Spectrophotometric Determination of stability Constant and Free Energy of Formation for the Complex of Cu(II) with 3, 6-Pyridazinediol

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Cu(II) reacts with 3,6-pyridazinediol in aqueous medium forming blue colored soluble complex having maximum absorbance at 605nm. The reaction has been used for the determination of stability constant and free energy of formation of the metal complex.

Cu(II) has been studied in aqueous media by gravitational, potentiometric and spectrophotometric methods with various reagents. However, there is no reference in the literature regarding spectrometric determination of this metal and ligand in aqueous medium. In the present communication 3,6-pyridazinediol has been used to determine the stability constant and free energy of formation of its complex with copper. It gives blue colour with Cu(II) with maximum absorbance at 605nm. Spectrometric study also indicates the metal to ligand ratio.

EXPERIMENTAL

Absorption measurements were carried out on a Beckman D B Spectrophotometer using quartz cells of one cm path length.

Solution of pure copper oxide (Fluka) was prepared by fusing it with potassium hydrogen sulphate and extracting the melt with 10 percent aqueous solution of oxalic acid. This solution was used as stock solution and diluted to the required concentration during operation.

RESULTS AND DISCUSSION

Cu(II) solution gives blue colored solution with 3,6-pyridazinediol immediately on mixing at pH 5.6. The complex gives maximum absorbance at 605nm . The reagent solution shows no absorbance in this region at that pH level.

The system was found to obey Beer's Law within range of 6 to 180 ppm of Cu(II). Stoichiometry of the complex has been determined by Job's Method of continuous variations and mole ratio method. Metal to Ligand ratio was found to be 1:1 by these methods.

INTERFERENCE BY FOREIGN ELEMENTS

Cu(II) with 3,6-pyridazinediol can be estimated in presence of Al, Bi, Cr, Fe, Co, V, Nb, U, and Pb ions, they do not interfere but Mg, Ti, Ta, Zr ions interfere in this study by these methods.

PHYSICOCHEMICAL CONSTANTS AND COMPOSITION OF THE COMPLEX

Vosburg and Cooper's method showed the existence of only one complex on this case under experimental conditions. Job's method of continuous variations as modified by Dey et al and mole ratio method were applied for the determination of stoichiometry and stability constant of this complex.

Calculated values of stability constant and free energy of formation are given in the Table below.

On the basis of the above studies stoichiometry has been given as 1:1 metal to ligand.

Metal Complex	Methods Used	Stability Constant (K)	Log K	Free Energy of Formation (ΔG^o) Cal deg-1 mol-1
Cu (II)- 3,6-pyridazinediol complex	Job's method of continuous variation			
	a. Equimolar	1.7×10^6	6.208	-3917.52
	b. Non-equimolar	1.8×10^6	6.249	-3798.56
	Mole ratio method	5.9×10^5	5.772	-3502.44

In the estimation of Cu(II) with 3, 6- pyridazinediol the effect of foreign ions was studied by adding several foreign ions at different concentrations. And it was found that Cu (II) can be estimated in the presence of AL, Bi, Cr, Fe, Co, V, Nb, U and Pb ions. The interference was measured up to 100ppm of these ions. While Mg, Ta, Ti and Zr interfere with its estimation.

SUMMARY

Cu (II) form purple colored soluble complex with 3,6-pyridazinediol in aqueous medium at pH 5.6 with maximum absorbance at 605nm. Stoichiometry has been determined as 1:1 metal to ligand ratio for this complex. Spectrophotometric method for estimation of Cu(II) in presence of other ions has also been developed.

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