Synthesis, Characterization and Biological Activity of Heterocyclic Azo-Schiff Base Ligand derived from 2-Amino-5-methyl thiazol and some Transition Metal Ions

Khalid Jawad Al-Adilee¹ and Sarah Riyadh Hasan²

¹ Department of Chemistry, College of Science, University of Al-Qadisiya, Iraq. Email: khalid.jawad@qu.edu.iq
² Chemistry Department College of Education University of Al-Qadisiya, Iraq. Email: sarahriad68@gmail.com.

Abstract:
A new dye with a heterocyclic azo-Schiff base has been produced. synthesized is being studied 5-(((E)-4-(dimethylamino)benzylidene)amino)-2-((E)-(5-methylthiazol-2-yl)diazenyl)phenol (LH) from reaction of 2-amino-5-methyl thiazole with (dimethylamino)benzaldehyde, 3-amino phenol .Azo-Schiff base ligand reacted and including some metal ions, such as Fe(II), Co (III), Ni(II) forming chelates complex. They characterized by various analytical techniques like UV-Visb, H¹-NMR, ¹³C-NMR spectroscopic, Molar conductance, FT-IR, Mass spectra, X-ray and FESEM elemental analysis also, The mole ratio, according to spectral tests, is [M:L] for complexes was [1:2]. This study also included the biological activity in the case of sensitive species Antibacterials include Escherichia coli (gram negative), Streptococcus (gram positive), and Penicillium (fungal). It has been noticed that some complexes are very effective against. Azo ligand and Co(III) Complex show cytotoxis action against human Breast cancer cell line. The findings suggested that it could be used as an anti-cancer drug in medicine and pharmacy.

1. Introduction
Schiff base and coordination complexes have obtained importance lately because of the applications like biological activity, analytical chemistry, antibacterial, antifungal⁴, and anticancer⁵,⁶. Azo Schiff bases consisting of the reaction of aromatic aldehydes and aromatic or aliphatic amines represent in important series of extensive studies organic ligands⁵. This compounds with transition metal ions are importance because of complexing, biological properties, catalytic⁶,⁷, and give inhabitation⁸ in acid medium⁹. Due to the obvious stability and biological activity of Schiff base metal complexes, (10), analytical (11,12), and oxidation catalysis applications (13). Because of the important applications in dyes and polymers, The focus of research has been on Schiff base complexes with nitrogen and other atoms as donors: chemical synthesis (14). Azo Schiff bases are studied because of their selectivity, sensitivity, as well as, the presence of an azomethine group, which aids in the discovery of biological, and chemical transformation mechanisms reactions.(15). In this work, We have an account of the preparation. and characterization of a new ligand base Schiff [5 - ((E)-4-(dimethylamino) benzylidene) amino] -2 - ((E) - (5-methylthiazol-2-yl) diazenyl (phenol)]( LH) and its complexes Fe (II), Co (III) and Ni (II) ions, is described biological activities(13) (antibacterial as Escherichia coli, streptococcus and antifungal such
asenicillium sp ). The ligand Schiff- base and Co (III) In vitro, anticancer function of a complex against human, breast cancer MCF7 was tested using the MTT assay.

Experimental

1.1. Measurement and materials

Chemicals and solvents, were purchased from developers as BDH, Fluk, and Aldrich and were of the highest purity. Elemental analysis C.H.N.S elementa analyzer, was used to should get elemental analysis (C.H.N.S). FT-IR spectra of the ligand and complexes were reported as KBr discs in the range (400-4000)cm⁻¹ on a FT-IR Shimadzu model 8400S Teast scan In a PerkinElmer (double beam UV-VIS spectrometer), electronic spectra were collected. for 10⁻⁵ M solution of the ligand and its complexes in absolute ethanol at 25°C using 1 cm quartz cell. The (¹H-NMR) for the prepared ligand was carried out using shimadzu flame atomic absorption model; AA-160. Melting point Electro thermal measurements were taken. meting point 9300, Bucker 500 mhz to NMR, Directprobe electron impact agilent 5973 mass spectrometer, XRD Siemens model D500, FESEM Oxford instruments model SEM S-3200N

