# Synthesis and Characterization of Some New Complexes With New Schiff Base Type ($N_2O_2$) Derived From Glyoxylic Acid and Ethylenediamine.

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## Abstract

New tetradentate Schiff base [$H_2L$] namely [2,2′ -(ethane-1,2- diylbis (azan-1-yl-ylidene) diacetic acid)] was prepared from condensation of ethylenediamine with glyoxylic acid in ethanol as a solvent in presence of drops of 48% HBr .The structure of ligand ($H_2L$) was characterized by,F-IR, U.V-Vis.,$^1$H-,$^{13}$C-NMR, pectrophotometer,melting point and elemental microanalysis C.H.N.

Metal complexes of the ligand ($H_2L$) in general Molecular formula [$M(L)(H_2O)_2$], where M= $Co^{(II)}$, $Ni^{(II)}$, $Cu^{(II)}$, $Mn^{(II)}$ and $Hg^{(II)}$; L=($C_6H_8N_2O_4$) were synthesized were characterized by, Atomic absorption, F-IR, U.V-Vis. spectra, molar conductivity and magnetic susceptibility.It was found that all the complexes showed octahedral geometries.And in vitro tests for antibacterial activity showed that most of the prepared compounds display a good activity to (*Staphylococcus aureus*),(*Bacillus cereus* ) ,(*Escherichia coli*) and (*Pseudomonas*).

**Keywords:** Tetradentate Schiff base, Glyoxylic acid, Enylenediamine and Biological activity.

# Introduction

Compounds containing an azomethine group (-CH=N-) are known as Schiff-bases. The schiff bases are derived from the condensation reaction of aromatic/aliphatic aldehydes/ketones and aromatic/aliphatic primary amines[1]. The Schiff bases can be used in photochemical, catalytic, biological and electrochemical applications[2]. These are generally bi, tri, tetra-dentate ligands capable of forming very stable complexes with transition metals. The easy preparation and variable geometries of the metal complexes obtained makes them important stereochemical models in transition metal coordination chemistry[3]. Tetradentate Schiff bases type $N_2O_2$ are chelating ligands containing O and N donor atoms .It is well known that several Schiff base complexes have anti-inflammatory, antipyretic, analgesic, anti-diabetic, anti-bacterial, anti-cancer and anti-HIV activity [4-7].And they have attracted many authors[8] because of variety of ways to coordinate them with metal ions. Glyoxilic acid and its derivatives play an important role in natural processes, participating in glyoxylate cycle which functions in plants and advancement of inorganic biochemistry[9] . The presnce of aldehyde group in glyoxylic acid allows numerous acyclic derivatives containing (C=N) bond- azomethine and hydrazones [10].

In this paper we rported synthesis of new Schiff base by condinsation glyoxlic acid with ethylenediamine, and it's complexes with $Mn^{(II)}$, $Co^{(II)}$, $Ni^{(II)}$, $Cu^{(II)}$ and $Hg^{(II)}$ were prepared. Also the antimicrobial and antifungal studies of the Schiff base and the complexes were done by disc diffusion method.

# Experimental

Glyoxylic acid and ethylenadiamine were purchased from sigma chemical Co.(USA). Hydrobromic acid (HBr) (48%) reagent and all other solvents were of high purity (asigma) and were used without further purification).The metal salts used for complexation:Copper(II) chloride dihydrate; Cobalt(II) chloride hexahydrate; Nickel(II) chloride hexahydrate ; Manganese (II) chloride tetrahydrate and Mercury (II) chloride were obtained from British Drug House (BDH) chemical limited company**.**

# Instrumentation

Melting point was determined on "Gallen kamp Melting point Apparatus".Elemental microanalys C.H.N. were carried out using Euro Vector EA 3000 A Elemental Analysis (Italy).FT-IR measurements were recorded on Shimadzu- 8300 Spectrophotometer in the range of (4000-400cm$^{-1}$) as KBr disc. Electronic spectra were recorded using U.V-Vis. spectrophotometer type CECIL, England, with quartz cell of (1cm) path length in range (200-1000)nm in $H_2O$ at room temperature.$^{1}$H and$^{13}$C-NMR spectra were recorded by using a Bruker 300 MHZ (Switzerland),Chemical shift was recordedin δ(ppm) unit downfield internal reference (TMS),using DMSO as a solvent.Conductictivity measurements were obtained from WTW conductivity meter by using distilled water as a solvent of $10^{-3}$M concentration at room temperuture. Magnetic susceptibility measurements were obtained at room temperuture on the solid state applying Faraday's Method using Bruker BM6 instrument. Metal analysis of comlexes were determined by Atomic Absorption(A.A.) technique. Using a shimadzu PR-5.ORAPHIC PRINTER atomic absorption spectrophotometer.

### Synthesis of [2,2' -(ethane -1,2- diylbis (azan-1-yl-ylidene )diacetic acid) ($H_2L$)

To a solution of ethylenediamine (0.06g. 1mmole) in (5mL) of ethanol, a solution of glyoxylic acid (0.148g. 2 mmole) in (5 mL) of ethanol with presence of drops of 48% HBr, was added. The mixture was refluxed at 80ºC for 3 hrs. upon cooling a dark brown precipitate formed,was filtered off and recrystallized from a hot mixture of [(5mL) methanol, (5mL) acetone and (2mL) distilled water].A pale brown precipitate, yield 90%, melting point 171°C, and elemental microanalysis C.H.N were listed in Table(1).

