WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.074
Volume 7, Issue 4, 1-8. Research Article ISSN 2277– 7105

LIQUID- LIQUID EXTRACTION METHOD FOR EXTRACTION ZN(II) FROM AQUEOUS SOLUTIONS BY ORGANIC REAGENT

Sahar A. Hussein*[1], R. K. Al-Kubaisy[2], Taghreed H. Al-Noor[2], Hawraa K. Musa[1], Hadier K. Mubarak[1] and Hayder Yaseen Noor[1]

[1]Pharmaceutical Chemistry Department - Faculty of Pharmacy, Al-Najaf.

[2]Chemistry Department-College of Education for Pure Science-Ibn Al-Haitham Baghdad.

Article Received on
24 Dec 2017,
Revised on 13 Jan. 2018,
Accepted on 03 Feb. 2018,
DOI: 10.20959/wjpr20184-10528

***Corresponding Author**
Sahar A. Hussein
Pharmaceutical Chemistry Department - Faculty of Pharmacy, Al-Najaf.

ABSTRACT

Extraction experiments for Zn^{+2} ion from aqueous phase by new laboratory prepared Azo derivation as complexation agent 2- [(4-Benzyloxy phenyl)azo]- 5- nitro-4-phenyl imidazole (BANI) shows the optimum conditions for this extraction method was (pH= 9) (10 minutes) shaking time and 100µg ($1.5x10^{-4}$M) concentration of Zn^{+2} ion in aqueous phase. Organic solvents effect study shows there is not any linear relation between distribution ratio (D) for extraction of Zn^{+2} ion and dielectric constant (ε)for organic solvents used but there is un effect for organic solvent structure on the extraction of Zn^{+2} ion and distribution ratio (D) values. Stoichiometric studies demonstrated the more probable structure ion pair complex extracted for Zn^{+2} was 1:1.

KEYWORD: Zn (II), Solvent extraction, azo ligand.

INTRODUCTION

Extraction of Cd(II) and Zn (II) complexes by using 2-[(4-Hydroxy phenylazo]-4,5-diphenyl imidazol and 2-[2-pyridil azo]-4-benzen naphthol. The optimization of extraction parameters such as pH, metal concentration, shaking time and organic solvents was studied. The stoichiometry shows the extracted species which was $[M^{+2}(HPADPI)]_2Cl^-$ and$[M^{+2}(PABN^-(Cl^-)]$ when (M^{2+}= Cd^{2+}, Zn^{2+}).[1] New imidazol ligands were synthesized and used for extraction and spectrophotometric determination of cobalt (II), nickel(II) and copper(II).[2] Chromium in steel was determined spectrophotometricaly after its complexation with 4-[thiozolyl azo)-resorcinol (TAR)[3], extraction of Zn(II) and Ni(II) complexes with 1-octyl imidazol and 1-octyl-2-methyl imidazole.[4] Study by use 2-(2-benzimidazolyl azo)-4-

acetoamidophenol by use complex formation with Fe(III),Co(II),Ni(II),Cu(II),Zn(II) and Cd(II).[5] The extraction of Zn(II) and Cd(II) with mixtures of neutral organophosphorus extractants (branched cyclic trialkyl phosphine oxide, Cyanex 925or aliphatic trialkyl phosphine oxide, Cyanex923) and amine extractants, (trialkyl amine, N235) or (N,N-di(1-methylheptyl) acetamide, N503. Synergistic effects were observed for Zn(II) with N503+Cyanex 923 also for Cd(II) with N235+ Cyanex 923 and N235+ Cyanex 925. However, the other mixing systems do not have synergistic effects on Zn(II) and Cd(II).[6] Extraction procedures for Ag+ from aqueous solutions by 2-[(4-Chloro-2-Methoxy phenyl) azo]-4,5-diphenyl imidazole (4-ClMePADPI) shows aqueous solutions must be at (pH=10) and concentration of Ag+ ions is (40µg)(7.36×10-5 M), with shaking time (11minutes), organic solvents effect on extraction method demonstrate there is not any linear relation between dielectric constant (ε) for organic solvents used and distribution ratio values (D), but there is effect for structure of organic solvent. Stoichiometry studies shows more probable structure of ion pair complex extracted was (1:1) (Metal:Ligand) [Ag(4-ClMePADPI)]+NO3-,temperature effect shows from thermodynamic viewpoint the reaction between Ag+ ions and ligand (4-ClMePADPI) was endothermic reaction, synergism studies appear there is one molecules of TBP participate in ion pair complex extracted [Ag(4-ClMePADPI)(TBP)]+$NO3^{-}$.[7]

