

## SPECTROPHOTOMETRIC STUDY OF COMPLEXATION OF LABETALOL WITH SOME TRANSITION METAL IONS

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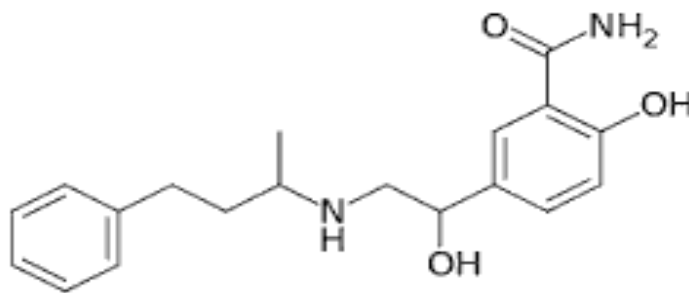
### ABSTRACT

UV- Visible spectrophotometric is a selective method for determination of the complexation of antihypertensive drug labetalol with Cu, Zn, Cd Metal ions. The proposed method is based on the formation of stable Cu(II), Zn(II),Cd(II) complexes with labetalol, labetalol react with these metal ion in aqueous buffer solution where by a coloured complex are formed which absorbed maximally at 350 nm. The different experimental parameters affecting the development and stability of the colour were carefully studied and optimized. Here the selected drug is  **$\beta$ -blocker** having amino group so the chealation with cu (II) ion is easily and stable.

**KEYWORDS:** complexation, spectrophotometric, absorbance, labetalol, Stability, antibiotics.

### INTRODUCTION

The interaction between antihypertensive drug labetalol and Cu (II), Zn (II),Cd(II) metal ions leads to formation of the binuclear green and white complex. It was characterized by spectroscopic (UV-Visible) double beam spectrophotometer.<sup>[1]</sup> The  $\beta$ : $\alpha$  antagonism of labetalol is approximately 3:1. It is chemically designated in International Union of Pure and Applied Chemistry (IUPAC) nomenclature **2-hydroxy-5-[1-hydroxy-2-[methyl phenyl propyl] amino] ethyl] monohydrochloride.**



**Structure of Labetalol**

Labetalol (LBT) hydrochloride (mixed  $\alpha$ - and  $\beta$ - adrenoreceptor blocking agent) is considered as one of the major therapeutic drugs for the treatment of hypertension. LBT hydrochloride is also used to induce hypotension during surgery<sup>[2]</sup> as it reduces blood pressure more rapidly than other receptor blockers. LBT hydrochloride therapy exhibits hepatotoxicity and renal failure due to overdose. The efficacy and safety of different drug classes; management of hypertension in groups at higher risk, including people with diabetes; the importance of assessing the total risk of cardiovascular disease; and **additional** benefits associated with the use of **metal ions**. In this paper, the interaction of labetalol with some transition metal ions is an attempt to examine the mode of labetalol co-ordination and the determination of stability constant of the resulting complexes.<sup>[3]</sup>

#### **MATERIAL AND METHOD**

A Systronic UV/Vis spectrophotometer with 1 cm quartz cells was used to measure the absorbance. The pH measurements were made with systronic pH meter model 371 all measurements were performed at room temperature ( $35 \pm 0.01^\circ\text{C}$ ). labetalol stock solution ( $1 \times 10^{-2}$  M) was prepared by dissolving the accurately weighed amount in glacial acetic acid and the volume was completed to the mark with distilled water. Metal stock solution (0.1M) was prepared by dissolving the appropriate amount of copper acetate, zinc acetate, cadmium nitrate with distilled water. The universal, borate and phosphate buffer solutions of varying pH values.<sup>[4]</sup>

A series of solutions containing up to 4.0 ml of buffer solution, 1 ml (0.1 M) of the metal ions and 0.2-2.6 ml ( $1 \times 10^{-2}$  M) of labetalol was mixed in 10 ml measuring flask and then diluted up to the mark with water. The mixture was allowed to stand for 10 min. The absorbance was measured at the maximum wavelength ( $\lambda_{\text{max}}$ ) against a blank solution prepared in the same manner but not contains metal ions. The calibration graph was prepared

by using the same procedure (at least seven concentration points) and were linear passing through the origin.

