

Synthesis and Biological Studies of Co(II),Ni(II),Cu(II) and Zn(II)

Complexes with New Compound N-[(2,3-dioxoindolin-1-yl)-N-methylbenzamide].

*Heam H.Alkam, Muhanned A.Mahmood, Ruaa M.Dedan, ,*Amer J.Jarad **Zahraa

R.Abdulmageed, Rana I.Omran***

Synthesis and Biological Studies of Co(II),Ni(II),Cu(II) and Zn(II)Complexes with New Compound N-[(2,3-dioxoindolin-1-yl)-N-methylbenzamide].

*Heam H.Alkam, Muhanned A.Mahmood, Ruaa M.Dedan, ,*Amer J.Jarad **Zahraa

R.Abdulmageed, Rana I.Omran***

*Department of chemistry, Ibn-Al-Haitham College, University of Baghdad

Department of chemistry, College of Science for Women, University of Baghdad

**Department of chemistry, College of Science Al-Nahrin, University of Al-Nahrin

***Department of Analyses Diseases, College of Health and Medical

Technology, Baghdad

Received 10 June 2014 ; Accepted 2 November 2014

Abstract

The N-[(2,3-dioxoindolin-1-yl)-N-methylbenzamide] was prepared by the reaction of acetanilide with isatin then in presence of added paraformaldehyde, the prepared ligand was identified by microelemental analysis, FT.IR and UV-Vis spectroscopic techniques. Treatment of the prepared ligand with the following selected metal ions (Co^{II}, Ni^{II}, Cu^{II} and Zn^{II}) in aqueous ethanol with a 1:2 M:L ratio, yielded a series of complexes of the general formula [M(L)₂Cl₂]. The prepared complexes were characterized using flame atomic absorption, (C.H.N) analysis, FT.IR and UV-Vis spectroscopic methods as well as magnetic susceptibility and conductivity measurements. Chloride ion content was also evaluated by (Mohr method). From the obtained data the octahedral structure was suggested for all prepared complexes. In addition biological activity of the ligand and complexes against three selected type of bacteria were also examined. Some of the complexes exhibit good bacterial activities.

Keywords:- Mannich base, biological activity, spectral studies.

Synthesis and Biological Studies of Co(II), Ni(II), Cu(II) and Zn(II)

Complexes with New Compound N-[(2,3-dioxindolin-1-yl)-N-methylbenzamide].

*Heam H. Alkam, Muhanned A. Mahmood, Ruaa M. Dedan, *, Amer J. Jarad **, Zahraa

R. Abdulmageed, Rana I. Omran ***

تحضير ودراسة بايولوجية لمعقدات الكوبالت (II)، النيكل (II)، النحاس (II) والزنك (II) مع المركب الجديد N-(3,2-داي اوكسواندولين -1-يل)-N-مethyl بنزاميد.

*هيام هادي عاكم، مهند عبد اللطيف محمود، رؤى محمد ضيدان،

*عمار جبار جراد، *زهراء رشيد عبدالمجيد، ***رنا عيسى عمران

قسم الكيمياء- كلية التربية(ابن الهيثم)- جامعة بغداد

قسم الكيمياء- كلية العلوم للبنات- جامعة بغداد

**قسم الكيمياء- كلية العلوم- جامعة النهرين

***قسم التحليلات المرضية- كلية التقنيات الصحية والطبية- هيئة التعليم التقني

الخلاصة

حضرت الليكاند من تفاعل اسيتانالايد مع الاساتين بوجود بارافورمالديهايد. شخص الليكاند المحضر بواسطة اطياف الأشعة تحت الحمراء وفوق البنفسجية - المرئية والتحليل الدقيق للعناصر (C.H.N). تمت مفاعلة الليكاند مع ايونات Co(II), Ni(II), Cu(II) and Zn(II) وبنسبة مولية (2:1) فلز: ليكاند. شخصت المعقدات المحضرة بواسطة التحليل الدقيق للعناصر (C.H.N)؛ تقنية الإمتصاص الذري اللهبى واطياف الأشعة تحت الحمراء وفوق البنفسجية - المرئية، فضلا عن قياسات الحساسية المغناطيسية والتوصيلية الكهربائية، اذ بينت النتائج التي تم الحصول عليها ان الشكل الهندسي المقترح للمعقدات المحضرة هو ثنائي السطوح. كما تم دراسة الفعالية البيولوجية لليكاند ومعقداته ضد ثلاثة انواع منتخبة من البكتريا ، حيث اظهرت النتائج ان لهذه المعقدات قابلية متباينة على قتل الانواع المنتخبة من البكتريا.

الكلمات المفتاحية: قواعد مانخ ، الفعالية البيولوجية، الدراسات الطيفية.