EXPERIMENTAL

Instruments

All spectrophotometric measurements and absorbance were registered by using a double beam (UV-Vis) spectrophotometer shimadz UV 1700 (Japan) and a Single beam (UV-Vis) spectrophotometer TRIUP international corp. TRUV 74,S (Italy), IR-Spectra for the complexes were recorded by using FTIR S 8400 (England).

Materials

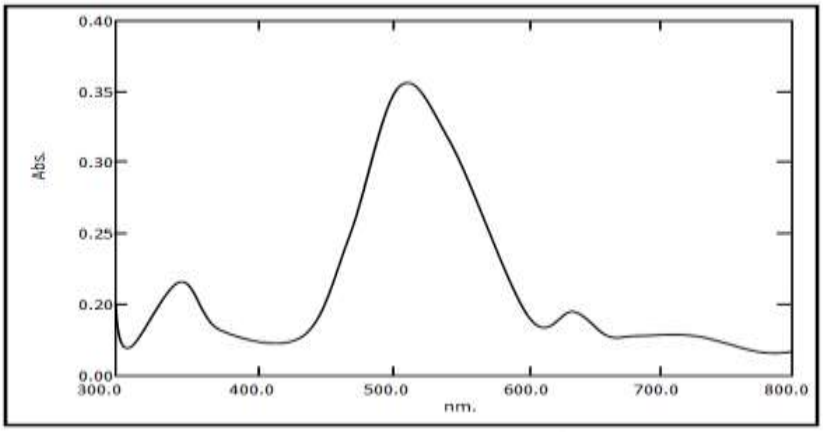
All chemicals used provided from Fluka and Merck.

General procedure

Aqueous solution 5ml in volume contain limited concentration of metal cation Zn(II) at optimum pH shaking with 5ml of chloroform solution (BANI), after complete shaking separate aqueous solution from organic phase and determine remainder quantity of metal cation in aqueous solution by spectrophotometric method (dithizone method)[8], at later calculate distribution ratio(D) for each ion.

RESULTS AND DISCUSSION

The UV-Vis. spectrum and IR spectrum as well as the results obtained by in Figures 1,2 demonstrate the structure of azo ligand prepared.[9]



Figures 1:-absorption UV–Vis spectrum for ion pair complex.

