



Synthesis and characterization of New binuclear complexes of Fe(II), Co(II), Zn (II), and Cd(II) with Schiff base ligands derived from Isotins and amines, spectroscopic study and evaluation of their biological activity

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Abstract

The research includes the preparation of eight new binuclear complexes of Schiff base ligands prepared from azatine derivatives ethylenediamine-bis(aza) and 1,3-propanediamine-bis(aza) and 1,3-propanediamine-bis(aza). And also the aliphatic like (Propanediamine) with the metals iron (II), cobalt (II), zinc (II) and cadmium (II). The complexes were also measured by spectroscopic methods UV-Vis, electronic spectra, infrared, as well as by XRD. The results showed the formation of iron complexes with a square pyramid shape, while cobalt complexes with an octahedral shape. The biological activity of complexes with fungi was estimated. Their effect was clearly visible.

Keywords: binuclear, Azatine, ethylenediamine-bis-Azatine, 1,3-propane-diamine-bis-(Isa).

Introduction

The transition metals are called by this name when the secondary outer shell f, d is partially filled with electrons, and these metals are characterized by a great tendency to form metal-ligand complex, where the five d orbitals are partially filled in most cases[1]. The stability of their complexes depends on the different colors and magnetic properties, The factors controlling the stability of transition metal complexes, including: the ionization potential of the metal ions, the electrode potential of the metal ions, the electronic arrangement of the metal ions, the electronic arrangement and the nature of the ions and ligands in relation to their polarization and their ability to donate and accept electrons, and the nature of the solvent[2]. A tetrahedral, octahedral, and a flat square[3]. The zinc complex has a distorted octahedral shape[4].

Several dinuclear complexes have been prepared from the reaction of divalent ions with a multidentate Schiff-base ligand. The complexes were prepared from the reaction of the corresponding metal chloride

with the ligand, These studies revealed complexes of the general formulae $[M_2 (L)_2]$ with tetrahedral geometries for CoII, ZnII and CdII complexes,

while square planar geometries have been suggested for FeII complex. Biological activity of the ligand and its metal complexes revealed highly resistive to the microbial activities as compared to the free ligand [5].

Azatin compound and its derivatives have very important biological activity. They have been used as antibiotics for bacteria, fungi, as a treatment for some malignant diseases, and an antibiotic for HIV [6].

Schiff bases are derived from isatine and amine compounds, This type contains four donor groups that can coordinate with metal ions, namely the two azomethane groups and a product of the reaction of isatine with the amino compound and the two oxygen atoms of the carbonyl group in isatine[7]. This type of ligand is used alone as a chelate in the preparation of many of the compounds and other ligands such as isatin 3- imine hydrazine, isatine 3- imine, heterocyclic aromatic compounds and other ligands

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and Schiff bases consisting of isatine and an amine group. Extensive medical and biological applications[8].

Experimental part

Chemicals: All materials and solvents used have been supplied by (Fluka) and (BDH). chemical companies

Preparation of the ligand (L₁) (I₂ED) and (L₂) (I₂PD)[11]:

Schiff bases are compounds of great importance in the industrial field as well as their biological activities as they have been used as antibiotics for malaria, and fevers [9,10].

The ligand was prepared from the reaction of isatine with the aliphatic compound ethylene diamine once and with 1,3-propanediamine in a ratio of 2:1 by the common method. The result is a dark yellow precipitate, the yield is 80%, the theoretical molecular weight is 318 and the melting point is 223°C. Figure(1) shows equation of the reaction:

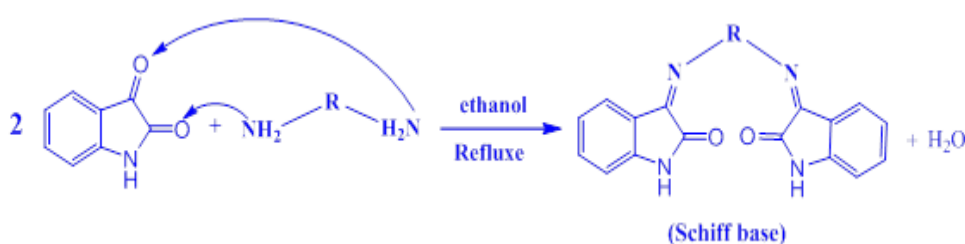


Fig.1. The equation for the preparation of the ligand (I₂ED) and (I₂PD).

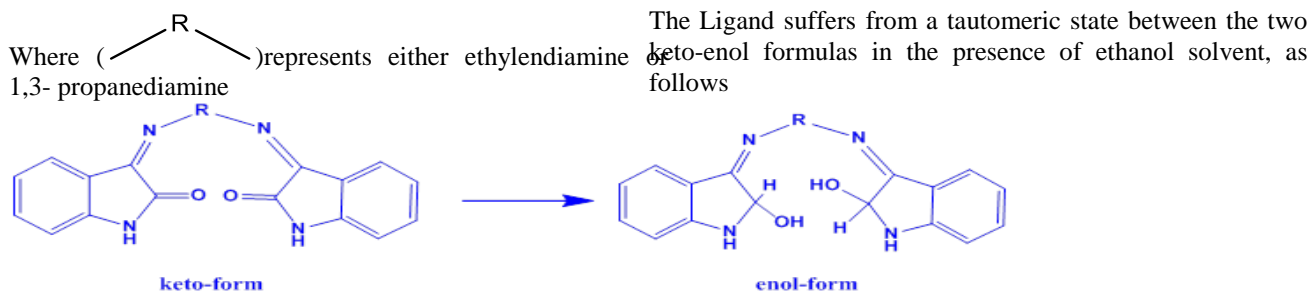


Fig.2. The tautomeric case of ligand And used the ready-made ligand (L₃) (PD), which is 1,3-propanediamine.