1.2. Azo – Schiff Base Ligand Synthesis (LH)

The Azo-schiff base ligand (LH) was provided in a unique way by the researcher. Al-Adilee et al. (16), with some modifications in a two-phase phase as shown below. The 2-amino-5-methylthiazole 1.4 gm (0.01 mol), was gradually dissolved in a mixture of 5 mL concentrated hydrochloric acid and 35 mL distilled water (scheme 1), cooing and stirring until the temperature (0-5) °C, was reached, and diazotized below 5°C with a solution of sodium nitrite NaNO₂ 1 gm (0.01 mol) dissolved in 25 mL distilled. The diazonium chloride compound was then mixed with 3-amino phenol in alkaline media. The temperature is 5 degrees Celsius. The pH degree, The value was held between 6-7 during the coupling, and the coupling to the 3-amino phenol, took place in simple media. The ligand (LH) was synthesized using a known condensation, method at the para-position to the amine group to produce Azo compound in the second step, while the ligand, To make Azo compound, (LH) was synthesized using, a well-known para-position condensation method, for the amine group. Azo compound is synthesized, using a well-known condensation method, at the para-position to the amine group. Around 1.2 g of (Azo compound) in (absolute- ethanol) (25 ml) was applied, drop-wise to a hot absolute- ethanol (50 ml) solution of 4-(dimethylamino)benzaldehyde 1 g (0.01 mol), with a few drops of glacial acetic acid, as a catalyst (Scheme-1). At 80°C, the solution was slowly, refluxed and stirred for 6-8 hours. The solid product was filtered, and washed several times, with cold distilled water before, being dried in vacuum for several hours and recrystallized twice, from hot ethanol to yield red crystals coloured powder., which was then washed, over anhydrous calcium chloride, in a desiccator 82% yield; m.p. 157 °C The techniques of element analysis, and thin layer chromatography (TLC) were It's a measure to see if anything is pure. ¹H-NMR, mass spectra, IR, and UV-visb. spectra were used to deduce, the structure of the Azo schiff base ligand (LH). The ligand's structure (LH) is shown below.
3

Scheme(1):- preparation of new azo-Schiff base ligand (LH)

1.3. Synthesis of Metal Complexes

The ligand LH 0.388 g (0.01Mol) was dissolved in 50 ml ethanol. The mixture was then refluxed for 60 minutes. But Fe(II),Co(III),Ni(II) The complexes were made by dissolving correct metal salts (0.01g in 15 ml hot buffer) in a solution. (ammonium acetate) at PH=7.0 for each metal ion in an LH solution (0.01mol, in 25 mL absolute ethanol). The resulting solutions were refluxed for 1 hour before being reduced to half their original volume by evaporation. The precipitate was extracted out, washed with distilled water, and washed with 5 mL ethanol before being dried in the air to eliminate any traces of unreacted items.

2. Results and Discussion

2.1. Physical and chemical properties of Schiff Base ligand(LH)

The Azo- Schiff base ligand(LH) is dark purplish However, depending on the metal ions, crystals display the prepared complexes for this ligand color. The Schiff base ligand (LH) and its complexes are insoluble in water but soluble in ethanol, acetone, DMSO, and methanol at room temperature. The ligand's physical and chemical properties, In addition to its 82% yield, m.p., color, molecular formula, M.wt and element analysis data (C.H.N.S) are described below. Table 1 lists the awards as follows:

Table (1):- Physical properties and elemental analysis occur for the ligand (LH) and its metal complexes.
3.2. \( ^1H \)-NMR Spectra