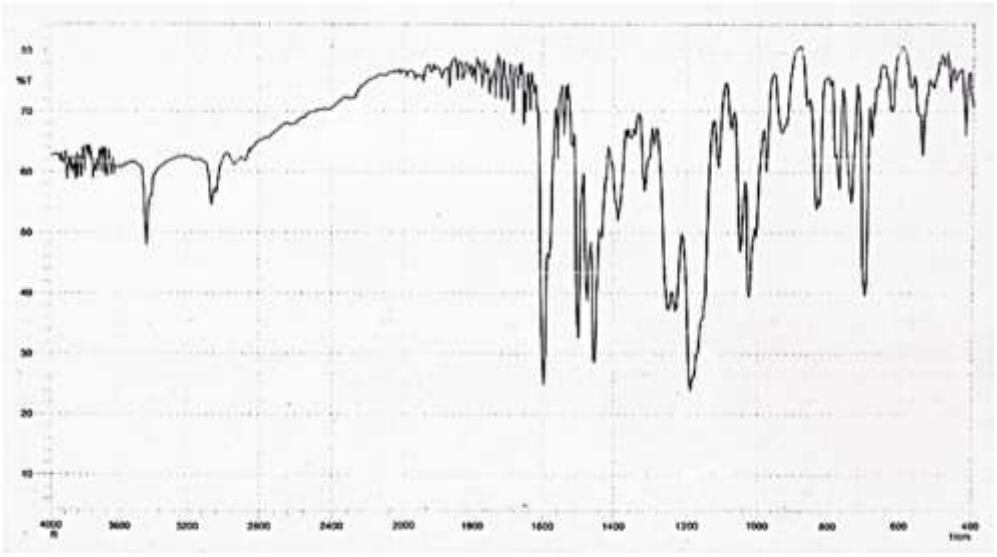


Figure (2): FTIR-spectrum of organic reagent 2- [(4- Benzyloxy phenyl)azo]- 5- nitro-4-phenyl imidazole (BANI).[9]

Table(1):- FTIR-spectrum of organic reagent 2- [(4- Benzyloxy phenyl)azo]- 5- nitro-4-phenyl imidazole (BANI).[9]

Bands (cm^{-1})	Assignments
3414.12	N-H stretching
3339.03	aromatic CH stretching
1616.4,1392.65	C=N stretching and bending
1494.88	for –N=N-
1556.16	C=C
3045.7	CH aliphatic

Effect of pH

Extraction of 50 µgZn^{2+}/5ml by ligands at different pH(1-12) as in general procedure and calculate D value at each pH, Figures(3,4) shows optimum pH_{ex} for $Zn^{2+}$was pH_{ex}=9 with (BDPI).

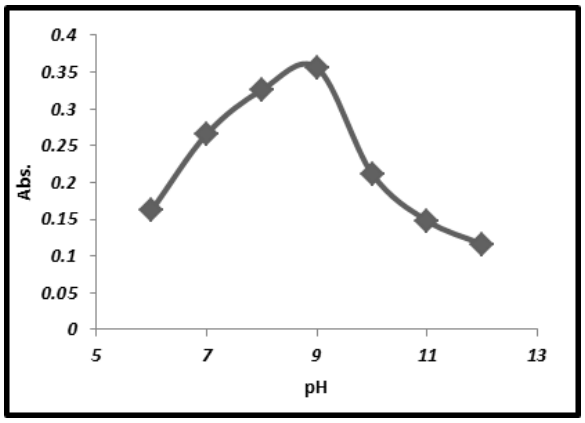
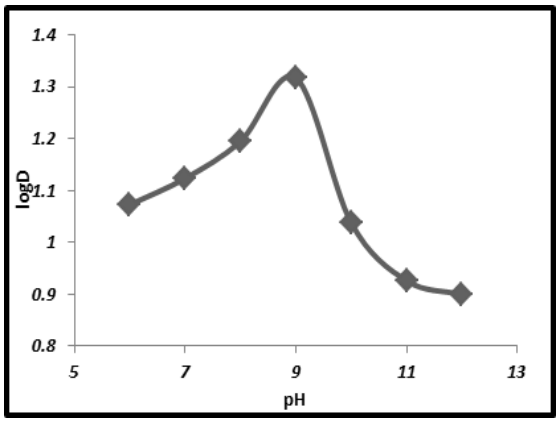


Figure (3): Effect of pH on complex formation and extraction efficiency

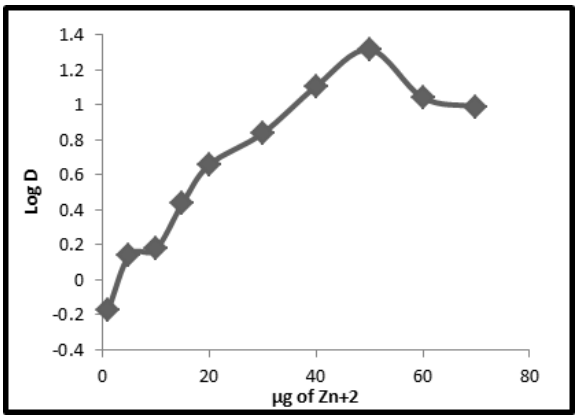


Figure(4):D=f(pH)

