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Research Article

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Spectrophotometric Determination Studies of Copper (II)roxithromycin Complex

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Abstract In this work roxithromycin and its Cu (II) metal complex determination were carried out by spectrophotometric method. The following experimental procedures like effect of pH, effect of metal ion concentration, effect of drug concentration, effect of time and the composition of the complex by mole ratio .In this research work, it is clear that Cu forms a stable 1:1 colored complex with roxithromycinin acidic medium it is noticed from that at pH 3.2 and roxithromycin colored complex was formed.

Keywords Spectrophotometric Determination, roxithromycin, Copper

Introduction

Roxithromycin [Fig.1] is a semi-synthetic macrolide antibiotic. In 1987, a German pharmaceutical company, Hoechst Uclaf, introduced roxithromycin. It is available in the form of tablets and oral suspensions. It is derived from erythromycin with *N*-oxime side chain attached to the lactone ring. It is a white solid having a melting point of 111°C. It is soluble in ethanol, methanol, acetonitrile, and acetone. Many researches studies the complextion of antibiotics and it's characterization [1-7]. In this research article carried out a spectrophotometric method for determination of Roxithromycinin by using Copper. In this method reaction of drug with Copper (II) in acidic condition to form stoichiometrically a blue Roxithromycin - Cu (II) complex at optimum conditions. This method is convenient, simple, rapid, economically viable and selective method for the determination of drug as well as metal ions in pharmaceutical formulations.

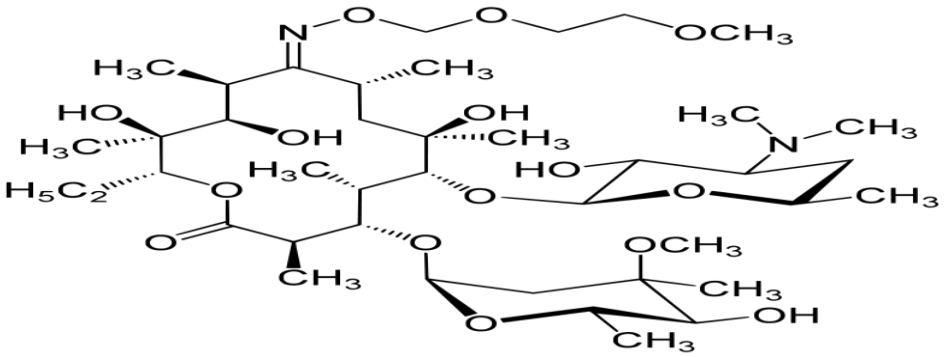


Figure 1: The structure of the Roxithromycin

Experimental

All the molecular absorption measurements were made using UV-Vis spectrophotometer type Shimadzu model UV-160 equipped with 10mm matched quartz cell. For pH measurement it is used a pH Meter (Elico) with combined electrode. Well calibrated glassware was used to carry out experiments. Hydrochloric acid, sodium acetate, acetic acid, ammonia, methanol, ammonium chloride, cadmium chloride and copper chloride were purchased from Merck. Roxithromycin were purchased from Ranbaxy laboratories Ltd. All the used chemicals were of analytical reagent grade; deionized water was used for diluting the reagents and samples.

a) Absorption spectrum

5ml of buffer solution of required pH and appropriate volumes of DMF and the reagent solution are taken in a 10 mi volumetric flask. The total volume of the mixture is brought to 10 ml with distilled water. The absorbance of the solution is measured in suitable wavelength region against a blank consisting of 5 ml of buffer solution, appropriate volume of DMF and made up to the mark in 10 ml volumetric flask. A plot between absorbance and the wavelength is then made.

b) Absorption spectrum of the solution containing the complex species

In a 10 ml volumetric flask, 5 ml of buffer solution of desired pH and appropriate volumes of DMF, metal ion solution and reagent solution are taken. The contents of the flask are brought to the mark with distilled water. Its absorbance is measured in suitable wavelength region against the reagent blank prepared under identical conditions. A plot between absorbance and the wavelength is drawn from which the analytical wavelength is selected.

c) Effect of pH on the absorbance of the solution containing complex species

A known aliquot of metal ion and appropriate volumes of DMF and reagent solutions are taken in different 10ml volumetric flasks each containing 5 ml of buffer solution of different pH values. The contents of each flask are made up to the mark with distilled water and the absorbance of these solutions is measured against the corresponding reagent blank at the analytical wavelength. A plot is then made between absorbance and pH, from which the working pH is chosen [8].