Synthesis and Biological Studies of Co(II), Ni(II), Cu(II) and Zn(II)**Complexes with New Compound N-[(2,3-dioxindolin-1-yl)-N-methylbenzamide].*****Heam H. Alkam, Muhanned A. Mahmood, Ruaa M. Dedan, *, Amer J. Jarad **Zahraa****R. Abdulmageed, Rana I. Omran*******Introduction**

Mannich reaction is one of the most important carbon-carbon bond formation reactions in organic synthesis⁽¹⁻³⁾ and very useful compounds as building blocks in the synthesis of pharmaceuticals and natural products^(4,5). With their advantages of atom-efficient transformations, readily available materials, and various products, multicomponent reactions (MCRs) have received significant research interest from chemical and medicinal communities^(6,7). As one of the mostly studied MCRs, discovered in 1912, Mannich reaction is an aminoalkylation reaction of aldehyde⁽⁸⁾. It is an important basic reaction in organic synthesis. Mannich bases have several biological activities such as antimicrobial, cytotoxic, anticancer and analgesic activity. Morpholine derivative plays important role in the treatment of several diseases. Heterocyclic ring system having morpholine nucleus have aroused great interest in recent years due to their variety of biological activities⁽⁹⁾. The present paper reports the synthesis and characterization of new Co(II), Ni(II), Cu(II) and Zn(II) complexes.

Experimental**Instrumentation**

UV-Vis spectra were recorded on a (Shimadzu UV-160 A) Ultra Violet-Visible Spectrophotometer. I.R-spectra were taken on a (Shimadzu, FTIR-8400 S) Fourier Transform Infrared Spectrophotometer (4000-400) cm^{-1} with samples prepared as KBr discs. Atomic Absorption was obtained by using a (Shimadzu A.A-160A) Atomic Absorption / Flame Emission Spectrophotometer. Microelemental analysis (C.H.N) was performed in AL-al- Bayt University, Jordan by using (Euro Vector EA 300 A Elemental Analyser). Conductivities were measured for 10^{-3}M of complexes in DMF at 25°C by using (Philips PW- Digital Conductimeter). Magnetic susceptibilities were performed by using (Brucker Magnet B.M.6) instrument at 25°C . In addition, melting points were obtained by using (Melting Point Apparatus).

Synthesis and Biological Studies of Co(II), Ni(II), Cu(II) and Zn(II)

Complexes with New Compound N-[(2,3-dioxindolin-1-yl)-N-methylbenzamide].

*Heam H.Alkam, Muhanned A.Mahmood, Ruaa M.Dedan, *, Amer J.Jarad **, Zahraa

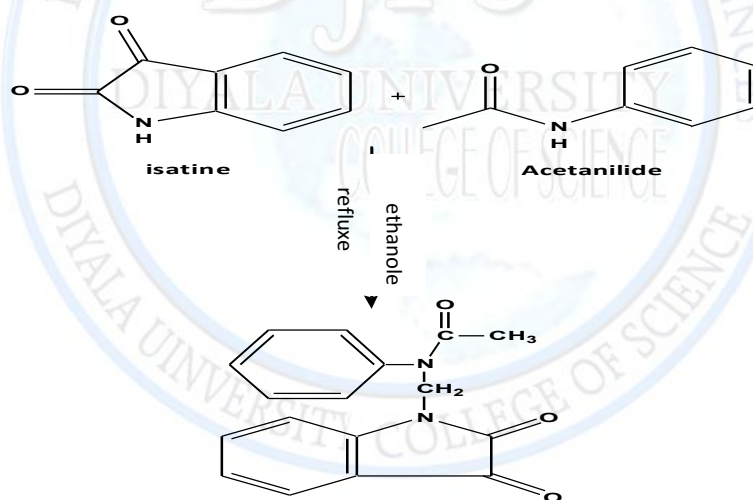
R.Abdulmageed, Rana I.Omran ***

Materials

The following chemicals were used as received from suppliers; acetanilide, isatine, paraformaldehyde, cobalt(II) chloride hexahydrate 98.8%, nickel(II) chloride hexahydrate 99.9%, copper(II) chloride dihydrate 98% and zinc(II) chloride 98.8% (Merck), Dimethylsulphoxide) 99%, Ethanol 99.8%.

Synthesis of the Ligand

Acetanilide (0.005mol) in (25ml) absolute ethanol was added to isatine (0.005mol) with paraformaldehyde (0.006mol) and refluxed four hours, then (100ml) of ice distilled water was added, the precipitate was filtered, dried and recrystallized from ethanol. ⁽¹⁰⁾



N-((2,3-dioxindolin-1-yl)-N-methylbenzamide).

Preparation of Metal Complexes (general procedure)

An aqueous solution of the metal salts containing 0.118g, 0.118g, 0.085g and 0.068g (1mmole) of $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$, $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$, $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ and ZnCl_2 respectively was added gradually with stirring to ethanolic solution (0.25g, 2mmol) of the ligand by using

Synthesis and Biological Studies of Co(II), Ni(II), Cu(II) and Zn(II)

Complexes with New Compound N-[(2,3-dioxindolin-1-yl)-N-methylbenzamide].