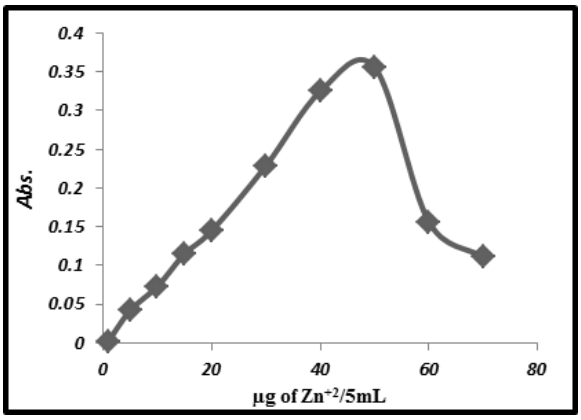
Acidic media not suitable for extraction because effect to protonated ligand molecule and decline extraction and distribution ratio (D), also pH more than optimum value not as well suitable for extraction because dissociation of complex and formation stable species' of metal cation.

Effect of metal ion concentration

Aqueous solutions 5ml in volume contain (1 µg-70 µg) Zn(II) extracted by (BDPI),. after calculate distribution ratio (D). The results in Figure(5,6) shows optimum concentration of Zn(II) was 50 µg with (BDPI).



Figure(5): Effect of Zn(II) concentration on activity of extraction and D value

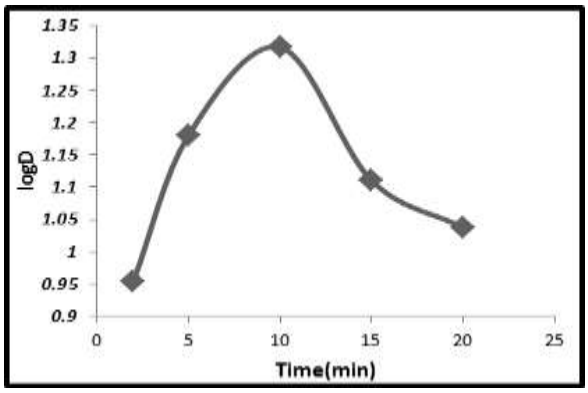


Figure(6): Effect of Zn(II) concentration on thermodynamic equilibrium for complex formation and extraction

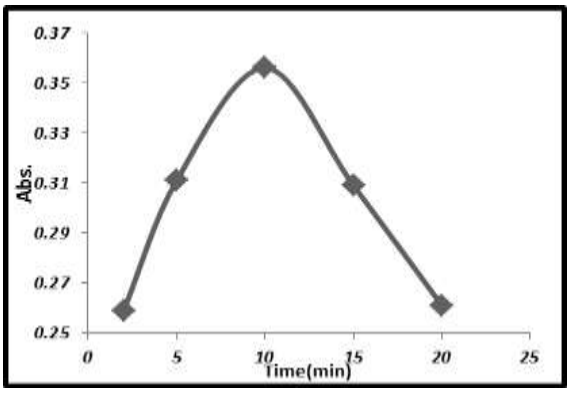
According to thermodynamic equilibrium for complexation reaction, concentration of metal cation play major rule for formation and stability of complex extracted.

Effect of shaking time

For the kinetic side of the extraction methods are carried out by studying the effect of shaking time on the extraction activity and distribution ratio values. After extracted 50µg Zn(II) ions in 5ml aqueous phase at (pH=9) by 5ml of (1×10^{-4} M) organic reagent (BANI). dissolved in chloroform by different shaking time, the results of this study in Figure 7,8.demonstrate the optimum shaking time of two layers was (10min.) to reach the equilibria of extraction and at this time obtain the maximum distribution ratio value (D) and Absorbance at 438nm shaking time but less than optimum no allow to reached the equilibria of extraction, so that she shaking time more than optimum favorite the dissociation equilibria and minimize the distribution ratio(D)and absorbance.



