



ISSN 0975-413X  
CODEN (USA): PCHHAX

Der Pharma Chemica, 2016, 8(1):28-31  
(<http://derpharmachemica.com/archive.html>)

## Evaluation of stability constants of trifluperazine with Cd (II) and Pb (II) complexes based on voltammetric measurements

Tanaji N. Bansode

Department of Chemisry, B.N.N.College, Bhiwandi, Thane (M.S.), India

### ABSTRACT

A voltammetric study on the binding properties of the Trifluperazine dihydrochloride with cadmium and lead ions were performed. Measurements were carried in sodium acetate buffer at pH 6.00 in aqueous solutions at 0.15M ionic strength. It was observed that Trifluperazine forms 2:1 and 1:1 complexes with Cd (II) and Pb (II) respectively. The stability constants of the metal complexes were evaluated with the DeFord-Hume procedure at different ligand concentrations. The logarithm values of stability constants of Cadmium and lead complexes are 9.650 and 8.958 respectively.

**Keywords:** Trifluperazine, Stability constant, voltammetry, Cadmium, Lead.

### INTRODUCTION

Trifluperazine is a typical antipsychotic drug of the phenothiazine class. It has central antiadrenergic [1], antidopaminergic [2-3], and minimal anticholinergic properties [4]. However, in recent years coordinating behavior of N-alkyl phenothiazines has gained much importance in the pharmaceuticals and chemical analysis [5, 6]. Literature survey reveals that few studies have been reported on phenothiazines-metal complexes [7-12].

Voltammetric techniques are a desirable analytical choice, considering their relatively low cost, simplicity, good sensitivity and selectivity. Considering above facts, in the present paper attempts have been made to determine complex formation of Cd(II) and Pb (II) with Trifluperazine in buffer solution at pH 6.00 by voltammetrically. The overall stability constants of resulting complexes have been evaluated by DeFord- Hume.s method [13].

### MATERIALS AND METHODS

**2.1 Reagents and Solutions.** All chemicals were purchased from Aldrich and Merck (Mumbai, India) and used without purification. All solutions were prepared with double distilled and deionized water. The stock solution of Trifluperazine was prepared by dissolving the analytical grade chemical in double distilled and deionized water, which had been previously degassed with nitrogen for 30 minutes. The solution was kept in darkness at 4 °C and was found to be stable over a period of several weeks. Diluted solutions of Trifluperazine were prepared from the stock just prior to analysis. Pure nitrogen (99.99 %) was used to deaerate the solutions.

### 2.2 Instrumentation.

The voltammetric system used for the studies was metrohm ion analysis PGSTAT 30 version 757 VA computrace 1.0 software, with metrohm 663VA standard electrode system installed for analysis. The instrument settings were as follows: The capillary of drop size 04 with the surface area of 0.04mm<sup>2</sup> was used. Before each measurements a stream of pure nitrogen deaerated the solution. The time of purging was 300s and the time of equilibrations was 20s. The potential scans were recorded at scan rate of 10 mVs<sup>-1</sup> and pulse amplitude of 50 mV. All experiments were carried out at the ambient temperature (approximately 25 °C).

### 2.3 Procedure.

The experiments were performed using  $9 \times 10^{-5}$  M of metal ions concentration while the ligand concentration was from  $1.99 \times 10^{-5}$  M to  $9.99 \times 10^{-5}$  M. A stream of pure nitrogen was used for 300 s to remove the dissolved oxygen in the solution before voltage scanning.

