International Journal of ChemTech Research
CODEN (USA): IJCRGG, ISSN: 0974-4290, ISSN(Online):2455-9555
Vol.10 No.5, pp 610-614, 2017

To Study the Interaction Between some Transition Metal Ions with Substituted Thiocarbamidophenol Spectrophotometrically

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Abstract : Stability constant is an effective parameter in pharmacodynamics and pharmacokinetic study of molecules. The medicinal properties of any molecule are checked after synthetic process for that various physical methodologies are used. Stoichiometry and equilibrium study the metal ion and ligand conducted in 70% ethanol-water mixture solution by spectrophotometry. Stability constant of the complexes are determined by using Job's variation method. The results of this method provide the information about the formation of complexes.
Key words : Substituted thiocarbamidophenols, stability constant, spectrophotometry.

Introduction

In organic chemistry, from many years' new compounds has been discovered by many researchers and their co-workers. Mostly hetrocyclic, benzonoide and non-benzonoide molecules containing compounds achieve great importance in medicinal, pharmaceutical, industrial and agricultural field. Now days many researchers performing various research methods and technique to study the physical and chemical properties of newly synthesized compound. Spectrophotometric is one of the important branches of science and among the several techniques spectrophotometric method for determination of metal ions have an attractive attention due to their simplicity and low operating costs. Rafi and Reddy[1] studied the determination of gold (III) using alfuzoin hydrochloride(R,S)-N-[3-[(4-amino-6,7-dimethoxy-2-quinazolinyl) methylamino] propyl] tetrahydro-2-furancarboxamide hydrochloride reagent spectrophotometry. Khobragade[2] has investigated Co(II)-peptide complex formation spectrophotometrically by isobestic point and Job's method. Upadhyay *et al*[3] investigated the stability constants of Cr(III), Ni(II) and Cu(II) complexes with a Schiff's base in different solvent spectrophotometrically. Study of complex formation of uranyl with oxalic acid by spectrophotometric measurement was reported by Havel[4]. Edrisi*etal*[5] studied the stability constant of cobalt (II) piroxicam complex by spectrophotometric method. A.K.CuCu*et al*[6]studied the stability constant of finasteride complexes with various metal by spectrophotometric technique.The spectrophotometric determination of vanadium (V) with 7-amino-1-naphthol-3,6-disulphonic acid was investigated by Agarwala*et al*[7]. Ghomi and Mazinani[8] studied the stability constants of metal complexes of promethazine at different temperatures spectrophotometrically.Zou *et al*[9] studied the determination of stability constant of anti-stepwise complexes spectrophotometrically.Ohyoshi[10] investigated the complex formation constants with the help of estimated of free ligand concentration spectrophotometrically. All this things are taken into consideration this research scheme is designed. In this present work, an attempt has been made to study the interaction between different metal ions and ligands.

Experimental section

In this research work all AR grade chemical are used. In the laboratory the ligand2-phenyl thiocarbamidophenol(L_1), Ligand 2-methyl thiocarbamidophenol(L_2) and ligands 2-p-chloro thiocarbamidophenol(L_3) were synthesized. The nitrates of copper, cobalt, cadmium and nickel were used and their solutions were prepared in double distilled water.

Job's method

Job's variation method was used to know the nature of complexes. The composition of metal ion solution ($1x10^{-5}$ M) and ligands ($2x10^{-5}$ M) where prepared in series. Ionic strength was maintained (0.1M) by adding an appropriate amount of 1M KNO_3 solution in 10ml volume λ_{max} was determined using one of the composition at which there is maximum absorption.

The absorption for all the compositions was recorded at a constant wavelength (λ_{max}). The data of absorption and percentage composition of metal ion and ligand solution at constant pH can be used and curves were constructed. Each solution diluted upto 15ml and recorded absorption at same (λ_{max}). The conditional stability constant of metal-ligand complexes were calculated for all the systems using following equation.

$$K = \frac{X}{(a_1 - x)(b_1 - x)} = \frac{X}{(a_2 - x)(b_2 - x)}$$

K = Conditional stability constant of complex.
X = Concentration of complex.
a_1 and a_2 = Concentration of metal ions.
$b_1$and b_2 = Concentration of ligand.

