

# Spectrophotometric Determination Of Pure Amitriptyline Hydrochloride Through Ligand Exchange On Mercuric Ion

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**Abstract:** The simple spectrophotometric method for the estimation of chloride ions based on reaction between chloride ion and mercuricthiocyanate, formation of a coloured complex by the reaction between released thiocyanate and ferric ions is applied for the determination of pure chloride salt of drug substance viz., Amitriptyline Hydrochloride. The maximum absorbance was found at 460nm. The coloured complex is stable for 6hrs. It obeys Beer's law in the concentration range of 0-60 $\mu$ gCl/ml. The applied method can be used routinely for the estimation of pure drug salts through their chloride concentration.

**Key words:** Amitriptyline Hydrochloride, Ligand Exchange, Mercuric Ion.

## Introduction

Number of drug substances is available in the form of halide salts<sup>1</sup>. These are conveniently analysed for the drug base or the halide concentration. Number of these salts are analysed by non-aqueous titration utilizing the reaction between halide ion and mercuric acetate<sup>2</sup>. Amitriptyline is estimated by potentiometry<sup>3</sup>, AAS<sup>4</sup>, Chromatography<sup>5,6</sup> and oxidative coupling with MBTH in presence of iron(III)<sup>7</sup>. In our present study Amitriptyline Hydrochloride (pure drug) was analysed through its chloride content from the reaction between the chloride ion and mercuricthiocyanate<sup>8</sup> resulting in the formation of pink coloured complex with the reaction between the released thiocyanate and ferric ions.

## Experimental

**Instrument:** A Shimadzu model 1601PC UV/Visible spectrometer (computer interface) with 1cm quartz cuvettes was used for absorbance measurements.

**Reagents:** a) Ferric ammonium sulphate solution: 6g of ferric ammonium sulphate (A.R)  $\text{FeNH}_4(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$  was dissolved in 50 ml double distilled water and 20ml of concentrated nitric acid

was added and diluted with double distilled water to 100ml.

b) Mercuric thiocyanate solution: 0.5g of mercuric thiocyanate(A.R) was dissolved and diluted to 100 ml with methanol. Mixed and filtered through filter paper.

c) Working standard sodium chloride solution covering the range 0-60 $\mu$ gCl/ml was prepared in double distilled water.

## Procedure

### 1.Preparation of standard curve (sodium chloride):

**a)Stock solution:** 0.0824 g of pre dried pure sodium chloride was transferred to a 100 ml volumetric flask and diluted to 100 ml with double distilled water.

**b)Colour development:** From the stock solution 1ml, 2ml...8ml were transferred respectively to each 50ml volumetric flask and 10ml of double distilled water was added. To each flask, 2ml ferric ammonium sulphate solution and 2ml saturated solution of mercuric thiocyanate were added and mixed well. This was diluted to 50ml with double distilled water. After 10 min, the absorbance was measured at 460nm.

## 2.Preparation of standard curve (Amitriptyline Hydrochloride)

**a) Stock solution:** 0.1940 g of amitriptyline hydrochloride was transferred to 100ml. volumetric flask, dissolved and diluted to 100ml with double distilled water.

**b) Colour development:** From the stock solution 2ml, 4ml...10ml were transferred respectively to each 50ml volumetric flask and 10ml double distilled water was added. 2ml ferric ammonium sulphate solution and 2ml saturated solution of mercuric thiocyanate were added to each flask and mixed well. This was diluted to 50ml with double distilled water. After 10min, the absorbance was measured at 460nm.

## 3.Estimation:

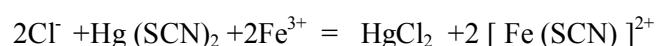
### Amitriptyline Hydrochloride

**a)** The concentration of pure amitriptyline hydrochloride was estimated from its chloride content using the sodium chloride standard curve. These values were compared with the I.P titrimetric method. Recovery study was carried out for the validation of the method.