### Synthesis of $[Cu(L)(H_2O)_2]$ complex

To a solution of ligand ($H_2L$) (0.172g. 1mmole) in (5 mL) of ethanol, a solution of $CuCl_2.2H_2O$ (0.170g. 1mmole) in (5 mL) of ethanol ,was added. The precipitate immediately formed, stirring at 50°C for (30 min.), filtered off, recrestallized from a hot of (10mL) methanol, a dark brown precipitate was formed , yield 88%, decomposed at 110 °C .Some physical properties of complex was listed in Table (1).

### Synthesis of $[Mn(L)(H_2O)_2]$, $[Co(L)(H_2O)_2]$, $[Ni(L)(H_2O)_2]$ and $[Hg(L)(H_2O)_2]$ complexes

A similar method to that mentioned in preparing of $[Cu(L)(H_2O)_2]$ complex was used to prepare the complexes: $[Mn(L)(H_2O)_2]$, $[Co(L)(H_2O)_2]$, $[Ni(L)(H_2O)_2]$ and$[Hg(L)(H_2O)_2]$ complexes. Table (1) shows some physical properties of all prepared complexes and their reactants quantities.

## Results and Discussion

The Schiff base ($H_2L$) was synthesized in one step. The structure of ($H_2L$) was checked and confirmed by elemental miocranalyses data which are in good agreement with proposed formula $C_6H_8N_2O_4$.

### IR Spectrum of the ligand ($H_2L$)

The IR spectrum of the ($H_2L$)Fig.(1) shows disappearance of two bands of $\upsilon NH_2$ at (3500,3400) $cm^{-1}$ which due to $\upsilon_{asy.}NH_2$ and $\upsilon_{sy.}NH_2$ and of appearance new strong bands at (1734, 1647) $cm^1$ are due to $\upsilon(HC{=}N_{\ imine})$[8-9] compared with precursors . The new two bands at (1436, 1319)$cm^1$ are attributed to $\upsilon_{asym.}(COO^-)$ and $\upsilon_{sym.}(COO^-)$ respectively[14-15].The stretching band of middle intensity at (3446) $cm^{-1}$ attributed to υ (OH) of carboxylic group, which indicates the ligand ($H_2L$) has been obtained.

### Electronic Spectrum of the ligand ($H_2L$)

The U.V-Vis spectrum of ligand ($H_2L$) Fig.(3) displayed two absorption peaks,the first peak at (222)nm (45045)$cm^{-1}$ was assigned to $\pi\text{–}\pi^*$ electronic transition. The second peak at (356)nm (28089)$cm^{-1}$ were attributed to $n\text{–}\pi^*$ electronic transition.The U.V-Vis spectral data of the ligand ($H_2L$) were given in Table(5) .

### NMR spectrum for the ligand ($H_2L$)

$^1H$- NMR spectrum of the ligand ($H_2L$) in DMSO–$d_6$ Table(2), Fig. (5) is characterized by the appearance of chemical shift related to the proton of the protons aliphatic ($-CH_2\text{-}CH_2-$) at (2.50) ppm. The characteristic signals at (8.32-8.51)ppm. are assigned to HC=N. The COOH signal is found at (11.62 )ppm. .The DMSO signal appeared at (2.77-3.87) ppm. [13] .

$^{13}$C–NMR of the free ligand($H_2L$) Table (3)Fig (6) shows the HC=N peak at (43.50) ppm., the COOH peak at (162.44 )ppm, and carbon peaks for aliphatic are detected at (15.20-18.50) ppm.The peak at (40.25) ppm. assigned to DMSO [7-8].

## The IR Spectra for the Complexes

The IR spectra provide valuable information regarding the nature of the functional group attached to the metal ion. The IR data are presented in the Table(4). The (IR) spectra of the complexes showed band at the range (1589-1643) $cm^{-1}$ were assigned to azomethine $\upsilon$(C=N) groups., which shifted to a lower frequency in comparison with that of the free ligand, indicating the involvement of –C=N nitrogen in coordination to the metal ion[18,19]. Accordingly, the ligand acts as a tetradentate chelating agent, bonded to the metal ion *via* the nitrogen (–C=N) atoms and the oxygen atoms of carboxylic groups of the Schiff base.The $\upsilon_{asym.}$ ($COO^-$) and $\upsilon_{sym.}$ ($COO^-$) stretching vibrations of the carboxylate O are observed at (1436,1319) $cm^{-1}$ for the free ligand (L), these stretching vibrations are shifted to lower or higher frequencies at (1450-1471) $cm^{-1}$ and (1327-1392) $cm^{-1}$ for all the complexes, ($\Delta\ \upsilon_{asym.}$- $\Delta\ \upsilon_{sym.}$)=(79-123) $cm^{-1}$, supporting the idea that the ligand coordinate through deprotonated oxygen of carboxylate [14-15]. The broad bands at range (3402-3444)$cm^{-1}$ and the weak bands at (925- 968 $cm^{-1}$) were due to $\nu$(OH) and $\delta$(OH) for all the complexes refer to presence to coordinate aqua ($H_2O$)[20-22].

The new bands at range (594-570) $cm^{-1}$ were assigned to $\upsilon$(M-N) mode[18] .The other new bands at (482-465)$cm^{-1}$ were assigned to $\upsilon$(M-O) mode[18] ].Therefore from IR spectra, it is concluded that the ligand behave as anion tetradentate and bind to the metal ions via the two imine N and two carboxylate-O.