*Heam H. Alkam, Muhanned A. Mahmood, Ruaa M. Dedan, *, Amer J. Jarad **, Zahraa

R. Abdulmageed, Rana I. Omran ***

stichiometric amount (1:2) Metal to Ligand molar ratio. The mixture was refluxed with constant stirring for two hours. The mixture was cooled at room temperature dark precipitate was formed, filtered and recrystallized from ethanol.

Study of Biological Activity

Three selected types of bacteria were used includes, *Esherichia Coli (E. Coli)* as Gram Negative Bacteria, *Staphylococcus Aureus (Staph. Aureus)* as Gram Positive Bacteria and *Pseudomonas Aeruginosa (Ps. Aeruginosa)* in Neutrient Agar medium, using (DMSO) as a solvent and as a control, the concentration of the compounds in this solvent was 10^{-3} M, using disc sensitivity test. This method involves the exposure of the zone of inhibition toward the diffusion of micro-organism on agar plate. The plates were incubated for 24hr. at 37°C .

Results and Discussion

The solid complexes were prepared by reaction of alcoholic solution of the ligand with the aqueous solution of the metal ions in a (M:L) of (1:2). The (C.H.N) analysis with metal contents of these complexes were in good agreements with the calculated values (Table-1) includes some physical properties and elemental analysis.

Table(1):- Some Physical Properties and Elemental Analysis of the Ligand and It's Metal Complexes.

| Compounds | Color | M.P $^{\circ}$ C | Yield% | Analysis Calc (Found) | | | | | M.Wt gm/mol |
|-----------------------|---------------|------------------|--------|-----------------------|----------------|------------------|----------------|----------------|-------------|
| | | | | Cl% | M% | C% | H% | N% | |
| Ligand | Orange | 178 | 78 | - | - | 69.38 (68.74) | 4.76 (3.87) | 9.52 (8.17) | 294 |
| [Co(L) $_2$ Cl $_2$] | Reddish Brown | 235 | 72 | 9.88 (8.74) | 8.21 (7.48) | 56.82 (55.74) | 3.89 (3.13) | 7.79 (6.75) | 718 |
| [Ni(L) $_2$ Cl $_2$] | Green | 227 | 65 | 9.90 (9.03) | 8.08 (7.35) | 56.90 (56.02) | 3.90 (3.07) | 7.81 (6.58) | 718 |
| [Cu(L) $_2$ Cl $_2$] | Green | 243 | 71 | 9.82 (8.58) | 8.85 (7.66) | 56.43 (55.87) | 3.87 (2.96) | 7.74 (6.66) | 723 |
| [Zn(L) $_2$ Cl $_2$] | Yellow | 253 | 78 | 9.80 (8.73) | 8.97 (7.36) | 56.35 (55.93) | 3.86 (2.88) | 7.73 (6.76) | 724 |

Synthesis and Biological Studies of Co(II), Ni(II), Cu(II) and Zn(II)

Complexes with New Compound N-[(2,3-dioxindolin-1-yl)-N-methylbenzamide].

*Heam H. Alkam, Muhanned A. Mahmood, Ruaa M. Dedan, *, Amer J. Jarad **, Zahraa

R. Abdulmageed, Rana I. Omran ***

The molar conductance of the complexes as (10^{-3} M) in ethanol indicating their non-electrolytic nature (11), the data were recorded in (Table- 2).

The effective magnetic moments (Table-2) of the complexes lie in the range (1.73-4.57) B.M. This value refers to a paramagnetic (high spin) which has been reported for most octahedral geometry. In case of Zn(II) complex because of filled-d orbital, therefore the magnetic moment ($\mu=0$) is diamagnetic (12).

The UV-Vis spectra data for the free ligand and all metal complexes are listed in (Table-2).

Table(2):- UV-Vis, Magnetic Susceptibility and Conductance Measurements Data.

| Compounds | λ_{\max} (nm) | ABS | Wave number (cm^{-1}) | ϵ_{\max} ($\text{L.mol}^{-1}.\text{cm}^{-1}$) | Λ_m ($\text{S.cm}^2.\text{mol}^{-1}$) in ethanol(10^{-3}M) | μ_{eff} (B.M) | Assignment |
|---------------------------------------|--------------------------|----------------------------------|--|---|---|-----------------------------|--|
| Ligand(L) | 262 345 | 0.404 1.318 | 38167 28985 | 404 1318 | - | - | $\pi - \pi^*$ $n - \pi^*$ |
| [Co(L) ₂ Cl ₂] | 305 609 673 827 | 1.832 0.227 0.334 0.019 | 32786 16420 14858 12091 | 1832 227 334 19 | 21.87 | 4.57 | C.T ${}^4T_{1g}(F) \rightarrow {}^4T_{1g}(P)$ ${}^4T_{1g}(F) \rightarrow {}^4A_{2g}(F)$ ${}^4T_{1g}(F) \rightarrow {}^4T_{2g}(F)$ |
| [Ni(L) ₂ Cl ₂] | 268 421 611 795 | 1.390 0.378 0.102 0.061 | 37313 23752 16366 2578 | 1390 378 102 61 | 18.83 | 3.05 | C.T ${}^3A_{2g}(F) \rightarrow {}^3T_{1g}(P)$ ${}^3A_{2g}(F) \rightarrow {}^3T_{1g}(F)$ ${}^3A_{2g}(F) \rightarrow {}^3T_{2g}(F)$ |
| [Cu(L) ₂ Cl ₂] | 337 421 | 1.397 0.559 | 29673 23752 | 1397 559 | 23.65 | 1.73 | C.T ${}^2E_g \rightarrow {}^2T_{2g}$ |
| [Zn(L) ₂ Cl ₂] | 311 | 1.827 | 32154 | 1827 | 19.77 | 0.00 | C.T |

