beam UV-Vis spectrophotometer UV 5704 SS was used for absorbance measurement using matched quartz cells. Arsenazo-III and $CuCl_2$ were obtained from BDH. All the reagents were of analytical grade. The solutions were prepared in double distilled water. pH was measured on EC made L 1612 microprocessor based pH- meter. All the experiments were performed at 25±0.1°C. The total volume of the mixture prepared for the measurement was kept 25 mL. The requisite amounts of buffer solutions were added to maintain the desired pH.

The method applied for determination of stability constant are Job's method of continues variation[10] and Dey and Coworkers'[11] method and mole ratio method[12]. The method of Vosburgh and Cooper[13] was employed to determine the nature of the complexes formed in the solution.

RESULTS AND DISCUSSION

In view of the observation of Dey and Coworkers[11], the organic chelating agents behave as colloidal electrolytes; dilute solutions of 10^{-4} M and 10^{-5} M of arsenazo-III were employed to avoid complications in absoptiometric measurements. With variation in hydrogen ion concentration arsenazo-III changes its colour and its region of maximum absorption is found to shift. From *table-1* it is concluded that arsenazo III exists in two different forms depending upon the pH of the solutions.

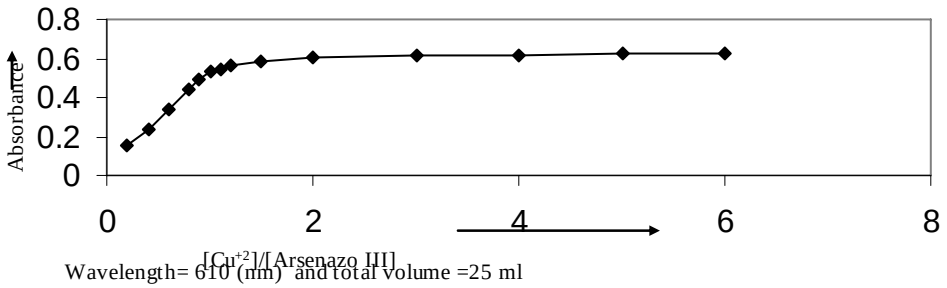
The method of Vosburgh and Cooper[13] was employed to determine the nature of the complex formed in solution. The reagent alone showed a maximum absorption at 530 nm at pH 4.5, but mixtures

containing varying proportions of metal (Cu^{+2}) and ligand (Arsenazo-III) i.e. 0:1.0, 1:0.5, 1:1, 1:2, 1:3, 1:4 had λ_{max} at 610 nm, indicated under the condition of study.

The color formation is instantaneous and the absorbance values remain constant up to 72 h. No significant change occurs when the order of addition of the reaction of the reactants is altered.

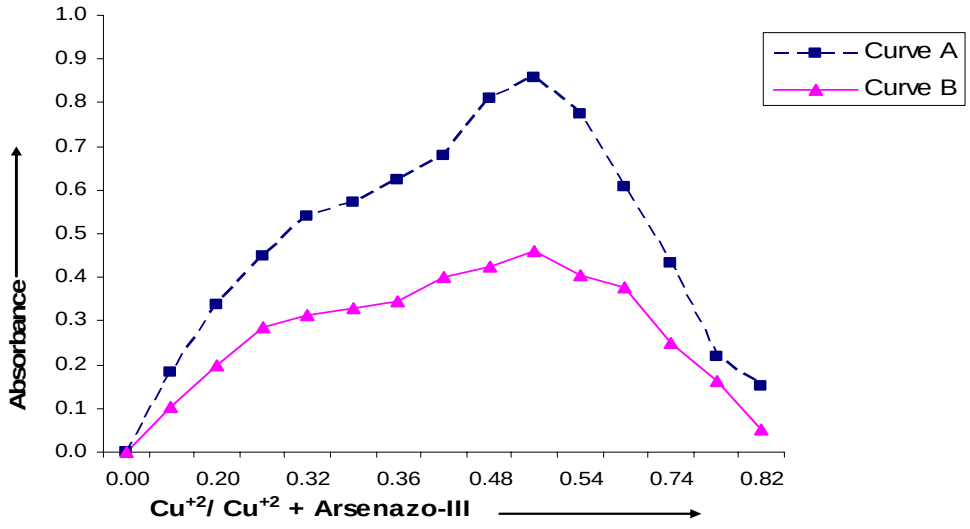
For determining the empirical formula of the chelate formed under the experimental conditions, mole ratio method (*figure 1)*, method of continues variation(*figure 2)* and Job's method of non-equimolar