Ligand (LH) was diagnosed using the proton NMR, \( ^1H \)-NMR spectrum technique using d6-DMSO as a solvent and TMS was used as a standard reference (14). The spectrum of the \( ^1H \)-NMR proton of the ligand showed a single beam at the chemical displacement \( \delta = 2.43 \) ppm, which is due to the presence of the methylation group at the 6 site of the thiazole ring, and as the one beam at the chemical displacement \( \delta = 2.50 \) ppm, as it is due to the presence of the two methylation groups at the sites 25 and 26 in the aromatic ring. As for the multi-beam at the chemical displacement \( \delta = 6.07-6.22 \) ppm, it returns to the aromatic ring proton at sites 13 and 11, and multiple beams appeared from the chemical displacement \( \delta = 6.38-6.36 \) ppm which belong to the aromatic ring protons at sites 20 and 22, as well as a single beam appeared at the chemical displacement \( \delta = 6.77 \) ppm, it returns to the proton of the thiazole ring at position 4, as the spectrum showed a single beam at the chemical displacement \( \delta = 7.09 \) ppm that returns to the proton of the aromatic ring at position 10, and the two mono beams at the chemical displacement \( \delta = 7.41-7.39 \) ppm which belongs to the two protons of the aromatic ring at sites 19 and 23, respectively, while the single beam at the chemical displacement \( \delta = 7.69 \) ppm belongs to the proton of the azomethene group \( N=CH \) at position 17. The spectrum also showed a single beam at the chemical displacement \( \delta = 9.66 \) ppm that belongs to the protons of the hydroxyl group in the aromatic ring at site 15, while the spectrum showed bands at the chemical displacement \( \delta = 3.04 \) ppm related to the
protons of the solvent DMSO-d6. Figure (1) illustrates a spectrum. Proton for Ligand NMR (LH).

Fig. (1): $^1$H-NMR spectrum of Schiff base ligand (LH)

3.3. $^{13}$C-NMR Spectra

Multiple signals appeared at the following chemical displacements of LH (12.35) = C$^{13}$, 39.36, 98.44, 109.75, 111.06, 119.64, 131.51, 132.71, 140.19, 150.95, 157.16, 158.12, 164.96 ppm) due to the carbon atoms in the sites, (6, 25). And 26, 9, 13, 11, 22 and 20, 19 and 23, 5, 4, 12, 14, 2, 17) respectively. Moreover, Also observable on the spectrum was a single solvent signal (DMSO) at the chemical displacement C$^{13}$ = (40.04-39.04) ppm. Fig. (2) C$^{13}$-NMR illustrates the base-flux (LH).
3.4. **Mole ratio [Metal: Ligand] ratio**

When concentration and wavelength limit (max) for metal ion and amount increasing of Schiff base ligand solution, the metal complexes solutions color working increasing strength, ratio [M:L] and continuous color stability indicates configuration the metal complexes were tested spectrophotometrically by mole ratio process. Each metal complex's suggested molar ratio [M:L] [1:2] \(^{19}\).

3.5. **Measuring molar conductivity**

The metal complexes' ionic feature can determine from the data conductivity, that the values fit with the ionic species in solutions\(^{20}\). It was also used ethanol as a solvent and table (2) included of results.

**Table (2): Metal ions, maximum wavelength (\(\lambda_{max}\)), values of stability constants (and ( Log \(\beta\)), and molar conductivity of metal complexes.**

| LH \(\lambda_{max} = 484\text{nm}\) | Metal ion | Optimal Conc. \(10^{-4}\) | \(\lambda_{max}\) (nm) | \(\beta\) \(L^2\cdot\text{M}^{-2}\) | Log \(\beta\) | MolarCond. \(S\cdot\text{cm}^{-1}\cdot\text{mol}^{-1}\) |
|---|---|---|---|---|---|---|
| Fe(II) | 1.75 | 486 | 2.37 \times 10^8 | 8.37 | 9.87 |
Mass spectrum