Figure(7):D=f(shaking times).

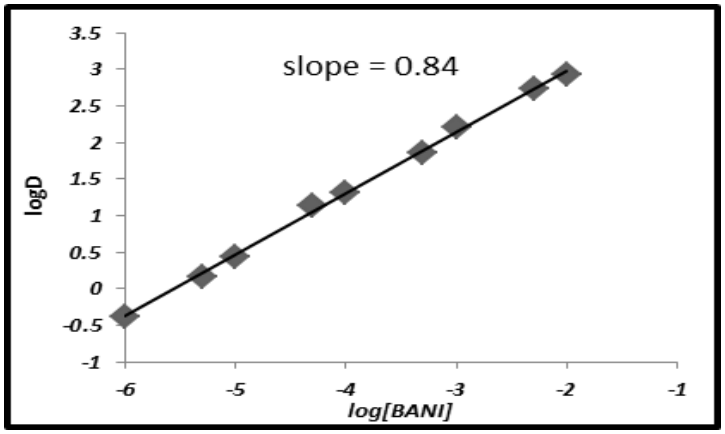


Figure(8): Shaking time effect on complex formation and extraction.

STEREOCHEMISTRY

Slope analysis method

Extraction metal cations from 5ml aqueous phase according to general procedure by 5ml ligands solution dissolved in chloroform at different concentration (1×10^{-6}-5×10^{-4}M), sequentially separate the two layers after separate organic phase from aqueous phase, determine remain Zn(II) in aqueous phase and transferred quantity to organic phase and calculate distribution ratio (D) at each concentration of ligand, afterward plot log D against log[ligand] get the graph in Fig (9).



The slope of straight lines in Figure(9) demonstrate the complex extracted was 1:1 metal: ligand.

CONTINUOUS VARIATION METHOD

In this spectrophotometric method for determining the probable structure of ion pair complex extract. prepared aqueous phase of Zn(II) and organic solution of (BANI) dissolved in chloroform at same molar concentration($1x10^{-4}$M) and then mix different volumes of these solutions to maximum volume (10mL) at (pH=9) and shake each solution for (10minutes) afterward separate aqueous phase from organic phase and measure the absorbance of organic phase at wave length λmax =(511 or 501)nm respectively against organic reagent solution of (BANI). After plotting the absorption value against VL/VT the results were as in Figures (10).

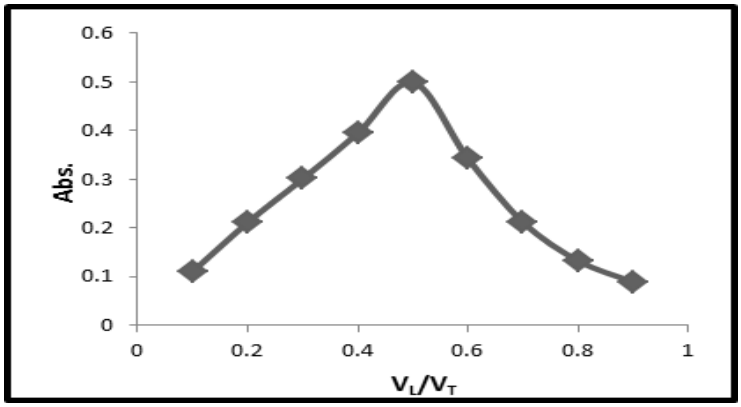
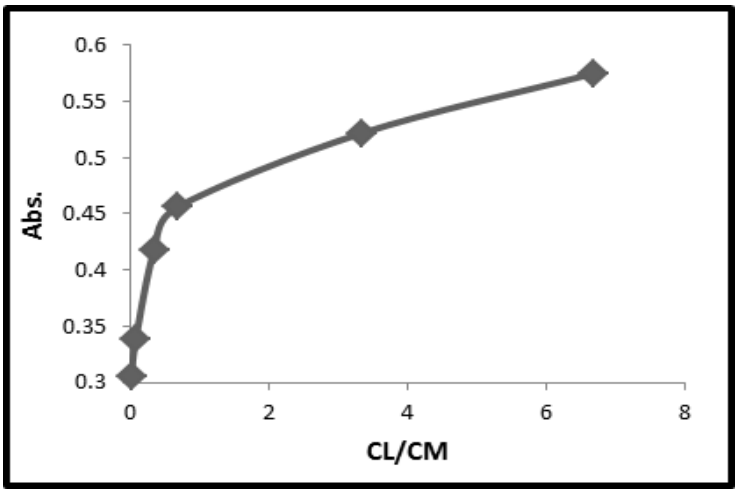