As shown in fig(2), the Table(4) The (IR) spectra of the $[Ni(L)(H_2O)_2]$ complex $\upsilon$(C=N) (1629-1618), $\upsilon_{asym.}$ ($COO^-$) (1450), $\upsilon_{sym.}$ ($COO^-$) (1327), $\nu$(OH) (3429) ,$\delta$(OH) (968), $\upsilon$(M-N)(594) and $\upsilon$(M-O)(468)

## The Electronic Absorption Spectral and Magnetic Studies

The U.V-Vis spectrum of the Co(II) complex Table(5),Fig(4) displayed four absorption peaks. The first peak at (212)nm (47169 $cm^{-1}$) was assigned to ligand field, while the second peak at(350) nm (28571) $cm^{-1}$ refers to charge transfer electronic transition.The third peak at (793)nm (12610) $cm^{-1}$ and the fourth peak at (817)nm (12240) $cm^{-1}$ was attibuted to (d-d) electronic trasition type $^4T_1g_{(F)} \rightarrow {}^4A_2g_{(F)}$ and $^4T_1g_{(F)} \rightarrow {}^4T_2g_{(F)}$ respectively, suggesting high spin octahedral geometry around Co(II) central ion [20]. The magnetic susceptibility measurement for the solid Co(II) complex is (5.42) B.M. also is indicative of four unpaired electron per Co(II) ion suggesting consistency with its octahedral environment[21].

The U.V-Vis spectrum of the Cu(II) complex exhibited three absorption peaks .The first peak at (215) nm (46511 $cm^{-1}$) was assigned to ligand field, while the second peak at(357) nm (28011 $cm^{-1}$) referred to charge transfer electronic transition. The third peak at (741)nm (13495 $cm^{-1}$) was attributed to (d-d) electronic transtion type $^2B_1g \rightarrow {}^2B_2g$, that is a good suggestment with high spin octahedral geometry [24].The magnetic susceptibility measurement of Cu(II) complex is (1.81) B.M., which suggests the presence of one unpaired electron with its octahedral environment[25].

The U.V-Vis spectrum of the Ni(II) complex displayed four absorption peaks .The first peak at (222)nm (45045$cm^{-1}$) was refer to ligand field , while the second peak at (356)nm (28089$cm^{-1}$) referred to charge transfer electronic transition. The third peak at (625)nm (16000$cm^{-1}$) and the fourth peak at (892) nm (11210$cm^{-1}$), were attributed to (d-d) electronic transtion type $^3A_2g_{(F)} \rightarrow {}^3T_1g_{(F)}$, $^3A_2g_{(F)} \rightarrow {}^3T_2g_{(F)}$, respectively, that is agood suggestment with high spin octahedral geometry [22] Fig(4). The magnetic susceptibility measurement for the solid Ni(II) complex is (2.95) B.M. also is indicative of two unpaired electron per Ni (II) ion suggesting consistency with its octahedral geometry[23].

The U.V-Vis spectrum of the Mn(II) complex exhibits four absorption peaks. The first peak at (210) nm (47619 $cm^{-1}$) was due to ligand field, while the second peak at (354) nm (28248 $cm^{-1}$) was refer to charge electronic transtion. The third peak at (400)nm (25000$cm^{-1}$) and the fourth peak at (744) nm (13440 $cm^{-1}$ ) were assigned to (d-d) forbbiden electronic transtion type $^6A_1g_{(F)} \rightarrow {}^4T_2g_{(G)}$ and $^6A_1g \rightarrow {}^4T_1g_{(G)}$ respectively,which suggested a high spin octahedral geometry around Mn(II) centeral ion [20]. The magnetic susceptibility measurement of Mn(II) complex is (5.72) B.M.,which suggests the presence of one unpaired electron with its octahedral environment[26].

The U.V-Vis spectrum of the Hg complex displayed two absorption peaks. The first peak at(212) nm (47619 $cm^{-1}$) was assigned to ligand field , while the second peak (350) nm referred (28571 $cm^{-1}$) was refer to charge electronic transtion only [27,28]. The U.V-Vis spectrum of the Hg(II) complex showed no d-d transitions in the visible region, indicating for Hg(II), this means electronic transitions happened octahedral geometry has been assigned to the Hg(II) complex. Table(2) and Table-3.According to the elemental analysis Table(1) and FT-IR spectra, the structures of these complexes can be suggested octahedral[29].