Table 1: Predicted formulas and physical properties of the ligands.

ligand number	ligand formula	Theoretical molecular weight g/mol	ligand color	The degree of melting and dissociation	The resulting %	ligand name
L ₁	I ₂ ED (C ₁₈ H ₁₆ N ₄ O ₂)	318	dark yellow	223d	85	ethylenediamine-bis(isa)
L ₂	I ₂ PD (C ₁₉ H ₁₆ N ₄ O ₂)	332	yellow	210 – 212	89	1,3-propanediamine-bis(isa)
L ₃	PD	74.4			---	Propandiamine

Preparation of the complex[12].

- Preparation of complexes in a ratio of 1:2:1 ligand: metal:2 ligands

[L₁ or L₃: M₂, M₁: L₂]

1- The complexes were prepared from the reaction of standard solutions of metals in an ethanolic aqueous medium at a ratio of 2:2:1 and by taking standard weights of metal salts, whereby they are binary complexes of different metals, where zinc and

iron salts were used, and iron was used in the form of aqueous iron chloride $\text{FeCl}_2 \cdot 4\text{H}_2\text{O}$ and zinc in the form of $\text{Zn}(\text{CH}_3\text{COO})_2$, although it was better to use chloride, but due to its unavailability, acetate salt was used.

2- Salt solutions were used with equal amounts of ligands dissolved in absolute ethanol, where they were mixed, then heated up for three hours until the color stabilized. The precipitate was formed, left

until the second day and ethanol was added to the mixture. Then it is left to settle and the precipitate is formed, which is dark red in color, is filtered and washed with cold methanol and ether and dried, and then recrystallized with absolute ethanol. This method was applied in preparing the rest of the complexes when using cadmium salt with iron salt, as well as cobalt with iron. The following equations show the preparation:



where $\text{L}_1 = \text{I}_2\text{ED}$, $\text{L}_2 = \text{I}_2\text{PD}$, $\text{L}_3 = \text{PD}$, $(\text{CH}_3\text{COO})_2$, $\text{M}_1 = \text{Zn}$, and $\text{M}_2 = \text{Fe}$, and $\text{M}_3 = \text{Co}$ or Cd

Table 2: Expected formulas and a number of physical properties of the prepared complexes.

complex number	salt formula	complex color	Theoretical molecular weight	percenta ge%	Complex formula
1	$\text{FeCl}_2 \cdot 4\text{H}_2\text{O}$ $\text{Zn}(\text{CH}_3\text{COO})_2$	reddish brown	712.70	% 83	$[\text{FeCl}_2(\text{L}_3)(\text{L}_1)\text{Zn}](\text{CH}_3\text{COO})_2$ $\text{C}_{16}\text{H}_{28}\text{Cl}_2\text{FeN}_6\text{O}_6\text{Zn}$
2	$\text{FeCl}_2 \cdot 4\text{H}_2\text{O}$ CdCl_2	Brown	716.50	% 79	$[\text{FeCl}_2(\text{L}_3)(\text{L}_1)\text{CdCl}_2]$ $\text{C}_{21}\text{H}_{22}\text{CdCl}_4\text{FeN}_6\text{O}_3$
3	$\text{CoCl}_3 \cdot 6\text{H}_2\text{O}$ $\text{Zn}(\text{CH}_3\text{COO})_2$	light brown	702.30	86%	$[\text{CoCl}(\text{H}_2\text{O})(\text{L}_3)(\text{L}_1)\text{Zn}](\text{CH}_3\text{COO})_2$ $\text{C}_{25}\text{H}_{30}\text{ClCoN}_6\text{O}_8\text{Zn}$
4	$\text{CoCl}_3 \cdot 6\text{H}_2\text{O}$ CdCl_2	reddish brown	702.20	% 81	$[\text{CoCl}(\text{H}_2\text{O})(\text{L}_3)(\text{L}_1)\text{CdCl}_2]$ $\text{C}_{21}\text{H}_{24}\text{CdCl}_3\text{CoN}_6\text{O}_4$
5	$\text{FeCl}_2 \cdot 4\text{H}_2\text{O}$ $\text{Zn}(\text{CH}_3\text{COO})_2$	Brown	714.70	% 85	$[\text{FeCl}_2(\text{L}_3)(\text{L}_2)\text{Zn}](\text{CH}_3\text{COO})_2$ $\text{C}_{26}\text{H}_{30}\text{Cl}_2\text{FeN}_6\text{O}_6\text{Zn}$
6	$\text{FeCl}_2 \cdot 4\text{H}_2\text{O}$ CdCl_2	Brown	714.50	87%	$[\text{FeCl}_2(\text{L}_3)(\text{L}_2)\text{CdCl}_2]$ $\text{C}_{22}\text{H}_{24}\text{CdCl}_4\text{FeN}_6\text{O}_2$
7	$\text{CoCl}_3 \cdot 6\text{H}_2\text{O}$ $\text{Zn}(\text{CH}_3\text{COO})_2$	light brown	717.80	% 70	$[\text{CoCl}(\text{H}_2\text{O})(\text{L}_3)(\text{L}_2)\text{Zn}](\text{CH}_3\text{COO})_2$ $\text{C}_{26}\text{H}_{30}\text{Cl}_2\text{CoN}_6\text{O}_6\text{Zn}$
8	$\text{CoCl}_3 \cdot 6\text{H}_2\text{O}$ CdCl_2	reddish brown	717.60	% 72	$[\text{CoCl}(\text{H}_2\text{O})(\text{L}_3)(\text{L}_2)\text{CdCl}_2]$ $\text{C}_{22}\text{H}_{24}\text{CdCl}_4\text{CoN}_6\text{O}_2$

Physical, Analytical and Spectral Measurements

Analytical Measurements

The elemental analysis (C.H.N.) of the prepared ligands and complexes were carried out, using the (Elementar el III) device of American origin. The amount of metals for the complexes was estimated using the EuroEA Elemental Analyzer, the type of the Euro EA 3000/Italy device. It was measured in the laboratories of the College of Education for Pure Sciences / Ibn Al-Haytham / University of Baghdad.

