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Spectrophotometric Studies the Interaction of 4-(P-Tolyl) Thiocarbamidophenol and Cu (II), Cd (II), Cr (II) and Ni (II) Metal Ions in 70% Ethanol-Water Solvents Media



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ABSTRACT

Present work highlights the spectrophotometric studies the interaction of 4-(p-Tolyl) thiocarbamidophenol and Cu (II), Cd (II), Cr (II) and Ni (II) metal ions in 70% ethanol-water solvents media at different proportions. Job's method of continuous variation is used through this investigation. It is the spectrophotometric study. The stoichiometry of complex formation found to be 1:1. This investigation helps to understand drug effect and drug activity of newly synthesized drugs.



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INTRODUCTION

Physical and chemical properties are varied due to complexation. Composition as well as conformation of complex formation can be measured from study of various physicochemical properties by spectrophotometric method. Spectrophotometric technique has a great significance in measurements of stability constant and confirmation of complex formation in solution. Wagh [1] and Deshmukh [2] determined log K value of chalcones pyridine carboxylic acids and hydroxyl ethyl benzene. Galhan *et al.* [3] studied (E)-2-(mercaptophenyl amino methylene)-3-oxo-N-p-tolylbutamide with some metal ion by spectrophotometrically. Boldescu *et al* [4] spectrophotometrically studied sangurine-bcyclodextrin complex formation. Spectrophotometrically determination of phenylephrine hydrochloride and salbutamol sulfate drugs in pharmaceutical preparation using diazotized metacloprine hydrochloride was carried out by Al-Abachi and Abed [5]. Alsamarrai *et al.* [6] investigated ephedrine-hydrochloride by spectrophotometrically. Saleha *et al.* [7] investigated sulphasalazine antibiotics drugs. Investigation of ion complex formation of anti-hypertensive drug methyldopa was studied [8]. Meshram [9] studied complexation by interaction of Dy (III) with lincomycin and pyridoxine in 70% ethanol-water medium. Spectrophotometric study of diflunisal febusostat metaxalone, fexofenadine methyl ester and linezolid pharmaceutical dosages using tetracyanoethylene was carried out by Shrinivas *et al.* [10]. Valtierra –Alvarado *et al.* [11] investigated complex formation equilibrium of Cu(II). Solvent effect on dissociation of ammonium and pyridinium ion was studied by Ohataki [12]. Investigation of effect of dielectric constant on Cu(II) –Complexes of phthalic acid in various percentage of dioxane-water mixture was carried by Palaskar [13]. Metal-ligand stability constant and confirmation of complexes formation of 4-(p-Tolyl)thiocarbamidophenol (L₃) and with Cu(II), Cd(II), Cr(II) and Ni (II) metal ions had been investigated respectively by Spectrophotometric technique at 0.1 M ionic strength. This work mainly base on Jobs method of continuous variation. It is especially associated to study of effect of solvents, effect of ligands and group as well as effect of metal ions during formation of complexes.

MATERIALS AND METHODS

Experimental

4-(p-Tolyl)thiocarbamidophenol (L₃) has been synthesized in the laboratory by standard method. The nitrate salts of Copper Cadmium, Chromium and Nickel were used & their

solutions were prepared in double distilled water. The solutions of potassium nitrate were prepared (1M) & used for maintaining ionic strength constants. Absorption is measured by UV Spectrophotometer model 106, (Systronic make) with an accuracy = ± 0.005 was used.

RESULTS AND DISCUSSION

Spectrophotometric Measurement

Job's Method

Job's method of continuous variation method is reliable method for investigation of formation of complex [14]. Jobs method consist of equimolar solutions of metal and ligand varying proportion in such manner that total concentration of metal plus ligand is constant in resulting mixtures[15]. The compositions of metal ions solution (1×10^{-2} M) & ligand (1×10^{-2} M) were prepared in ten series. Ionic strength was maintained constant (0.1M) by adding an appropriate amount of 1M KNO_3 solution in 10 ml volume (λ_{max}) was determined using one of the compositions at which there is maximum absorption. The absorption for all the compositions was recorded at a constant wavelength (λ_{max}). The data of absorption & % composition of metal ion and ligand solutions at constant pH can be used to construct the curves. It was observed that 1:1 complex formation occurs in the pH range of 3 to 6. Each solution is diluted up to 15 ml and recorded absorption at same (λ_{max}). Conditional stability constants of metal-ligand complexes were calculated for all the systems using following expression.

$$K = \frac{X}{(a1-x)(b1-x)} = \frac{X}{(a2-x)(b2-x)}$$

K = Conditional stability constants of complex. X = Concentration of complex.

a1 & a2 = Concentration of metal ions; b1 & b2 = Concentration of ligand.

Conditional stability constants of metal-ligand complexes showed in Table-1

Table – 1: Determination of Conditional Stability of Metal-Ligand Complexes

System	Conditional stability constant	Log K
$\text{L}_3+\text{Cu(II)}$	4.6369×10^{-3}	0.6663×10^{-3}
$\text{L}_3+\text{Cd(II)}$	1.5669×10^{-3}	0.1951×10^{-3}
$\text{L}_3+\text{Co(II)}$	3.1430×10^{-3}	0.4974×10^{-3}
$\text{L}_3+\text{Ni(II)}$	3.1430×10^{-3}	0.4974×10^{-3}

CONCLUSION

From **Table 1** it was concluded that resultant values obtained are fairly good. There is no appreciable change in log K values. This indicated the simultaneously complex formations. Variation in Log K values observed due to direct interfere of dielectric constant, solvent-solvent interaction, solute-solvent interaction and solute-solute-solvent interaction. Table 1 revealed that Log K value of L_1 greater for Cu (II) than Cd (II) Cr (II) and Ni (III). Thus L_3 form more stable complex with Cu (II) than Cd (II), Cr (II) and Ni (II). This investigation helps to study of drug activity and drug effect of newly synthesized drugs.

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