The Azo Schiff-base ligand's mass spectrum (LH) and Ni-complex is on view, schemes 2 and 3 with figures 3 and 4, the molecular ion peak $m/z^+ = 368.4$, while the molecular weight of a ligand is (365.46). The Ni-complex chelate, $[\text{Ni(L)}_2]\text{H}_2\text{O}$, its molecular ion peak $m/z^+ = 805.632$. The result is very near to the molecular formulae. (21)

Figure 3: Azo-Schiff base ligand mass spectrum (LH).
3.7. Infrared spectra of Schiff base

**Scheme (2): Schiff base ligand fragmentation in mass spectrum (LH)**

**Scheme (3): Fragmentation of the Ni(II)-complex mass spectrum.**
The IR spectra of Azo- Schiff base, ligands (LH) and metal complexes containing, Fe(II), Co(III), and Ni(II) metal ions are shown in Table 1. (3). Due to the presence of a hydroxyl group (OH), the IR spectrum of azo - Schiff base ligand displays a medium wide band around 3417.63 cm⁻¹. The IR several shifts aforesaid in, the form of the metal complexes band contrast with the free ligand in order to locate, the coordination sites that are involved in chelation (22,23). The IR spectra of Azo Schiff-base (LH) ligand and complexes in (cm⁻1) data are shown in Figures 5, 6, 7, and 8. The locations or intensities of, these bands were supposed to change during complex formation.

**Table 3:** The Schiff – base(LH) ligand and its complexes IR in(cm⁻1) info.

| Group  | Ligand (LH) | Fe(II) Complex | Co(III) Complex | Ni(II) complex |
|--------|-------------|----------------|-----------------|---------------|
| υ- OH  | 3417m.br    | 3332m.br       | 3379m.br        | 3363m.br      |
| υ- (CH₃)₂ | 2993,     | 2923w          | 2923w           | 2916w         |
| υ- (N-H)  | 3317m   | 3163s          | 3217m           | 3224m         |
| υ- (C=N) | 1589m    | 1589s          | 1596s           | 1604s         |
| υ- (N=N)  | 1488s  | 1481s          | 1473s           | 1465s         |
| υ- (C=Ph) | 1527,    | 1589s,        | 1596s,          | 1535s,        |
| υ- (C-S) Thia | 1240s   | 1296m         | 1249s           | 1211s         |
| υ- (C-N)Thia | 1164s | 1157s         | 1164s           | 1157s         |
| υ- (M-O) | ........  | 671w          | 538w            | 524w          |
| υ- (M-N) | ........  | 501w          | 525w            | 556w          |