The degree of melting, conductivity and magnetism of the complexes prepared in the laboratories of the Department of Chemistry / College of Education for Pure Sciences / University of Mosul was measured using (Electro thermal

TA9100 melting point apparatus) type (SMP30) (not corrected) supplied by the British company (STUART) and with an electro thermal fusion device 9300 and a (Richert- Jung Heiz bank (WME), * The molar electrical conductivity was measured using the electrical conductivity device (Start-cr3100c) using dimethylformamide (DMF) at a concentration of (10-3 M) at a temperature of 25°C. In the Department of Chemistry - College of Education for Pure Sciences - University of Tikrit * The magnetic susceptibility of the prepared complexes was measured using a Magnetic susceptibility balance device imported from (Sherwood scientific MK1) company (Cambridge, UK) in the Department of Chemistry - College of Education for Pure Sciences - University of Tikrit.

Spectral measurement:

The electronic spectra of the prepared compounds were measured using a (Spectrometer (V-530) Jasco UV-Vis) device using a dimethylformamide (DMF) solvent at a concentration of (10^{-3} M) in the laboratories of the College of Education for Pure Sciences / University of Mosul, * Infrared spectra were measured. for all compounds prepared using infrared device (FTIR-8400) by (SHIMADZ) company with a range (400-4000 cm^{-1}) by crushing the sample and pressing it in the form of tablets with KBr, the measurement was taken in the central laboratories - College of Education for Pure Sciences / Ibn al-Haytham / University of Baghdad.

As for the Xrd diffraction measurement using a device type (America Q600 / PANalytical / Philips CM120 / ICON. Bruker.. It was carried out in the central laboratories of the College of Education for Pure Sciences / Ibn Al-Haytham / University of Baghdad.

Results and discussion

Based on the analytical results that included the determination of the amount of divalent metals (II) and the analysis of microelements, the analytical results proved that the amount of metals and the amount of carbon, hydrogen and nitrogen listed in the table (3) were in agreement with the proposed formulas for the complexes.

Table 3: Percentages of elements in complexes.

	%C (practical) theoretical	%H (practical) theoretical	%N (practical) theoretical	%Zn (practical) theoretical	%Fe (practical) theoretical	%Co (practical) theoretical	%Cd (practical) theoretical
1.	43.52 43.82	3.75 3.96	11.96 11.79	9.30 9.17	7.75 7.84	—	—
2.	35.20 35.15	3.15 3.10	11.69 11.73	—	7.75 7.79	—	15.71 15.69
3.	42.69 42.76	4.29 4.31	11.89 11.97	—	—	8.19 8.39	—
4.	35.10 35.93	3.22 3.45	11.77 11.97	9.50 9.31	—	8.19 8.39	16.21 16.01
5.	43.35 43.70	4.11 4.23	11.51 11.76	—	7.41 7.81	—	—
6.	36.40 36.98	3.15 3.30	11.45 11.76	—	7.41 7.82	—	15.62 15.73
7.	43.12 43.51	4.02 4.21	11.55 11.71	9.81 9.11	—	8.62 8.21	—
8.	36.62 36.82	3.11 3.37	11.44 11.71	—	—	8.52 8.21	15.12 15.66

Depending on the results of the analysis and the molar percentage of the reaction 2:2:1 (Legand: Metal: Metal: Legand: Legand) in the preparation of the complexes, which produced stable colored solids with a positive dipole charge (+2), the molar electrical conductivity of the prepared complexes was measured at concentration (10^{-3} mol) and using dimethylformamide at laboratory temperature, and it was found that the molar conductivity agrees with the expected structural formulas for the prepared complexes, as it appeared within the range of the class of complexes with non-electrolytic neutral behavior meaning that they are weak electrical conductivity and that the conductivity ratio It is 1:2,

and the purpose of measuring molar electrical conductivity in suitable solvents is to derive the ionic formula of the complex in solution. The magnetic results of the iron (II) prepared complexes in a ratio of 2:2:1 showed the values of the magnetic moment between (3.07 - 2.80) BM, which indicates that the ion is five-symmetric, which is due to the presence of two single electrons in the orbitals, d_{xy} and d_{z^2} , which confirms that the values of these complexes are in agreement with the magnetic moments of iron (II) pentagonal complexes of square hierarchical geometry and having a d^6 system[13]. As for the cobalt (II) complexes prepared in a ratio of 2:2:1, their magnetic moment values are between (4.06 -

3.83) BM. These complexes have a highly twisted d7 level $t_{2g} e_g$. These values prove that the cobalt system where three electrons are arranged in the outer complexes possess octahedral structure [14,15].

