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Spectrophotometric formation constant of complex fe (iii) - promazine

Tanaji N.Bansode

Department of Chemisry, B.N.N.College, Bhiwandi, Thane 421 305 (M.S.), (INDIA)

E-mail: bansodeaditya@yahoo.co.in, bansodeaditya@rediffmail.com

ABSTRACT

The stability constants of complex Fe (III) - Promazine were determined at different pH and at 0.1 M ionic strength in aqueous medium by spectrophotometric method. It was observed that Promazine forms 1:1 Complex with Fe (III) at pH 3.20, 3.50, 3.75. The complex formation was confirmed by adopting the slope ratio and Jobs continuous method.

KEYWORDS

Spectrophotometery;
Metal complex;
Promazine;
Stability constant.

INTRODUCTION

Formation constants can be key parameters for the investigation of equilibria in solution. They are very important in many fields such as industrial chemistry[1], environmental studies[2], medicinal[3] and analytical chemistry[4]. Therefore complexation reactions of metal ions with different ligands have been widely studied[5-7]. Several methods for the determination of formation constants, such as potentiometric titration[8], conductometry[9], and spectrophotometric determination[10], have been reported. Among the methods used for the determination of formation constants, spectrophotometric methods have the advantage of sensitivity and are suitable for determination of formation constants in solution under different experimental conditions.

Phenothiazine drugs are compounds with a well known neuroleptic activity[11]. All the phenothiazines possessing the antipsychotic activity have a three-carbon chain between the nitrogen atoms of the middle ring.

The present paper deals with the determination of the stability constants of complex Fe (III) – Promazine at different pH. The molar ratio of the metal ions to ligands [M]/[L] were studied spectrophotometrically using slope-ratio and continuous variation methods.

MATERIALS AND METHODS

The Spectropotometric measurements were made by using Perkin –Elmer spectrophotometer. The selection of wave length was made by recording the absorption spectra of the Fe (III) - Promazine system at different experimental conditions in the range of 400nm to 800nm.

All chemicals were purchased from Aldrich and S.d. Fine Ltd,Mumbai (India), and were used without further purification. The solutions of reagents were prepared in double glass distilled water having pH about 6.98 to 7.00.

An equimolar solution of (0.001M) of Fe (III) ion and promazine were prepared in aqueous medium. From these stock solutions the complex solution with varying concentration (M+L) i.e. 5+15,

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10+10, 15+5ml of metal and ligand were prepared and absorption spectra was recorded. By fixing the λ max, the absorbance of solution with varying concentration was made and Lambert –Beers law was verified (O.D. Vs C) Figure 1. The metal ion concentration was determined by using complexometric method. The molar extinction coefficient was determined from the slope of absorbance Vs concentration of complex solution. It was also predicted from the ratio of absorbance to the concentration of complex used. In order to evaluate the formation constant ($K_{conditional}$) again different composition (M+L) were prepared by taking 1+9, 2+8, 3+7, 4+6, 5+5, 6+4, 7+3, 8+2. 9+1ml metal ion and ligand in 20ml glass test tube measurements were made spectrophotometrically at 0.1M (KNO_3) ionic strength and at 298 ^{0} K. The stability constant ($K_{conditional}$) was determined by using the expression: $K = X / (a - x)(b - x)$. Where a and b refer to the concentration of metal and ligand, respectively, and x is the concentration of the complex species formed.

RESULTS AND DISCUSSION

Spectrophotometric measurements of iron (III) chelate of promazine in aqueous medium were made at 0.1M ionic strength. The standard solutions of promazine were mixed with Fe (III) ion solution and the absorbances were measured in the range of 400nm -800nm immediately after mixing. The spontaneous wine red colour formation by adding the promazine in Fe (III) ion solution promoted to investigate the behaviour of this complex in a wide range of pH. The conditional stability constant of Fe (III) – Promazine complex obtained in aqueous solution and at different pH are reported in TABLE 1

TABLE : 1 Stability constant of 1:1 complex species of Fe (III)-Promazine in aqueous medium

pH	Log K
3.20	6.222
3.50	6.096
3.75	6.082

The stoichiometry of the Fe (III) – promazine complex was determined at different acidities by continuous variation of promazine concentration, the concentration of Fe (III) ions being constant. The plot obtained by the slope ratio method[12] indicated that Fe (III) ions and promazine form complex in molar ratio of 1:1 Figure 3 and 4. The stoichiometric ratio between Fe (III) ions and promazine in the complex at different acidities was checked by Job's method of continous variation[13]. The Job's plot Figure 2 reached a maximum value at a mole fraction of 0.5:0.5, which confirmed that molar ratio between Fe (III) ions and promazine in the complex is 1:1.