## Molar Conductivity

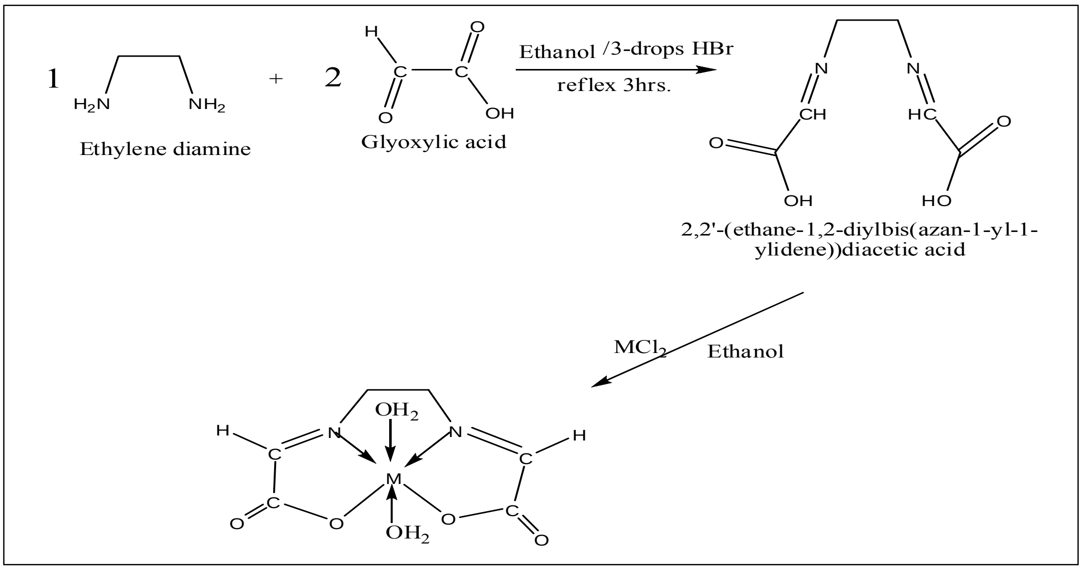
The molar conductance values of the the complexes in $H_2O$ lie in the range 107 to 35 $S.cm^2mol^{-1}$ which is quite lower than that expected for an electrolyte and reveal their non-electrolytic nature as in Table(6) .

## Biological Activities

The biological activities of the prepared ligand and its complexes were studied by using inhibition method [24,25] for four types of pathogenic bacteria. Two types of bacteria were gram positive which are *Staphylococcus aureus* and *Bacillus*, the second two were gram negative which are *Escherichia coli* and *Pseudomonas*. The data reveal that all compounds have good biological activity and some complexes have higher activities than the free ligand. This may be due to that the chelation considerably reduces the polarity of the metal ion mainly because of partial sharing of its positive charge with the donor groups and possible electron delocalization over the whole chelate ring such, chelation could also enhance the lipophilic character of the central metal atom, which subsequently favors its permeation through the lipid layer of the cell membrane [26,32] . Diameter of zone of inhibition Table (7) and (Figures.8,9,10,11)

# Conclusion

The new schiff ligand ($H_2L$) and metal complexes were aprepared [Mn(L)($H_2O$)$_2$], [Co(L)($H_2O$)$_2$], [Ni(L)($H_2O$)$_2$], [Cu(L)($H_2O$)$_2$] and [Hg(L) ($H_2O$)$_2$].The metal (II) ions are coordinated by two carboxylate- O atoms and two imine(H-C=N) atoms.Spectroscopic, structurical and magnetic data show that all complexes are six- coordinate metal complexes owing to the lgation of tetradentate schiff base moieties with two coordinated water as fellows in Scheme(1):



**Scheme (1)**

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**Table (1): Some physical properties of prepared lignad ($H_2L$) and it's complexes and weight of metal salts**

| Empirical Formula | Yield % | M.P ºC | Colour | | Metal salt | Weight (g) 1mmole | % (.Calc)Found | | | | Solubility |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | **C** | **H** | **N** | **Metal** | |
| **$H_2L$** | **90** | **173** | **pale brown** | | | - | **(41.12)<br>41.86** | **(4.65)<br>3.94** | **(15.88)<br>16.27** | - | Water ,DMSO DMF |
| **$[Co(L)_2(H_2O)_2]$** | **89** | **<256** | **dark brown** | | **$CoCl_2.6H_2O$** | **0.238** | - | - | - | **(22.09)<br>21.80** | = |
| **$[Cu(L)_2(H_2O)_2]$** | **88** | **110** | **dark brown** | | **$CuCl_2.2H_2O$** | **0.170** | - | - | - | **(23.38)<br>22.91** | = |
| **$[Ni(L)_2(H_2O)_2]$** | **94** | **204** | **greenth brown** | | **$NiCl_2.6H_2O$** | **0.238** | - | - | - | **(22.09)<br>21.80** | = |
| **$[Mn(L)_2(H_2O)_2]$** | **88** | **<256** | **white** | | **$MnCl_2.4H_2O$** | | - | - | - | **(15.88)<br>16.27** | = |
| **$[Hg(L)_2(H_2O)_2]$** | **91** | **123** | **brown** | | **$HgCl_2$** | | - | - | - | **(15.54)<br>16.12** | = |

**Table (2): $^1$H-NMR Chemical Shifts for ligand ($H_2L$) (ppm in DMSO)**

| DMSO | Aliphatic protons | HC=N | COOH |
|---|---|---|---|
| 2.5 ppm | **2.77-3.87ppm.** | **8.42ppm** | **11.62ppm** |

**Table (3):$^{13}$C-NMR Chemical shifts for ligand ($H_2L$) (ppm in DMSO)**

| DMSO | Aliphatic crobons | HC=N | COOH |
|---|---|---|---|
| 40.25ppm | **15.20-18.50 ppm** | **143.50ppm** | **162.44ppm** |