Table 4: A Number of physical properties of the prepared complexes.

	complex formula	M _{eff} (B.M)	Λ _m	melting or dissociation point
1	[FeCl ₂ (L ₃)(L ₁)Zn](CH ₃ COO) ₂	2.80	50	242d
2	[FeCl ₂ (L ₃)(L ₁)CdCl ₂]	2.93	53	252d
3	[CoCl(H ₂ O)(L ₃)(L ₁)Zn](CH ₃ COO) ₂	4.05	48	240d
4	[CoCl(H ₂ O)(L ₃)(L ₁)CdCl ₂]	3.97	45	243d
5	[FeCl ₂ (L ₃)(L ₂)Zn](CH ₃ COO) ₂	2.81	51	250d
6	[FeCl ₂ (L ₃)(L ₂)CdCl ₂]	2.97	51	248d
7	[CoCl(H ₂ O)(L ₃)(L ₂)Zn](CH ₃ COO) ₂	3.00	44	230d
8	[CoCl(H ₂ O)(L ₃)(L ₂)CdCl ₂]	3.83	49	250d

Λ_m = molar conductivity, M_{eff} = effective magnetic moment.

The electronic spectra of the prepared five-coordination iron (II) complexes were studied. A bundle appeared at the site (9011,4 – 25906,7 cm⁻¹), which indicates the occurrence of a d-d transition[16]

at(32051,2 – 3333,3 cm⁻¹) and to the charge transfer (CT) bundle of the five-coordinate iron (II) complexes with a square pyramid arrangement. , as in the table(5).

Table 5: Electronic spectra of five-coordination iron (II) complexes using DMF.

complex number	d- d (cm ⁻¹)	C. T (cm ⁻¹)
1	19157.01	32894.70
2	25906.70	33333.30
5	19230.70	32051.20
6	19011.40	32894.70

As for the prepared hexagonal cobalt (II) complexes, the results of the electronic spectrometry showed the presence of absorption bands in the region (9032.1 - 10753.4cm⁻¹) due to transmission (v_1) and absorption band in the region (12133.36 - 15354.2 cm⁻¹) due to transmission (v_2) As for the

beam that appeared in the region (21975.6 - 22584.9 cm⁻¹), it goes back to the transition (v_3), where the locations of these beams prove that the octahedral cobalt complexes are highly twisted[17,18] As in the table (6).

Table 6: Electronic spectrum of hexa-symmetric cobalt(II) complexes using a DMF solvent.

complex number	V ₁ (cm ⁻¹)	V ₂ (cm ⁻¹)	V ₃ (cm ⁻¹)	C. T (cm ⁻¹)
3	9032.1	12133.36	22084.9	33112.58
4	9727.3	15354.2	22584.9	33333.3
7	10753.4	14164.3	21987.01	331125.83
8	10602.3	14771.1	21975.6	331125.83

It showed wide bands at the region (-14.00 cm^{-1} 18.00), which is attributed to the gathering of the two electron transitions in the form of one band to converge its location.

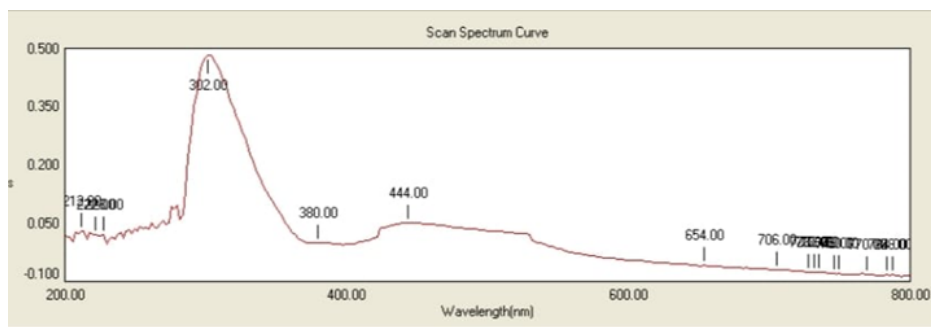


Fig.3. The electronic spectrum of the complex No.(7).

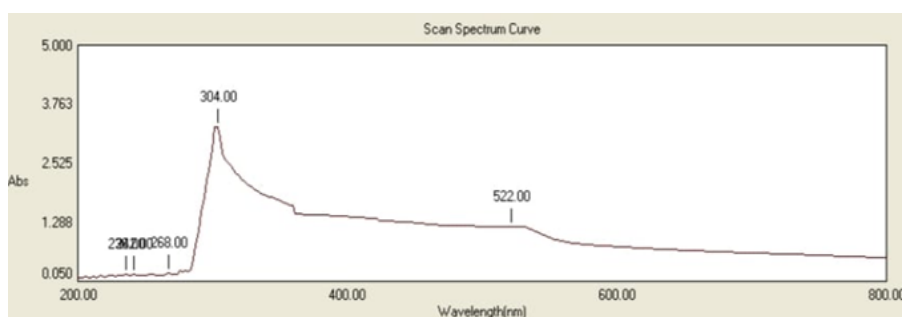


Fig.4. The electronic spectrum of the complex No.(1).

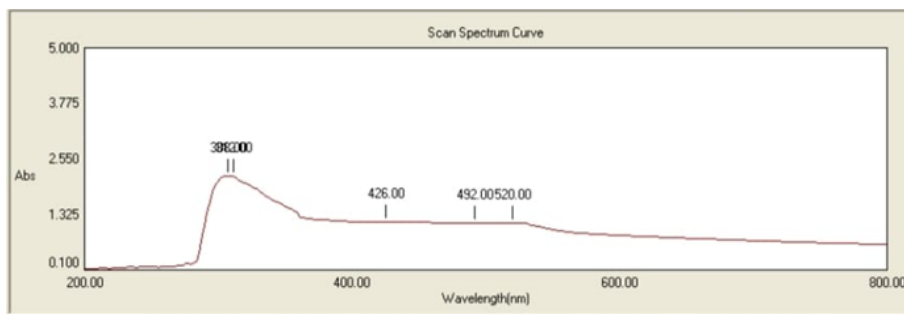


Fig.5. The electronic spectrum of the complex No.(5).