The conditional stability constant (K) of the Fe (III)–promzine complex was calculated according

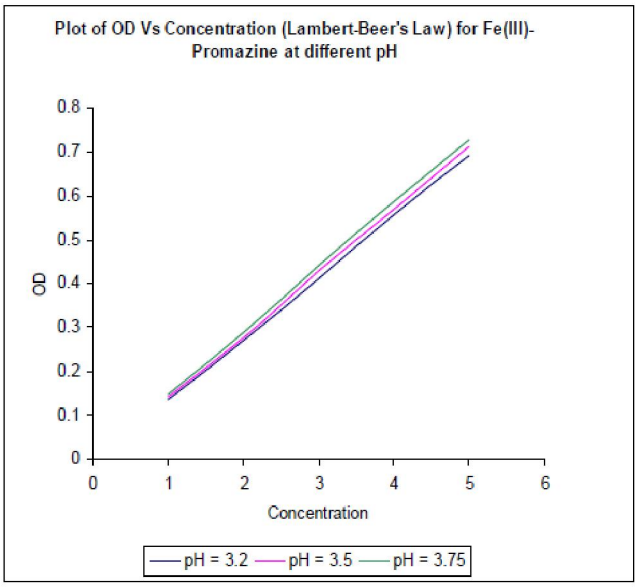

Figure 1

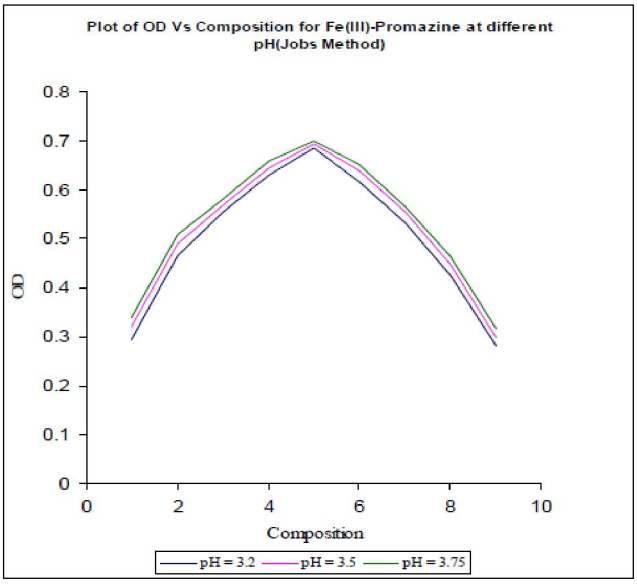

Figure 2

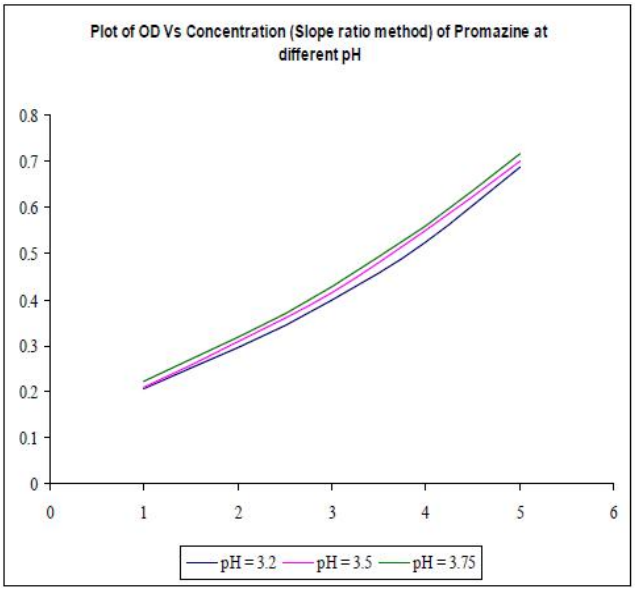

Figure 3

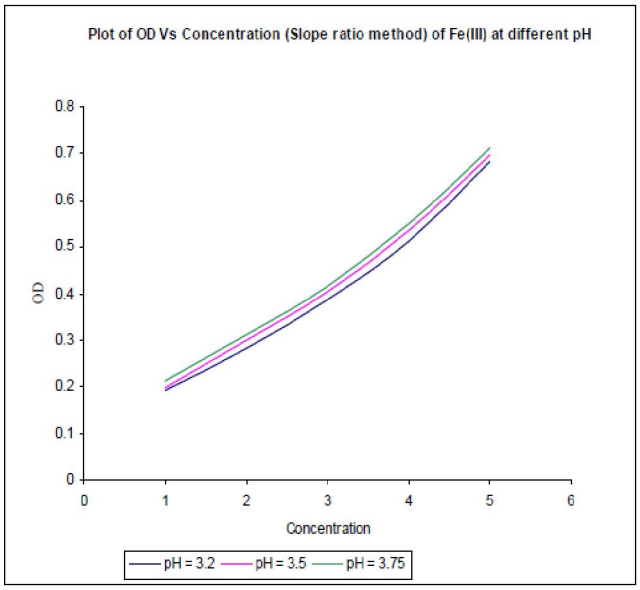

Figure 4

to the methods of Sommer[14] and Asmus[15] using data from Job's plot for equimolar solutions. It can be noticed that the log K values obtained by Sommer's and Asmus's methods are in good agreement. The value of conditional stability constant indicates that the Fe (III)–promazine complex is a complex of medium stability. It could be observed from above results that K_{cond} values were found to be decreases with increase in pH. Thus the 1:1 complex species studied in this part are stable at low pH.

CONCLUSIONS

The complexation reaction occurring between metals ions and Promazine can be followed using spectophotometry, which allow the identification of the complexes formed as well as the determination of their stability constants. Also it is a fast, cheap and sensitive technique for the study of the formation of complexes.

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