**Table (4): Infrared spectral data (wave number υ′) cm$^{-1}$for the ligand ($H_2L$), precursors and its complexes**

| Compound | υ(OH) | υ(C=O) | $\upsilon(NH_2)$ | $\upsilon(HC{=}N)_{imine}$ | $\upsilon_{assm.}COO^-$ | $\upsilon_{symm.}COO^-$ | Δυ cm$^{-1}$ | $\delta(OH)_{roking}$ | M–N<br>M–O |
|---|---|---|---|---|---|---|---|---|---|
| Glyoxylic acid | **3361** | **1745** | - | - | - | - | - | - | - |
| Ethylene diamine | - | - | **3387<br>3363** | - | - | - | - | - | - |
| $H_2L$ | **3446** | - | - | **1647<br>1616** | **1436** | **1319** | **117** | - | - |
| $[CO(L)(H_2O)_2]$ | **3419** | - | - | **1635<br>1618** | **1456** | **1338** | **118** | **966** | **570<br>478** |
| $[Cu(L)(H_2O)_2]$ | **3407** | - | - | **1623<br>1597** | **1455** | **1339** | **116** | **928** | **574<br>468** |
| $[Ni(L)(H_2O)_2]$ | **3429** | - | - | **1629<br>1618** | **1450** | **1327** | **123** | **968** | **594<br>468** |
| $[Mn(L)(H_2O)_2]$ | **3444** | - | - | **1620<br>1589** | **1471** | **1392** | **79** | **925** | **582<br>482** |
| $[Hg(L)(H_2O)_2]$ | **3402** | - | - | **1643<br>1624** | **1454** | **1341** | **113** | **926** | **577<br>450** |

**Table (5): Electronic spectral data of the ligand ($H_2L$) and its metal complexes**

| Compound | $\mu_{eff}$ | $\Lambda_m$ $S.Cm^2 molar^{-1}$ | λnm | υ–wave number $cm^{-1}$ | (εmax $molar^{-1}$ | Assignments |
|---|---|---|---|---|---|---|
| $H_2L$ | - | - | **222** | **45045** | **2295** | **π→π*** |
| $[Co(L)(H_2O)_2]$ | **5.42** | **83** | **212** | **47169** | **1909** | **L.F** |
| | | | **350** | **28571** | **264** | **C.T** |
| | | | **793** | **12610** | **22** | $^4T_1g(F)\rightarrow{}^4A_2g(P)$ |
| | | | **817** | **12240** | **21** | $^4T_1g(F)\rightarrow{}^4T_2g(F)$ |
| $[Cu(L)(H_2O)_2]$ | **1.81** | **79** | **215** | **46511** | **2031** | **L.F** |
| | | | **357** | **28011** | **392** | **C.T** |
| | | | **741** | **13495** | **32** | $^4Eg\rightarrow{}^4T_2g$ |
| $[Ni(L)(H_2O)_2]$ | **3.23** | **70** | **222** | **45045** | **2281** | **L.F** |
| | | | **356** | **28089** | **238** | **C.T** |
| | | | **625** | **12610** | **16** | $^3A_2g(F)\rightarrow{}^3T_1g(F)$ |
| | | | **892** | **12240** | **4** | $^3A_2g(F)\rightarrow{}^3T_2g(F)$ |
| $[Mn(L)(H_2O)_2]$ | **5.72** | **92** | **210** | **47619** | **1821** | **L.F** |
| | | | **354** | **28248** | **124** | **C.T** |
| | | | **400** | **25000** | **106** | $^6A_1g(F)\rightarrow{}^4T_2g(G)$ |
| | | | **744** | **13440** | **8** | $^6A_1g(F)\rightarrow{}^4T_1g(G)$ |
| $[Hg(L)(H_2O)_2]$ | - | **72** | **212** | **47169** | **1888** | **L.F** |
| | | | **350** | **28571** | **242** | **C.T** |

**Table (6) Diameter of zone of inhibition (mm)**

| Comp. | $H_2L$ | $[Co(L)(H_2O)_2]$ | $[Cu(L)(H_2O)_2]$ | $[Mn(L)(H_2O)_2]$ | $[Ni(L)(H_2O)_2]$ | $[Hg(L)(H_2O)_2]$ |
|---|---|---|---|---|---|---|
| ***Escherichia. Coli*** | **2** | **8** | **7** | **13** | **10** | 9 |
| ***Staphylococcus aureus*** | **6** | **10** | **15** | **17** | **7** | 18 |
| ***Bacllus*** | **5** | **12** | **25** | **22** | **13** | 11 |
| ***pseudmonas*** | **1** | **23** | **10** | **12** | **20** | 11 |

