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NOTE

Use of 3-Hydroxy-3-Phenyl-1-*m*-Hydroxyphenyltriazene in the Spectrophotometric Determination of Cobalt(II)

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The tile reagent has been used for spectrophotometric determination of Co(II). The composition of yellow coloured complex has been found to be 1 : 2 (Co : R) with absorption maximum at 404 nm in the pH range 6.80–7.45. Absorbance measurements were made at 412 nm. Beer's law was followed in the studied concentration range 5.0×10^{-6} M to 3.0×10^{-5} M. The value of molar absorptivity, Sandell's sensitivity, stability constant (log β) and free energy of formation were found to be 20,000 L/mole cm, 2.94 ng/cm^2, 10.18 and −13.88 kcal/mole respectively. Interference of twentyfive diverse ions has been examined.

Attempts were made to develop hydroxytriazenes, as spectrophotometric reagents for determination of cobalt[1–5]. In continuation, the present paper deals with the spectrophotometric determination of cobalt(II) with 3-hydroxy-3-phenyl-1-*m*-hydroxyphenyltriazene.

Systronics UV-visible spectrophotometer-108 has been used for absorbance measurements. For pH measurements Systronics pH-meter-324 was used.

The reagent was prepared as per the reported method[6]. The reagent solution of desired concentration was prepared by dissolving requisite quantity of 3-hydroxy-3-phenyl-1-*m*-hydroxyphenyltriazene in ethanol.

The stock solution of cobalt(II) 1.0×10^{-2} M was prepared by dissolving requisite quantity of AR grade cobalt nitrate hexahydrate in double distilled water and standardised with standard 1.0×10^{-2} M EDTA at pH 5.0–6.0 using xylenol orange[7] as an indicator. Weaker solutions were prepared by its appropriate dilution with double distilled water.

Cobalt(II) formed yellow ethanol soluble complex under optimum condition of cobalt to reagent ratio (1 : 6) and at pH between 6.80–7.45. The yellow complex showed λ_{max} at 404 nm. However, working wavelength was chosen at 412 nm such that the difference between absorbance of the complex and the reagent was maximum. However, still the reagent blank had to be used.

To determine the molar composition of cobalt(II) complex Job's method[8], mole ratio method[9, 10] and slope ratio method[11] have been used. All the three methods gave the complex composition as 1 : 2 (Co : R). Beer's law was obeyed in the studied concentration range 5.0×10^{-6} M to 3.0×10^{-5} M. The molar absorptivity and Sandell's sensitivity of the complex were found to be 20,000 L/mole cm and 2.94 ng/cm^2 respectively. The standard deviation (σ), under optimum condition of complex formation, was found as 0.002 ppm by measuring the absorbance of ten solutions containing 1.47 ppm of cobalt.

The conditional stability constant of cobalt(II) complex was found using Harvey and Manning's[12] mole ratio curve as $\log \beta = 10.18$ and Purohit's method[13] using Job's curve as $\log \beta = 10.22$. Both the methods gave comparable values of $\log \beta$. Using the value of $\log \beta$ (10.18) the value of free energy of formation of the complex at 27°C was calculated from the formula $\Delta G = -2.303RT \log \beta$. By substituting the values of R (1.987). T (300) and $\log \beta$ (10.18), the value of ΔG was obtained as −13.88 kcal/mole.

Interference studies revealed that 1.47 ppm of cobalt can be determined in presence of equimolar amount of sixteen cations and anions namely: Na(I), K(I), NH_4^+, Mg(II), Ca(II), Sr(II), Cd(II), Ba(II), F^-, Cl^-, Br^-, I^-, NO_3^-, CH_3COO^-, CO_3^{2-} and SO_4^{2-}, whereas equimolar amount of Ni(II), Cu(II), Zn(II), Sn(II), Hg(II), Th(IV), SO_3^{2-}, PO_4^{3-} and oxalate were found to interfere.

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