Conditional stability constant of metal ligand complexes were calculated and presented in **Table 1**

Table 1: Determination of conditional stability constant of metal-ligand complex

System	Conditional stability constant K	Log K
L_1+Cu(II)	$2.3809 X 10^{-3}$	0.37668
L_1+Co(II)	$4.4464 X 10^{-3}$	0.64801
L_1+Cd(II)	$1.8382 X 10^{-3}$	0.26439
L_1+Ni(II)	$2.3809 X 10^{-3}$	0.37668
L_2+Cu(II)	$2.3310 X10^{-3}$	0.36754
L_2+Co(II)	$1.4880 X 10^{-3}$	0.1726
L_2+Cd(II)	$2.3809 X 10^{-3}$	0.37668
L_2+Ni(II)	$3.4700 X 10^{-3}$	0.5432
L_3+Cu(II)	$1.2010 X 10^{-3}$	0.7954
L_3+Co(II)	$5.0000 X 10^{-3}$	0.69897
L_3+Cd(II)	$1.2010 X 10^{-3}$	0.7954
L_3+Ni(II)	$5.2911 X10^{-3}$	0.72354

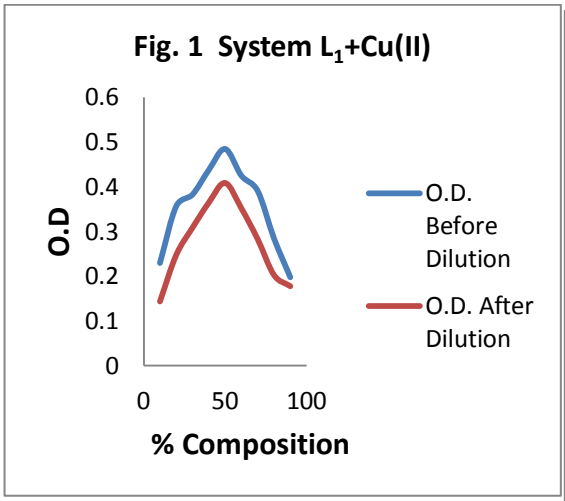


Fig. 1 System L_1+Cu(II)
O.D
0.6
0.5
0.4
0.3
0.2
0.1
0
0
50
100
% Composition
O.D. Before Dilution
O.D. After Dilution

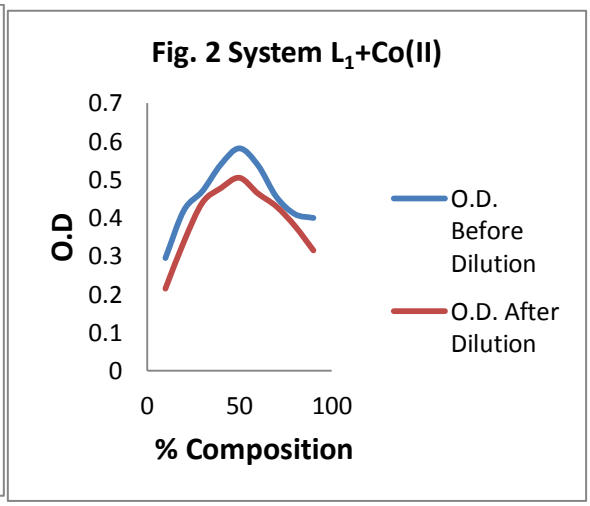


Fig. 2 System L_1+Co(II)
O.D
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
50
100
% Composition
O.D. Before Dilution
O.D. After Dilution

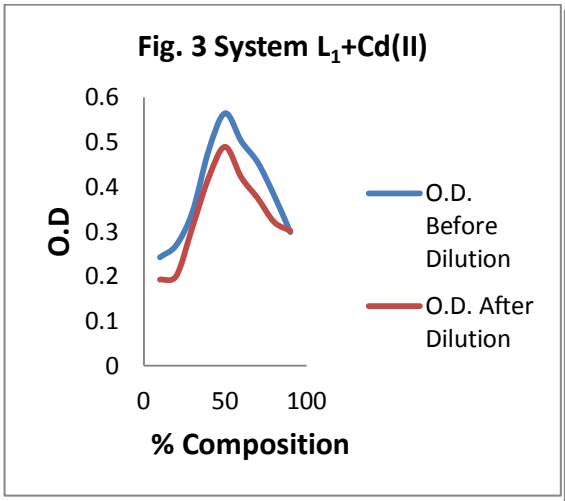


Fig. 3 System L_1+Cd(II)
O.D
0.6
0.5
0.4
0.3
0.2
0.1
0
0
50
100
% Composition
O.D. Before Dilution
O.D. After Dilution