Fig 1 Composition of Cu^{+2}-Arsenazo III complex by Mole Ratio Method



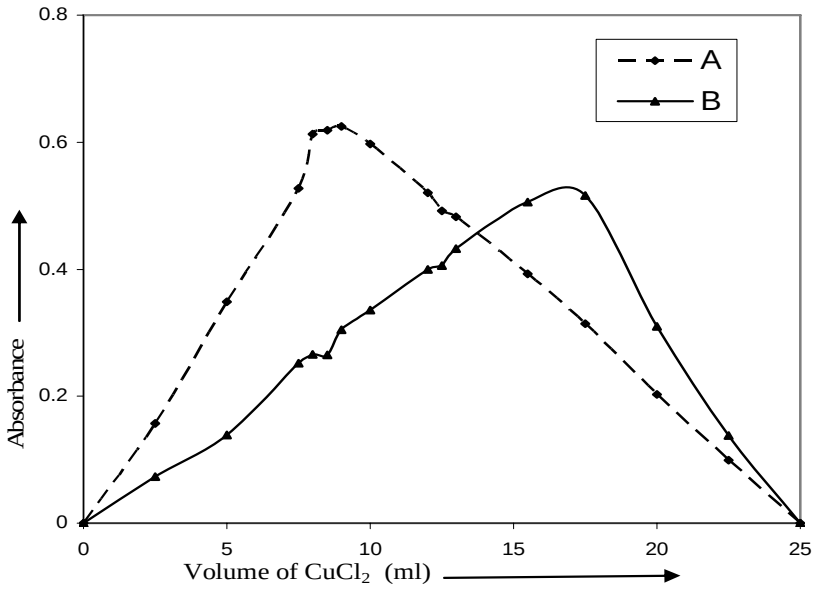
Wavelength= 610 (nm) and total volume =25 ml
Concentration of Arsenazo-III in 10^{-5}M
Concentarion of Cu^{+2} = $8X10^{-5}$ M

Fig. 2 Composition of Cu^{+2}-Arsenazo-III Complex by Method of Continous Variation



Conc. of Arsenazo-III in curve A = 4 X 10^{-5} M and curve B = $2X10^{-5}$ M
Volume of Cu^{+2} at peak = 12.5 ml and Total volume = 25.0 ml
Composition of chelate Cu^{+2} : Arsenazo -III = 1:1

Fig 3 Composition of Cu^{+2} : Arsenazo-III complex by Job's Method of non-equimolar concentartion



Wavelength= 610 nm and total volume= 25ml.
Curve A Conc. of Arsenazo-III= 2X 10^{-5} M and Cu^{+2}= 4 X10^{-5} M
Curve B Conc.of Arsenazo-III= 4 X 10^{-5} M and Cu^{+2}= 2 X10^{-5} M

concentration (*figure 3)* were used. It was found that the combining ratio of Cu^{+2}- Arsenazo- III was 1 : 1 at 3.0 pH suggesting the formation of M (arsenazo-III).

The apparent stability constants were calculated by three different methods. Values of log K are reported in *table -2.*

The maximum colour formation is only attained when the mixture contains a six fold concentration of the reagent with the metal ion. The effective pH range for the determination of Cu^{+2} using arsenazo III as a spectrophotometric reagent and where the result is reproducible is 2.5-4.0, which is shown by the constancy of both wavelength and absorbance of the chelate within the range of pH.

Table-1: Shift of λ_{max} With Change in pH

pH	**Region of maximum Absorption (nm)**
2-9	530
Above 9	550

Table –2: Values of Log K

Method	**Cu^{2+}-Arsenazo III**
The Mole Ratio Method	5.67
Continuous Variations	5.53
Non-equvimolar concentration	5.44
Average value of log K	**5.48**

REFERENCES

1. K.Y. Choi, J.J. Oh and Y.I. Lee, *Microchem. J*, **55**, 357 (1997).
2. M.J. Eapan, C.S. Dorai and V. Damodharan, *Ind. J. Chem*, **28**, 1022 (1989).
3. H.W. Gao, Y.S. Chen and P.F. Zhang, *Asian J. Chem.*, **11**, 300 (1999).
4. P.K. Govil, C.D. Dwivedi and S.K. Benerji, *Indian J.Chem.*, **10**, 211(1972).
5. Y.M. Issa, H.A. Mohamed, M.S. Rizk and S.I. Mohamed, *Egypt. J. Hal. Chem.*, **5**, 1 (1996).
6. R.S. Lokhande and N.A. Degwekar, *Asian J.Chem.*, **11**, 267 (1999).
7. S. Nohut, S. Karabocek, S. Guner and Y. Gok, *J. Pharm. Biomed. Anal*., **20,** 309 (1999).
8. M.I. Roushdy, Y.M. Issa, S.M. El-zein and F.M.S., Harb, *Asian J. Chem.*, **11,** 359 (1999).
9. P.K. Santra, T.K. Mishra and C. Sneha, *Ind.J.Chem.*, **38**A, 82 (1999).
10. P. Job, *Ann. Chim. France*, 9, 113 (1928).
11. A.K. Mukherji and A.K. Dey, *Kolloid Z.*, **158**, 147 (1958).
12. J.H. Yoe and A.L. Jones, *Ind. Eng. Chem., Analyst Ed*., **16**, 111 (1944).
13. W.C. Vosburgh and G.R. Cooper, *J. Am. Chem. Soc.*, **63**, 441 (1941).

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