### 2.4 Method of calculation.

The modified method of DeFord and Hume was used to determine the stability constants of the irreversible complexes according to the equation

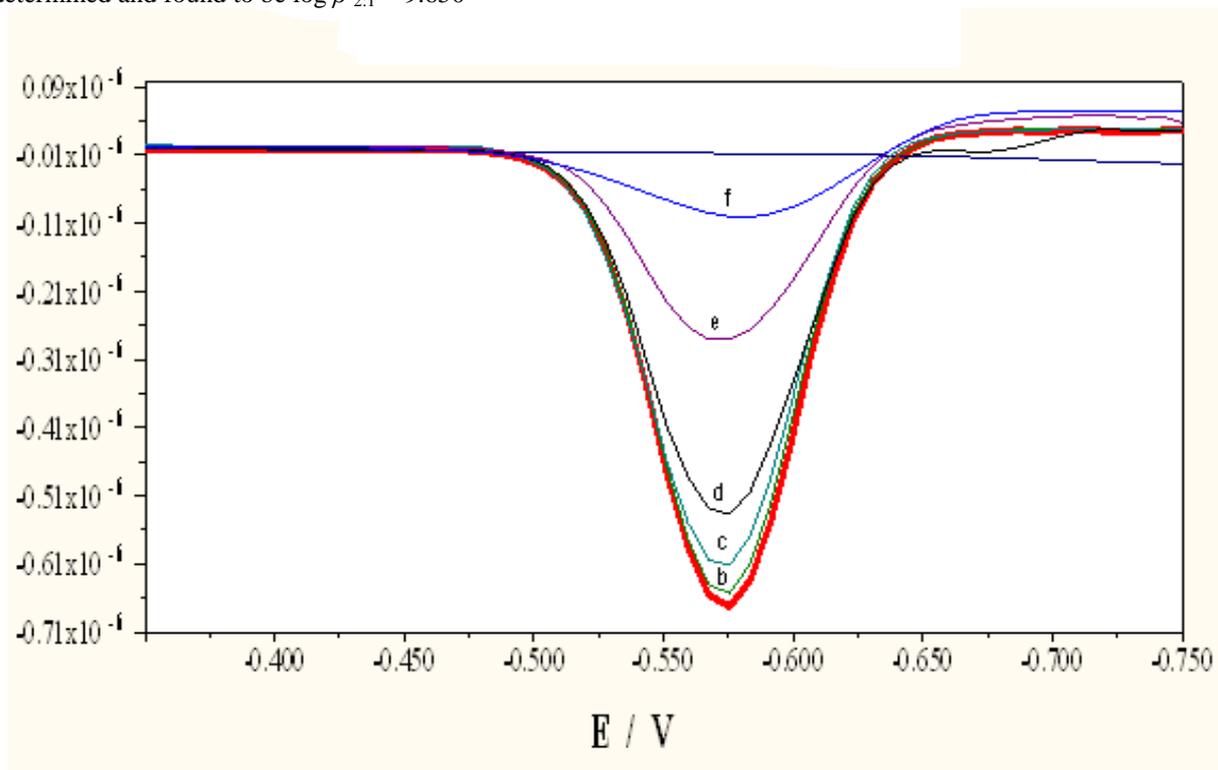
$$(0.434 nF/RT) \Delta E_p + \log [(ip)_M / (ip)_C] = \log \beta ML_p + p \log C_L$$

where  $\beta ML_p$  is the stability constant of the  $ML_p$  complex (where  $M$ , metal;  $L$ , ligand),  $C_L$  is the concentration of ligand,  $\Delta E_p$  is the distance of the peak potentials of the free metal ion and the complex,  $p$  is the ligand/metal value, and  $(ip)_M$  and  $(ip)_C$  are the peak currents of the free metal ion and the complex, respectively. Since no shift was observed in the peak potential in the complexes of Trifluperazine with Cd(II) ions (where  $\Delta E_p$  is constant),  $p$  values were calculated from the slopes of the plots of  $-\log[(ip)_M / (ip)_C]$  versus  $-\log[\text{Trifluperazine}]$ .