d) Effect of the reagent concentration

In a series of 10 ml volumetric flasks containing 5 ml buffer solution of desired pH, appropriate volume of DMF, different known aliquots of the reagent solution, a known aliquot of metal ion solution is taken and the contents are brought up to the mark with distilled water. The absorbance of the solution in each flask is measured against the corresponding reagent blank at the analytical wavelength, from which the required molar excess of the reagent necessary for maximum colour formation is ascertained.

e) Effect of DMF volume on the absorbance

The reagent and many of its metal complexes are insoluble in aqueous medium. But it is observed that the reagent and its complexes are soluble in aqueous DMF. In order to arrive at the optimum percentage of DMF required to retain them in solution, the following procedure is adopted. To different 10 ml volumetric flasks each containing 5 ml of buffer solution, appropriate volume of metal ion solution, required aliquots of reagent solution and different volumes of DMF are added. The contents of the flasks are made up to the mark with distilled water and the absorbance of these solutions is measured at the selected analytical wavelength against the reagent blank.

f) Effect of time on the colour development and on the stability of the colour

5 ml of buffer solution, required volume of DMF, an aliquot of metal ion and the reagent solutions are taken in a 10 ml volumetric-flask and made up to the mark with distilled water. The absorbance of the solution is measured at different time intervals at the selected wavelength against the reagent blank from which the time interval required to be allowed after mixing various components of the reaction mixture and before measuring the absorbance is known [9].

g) Adherence of the systems to Beer's law [10,11]

To ascertain the sensitivity of the colour reactions and to explore the possibility of determining micro amounts of metal ions, the following procedure is adopted. Varying known aliquots of metal ion solutions are added to a set of 10ml volumetric flasks, each containing 5 ml of buffer solution of desired pH, known volume of DMF and the necessary excess of the reagent solution. The contents of the flasks are brought up to the mark with distilled water

and the absorbance of the solutions are measured at the analytical wavelength against the reagent blank. A plot of absorbance and amount of metal ion(µg/ml) is constructed. The slope and the intercept of the plot are computed. The molar absorptivity is calculated from the slope.

Results and Discussion

A blue complex is formed between Cu^{2+} and Roxithromycin by preparing serial concentrations for Copper and Roxithromycin. Maximum absorption of the band of the mixture solution at 326 nm. Therefore this wavelength was used for linear range study., while molar absorptivity value (ε) of the complex with value equal22500 L $mole^{-1}cm^{-1}$ (Figure 2). The complex formed immediately and was determined to be stable for at least 24 h after they had formed. It is generally reported that the more points of attachment, the more stable the resulting complex, the complexes show potential for sensor design and development. From the mole ratio method it's found that the most stable formation of complex at ratio (1:1),

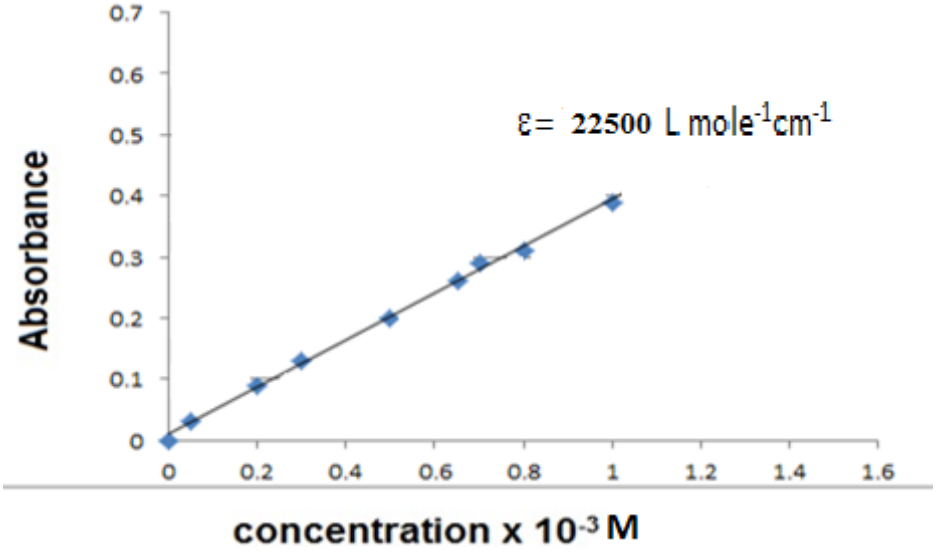


Figure 2: Confirms that increasing the concentration of Cu^{2+} causes increased absorption of the band of the mixture solution at 326 nm. Therefore this wavelength was used for linear range study