Figure (10): Job method by using organic regent (BANI).

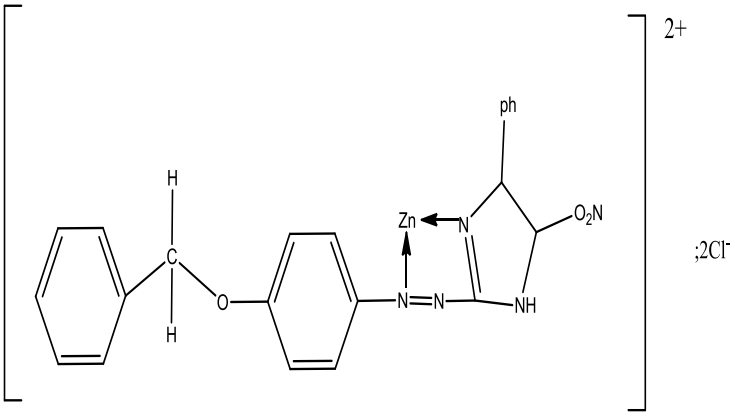
Mole ratio method

Extraction metal cations from 5ml aqueous phase according to general procedure by 5ml ligands solution dissolved in chloroform at different concentration (1×10^{-6}-$5\times10^{-}$4M),

sequentially separate the two layers, afterward plot absorbance vis CL/CM get the graph fig (11).



The graph in Fig (11) shows the complex extracted was 1:1 metal: ligand, so we can suggest the following structures of the complexes as shown below:



REFERENCES

1. Jawad, S.K., and AL-Ghurabi, F. A. Al-Qadysia Journal, 2013; 1(2): 23-50.
2. Ibrahim Erden, Nebahat Demirhan and Ulvi Avcita synthesis and Reactivity in organic, 2007; 7: 559-562.
3. Luciene S.de carralho Antonio Celso S.Costa, Sergio L.C. Ferreira, Leonardo S.G. Teixeira. J.Braz. chem. SOC., Jan/feb, 2004; 15(1).
4. Beniamin Lenarcilc, Teresa ranckte and Agnieszka Kierzkowska XVIII, the ARS separation-Zloty potok, polaud, 2003.
5. G.G. Mohamed, Nadia E.A. El Gamal, F.Teixidor, polyhedron, 2001; 20: 2689-2696.

6. Tian, M., Jia, Q., Quan, X., and Liao, W. J. of chemical and engineering data, 2011; 56(5): 2225-2229.
7. Jihan. R. Mosslem, Ghosoon Fadhee. Hameed, Sahar A. Hussein Journal of Kufa for Chemical Science, 2011; 2.
8. Z.Marczenko (spectrophotometric determination of elements) All is tlorwoord limited, 1986.
9. Sahar A. Hussein, R.K. Al-Kubaisy, Taghreed H. Al-Noor. Transactionson Engineering and Sciences ISSN: 2347-1964 (Online) 2347-185, October-December 2015; 3(6).