*(H₂O) outside of sphere coordination, S=strong, m=medium, w=weak, br=broad

**Figure 5:** Schiff base ligand IR spectrum (LH)
Figure (6): Fe(II)-complex IR Spectrum

Figure (7): Co(III)-complex IR Spectrum

Figure (8): Ni(II)-complex IR Spectrum

3.8. Electronic spectroscopy measurements

Schiff – base ligand electronic spectrum (LH) and complexes , were dissolve in ethanol absolute solvent, UV- Vis. region 200-1100(nm) at room temperature table (4) and figure (9)[24]. The spectrum of , ligand Schiff –base (LH) showed a strong absorption, band at 479 nm (20876.83 cm⁻¹) to the azo group’s n→π*, transformation, (-N=N-) [25], and second group at 339 nm (29498.53cm⁻¹) (-C=N-) give transition of π→π*, the third group (-C=C-) at 207
nm (48309.18 cm−1) due to π→π* bond for aromatic ring of thiazole ring. This is within the spectrum of octahedral values, geometry The Fe(II)-complex has a formation spectrum of an octahedral geometry with the show three band centered at 491 nm (20366.60 cm−1), which may be assigned to 1A₁g → 1T₁g (ν₁) and 1A₁g → 1T₁g(ρ) ν at 338nm (29585.80 cm−1) while the third band located in 206 nm (48543.69 cm−1) is 1A₁g → 1T₁g(ρ) transition in and approximately octahedral environment d²sp³ [26]. For Co(III)-complex, the spectrum shows three band at 521 nm (19193.86 cm−1), 335 nm (29850.75 cm−1), 205 nm (48780.49 cm−1) due to 1A₂g → 1T₂g(ν₁), 1A₁g → 1T₁g(ν₂), 1A₁g → 1T₁g(ν₃) transition. In is reasonable to suggest, octahedral configuration and hybridization d²sp³(d²- low spin) (²Ni(II)-complex has The octahedral geometry is shown by three magnetic values. The data from the electronic spectrum at 532 nm there was one band (18796.99 cm-1) due to ³A₂g → ³T₂g transition, 341 nm (29325.51 cm-1) due to ³A₂g → ³T₁g(ν₁) and the third transition at 208 nm (48706.92 cm⁻¹) to ³A₂g → ³T₁g(ν₂). The electronic spectral effects of, the azo Schiff - base ligand (LH) And its metallic complexes.

Tab. (4):- Electronic spectra (nm and cm-1), magnetic moments, proposed geometry, and hybridization of metal complexes

| Comp. | λmax  (nm) | Absor. Bands(cm⁻¹) | Transitions | μeff (B.M) | Molar conductance (s.cm² mol⁻¹) | Geometry | Hybridization |
|-------|-----------|---------------------|-------------|-----------|---------------------------------|----------|---------------|
| Li4gand=LH | 479 | 20876.83 | n—π* | - | - | - | - |
| [Fe(L)₂].H₂O | 491 | 20366.60 | 1A₁g → 1T₁g | Dia | 9.87 | Octahedral | d² spt (Low spin) |
| [Co(L)₂]Cl.H₂O | 525 | 19193.86 | ³A₂g → ³T₂g | Dia | 76.18 | Octahedral | d²sp³ | (low spin) |
| [Ni(L)₂].H₂O | 532 | 18796.99 | tA₂g → tT₂g | 2.85 | 10.23 | Octahedral | spt d³ | (high spin) |
3.9. Diffraction study using X-rays

Schiff base ligand patterns are generated, by X-ray diffraction, or XRD. Table 5 and Figure 10 display the (LH) and metal complex. Sharp diffraction peaks at about $2\theta=50^\circ$–$80^\circ$ in .The pattern of the XRD of, the ligand (LH) and metal complex [Fe(L)$_2$]Cl.H$_2$O suggest Schiff-base ligand (LH) and complex. To be able to, observe Many structural properties, such as crystalline structure, crystalline size, dislocation density, and microstrains, are used to determine purity and defects in the crystalline structure, when converting the Schiff base ligand (LH) to metal complex. The Debye-Scherer equation was used to measure the crystalline size of the ligand (LH) and one metal.

$$D = \frac{k\lambda}{\beta \cos \theta}$$

The equation can be used to calculate dislocation density. (26):

$$\delta = \frac{1}{D^2}$$

where $D$ = average crystallite size, $\beta$ = line broadening in radians at half the maximum strength, where $k$ is the Blanks constant (0.891) , $\theta$ = Bragg angle, $\lambda$ = X-ray wavelength , $\delta$= Dislocation density.