The UV-Vis spectrum of the ligand (L) (Fig-1) shows two peaks at 262 nm and 345 nm assigned to ($\pi - \pi^*$) and ($n - \pi^*$) electronic transitions respectively (13,14). The electronic spectrum of Co(II) complex (Fig-2) showed peak at 305 nm due to charge transfer. Other three peaks at 609 nm, 673 nm and 827 nm were found to be caused by (d-d) electronic transition type ${}^4T_{1g}(F) \rightarrow {}^4T_{1g}(P)$, ${}^4T_{1g}(F) \rightarrow {}^4A_{2g}(F)$ and ${}^4T_{1g}(F) \rightarrow {}^4T_{2g}(F)$ respectively (15). The spectrum of Ni(II) complex appeared absorption peak at 268 nm was related to charge

Synthesis and Biological Studies of Co(II), Ni(II), Cu(II) and Zn(II)

Complexes with New Compound N-[(2,3-dioxindolin-1-yl)-N-methylbenzamide].

*Heam H. Alkam, Muhanned A. Mahmood, Ruaa M. Dedan, *Amer J. Jarad **Zahraa

R. Abdulmageed, Rana I. Omran***

transfer, then other three peaks at 421 nm, 611 nm and 795 nm were assigned to electronic transition type ${}^3A_{2g(F)} \rightarrow {}^3T_{1g(P)}$, ${}^3A_{2g(F)} \rightarrow {}^3T_{1g(F)}$ and ${}^3A_{2g(F)} \rightarrow {}^3T_{2g(F)}$ respectively⁽¹⁶⁾. The spectrum of Cu(II) complex gave absorption peak at 337 nm due to charge transfer. The peak at 421 nm was caused by electronic transition⁽¹⁷⁾ ${}^2E_g \rightarrow {}^2T_{2g}$. The spectrum of Zn(II) complex showed absorption peak at 311 nm due to charge transfer. The absence of absorption peaks in the visible region indicated no (d-d) electronic transition happened; this is a good result for octahedral complex⁽¹⁸⁾.

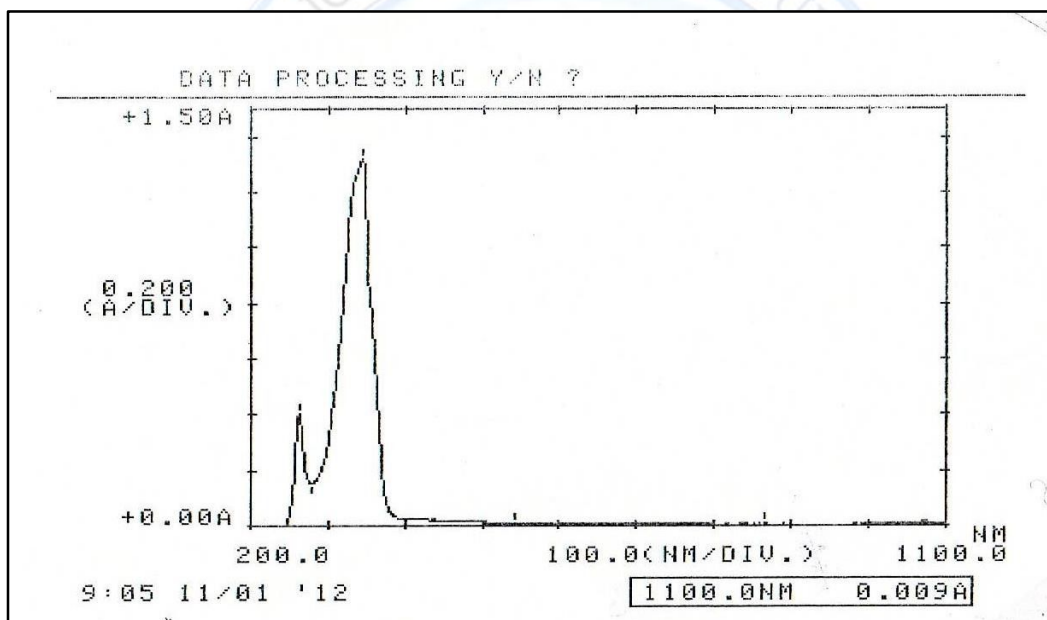


Fig.(1):- UV-Vis Spectrum of the Ligand.