From the mole ratio method it's found that the most stable formation of complex at ratio [1:1], Figure [3]

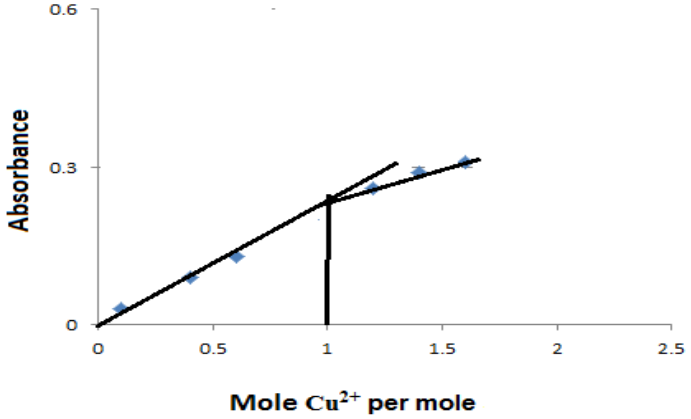
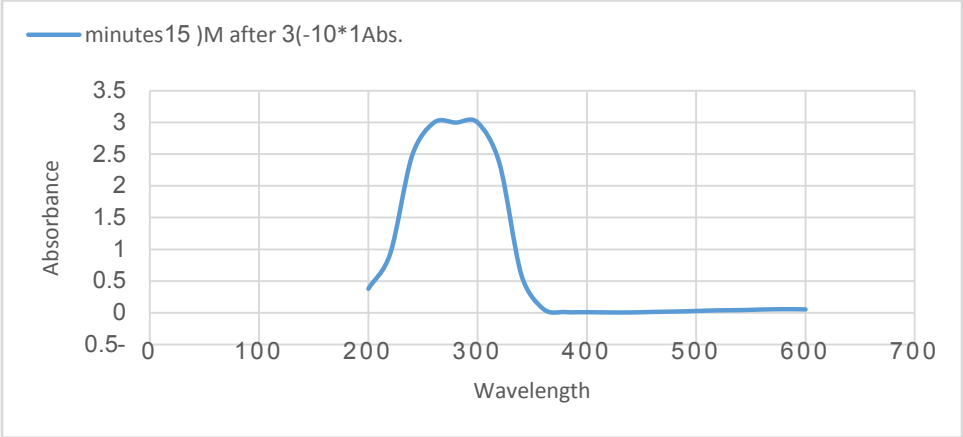


Figure 3: Molar ratio [M/L] vs. Absorbance

Effect of time on absorbance for cu[II]– roxithromycin Complex on neutral medium. The effect of time on absorption was studied for cu[II] – roxithromycin Complex for different concentration [$1x10^{-3}$] to [$5x10^{-3}$] molar concentration as shown in table 1 and figure 4.

Table 1: Effect of time on absorbance for 1×10^{-3} Molar concentration of cu [II] – roxithromycin Complex

Abs. 1×10^{-3} M after 15 minutes	**Abs. 1×10^{-3} M after 30 minutes**	**Abs. 1×10^{-3} M after 45 minutes**	**Abs. 1×10^{-3} M after 1 Hour**
0.376	0.73	0.386	0.386
0.932	0.929	0.942	0.939
2.477	2.466	2.484	2.48
3	3	3	3
3	3	3	3
3	3	3	3
2.352	2.343	2.375	2.37
0.593	0.582	0.581	0.592
0.058	0.058	0.058	0.068
0.008	0.011	0.009	0.019
0.006	0.002	0.002	0.01
0.002	0.001	0.002	0.004
0.002	0.007	0.004	0.001
0.01	0.013	0.016	0.007
0.016	0.018	0.02	0.014
0.025	0.029	0.031	0.019
0.035	0.039	0.04	0.029
0.039	0.043	0.044	0.031
0.048	0.052	0.051	0.038
0.053	0.053	0.052	0.04
0.05	0.052	0.05	0.038