Tab.(5 ):- Schiff–base ligand (LH) and Fe(II)-complex crystal data

| Compound       | No | $2\theta_{observed}$ (°) | $d_{observed}$ (Å) | I/Io (%) | FWHM | Crystallite size (nm) | Lattice strain | $\delta$X10$^{15}$ (lin m$^{-2}$) |
|----------------|----|--------------------------|---------------------|----------|------|----------------------|----------------|---------------------------------|
| Ligand=LH      | 1  | 10.203                   | 8.66250             | 100.00   | 0.071| 117.39               | 0.0035         | 7.25                           |
|                | 2  | 20.783                   | 4.27058             | 95.08    | 0.111| 76.03                | 0.0026         | 0.172                          |
|                | 3  | 17.994                   | 4.92573             | 76.33    | 0.24 | 35.019               | 0.0066         | 0.815                          |
|                | 4  | 26.040                   | 3.41907             | 60.73    | 0.26 | 32.76                | 0.0049         | 0.931                          |
|      |    |    |    |    |    |
|------|----|----|----|----|----|
| 1    | 32.747680 | 2.73476 | 100.00 | 0.153504 | 56.36 |
| 2    | 26.751530 | 3.33254 | 52.71  | 0.307008 | 27.79 |
| 3    | 35.244560 | 2.54653 | 43.22  | 0.179088 | 48.63 |
| 4    | 31.798160 | 2.81422 | 31.70  | 0.102336 | 84.34 |
| 5    | 11.94    | 7.40448 | 23.06  | 0.4      | 20.86 |

**Figure ten: Schiff base ligand (LH) and its complex X-Ray diffraction spectra.**

### 3.10. Test that used a FESEM (Field-emission, Scanning Electron Microscope)

All metal complexes were used to characterize, the Schiff-base ligand(LH) surface in terms of particle size, structure, and aggregates. KX.FESEM micrographs of metal complexes, with a cross section of 1.44 m and a magnification force of Mag =100.00 demonstrate that modifying the metal ions affects the surface morphology of metal complexes. (27,28). The FESEM image of Schiff-base ligand(LH) reveals a heterogeneous crystalline surface, with an average size of (48.57)nm, while the FESEM image of Fe(II)-complex reveals a homogeneous crystalline surface, with an average size of (48.57)nm. spherical crystals of irregular form with an average size of 42.87nm,. The FESEM image of the Co(III) complex revealed tiny heterogeneous surface crystals, with an average size of (94.15)nm, while the FESEM image of, the Ni(II) complex revealed heterogeneous small parts, with an average size of (55.09)nm. Images from the FESEM As seen in the diagram below,, The grain size of the ligand and complexes is less than 100 nm, and the compounds inhibit both the ligand and the complexes. Figure 11 depicts ligand and metal complexes in cancers, including breast cancer.
Fig. (11): Shiff - base ligand (LH) and its complexes FESEM images
4. Pharmacology Study results

4.1. It's antibacterial as well as antifungal.

Agar diffusion was used to measure antibacterial activity. Two varieties of (Gram-positive Bacteria1) Streptococcus and (Gram-Negative Bacteria2) Escherichia coli were also used, as well as one type of fungus (Penicillium sp). At 32°C, DMSO is used as a solvent for 24 hours. Bacterial suspensions and fungi were prepared in sterile distilled water for the agar spread assay. As shown in the data in table (6) and figure (12), Schiff, base ligand (LH) and metal complexes, Fe(II), Co(III), and Ni(II).

Table (6):- Data on synthesis compounds' antimicrobial activity.

| Comp. No.         | Anti-bacterial Activity | Anti-fungal Activity |
|-------------------|-------------------------|----------------------|
|                   | Streptococcus | E.coli | Penicillium |
| Ligand = (LH)     | ++           | +++    | -          |
| [Fe(L1)2].H₂O     | -            | -      | -          |
| [CO(L1)2]Cl.H₂O   | ++           | -      | ++         |
| [Ni(L1)2].H₂O     | -            | -      | +          |

 (+++): very active (inhibition zone > 12 mm), (++): moderately active (inhibition zone=9-12 mm), (+): mildly active (inhibition zone=6-9 mm), (-): inactive.