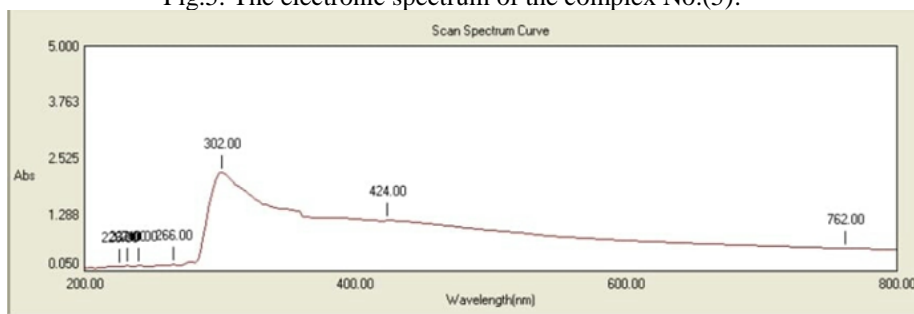


Fig.6. The electronic spectrum of the complex No.(3).

The (IR) spectra of the ligands L₁, L₂, L₃ and their complexes were recorded in the range (400-4000 cm⁻¹). The table (7) shows the values of the relevant bands and their locations in these spectra, as the coordination sites of the ligand molecules were studied and the bonds between the metal-ligand were studied by the location of the frequency bands of IR. For free ligands with complexes. Where the vibrations of the isomethane group (C = N -) appeared in the confined area between (1680-1590 cm⁻¹) when hydrogen or alkyl group binds to the isomethane group, it affects the vibrations of this group, as the nature of the compensators determines the location of the elastic frequency of this group. Bundles of Schiff base complexes derived from isatine appeared in the region between (1619-1608 cm⁻¹) [19] where the values were shifted towards lower frequencies by (8-52 cm⁻¹) due to the weakness that occurs in the double bond property of the isomethane group (C = N -) at consistency and this is consistent with what was published in the literature and research. As for the vibrations of the carbonyl group (C=O) and (C-O⁻) are located in the region (1700-1690 cm⁻¹) and (1739 - 1715 cm⁻¹) this bands appeared in the ligands It is in a tautomeric state . When preparing the complexes of these ligands , it was found that they interact with the metalion in the form of enol, and this was inferred by the disappearance of the (C = O) band and the appearance of a new band in the range range (1385-1301 cm⁻¹) is a (C - O⁻) , which indicates the occurrence of symmetry[20]. And the frequency

vibrations of the N-H group and C = N in the indol ring, it was observed that there were stretching bands at (3282 - 3183 cm⁻¹) due to the frequency of the NH bond belonging to the indol ring in The isatin and the appearance of the beam in this range is consistent with the published values in the literature on this type of ligand[21-22].

When forming complexes, the disappearance of the band was observed due to the interaction of the ligands with the metal ion in the form of enol, and a new band appeared in the range (1599 - 1457 cm⁻¹) due to the frequency of the C=N bond in the indole ring formed as a result of the proton departure. As for the vibrations of a group M - OH₂ and H₂O Stretch bands (H₂O) appeared in the area (3448 - 3342 cm⁻¹), while the bending and stretching bands appeared in the regin (908 - 824 cm⁻¹), (777 - 720 cm⁻¹), respectively. As for the vibrations of the M-O, M-N, and M-Cl groups, new bands that are not present in the ligands belonging to the M-O and M-N bonds were observed in the infrared spectra of the complexes prepared in the region (590-491 cm⁻¹) and (490 - 415 cm⁻¹) respectively. This agrees with other published results .The carboxyl group appears in the coordination ball, where the two acetate molecules remain with the metal and it is within the form of the complex in samples 1,3,5and 7 as it appears in the range between (1462 - 1466 cm⁻¹). The M-Cl is band less, it did not appear because it is outside the range of the measurement[23,25]Table (7) shows the apparent values from the measurement:

Table 7: Results of the IR spectrum of ligands and complexes (cm⁻¹).

Compl ex number	ν C=N (cm ⁻¹)	ν C=N (cm ⁻¹) (Indol ring)	ν N-H (cm ⁻¹) (Indol ring)	ν C=O (cm ⁻¹) (isatine)	Ac ν CO _{2as}	M - OH ₂ (cm ⁻¹)	M - O (cm ⁻¹)	M - N (cm ⁻¹)
1	1709	1614	3265	1385	1462	-----	577	492
2	1670	1612	3282	1363		-----	500	465
3	1649	1614	3267	1340	1462	3429	515	457
4	1660	1612	3276	1361		3440	575	467
5	1618	1587	3246	1331	1468	-----	569	463
6	1672	1612	3248	1356		-----	569	492
7	1666	1612	3230	1350	1466	3448	525	461
8	1618	1579	3183	1333		3415	534	496

XRD technique is used to characterize the crystal structure of unknown materials, The results of our research are as follows : Compound 1 showed high and medium intensity bands in the diffraction spectrum within the range 10-50, which indicates the

presence of a crystal structure of the compound, as well as the wide bands i.e. high FWHM (Full Width at Half Measurement)values indicate the small nanoparticles and high porosity of the complex, which was calculated by the spark equation above.