## RESULTS AND DISCUSSION

### 3.1 Voltammetric Characteristics of Cd(II) Complexes:

The DPP for the complexation of Trifluperazine.2HCl with Cd (II) in buffer solution at pH 6.00 are given in **Figure 1**. Cd (II) shows a single reduction peak at -0.572 V. On gradually increasing the concentration Trifluperazine from  $0.80 \times 10^{-5}$  to  $4.80 \times 10^{-5}$  mol dm<sup>-3</sup> in the cell containing  $9 \times 10^{-5}$  mol dm<sup>-3</sup> Cd (II) metal solution, result in without much shift in peak potential towards more negative side with continuous decrease in peak current was observed. With continuous decrease in current, the peak disappeared completely when ligand concentration was almost half to that of metal, indicating that the complex has 2:1(metal: ligand) stoichiometry. As there was no shift in peak potential, the log K values have been calculated only by decrease in peak current The overall stability constant was determined and found to be  $\log \beta_{2:1} = 9.650$

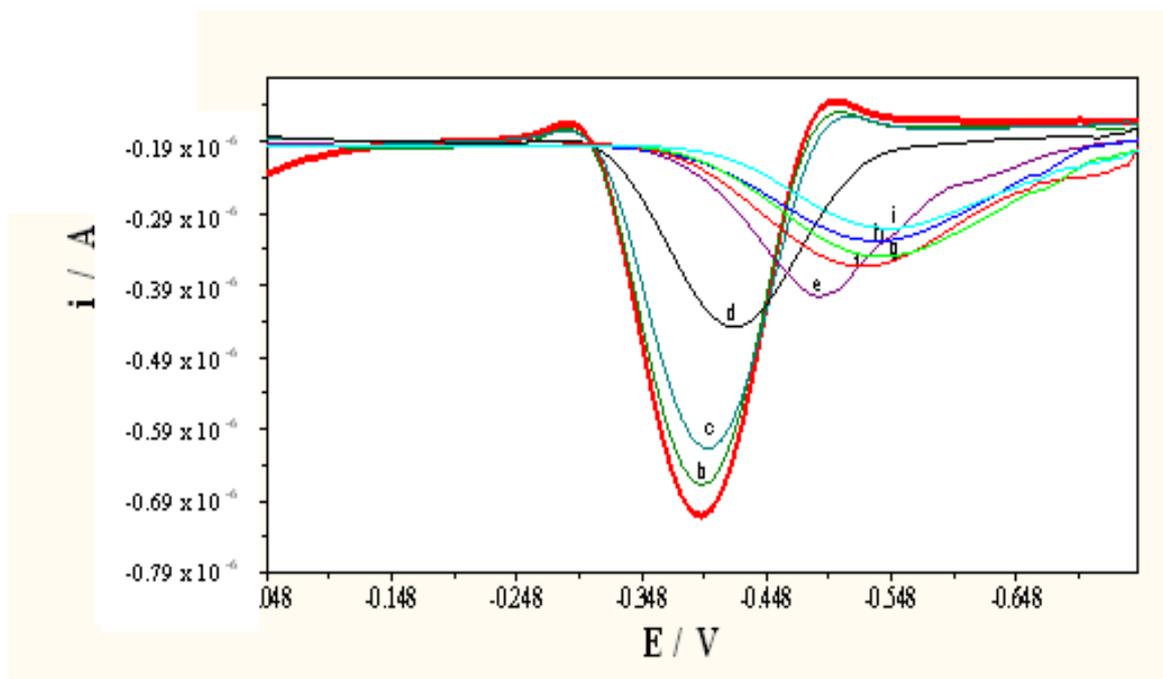


**Figure 1. DPP of  $9 \times 10^{-5}$  M Cadmium with increasing concentration of Trifluperazine.2HCl ( $0.80 \times 10^{-5}$  M to  $4.80 \times 10^{-5}$  M) in buffer solution of pH 6.00**

a =  $9 \times 10^{-5}$  M pure Cadmium [ — ] in buffer solution  
Ligand: b =  $0.80 \times 10^{-5}$ , c =  $1.60 \times 10^{-5}$ , d =  $2.40 \times 10^{-5}$ , e =  $3.20 \times 10^{-5}$ , f =  $4.00 \times 10^{-5}$ ,