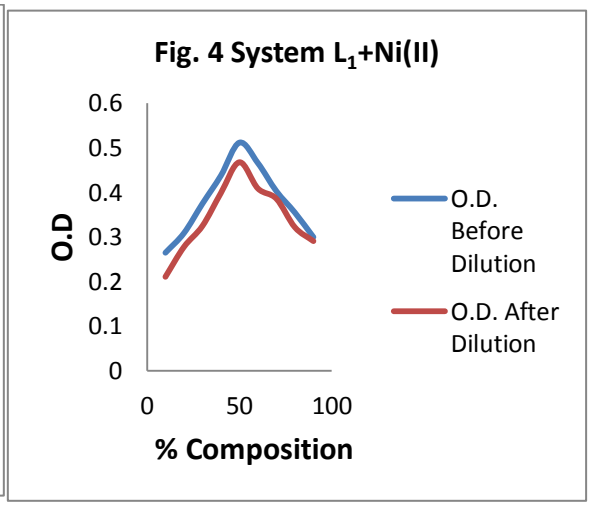


Fig. 4 System L_1+Ni(II)
O.D
0.6
0.5
0.4
0.3
0.2
0.1
0
0
50
100
% Composition
O.D. Before Dilution
O.D. After Dilution

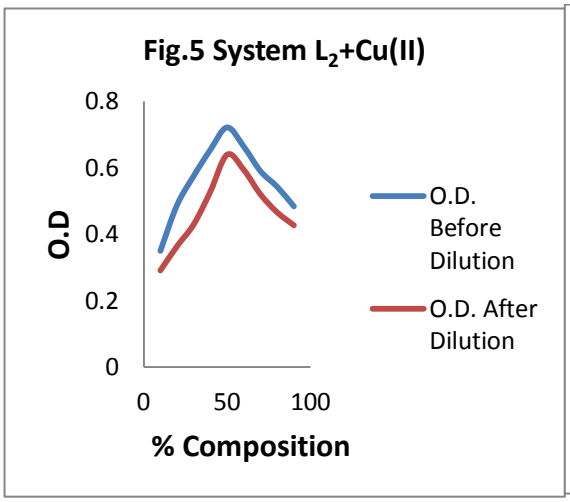


Fig.5 System L_2+Cu(II)
O.D
0.8
0.6
0.4
0.2
0
0
50
100
% Composition
O.D. Before Dilution
O.D. After Dilution

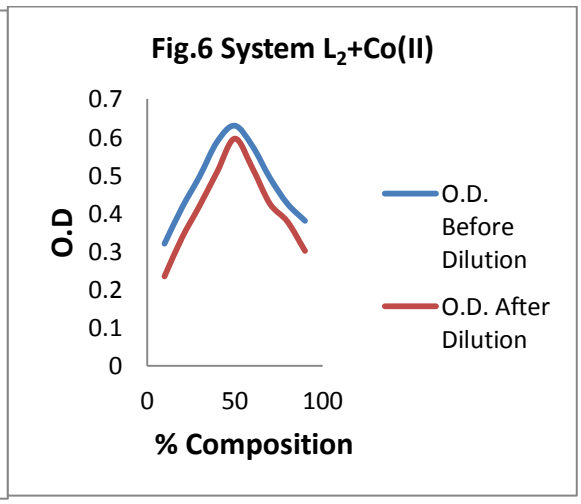
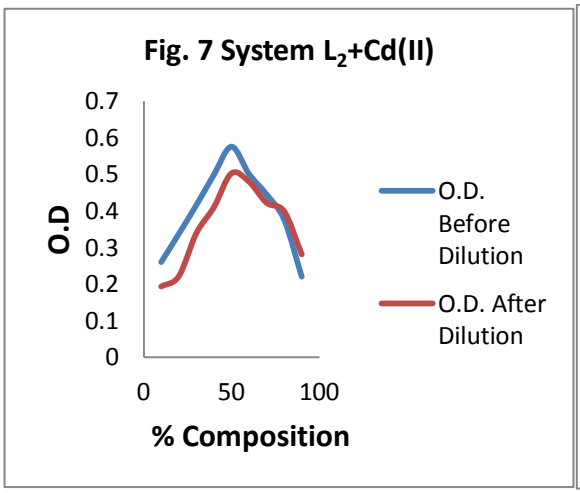
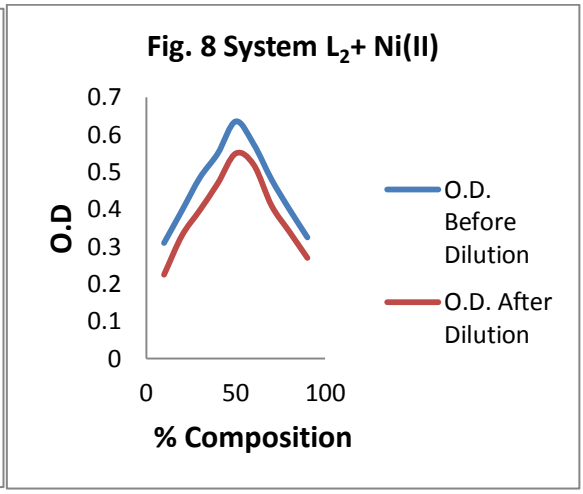
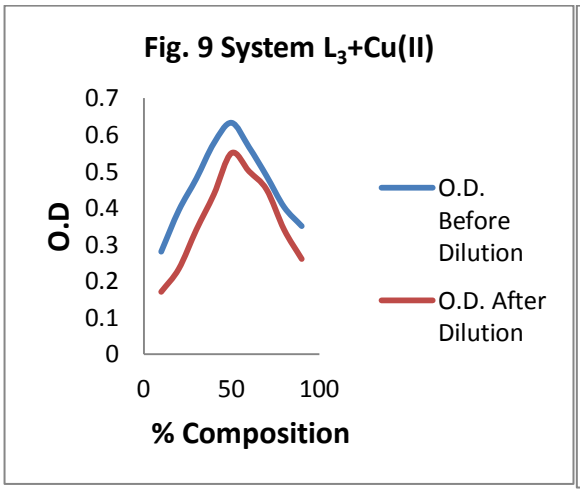
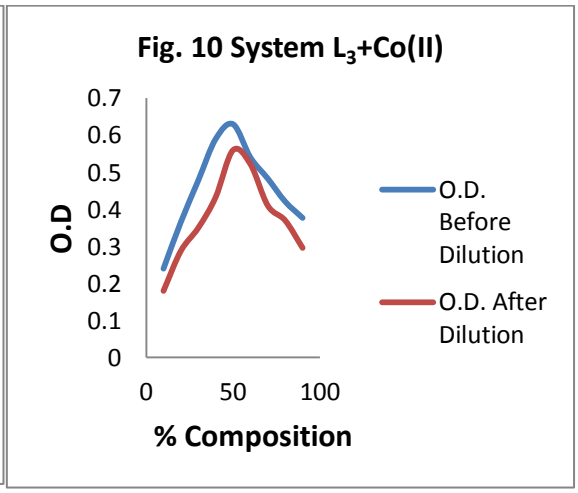