Figure (12) :- Statistical representation of ligand (LH) biological activity in complexes that have been prepared.
4.2. Assays for cell viability and cytotoxicity

Chemotherapy is the most important method of treating metastatic cancer (32). The MTT assay was used to determine the viability of cells. At a concentration of 25 g/mL, the ligand (LH) inhibited breast cancer (MCF-7) the most (28.85 %), although normal cells showed no effect at some concentrations. The Co(III)-complex, on the other hand, showed the strongest inhibition of (MCF-7) to (37.23 %) at a concentration of 25 g/mL. At the same concentration, the normal cellular cell (WRL-68) had little effect. Table (7) and figures (13,14) display the effect of the ligand and metal–complex on (MCF-7) cells in a 24-hour MTT test at 37°C when compared to regular cells of the same concentration.

Table(7):- At 37°C, the ligand (LH) had the same effect on MCF-7 cells as the usual cell line at the same concentration in a (24-hour) MTT test.

| Concentration (μg/mL) | Ligand (LH) | Cancer line cells of MCF-7 | Normal line cells WRI-68 |
|-----------------------|-------------|---------------------------|--------------------------|
|                       |             | Mean (μg/mL)              | SD (μg/mL)               | Mean (μg/mL) | SD (μg/mL) |
| 25                    | 15.16375    | 1.044455                  | 37.85663                 | 6.442705     |
| 50                    | 2.871243    | 0.997134                  | 33.74454                 | 6.141961     |
| 100                   | 0.807537    | 0.396221                  | 12.1243                  | 1.027967     |
| 200                   | 0.493495    | 0.385928                  | 0.720675                 | 0.320057     |
| 400                   | 0.493495    | 1.100749                  | 0.932638                 | 0.893268     |

Figure 13: For ligand viability and inhibition, a comparison was made between carcinoma and natural cells (LH).
Figure 14: For Ni-complex, viability and inhibition in carcinoma and natural cells were compared.

Table (8): A (24-hour) MTT test at 37°C was used to compare the effect of the Co(III)-complex on MCF-7 cells to a control cell line at the same concentration.

| Con. (μg.mL⁻¹) | Co(III)-complex |
|----------------|----------------|
|                | Cancer line cells of MCF-7 | Normal line cells WRI-68 |
|                | Mean | SD   | Mean | SD   |
| 25             | 35.30731 | 4.342235 | 59.18013 | 1.590148 |
| 50             | 23.05967 | 1.6678 | 54.64411 | 1.273897 |
| 100            | 7.537012 | 1.98719 | 29.88681 | 1.086606 |
| 200            | 2.736653 | 1.106221 | 5.977362 | 2.206454 |
| 400            | 0.403769 | 1.157783 | 0.593497 | 0.264742 |

IC₅₀ This concentration, kills approximately half of the cells but in vitro ligand cytotoxicity (LH), as well as human cell lines MCF-7 (LH) observed cytotoxicity against cancer cell line in figures 15, 16. Moreover With IC₅₀ = 16.17 g/mL and WRI-68 IC₅₀ = 44.08 g/mL, Ni-complex showed, selective cytotoxicity against cancer cell lines. The discovery that the type of compound has a significant effect on, the rate at which cancerous and normal cell growth is inhibited.
Conclusions

This work used the Azo Schiff–base ligand, 5-(((E)-4-(dimethylamino)benzylidene)amino)-2-((E)-(5-methylthiazol-2-yl)diazenyl) phenol (LH) and The metal complexes Fe(II), Co(III), and Ni(II) ions were synthesized with spectral characterization in, this work by Azo Schiff. –ligand with a base Azo Schiff-base ligand(LH) and prepared complexes, were tested for antibacterial and antifungal activity. The ligand with metal complexes has biological activities against antifungal and antibacterial structures of Schiff -bae ligand(LH) and their metal complexes have been licensed elemental analysis and spectroscopic techniques. The biological function also behaves cells viability and cytotoxicity assays, to ligand (LH) and its Ni(II) complex using cancerous barest cells of the type MCF7 and compared to ordinary cells, via tests conducted. to identify the possibility of using the ligand and Ni(II) complex to treat certain cancerous diseases that affect humans.

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