### 3.2 Voltammetric Characteristics of Pb (II) Complexes

On other hand, complexation of Trifluperazine.2HCl with Pb (II) is different. In case of Pb (II) a single reduction peak is observed at -0.397V (**Figure 2**). It is observed that a single reduction peak of Pb (II) shifted towards more negative side with continuous decrease in current on addition Trifluperazine.2HCl. This decrease in current and shift in peak potential is continued till  $[M] / [L] = 1$  indicating that complex has 1:1 (metal: ligand) stoichiometry. The  $\Delta E_p$  Vs  $-\log C_L$  plot is used to calculate the stability constant. The overall stability constant was determined to be  $\log \beta_{1:1} = 8.958$



**Figure 2.** DPP of  $9 \times 10^{-5}$  M Lead with increasing concentration of Trifluperazine 2HCl ( $0.99 \times 10^{-5}$  M to  $9.99 \times 10^{-5}$  M) in buffer solution of pH 6.00

a =  $9 \times 10^{-5}$  M pure Lead [ — ] in buffer solution

Ligand: b =  $0.99 \times 10^{-5}$ , c =  $1.99 \times 10^{-5}$ , d =  $2.99 \times 10^{-5}$ , e =  $3.99 \times 10^{-5}$ , f =  $4.99 \times 10^{-5}$ , g =  $5.99 \times 10^{-5}$ , h =  $6.99 \times 10^{-5}$ , i =  $7.99 \times 10^{-5}$  M.

### CONCLUSION

The complexation reaction occurring between metals ions and Trifluperazine can be followed using differential pulse voltammetry, 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.

The compound showed highest stability constant with metal ions due to two 'N' atoms.

### REFERENCES

- [1] J. Huerta-Bahena, R. Villalobos-Molina, JA García-Sáinz., *Mol. Pharma.* **23** (1): 67, (1983).
- [2] P. Seeman, T. Lee, M. Chau-Wong, K. Wong, *Nature* **261**, 717, (1976).
- [3] I. Creese, D.R. Burt, S.H. Snyder, *J. Neuro. Clin. Neuro.* **8** (2): 223, (1996).
- [4] Ebadi, S. Manuchair "Trifluoperazine Hydrochloride". CRC desk reference of clinical pharmacology (illustrated ed.). (CRC Press,1998) ISBN 978-0-8493-9683-0.
- [5] C. Cimpoi, S. Hodisan, M. Toşa, C. Paizs, C. Majdik, F.D. Irimie, *J Pharm Biomed Anal.*, 15, 385, (2002).
- [6] F. J. Lara; A. M. García-Campana; L. Gámiz-Gracia; J. M. Bosque-Sendra, F. Alés-Barrero, *Electrophoresis*, 27, 2348, (2006).
- [7] B. Keshavan, P.G. Chandrashekar, N. M. Made Gowda, *J. Mol. Stru.*, 553, 193,(2000).
- [8] M. Krstića, S. P. Sovilj, S. Grguric-Sipka, I. R. Evans, S. Borozana, J. F. Santibane, J. Kocic, *Eur.J. Med. Chem.*, 45 (9), 3669, (2010).
- [9] V. Debbeti; T. J. Ahmad; S. Ananda; N. M, Made Gowda, *Am. J. Chem.*, 2(6): 294, (2012).
- [10] T.N.Bansode, *Arch. Appl. Sci. Res.* 6 (6), 75. (2014)
- [11] T.N.Bansode, *Anal. Chem.* 10(5), 279, (2011).

[12] T.N.Bansode, *Der Pharm. Chem.*, 7(6), 59, (2015).

[13] D.D.De Ford, D.N.Hume; *J.Am.Chem.Soc*, 73, 5321 (1951)