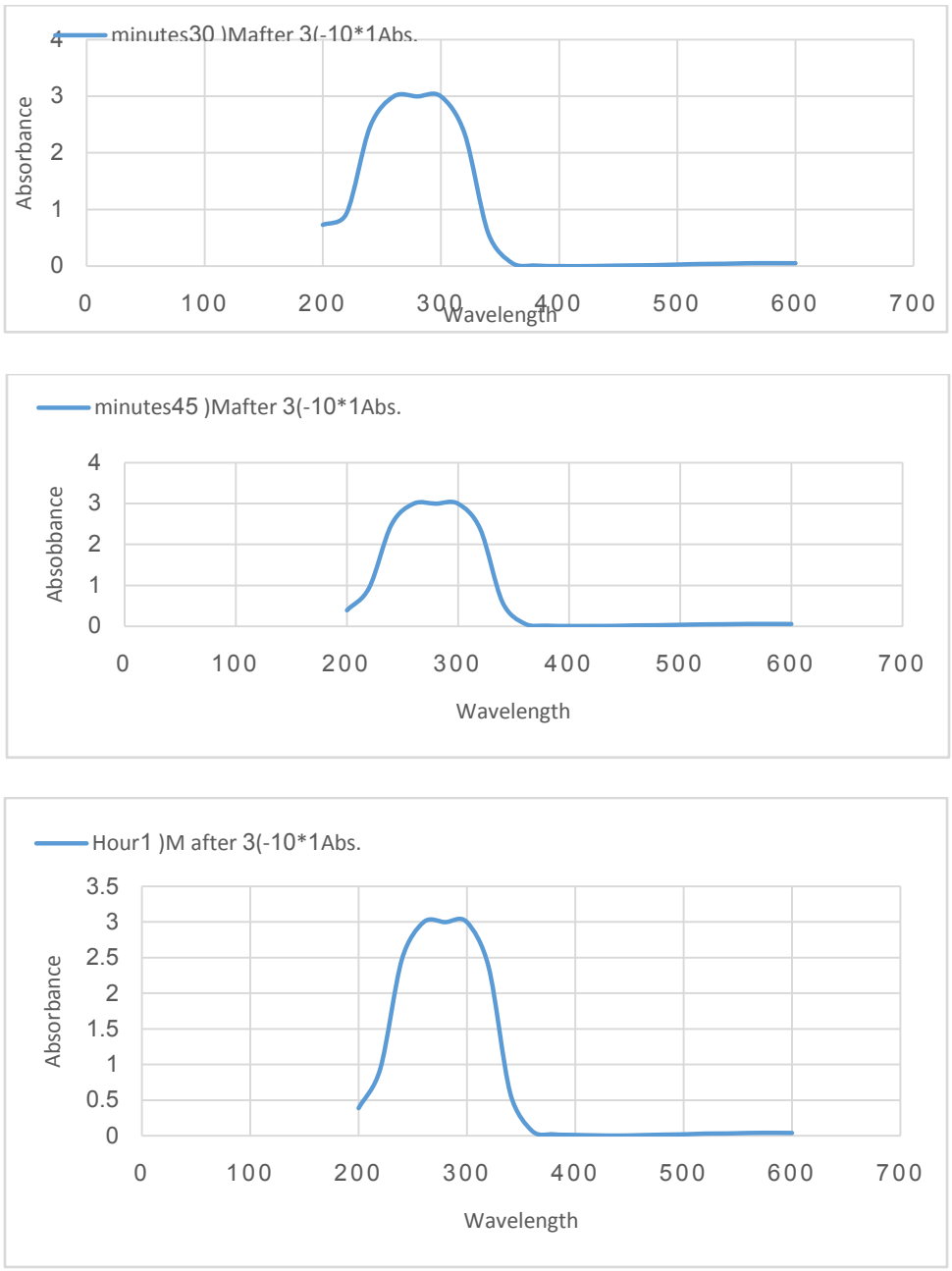


Figure 4: Spectra of effect of time on absorbance for 1×10^{-3} Molar concentration of cu [II] – roxithromycin Complex

Effect of Acidity

To see the effect of different pH we have taken 0.5 ppm Cu^{+2} solution. Of the various acids (nitric, sulfuric, hydrochloric and phosphoric) studied hydrochloric acid was found to be the best acid for the system. The absorbance was maximum when the pH of the solution is 3.2 at room temperature (25± 5) ^{0}C. We have controlled the pH of the solution using hydrochloric acid and ammonium hydroxide, NaOH or KOH as a base and double distilled water. Outside this range of acidity, the absorbance decreased (Fig.5). At λ_{max} = 326 nm the absorbance values of Cu^{+2}-Roxithromycincomplexare as follows.