Synthesis and Biological Studies of Co(II), Ni(II), Cu(II) and Zn(II)

Complexes with New Compound N-[(2,3-dioxindolin-1-yl)-N-methylbenzamide].

*Heam H.Alkam, Muhanned A.Mahmood, Ruaa M.Dedan, ,*Amer J.Jarad **Zahraa

R.Abdulmageed, Rana I.Omran***

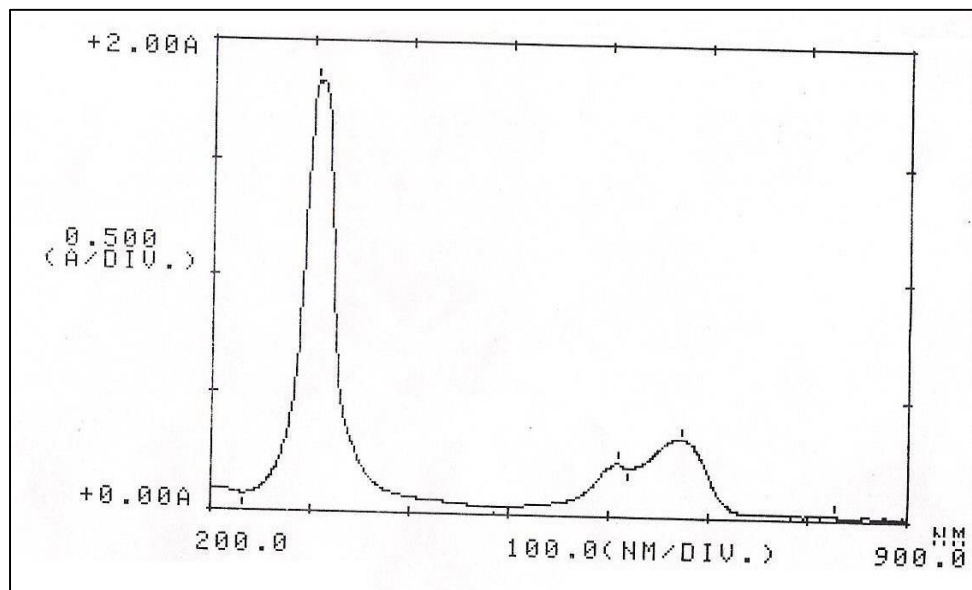


Fig.(2):- UV-Vis Spectrum of the $[Co(L)_2Cl_2]$ Complex.

In order to study the binding mode of the ligand with the metal ions, a comparison was made for the FT-IR spectra of the free ligand and those of the prepared complexes and the data was tabulated in (Table-3). The IR spectrum of the ligand (L) (Fig-3) exhibited band at 1728 cm^{-1} was assigned to $\nu(C=O)$ for acetanilide stretching frequency⁽¹⁹⁾. This band remained unaltered in the complexes spectra, indication that is no coordination from main band. The band at 1666 cm^{-1} in the ligand spectrum ascribed to $\nu(C=O)$ of five member ring⁽²⁰⁾, on complexation a shifting with change in shape was observed from this band, while increasing in intensity were noticed. The significant may be a result of coordination with metal ion (Fig-4). The bands at 1616 cm^{-1} and 1558 cm^{-1} in the ligand spectrum due to $\nu(C=C)$ aromatic. Since no change in this band was noticed, the possibility that coordination occur via the donation atom(N) in this group was excluded⁽²¹⁾. The new bands observed at $(576-430)\text{ cm}^{-1}$ are tentatively assigned to $\nu(M-O)$ (Metal-Ligand) stretching bands^(22,23).

Synthesis and Biological Studies of Co(II), Ni(II), Cu(II) and Zn(II)

Complexes with New Compound N-[(2,3-dioxindolin-1-yl)-N-methylbenzamide].

*Heam H. Alkam, Muhanned A. Mahmood, Ruaa M. Dedan, *, Amer J. Jarad **, Zahraa

R. Abdulmageed, Rana I. Omran ***

Table(3):- The Main Frequencies of the Ligands and It's Complexes(cm^{-1}).

| Compounds | $\nu(\text{C}=\text{O})$ | $\nu(\text{C}=\text{O})$ five member ringe | $\nu(\text{C}=\text{C})$ | $\nu(\text{M}-\text{O})$ |
|--------------------------------------|--------------------------|---|--------------------------|--------------------------|
| Ligand(L) | 1728 s. | 1666 sho. | 1616 s. 1558 sho. | - |
| $[\text{Co}(\text{L})_2\text{Cl}_2]$ | 1728 sh. | 1654 sh. | 1616 s. 1558 sh. | 534 w. 511 w. |
| $[\text{Ni}(\text{L})_2\text{Cl}_2]$ | 1727 s. | 1590 s. | 1614 s. 1556 sh. | 552 w. 521 w. |
| $[\text{Cu}(\text{L})_2\text{Cl}_2]$ | 1727 sh. | 1634 s. | 1616 s. 1557 sh. | 543 w. 527 w. |
| $[\text{Zn}(\text{L})_2\text{Cl}_2]$ | 1728 s. | 1643 sh. | 1617 sh. 1558 s. | 528 w. 511 w. |

sh =sharp, sho=shoulder, s = strong, w =weak

Synthesis and Biological Studies of Co(II),Ni(II),Cu(II) and Zn(II)
Complexes with New Compound N-[(2,3-dioxindolin-1-yl)-N-methylbenzamide].