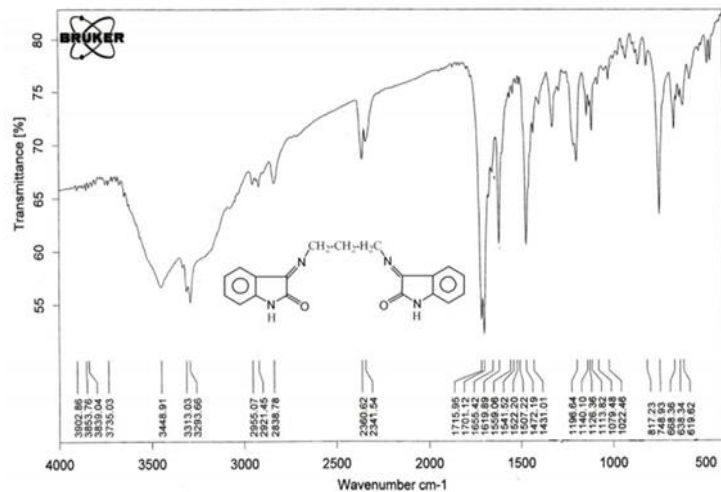


Fig.7. The IR spectrum of the Lykind (L1)

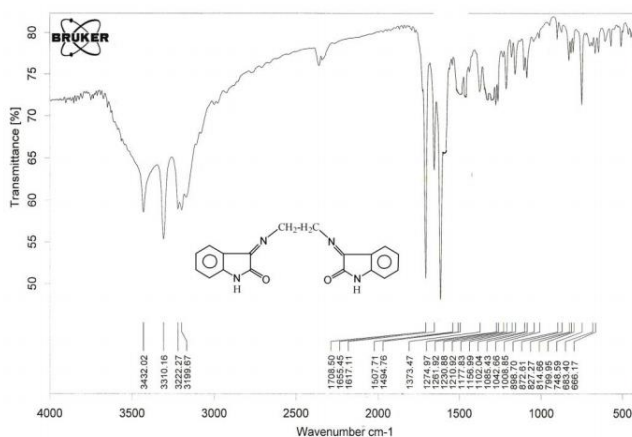
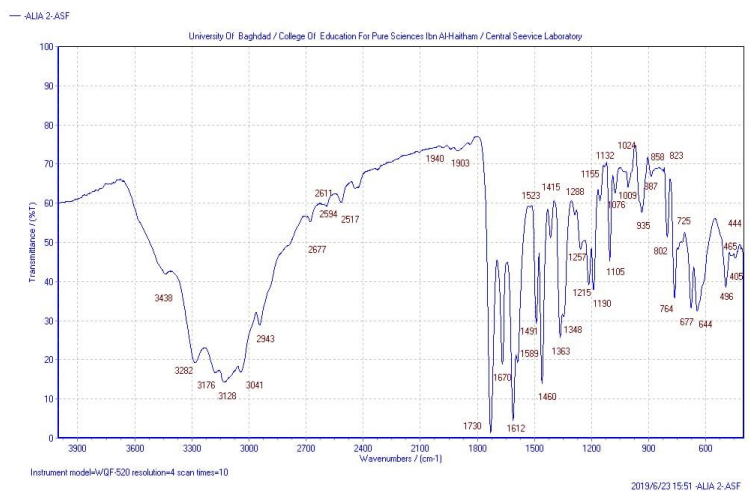
Fig.8. IR Liked Spectrum (L₂).

Fig.9. IR spectrum of complex No. (2)

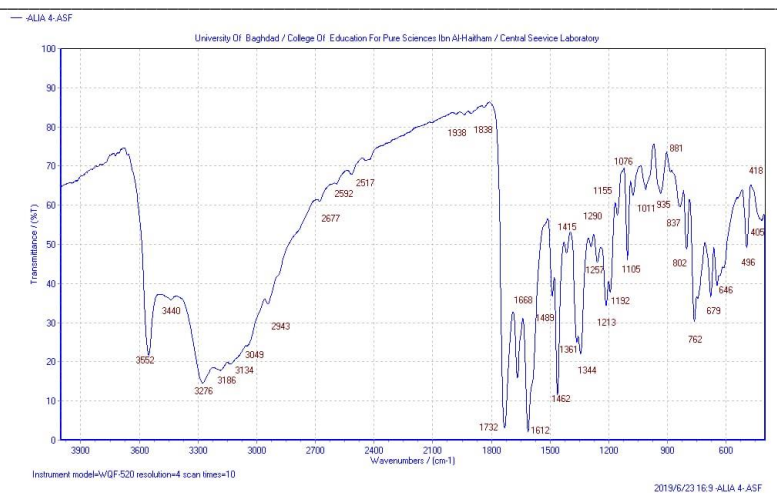


Fig.10. IR spectrum of complex No. (4)

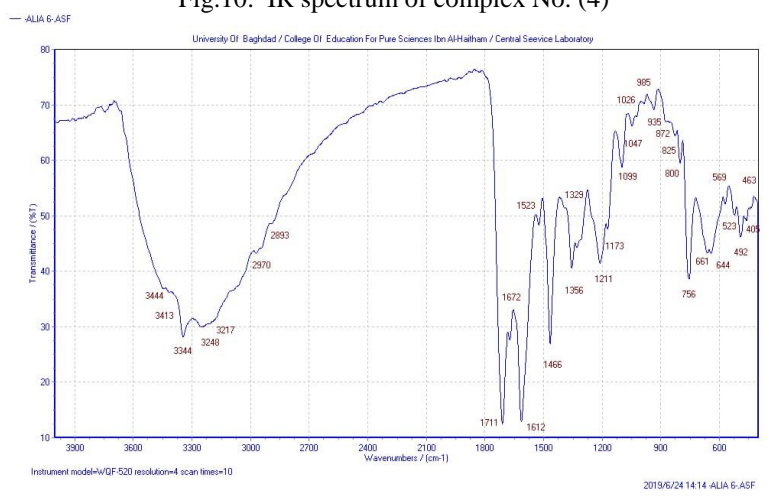


Fig.11. IR spectrum of complex No. (6)