**b)** Three amitriptyline hydrochloride raw material samples were analysed using the amitriptyline hydrochloride standard curve. 0.1950g of each raw material sample was transferred to 100ml volumetric flask and dissolved in 20 ml double distilled water. This was diluted to 100ml with double distilled water. 6ml of each dilution was transferred to 50ml volumetric flask and 10ml double distilled water was

added. 2ml ferric ammonium sulphate solution and 2ml saturated solution of mercuric thiocyanate were added and mixed well. This was diluted to 50ml with double distilled water. After 10min, the absorbance was measured at 460nm.

**Reaction:**  $\text{Hg}^{2+}$  will form strong aqueous complex with chloride ion. The chloride complex is stronger and displaces thiocyanate from mercuricthiocyanate. The free thiocyanate then complexes with  $\text{Fe}^{3+}$  and the concentration of this complex is determined spectrophotometrically.



## Results and Discussion

The pink coloured chromogen formed was stable for 6hrs. Beer's law is obeyed in the concentration range of 0-60 $\mu\text{g/ml}$  of chloride concentration. The spectrophotometric chloride determination was applied for the estimation of pure Amitriptyline Hydrochloride by employing sodium chloride calibration curve and the values were compared with the Non-aqueous assay method (I.P). The values are presented in table1. Recovery study was carried out and no interference was found. In addition, three raw material samples of Amitriptyline Hydrochloride were analysed employing Amitriptyline Hydrochloride calibration curve. The values were compared with the I.P method and presented in table 2.

**Table-1: Estimation of Amitriptyline Hydrochloride using sodium chloride standard curve.**

| S.No | Amount of Amitriptyline HCl $\mu\text{g/ml}$ | Amitriptyline HCl calculated through Cl content $\mu\text{g/ml}$ | % Purity*        | % Purity I.P (Titrimetric method)* | % Recovery** |
|------|--|--|------------------|------------------------------------|--------------|
| 1    | 77.6   | 77.5   | 99.87 $\pm$ 0.03 | 99.46                              | 99.54        |
| 2    | 155.2  | 154.88   | 99.87 $\pm$ 0.03 |                                    | 99.38        |
| 3    | 232.8  | 232.48   | 99.86 $\pm$ 0.02 |                                    | 99.12        |
| 4    | 310.4  | 309.93   | 99.84 $\pm$ 0.01 |                                    | 99.74        |
| 5    | 388.0  | 387.61   | 99.89 $\pm$ 0.02 |                                    | 99.65        |

\*Average of three determinations.

\*\*After adding drug solution equivalent to 10 $\mu\text{g/ml}$  chloride of each dilution.

Average of three determinations.

**Table-2: Estimation of raw material samples using Amitriptyline Hydrochloride standard curve.**

| Raw material | Amount of Raw material $\mu\text{g/ml}$ | Amitriptyline HCl found $\mu\text{g/ml}$ | % Purity          | % Purity (I.P Method) |
|--------------|---|--|-------------------|-----------------------|
| 1            | 234.0                                   | 231.7                                    | 99.02 $\pm$ 0.03  | 99.14                 |
| 2            | 234.0                                   | 235.1                                    | 100.47 $\pm$ 0.04 | 100.06                |
| 3            | 234.0                                   | 232.8                                    | 99.49 $\pm$ 0.06  | 99.72                 |

**Table 3: Optical characteristics**

| S.No. | Parameters  | Proposes method |
|-------|---|-----------------|
| 1     | $\lambda$ max (nm)  | 460nm           |
| 2     | Beer's law limit  | 0-50 $\mu$ g/ml |
| 3     | Sandells sensitivity ( $\mu$ g/cm <sup>2</sup> /0.001 absorbance unit | 0.076           |
| 4     | Regression equation (Y*)  |                 |
|       | Slope (b)   | 0.0137          |
|       | Intercept (a)   | 0.0015          |
| 5     | Correlation coefficient   | 0.9996          |

\*Y=a+bC, where C is the concentration in  $\mu$ g/ml

The applied method is simple, rapid and reproducible and which could easily be adapted for routine analyses of raw materials of Amitriptyline Hydrochloride. The optical characteristics and figures of merit are given in table 3 together with regression equation (obtained by

least square method) for the calibration plots. The precision and accuracy were determined by analyzing six replicate samples containing known amount of chloride content.

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