Stoichiometry of labetalol complexes formed in the solution was determined spectrophotometrically applying the continuous variation<sup>[5]</sup> and mole ratio<sup>[6]</sup> methods. The obtained results revealed the formation of 1:1 (M: L) labetalol complexes with Cu (II), Zn (II), Cd (II) metal ions respectively. The logarithmic constants ( $\log \beta_n$ ) and the free energy changes ( $\Delta G$ ) of the formed complexes was calculated from the data of continuous variation and mole ratio methods applying equations 1 and 2.

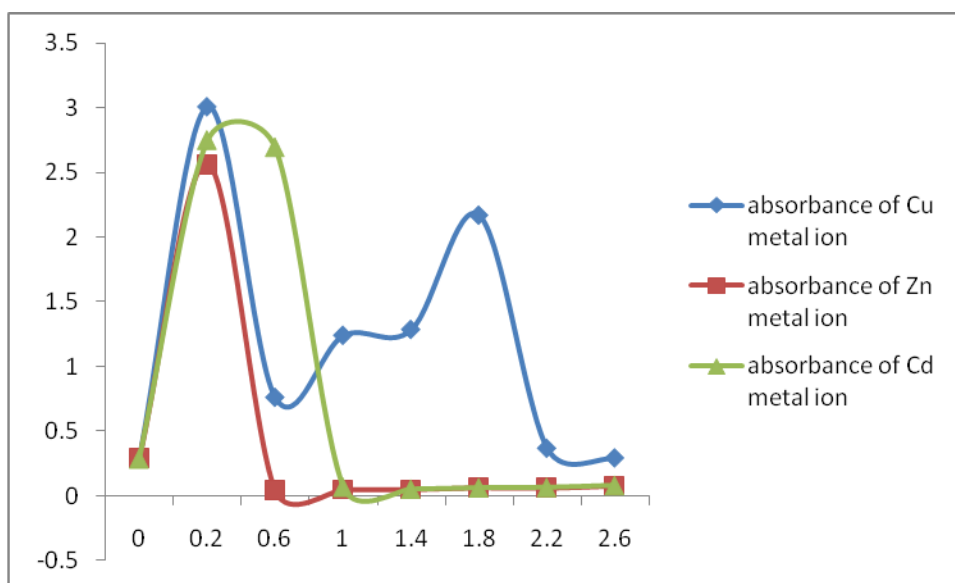
$$\beta_n = A/A_m / 1 - [A/A_m]^{n+1} C_1^n N^2 \quad \dots\dots\dots (1)$$

$$\Delta G = -2.303 RT \log \beta_n \quad \dots\dots\dots (2)$$

where  $\beta_n$  is the stability constant of the metal chelate, A is the absorbance at ligand concentration CL,  $A_m$  is the absorbance at full color developed, n is the order of the complex formed, T is the absolute temperature and R is the gas constant.

**TABLE: Spectrophotometric analytical characterstic of labetalol complex with cu (II), zn(II), cd(II) ions.**

Metal ion	$\lambda_{max}$	M/L Ratio	$\beta_n$	- $\Delta G$
Cu	350	1:1	4.62	3.92
Zn	350	1:1	2.80	2.59
Cd	350	1:1	3.49	3.12



**Figure: Absorbance vs Concentration plot for Cu (II) –labetalol Zn(II)-labetalol and Cd(II)-labetalol complexes.**

## RESULT AND DISCUSSION

The stability constant value for complexation of labetalol with Cu (II), Zn (II) and Cd (II) Metal ions by spectrophotometric method have been presented in table. Labetalol complexes in the UV-Visible region exhibits maximum absorption at 350nm for Cu,Zn,Cd complexes. The stability constant for metal labetalol have been found to be in the order Cu > Cd > Zn are 4.62 > 3.49 > 2.80 respectively. Thus the labetalol complex has the highest value with Cu (II)<sup>[7,8]</sup> The complexes of this antibiotic with all the metal ions indicate the formation of 1:1 complexes. The negative value of  $\Delta G$  indicates that complex formation is spontaneous.<sup>[9]</sup>

## CONCLUSION

The present research work has demonstrated that the use of UV-Visible spectroscopy is feasible in complexation reaction for determine the stability constant. The determination process is based on the ability of labetalol (ligand) to form stable 1:1 (M:L) complex with some transition metal ion.

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