*Heam H.Alkam, Muhanned A.Mahmood, Ruaa M.Dedan, *,*Amer J.Jarad **Zahraa

R.Abdulmageed, Rana I.Omran***

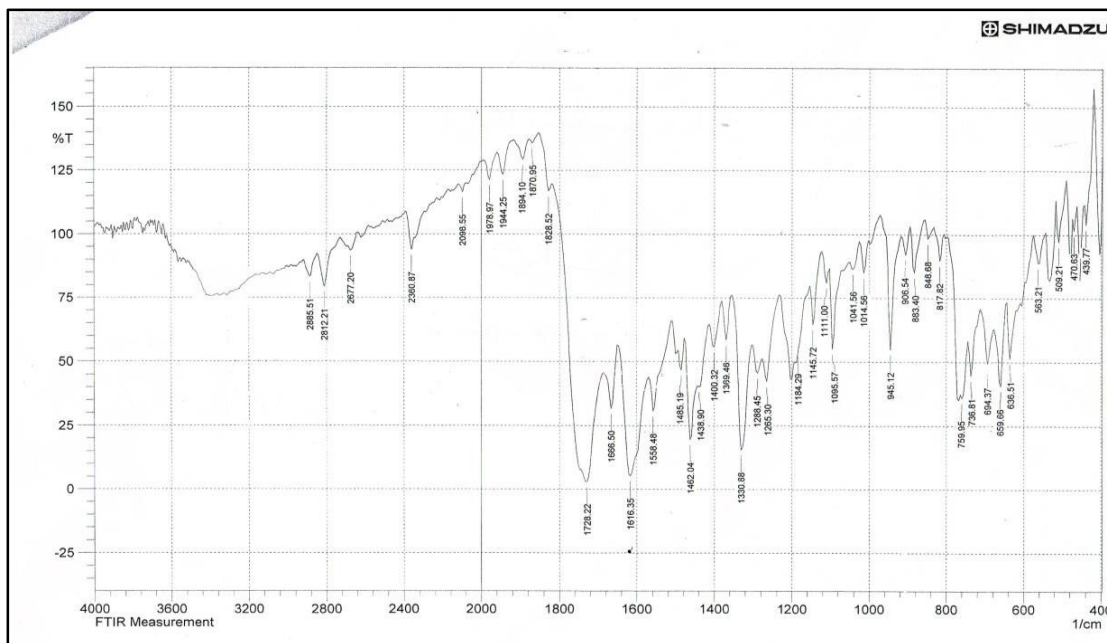


Fig.(3):- FT-IR Spectrum of the Ligand.

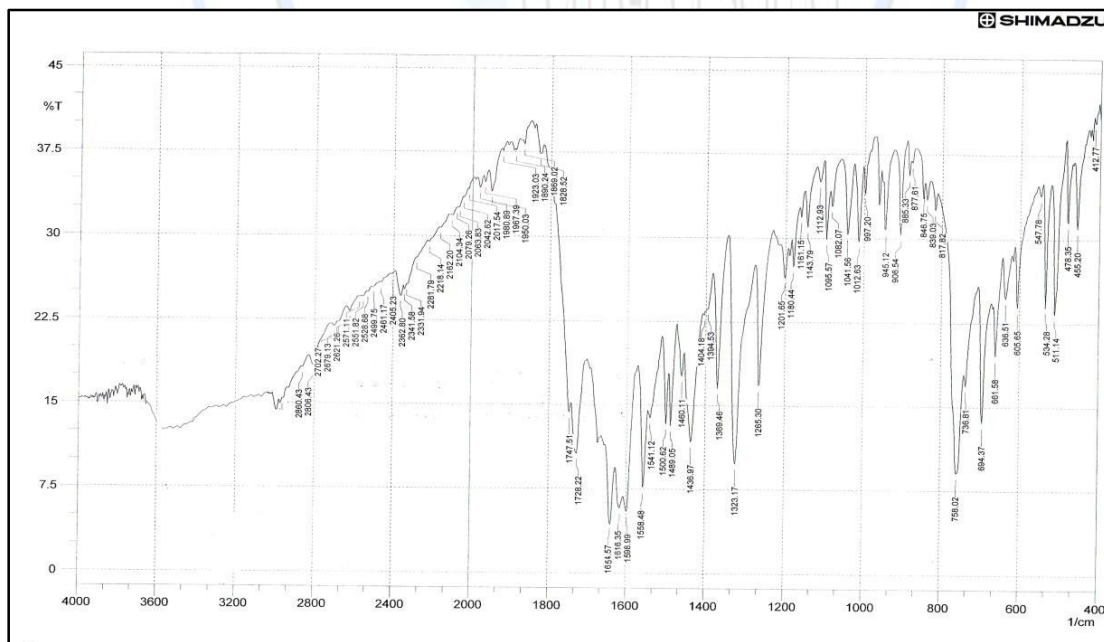


Fig.(4):- FT-IR Spectrum of [Ni(L)₂Cl₂] Complex.