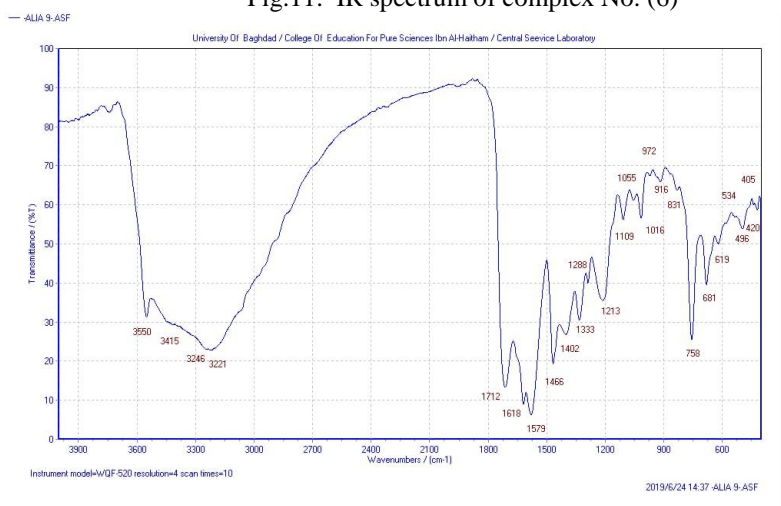


Fig.12. IR spectrum of complex No. (8)

The average minute size (D_{Avg}) is equal to (34.98nm), as for compound 2, the average minutesize was

calculated for it (29.52nm), while for compound 3, the average minute size was calculated by the same

method is (26.43652nm), and for compound 4 it was the calculated average minute size It is equal to (36.32297nm) and table (8) shows the data of the

diffraction spectra of the measured complexes, as well as the average volumes of the particles according to the Sharer equation[26-29].

Table 8: diffraction spectra data for the measured complexes

Complexes	D (nm)	d spacing	Intensity	FWHM	2 θ	Avg.D(nm)
Compound 1	59.39201	12.6828	16	0.14	6.966	34.9828
	92.49232	9.98944	16	0.09	8.845	
	20.31132	9.38153	100	0.41	9.419	
	18.93633	8.73487	31	0.44	10.118	
	36.77874	8.46975	38	0.23	10.436	
	29.77216	8.22016	19	0.28	10.754	
	20.90548	6.30368	47	0.40	14.038	
	9.096736	5.99063	63	0.92	14.775	
27.16014	4.57654	94	0.31	19.379		
Compound 2	21.90193	12.67916	16	0.38	8.560	29.52342
	34.73636	9.98944	16	0.24	10.830	
	16.3995	9.38153	100	0.51	14.210	
	26.14795	8.73487	31	0.32	14.600	
	44.17261	8.46975	38	0.19	17.100	
	20.04439	8.22016	19	0.42	19.300	
	36.87742	6.30368	47	0.23	23.800	
	40.62759	5.99062	63	0.21	26.800	
24.80303	4.57654	94	0.35	34.100		
Compound 3	39.7356	7.41422	19	0.21	11.900	26.43652
	16.06549	6.76855	96	0.52	13.100	
	33.45499	6.16757	22	0.25	14.210	
	32.23101	3.66485	17	0.26	15.900	
	26.47206	3.39075	100	0.32	23.100	
	30.30899	3.33144	37	0.28	24.100	
	17.39037	3.10772	36	0.49	26.200	
	25.20213	2.56321	31	0.34	28.800	
17.06802	2.54911	52	0.51	35.100		
Compound 4	26.07713	7.41422	19	0.32	11.920	36.32297
	37.97181	6.76855	96	0.22	13.070	
	34.85426	6.16757	22	0.24	14.350	
	47.16199	3.66485	17	0.18	24.270	
	36.76597	3.39075	100	0.23	26.260	
	20.31118	3.33144	37	0.42	26.740	
	43.93261	3.10772	36	0.19	28.700	
	43.50881	2.56321	31	0.20	34.980	
19.78763	2.54911	52	0.44	35.180		

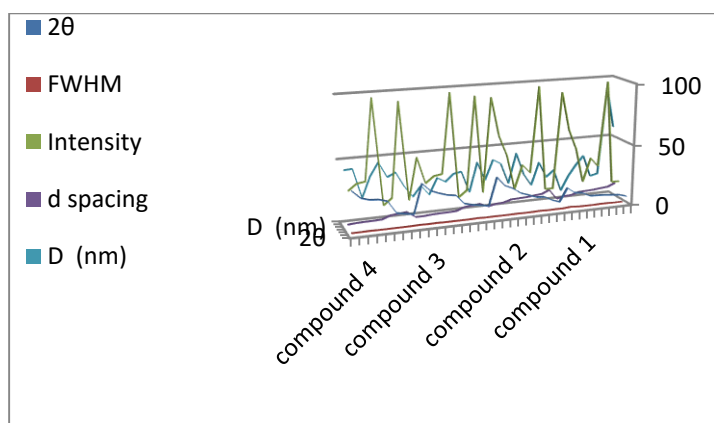


Fig.13.Scheme of the results of the X-ray spectrum for complexes

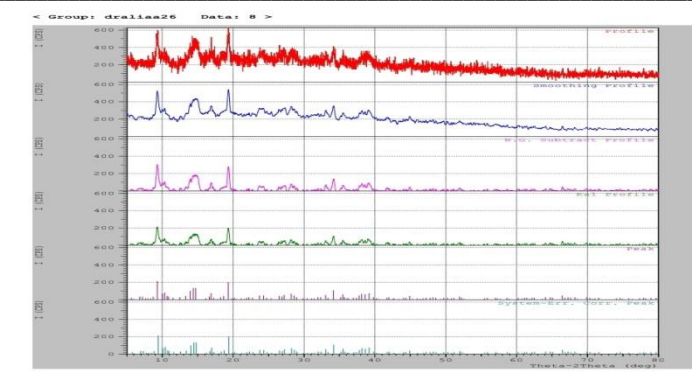


Fig.14.Scheme for X-ray measurement of the prepared complexes

Bio-efficacy assessment:

The results of evaluating the biological activity of the ligands and the complexes under study for a type of fungi, namely (*Candida albicans*) and (*Candida*

tropicalis), compared with a type of drug (Tindamax), where the prepared complexes showed a clear effect on this type of fungi, as in the results in Table No. (9). Pictures (1) and (2) illustrate this as well[30-33]

Table 9: The results of the inhibitory effect of the prepared complexes on fungi

Sample	<i>Candida tropicalis</i>				<i>Candida albicans</i>			
	62.5	125	250	500	62.5	125	250	500
1	13	14	14	15	18	9	10	12
2	15	15	15	15	22	-	7	11
3	16	16	16	19	23	17	13	10
4	14	14	16	16	16	10	11	15
5	15	18	18	18	13	10	10	15
6	10	10	11	15	21	10	8	8
7	21	15	12	10	20	19	10	10
8	23	16	16	14	20	15	15	10
Tindamax	20				20			



Picture No. (1)



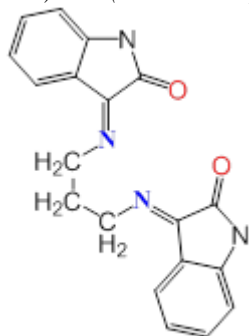
Picture No. (2)

Conclusions :

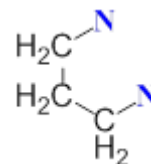
In this paper, the synthesis and coordination chemistry of some complexes derived from the

Schiff-base aisatin derivatives and aliphatic compound, The complexes were prepared by mixing at reflux 2 mmole of the Schiff-base ligand with 2

mmole of the appropriate metal chloride. Complexes of the general formulae $[M_2(L)_2]$ (where $M = Co^{II}$, Fe^{II} , Zn^{II} , Cd^{II}) was obtained. Physico-chemical analysis indicated the formation of four coordinate dicationic metal complexes. Biological activities revealed that the ligand has higher antifungal namely (*Candida albicans*) and (*Candida tropicalis*) activity

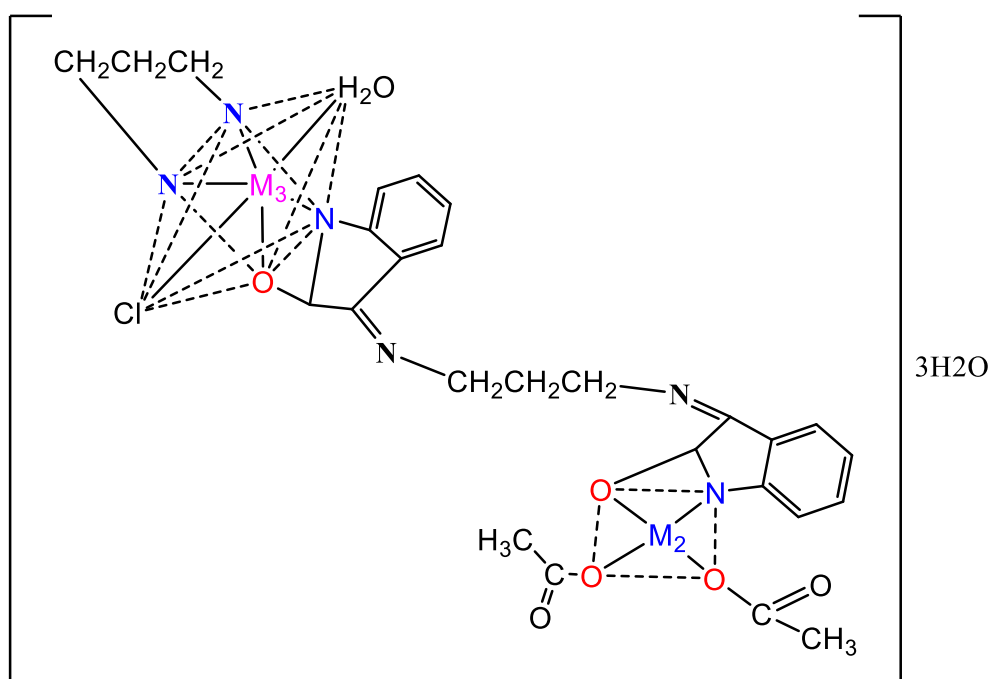


As for the aliphatic ligand diamine propane, it acts as a bi-dental as in the figure:



From this coordination with the metals, complexes with a square pyramid shape for iron (II) and a flat square for zinc (II) and cadmium (II) and also an octahedral shape of cobalt (II) were produced as in the figures below:

Where $Fe = M_1$ and $M_2 = Zn$ or Cd and $M_3 = Co$.



Some of these complexes proved to be biologically active for the fungi (*Candida albicans*) and (*Candida tropicalis*) compared to the antibiotic Tindazole (Tindamax).

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tropicalis) compared to the antibiotic Tindazole (Tindamax).

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