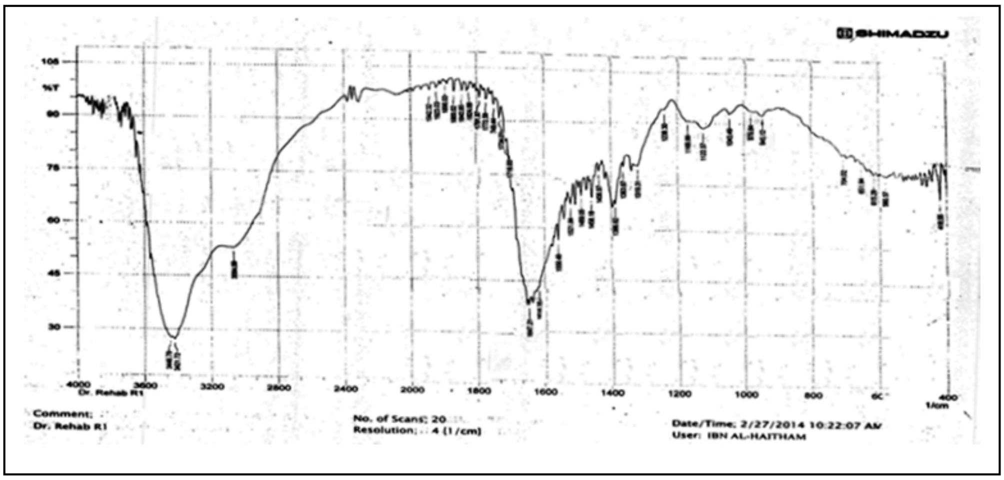

**Fig. (1): The IR spectrum of the ligand ($H_2L$)**

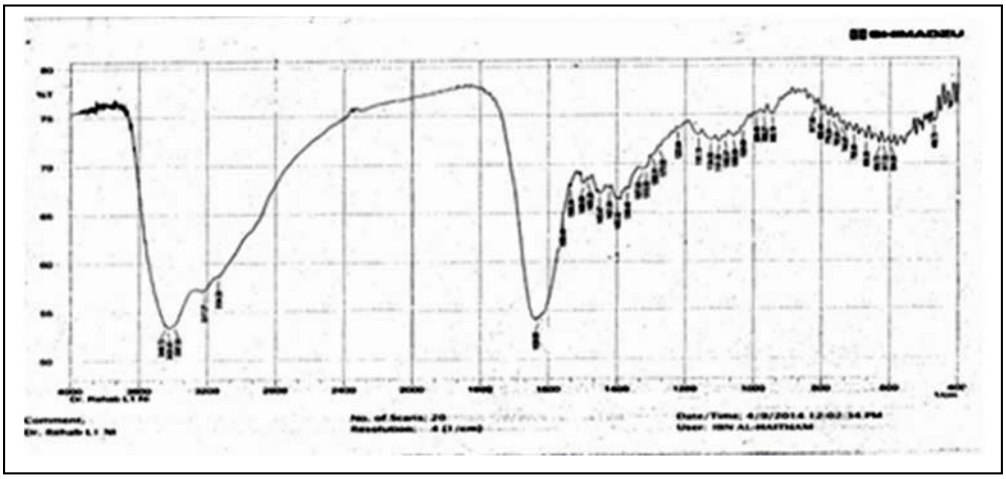

Fig.(2) :The IR spectrum of [Ni(L)$(H_2O)_2$]complex

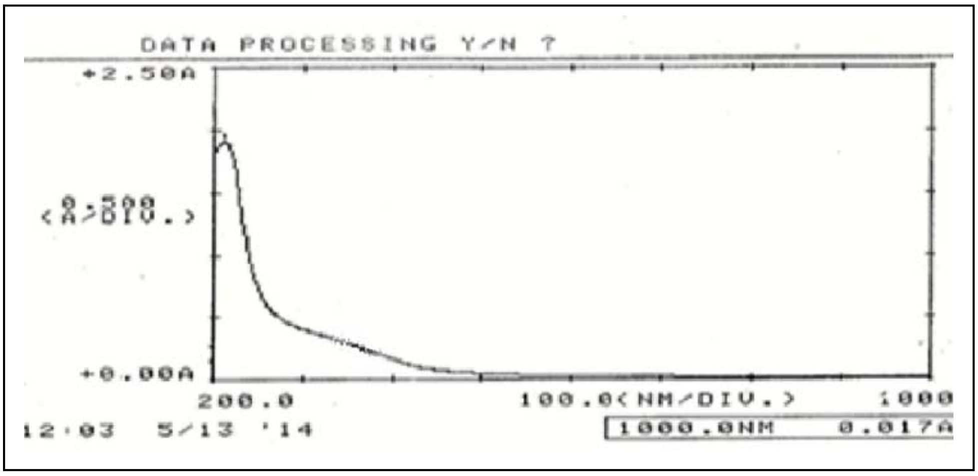

Fig.(3): Electronic spectrum of the ligand($H_2L$)