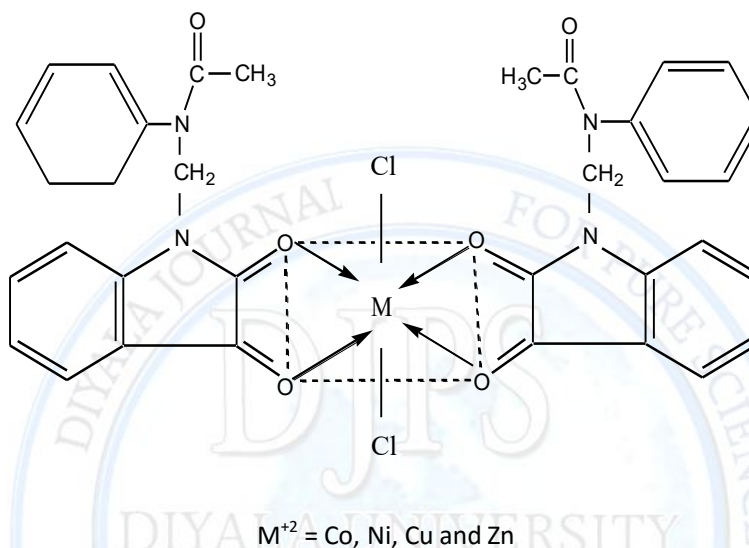
Synthesis and Biological Studies of Co(II), Ni(II), Cu(II) and Zn(II)

Complexes with New Compound N-[(2,3-dioxindolin-1-yl)-N-methylbenzamide].

*Heam H.Alkam, Muhanned A.Mahmood, Ruaa M.Dedan, *, Amer J.Jarad **, Zahraa

R.Abdulmageed, Rana I.Omran***

According to the results obtained and spectral analysis an octahedral structure has been suggested to these complexes.



Finally, the biological activities of the ligand and their complexes have also been tested against selected type of bacteria, (Table-4) show the deactivation capacity against the bacteria specimen of the prepared compounds under study.

Table(4):- Diameters (mm) of Deactivation of Bacteria for the Phenylalanine and It's Complexes.

| Compounds | Staphylococcus Aureus | Escherichia Coli | Pseudomonas Aeruginosa |
|---------------------------------------|-----------------------|------------------|------------------------|
| Ligand(L) | - | - | ++ |
| [Co(L) ₂ Cl ₂] | + | ++ | - |
| [Ni(L) ₂ Cl ₂] | - | - | + |
| [Cu(L) ₂ Cl ₂] | - | ++ | - |
| [Zn(L) ₂ Cl ₂] | + | + | + |

Synthesis and Biological Studies of Co(II), Ni(II), Cu(II) and Zn(II)

Complexes with New Compound N-[(2,3-dioxindolin-1-yl)-N-methylbenzamide].

*Heam H. Alkam, Muhanned A. Mahmood, Ruaa M. Dedan, *Amer J. Jarad **Zahraa

R. Abdulmageed, Rana I. Omran***

(-) = No inhibition.

(+) = Inhibition diameter (6-8) mm.

(++) = Inhibition diameter (8-10) mm.

References

1. Vicente, J., Abad, J. A., Lopez-Pelaez, B. and Martinez-Viriente, E. 2002. Synthesis and Reactivity toward Alkynes of 2-Formyl and 2-Acetylarylpalladium(II) (Aryl = Phenyl and 5-Nitrophenyl) Complexes. Formation of Indenols and Indenones, *Org. Metal* 21(1): 58-67.
2. Bhat, M. A., Siddiqui, N. and Khan, S. A. 2008. Synthesis of Novel 3-(4-Acetyl-5H-Methyl-5-Substituted Phenyl-4, 5-Dihydro-1, 3, 4-Oxadiazol-2-yl)-2H-Chromen-2-ones as Potential Anticonvulsant Agents, *Polish. Pharm. Soc* 65(3) : 235-239.
3. Shvekhgeimer, M. G. A. 2001. Synthesis of Heterocyclic Compounds Based on Isatoic Anhydrides, *Chemistry of Heterocyclic Compound*, 37:385-390 .
4. Islam, M., Siddiqui, A., Rajesh, R., Bakht, A. and Goyal, S. 2008. Synthesis and Antimicrobial Activity of Some Novel Oxadiazole Derivatives, *Acta. Poloniae. Pharmaceutica* 65(5): 441-447.
5. Rao, N. S., Bajja, B., Srivastava, Y. K. and Kumar, R. 2008. Microwave Induced Synthesis and Antibacterial Activity of Some 6-(2-Hydroxyphenyl)-4-(Substitutedphenyl)-3-oxo-2, 3,4 , 5-Tetrahydro-1H-Indazoles, *E. J. Chem* 5(2): 39-42.
6. Almasirad, A., Tabatabai, S.A. and Faizi, M. 2004. Synthesis and Biological Activity of 1, 3, 4-Oxadiazoles Derivatives, *Biorg. Med. Chem. Lett* 14: 6057.
7. Abdel Hamid, M. 2008. Synthesis and Cyclization Reactions with Oxadiazole Derivatives and Their Enzymatic Activity, *Acta. Chim. Slov* 55(3):492-501.
8. Chudgar, N. K., Shan, S. N. and Vorat, R. A .1989. Mesogenic Semicarbazones and Amino Oxadiazoles, *Mol. Cryst. Liq. Cryst* 172(13)51-56.
9. Houghton, R. P.1979. Metal Complexes in Organic Chemistry, New York.