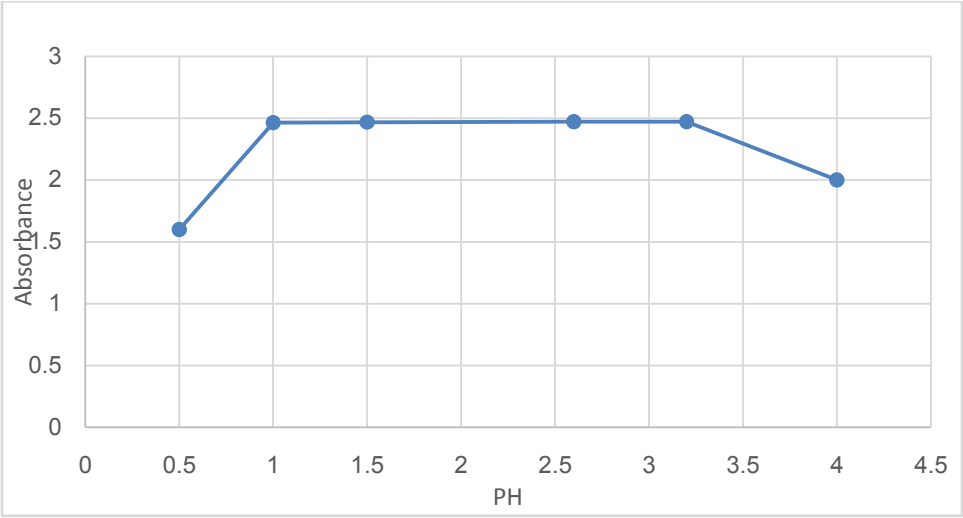


Figure 5: Spectra of effect of pH on absorbance of cu (II) – roxithromycin Complex at Wavelength =326 nm

Effect of Temperature

The Cu^{+2}-roxithromycin system obtained maximum and constant absorbance at room temperature $(25\pm5)^0$C. Outside this range of temperature, the absorbance decrease gradually. The results are as follows (Fig.6):

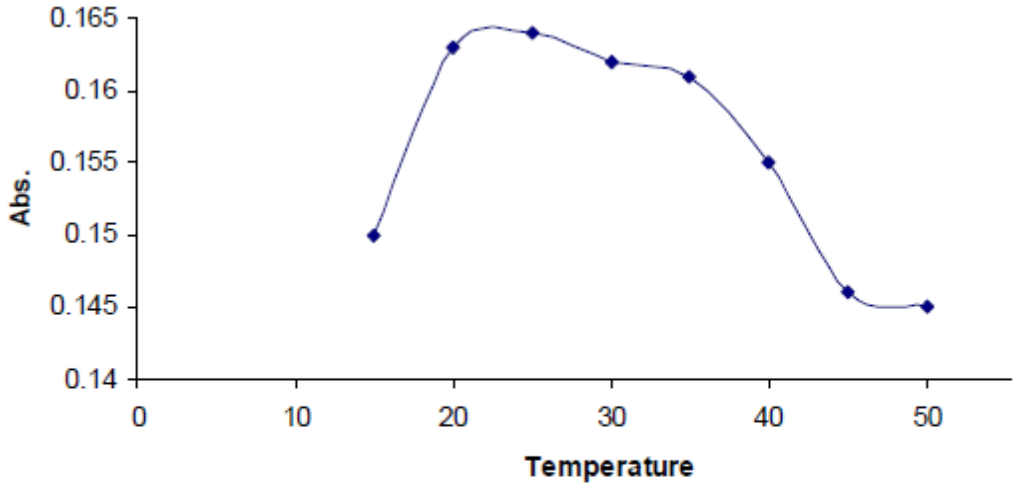


Figure 6: Effect of the temperature on the absorbance of Cr^{+3}-cephalxin

Conclusion

Thus, in this research work, it is clear that Cu^{+2} form a stable 1:1 colored complex with roxithromycin in acidic medium. Effect of pH is studied and colored complexes were formed. From mole ratio method it clearly showed that Cu a stable 1: 1 complexes with roxithromycin. Effect of time clearly suggest, that the maximum absorbance is obtained only after heating the mixture to 40^occomplex. It has been observed that the absorbance values remain constant thereafter. This method is can be used for the determination of metal ions as well as drug in pharmaceutical formulations because it is a simple, convenient and rapid technique.

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