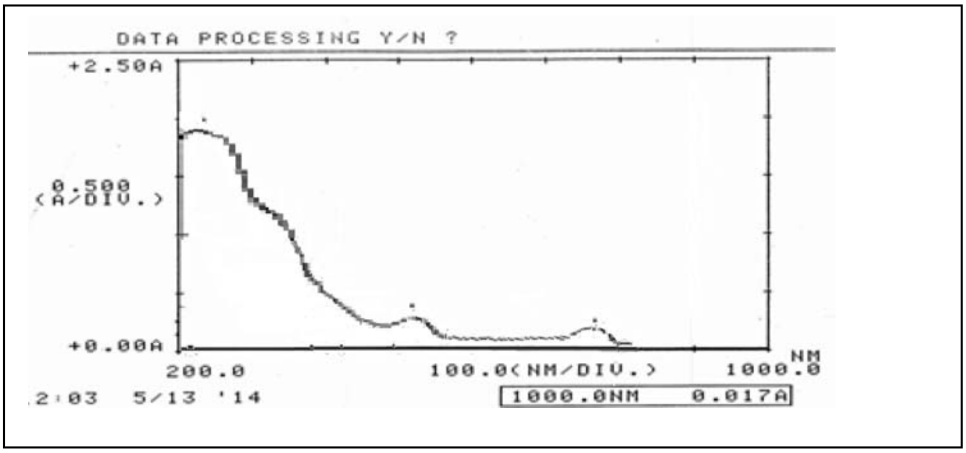

Fig.(4):Electronic spectrum of [Ni(L)$(H_2O)_2$]complex

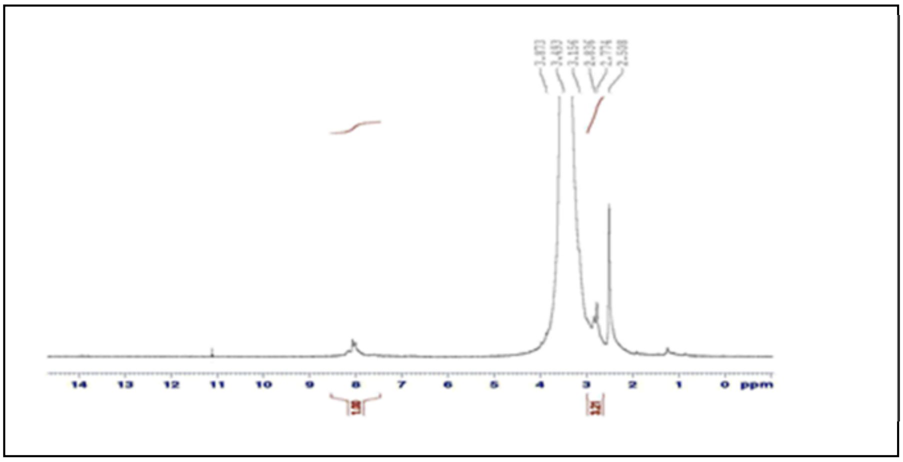

Fig.(5): The$^1$H-NMR spectrum of the ligand ($H_2L$)

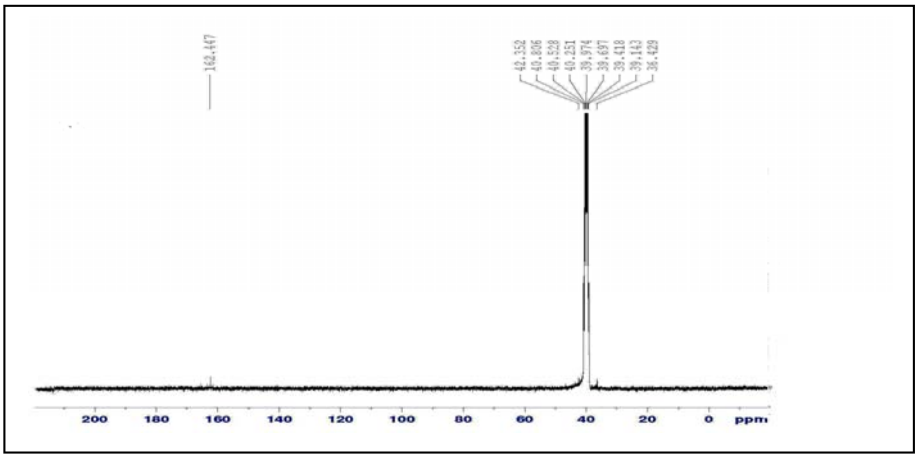

Fig.(6): The $^{13}$C-NMR spectrum of the ligand ($H_2L$)