Synthesis and Biological Studies of Co(II), Ni(II), Cu(II) and Zn(II)

Complexes with New Compound N-[(2,3-dioxindolin-1-yl)-N-methylbenzamide].

*Heam H. Alkam, Muhanned A. Mahmood, Ruaa M. Dedan, *, Amer J. Jarad **, Zahraa

R. Abdulmageed, Rana I. Omran ***

10. Chudgar, N. K., Shan, S. N. and Vorat, R. A. 1989. Mesogenic Semicarbazones and Amino Oxadiazoles, *Mol. Cryst. Liq. Cryst* 172: 51-56.
11. Geary, W.J. 1971. The use of Conductivity Measurements in Organic Solvent for the Characterization of Coordination Compounds, *Coord. Chem. Rev* 7:81-122.
12. Liwany, J. C., Zon-wang, M., Xinol-Loy, F. and Jin-Wang, H. 2004. Nickel Complexes Bridge by Unusual (N, O, O'). Coordination Amino Acids, Synthesis, Structure, Characterization and Magnetic Properties, *Trans. Mt. Chem* 29(4):418.
13. Suzuki, T., Shiotsuk, M., Wada, K., Kondo, T. and Mitsudo, T. 1999. Complexes of 5-(phenyl azo)-8-quinolinol with Al(III), Ga(III), In(III) and Tl(I), *Organo. Metal. Lics* 18(3): 18.
14. Sonmez, M. and Sekerci, M. 2002. Bis-[2-Phenylezo] pyridine] Copper (I) and Copper (II), *J. Chem* 76: 121-126.
15. Lever, A. B. P. 1984. *Inorganic Electronic Spectroscopy*, 2nd Ed, New York, pp.230-235.
16. Sandhu, S. S., Jaswal, J.S. and Sandhu, G. K. 1996. Metal Complexes of Sulfur Containing Peptides: Co(II) Complex of Mercaptopropionylglycine in Comparison with Glycylglycine, *Ind. J. Chem* 35: 218-222.
17. Guany, P. X. Y. and Guang, P. F. 2002. Synthesis and Electrochemical Studies of Phenylazo Substituted Tetraaza Macrocyclic Complexes of Ni(II), *J. Med. Gen. Med* 22(3): 6-8.
18. Daniel, E., Seema, C., Melryn, R. and Kim, M.K. 2001. Spectroscopic Investigation of Copper (II) Complex with Mixed Ligand Glutamic Acid and Urea, *Inorg. Chem* 40: 7-11.
19. Silverstein, R.M. and Webster, F. X. 1996. *Spectrometric Identification of Organic Compounds*, 6th Ed, New York, John Wiley and Sons, Inc, pp.260-286.
20. Osowole, A. A. 2008. Synthesis and Characterization of Some Tetradentate Schiff Base Complexes and Their Heteroleptic Analogues, *E. J. Chem* 5(1): 130-135.

Synthesis and Biological Studies of Co(II),Ni(II),Cu(II) and Zn(II)

Complexes with New Compound N-[(2,3-dioxindolin-1-yl)-N-methylbenzamide].

*Heam H.Alkam, Muhanned A.Mahmood, Ruaa M.Dedan, ,*Amer J.Jarad **Zahraa

R.Abdulmageed, Rana I.Omran***

21. Chauhan, M. B., Bhoi, D. K., Machhar, M. T., Solanki, D. K. and Solanki, D. 2010. Synthesis, Characterization and Mesomorphic Properties of Azoester Mesogens: 4-N-alkoxybenzoic acid 4-[3-(benzyliden-amino)-phenylazo]-phenyl ester, *Der. Pharma.Chem* 2(2): 30-37.
22. Hakim, A. A., Ahmed, A. and Benguzzi, S. A.2008.Synthesis and Characterization of Some Transition Metals Complexes of Schiff Base Derived From Benzidine and Acetyl acetone, *J. Sci. App* 2(2): 83-90.
23. Rajavel, R., Vadivu, M. S. and Anitha,C.2008. Synthesis, Physical Characterization and Biological Activity of Some Schiff Base Complexes, *E. J. Chem* 5(4): 620-626.