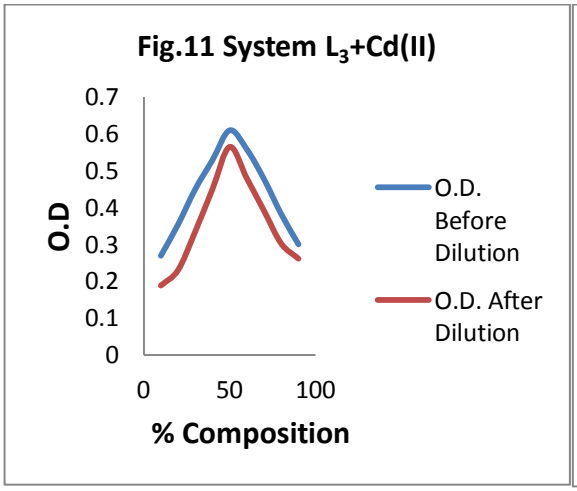
Fig.6 System L_2+Co(II)
O.D
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
50
100
% Composition
O.D. Before Dilution
O.D. After Dilution

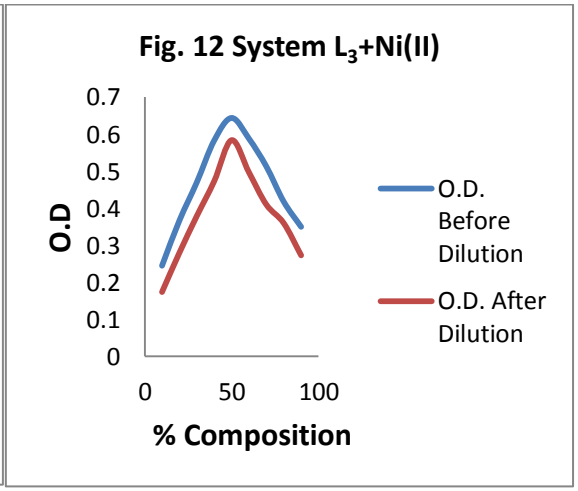












Conclusion

Fig.1 To **Fig.12** indicates the graphs are plotted between optical density and percentage composition of solute-solvent for ligand L_1, ligand L_2, ligand L_3 with transition metal ions which helps to calculate the value of conditional stability constant K by using above formula.

Table.1 Indicates that LogK value of L_1 is greater for Co(II) than Cu(II), Cd(II) and Ni(II). Thus L_1 forms more stable complex with Co(II) than Cu(II), Cd(II) and Ni(II). Thus L_2 form more stable complex with Ni(II) than Cu(II), Cd(II) and Co(II).While LogK value of L_3 is greater for Cu(II) and Cd(II) than Ni(II), Co(II).This type of investigation helps to study of drug activity and drug effect of newly synthesized drugs.

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