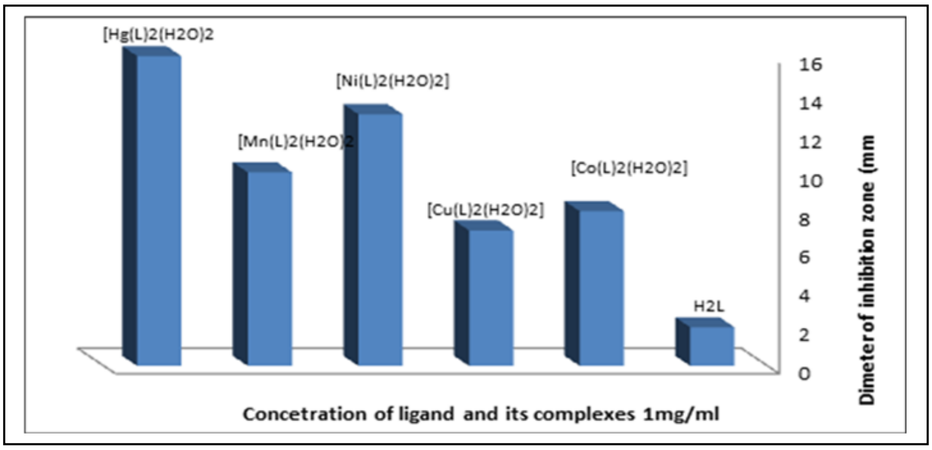

Fig. (7) :Effect of *Escherichia .Coli* gram negative

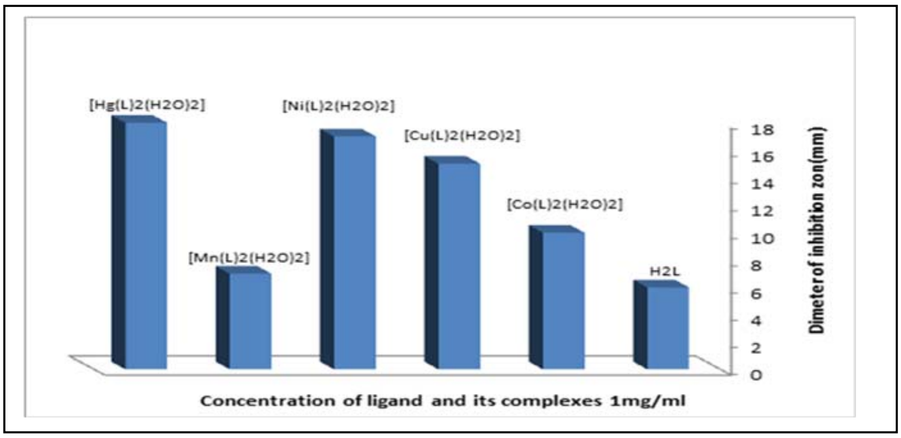

**Fig. (8): Effect of *Staphylococcus aureus***

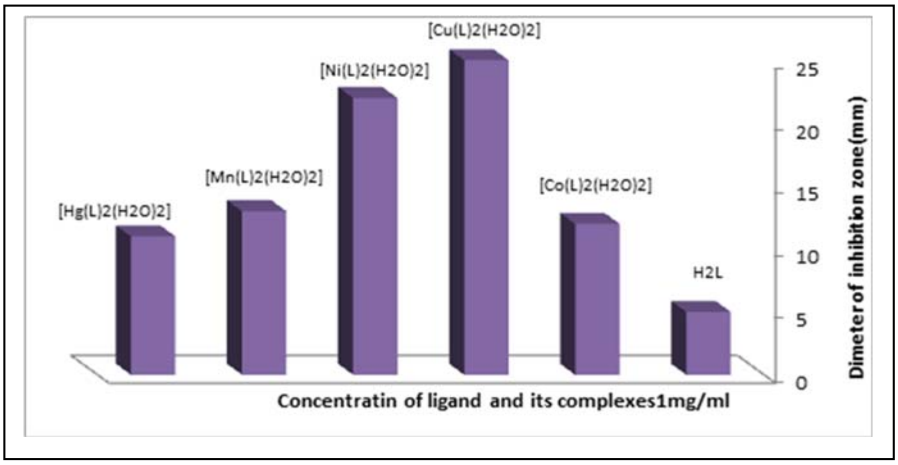

**Fig.(9): Effect of *Bacllus* gram**

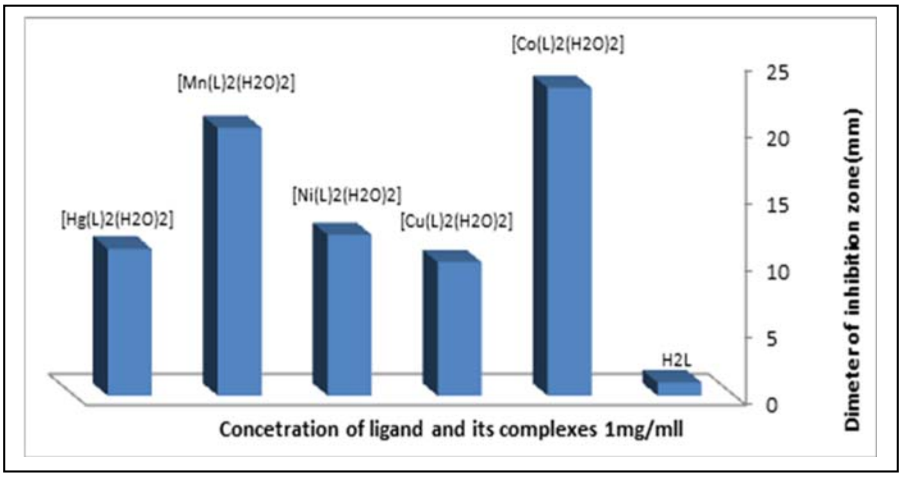

**Fig.(10): Effect of *pseudmonas* gram**

# تحضير وتشخيص بعض المعقدات الجديدة مع قاعدة شف جديدة نوع( $N_2O_2$) مشتقة من حامض الكلايوكسيليك مع إثيلين ثنائي أمين

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## الخلاصة

تم تحضير قاعدة شف رباعية السن جديدة أسمها [2،2′- (أيثان -2،1- دايل بس (أزان-1- يل- يليدين) ثناثي حامض الخليك] من تكثيف حامض كلايوكسيلك مع إثيلين ثنائي أمين في الايثانول كمذيب بوجود بعض قطرات من حامض الهايدروبروميك (48%) شخص تركيب الليكاند[$H_2L$] بوساطة أطياف (الاشعة تحت الحمراء، المرئية – فوق البنفسجية ، الرنين النووي المغناطيسي) و التحليل الكمي الدقيق للعناصر وقياس درجة الانصهار .كما تم تحضير معقدات لليكاند بالصيغة الجزيئية العامة $[M(L)(H_2O)_2]$ أذ $Hg^{(II)},Cu^{(II)}, Mn^{(II)}, Co^{(II)} = M; (C_6H_8N_2O_4) =L$ شخصت المعقدات المحضرة بوساطة أطياف تحت الحمراء ، طيف الاشعة ، طيف الاشعة المرئية – فوق البنفسجية و الامتصاص الذري التوصيلية المولارية والحساسية المغناطيسية .وقد وجد أن الشكل الهندسي لجميع المعقدات المحضرة هو ثماني السطوح.وقد وجد أن المركبات المحضرة أغلبها ذو فعالية مضادة جيدة لبعض أنواع من البكتريا هي : *(Staphylococcus aureus)*, *(Bacillus)*,*(Escherichiacoli)* و*(Pesudomonas)*.

**الكلمات مفتاحية :** قاعدة شف رباعية السن ، حامض كلايوكسيلك ،اثيلين ثنائي امين والفعالية البايولوجية.