

# Study Some New Metallic Coordination Complexes and their Antibacterial Activity Against Methicillin- Resistant *Staphylococcus Aureus*

Nevein Nasser Abotreek<sup>1</sup>, Mohammed Ahmed Awad<sup>2</sup>

<sup>1</sup>Post graduate, <sup>2</sup>Prof.Dr. Department of Chemistry, College of Education for Pure Sciences, University of Anbar, Anbar, Iraq

## Abstract

The ligands were prepared by condensing aldehydes with aromatic amines, then they were held together with Ruthenium element Ru (III) and gold Au (III). Spectroscopic studies were conducted on them and demonstrated that the gold complex was a good conductor opposite to the ruthenium complex depending on its molar conductivity value. The complex was described by measuring the spectrum of FT. IR (C. MASS JV-VISIBLE and C.H.N). From spectroscopic data, the octahedral geometry of the ruthenium and Square Berner complex has been proposed for the gold ligands nodes. Furthermore, ligands and complexes have been selected for the activity of the methicillin-resistant golden cluster bacterium and the study of gene expression, i.e., the impact of ingested substances on RNA bacteria (MAR).

**Keywords :** Complex , schiff base , MARS , ligand , coordination , staphylococcus , ruthenium .

## Introduction

Schiff's Base are of great chemical importance because they possess highly efficient ligands towards many ions, transition, and non-transition elements, and they are huge groups of metal-organic compounds. Besides, raw materials for the manufacture of heterogeneous ring compounds. (1) the Schiff Base Complex for Transition Metals contributes to multiple applications and in various fields, such as pharmaceutical medicine, industrial applications, organic creation, and biologic stimulation, as inhibitors against several types of bacteria and fungi. In the pharmaceutical field, it has been used as an anti-inflammatory. (2) anti-cancer, anti-

cramping, tuberculosis, and low blood pressure (3, 4) In the industrial area, they are used as anti-corrosion materials, polymerization catalysts, ink dyeing, and printing (5,6). The Schiff Base (imin compounds) consist of a condensate reaction of primary amines with aldehydes first prepared by the German scientist Schiff in 1864 and is distinguished by its containment of the effective isomethane group (C = N) and its formula (7) .

The efficacy and biological activity of isomethane complex are due to the correlation or hydrogen bonding between them and the transition elements, where the biological activity of the complex is enhanced and the cytotoxicity of each complex element is reduced (8).

## Expermental part

Chemicals, solvents, and salts of elements have been used according to the companies producing

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**Corresponding author:**

Nevein Nasser Abotreek

mail : nev19u4006@uoanbar.edu.iq

them. All materials used are high purity:

- 3,4-Di chloro benzal dehyde (Aldrich )
- 4-Formyl benzo nitrile ( Aldrich )
- 4-Nitro -O- phenylene diamine ( Aldrich )
- 3,4- Diamino toluene ( Aldrich )
- RuCl<sub>3</sub>, HAuCl<sub>4</sub>. 3H<sub>2</sub>O ( Aldrich )
- Enthanol , methanol ( Scharlau )

**Instrument**

FT.IR was measured within the range of 400-4000cm<sup>-1</sup>schimadzu (KBr Disc), UV-Vis, lc-Mass, and C.H.N measured and melting point measured.

**Working methods**

**(Table-1) Physical property and analyzed for Azomethine compounds and its Metal complexes**

Comp code	Molecular formula	M.wt	M.P. (oC)	Colour	Yield (%)	C%	H%	N%	CL %	M%
L1	C <sub>20</sub> H <sub>12</sub> O <sub>2</sub> N <sub>3</sub> Cl <sub>4</sub>	467.13	205-207	Yellow	68%	52.04 51.42	2.98 2.37	9.51 9.00	30.68 30.36	--
L2	C <sub>23</sub> H <sub>16</sub> N <sub>4</sub>	348.41	240-242	Orangish white	81%	79.85 79.29	4.01 4.63	17.23 16.08		--
N1	C <sub>40</sub> H <sub>22</sub> N <sub>6</sub> O <sub>4</sub> AuCl <sub>9</sub>	1166.68	300 <	Green	83%	41.44 41.18	2.40 1.90	8.07 7.20	27.99 27.35	17.08 16.88

**Anti bacterial activity ( MARS )**

The bacterial activity of ligands and the complexes prepared in the laboratory were tested to inhibit the growth of bacteria by the method of diffusion by drilling at a concentration of 15 mg/ml by dissolving the ligands and the complexes with a Dmsol solvent (13).

- Gene expression (molecular) was studied

- L1, L2 and its equipment N1.N2.N3.N4.N5

1.75 mg of 3,4-Di chloro benzal dehyde was dissolved in 25 mL of absolute ethanol in a 100 mL baker and heated to melting and dissolving 0.766mg of 4-Nitro-O-phenylene diamine in 50 ml of absolute ethanol in a baker’s capacity of 100 ml and heated until melting and then mixed the contents and raised the mixture for 3h until the solution precipitated and cooled with ice and filtered and collected the sediment and was recrystallized in ethanol (9,10).

The ratio of 2 ligands was then dissolved in a mixture of (ethanol and methanol) and 1 ml of ruthenium chloride or gold chloride dissolved in ethanol (11, 12), then rose for 4h, filtered the solution, and washed with water and ethanol.

during molecular diagnosis of bacterial isolation:

- a. Isolation of DNA methylation.
- b. Diagnosis with PCR technology.
- c. Electrophoresis of acarose gel.

After confirmation of isolation and proof that it was a positive, methicillin-resistant Staphylococcus aureus, RNA was extracted and transferred to CDNA

and the gene expression was determined by PCR examination.

## Results and Discussion

ligands were prepared by reacting aromatic aldehydes and aromatic amines by dissolving them in ethanol and then preparing their complexes with two elements of ruthenium and gold in a ratio of 2: 1 through the consistency between the nitrogen atom in (HC = N) and the elements. It was found that all the compounds dissolve in DMSO and DMF, and most of them dissolve in the rest of the solvents in varying ways, such as chloroform, methanol, and ethylene glycol. The prepared compounds were diagnosed by C.HN, FT.IR, UV.VIS and LCMAS spectroscopy and the results were identical to the suggested formulas.

### Infrared spectrum

The infrared spectra of the gold and ruthenium complexes were determined and compared with the spectra of ligands, where they showed clear and

strong signals at 1610-1661 belonging to the C = N group of azomethine (14), and the mixture appeared to ruthenium at lower frequencies where exposure occurred in the C-N beam due to the difference of the ligands (15). When the complexes are formed, the absorption sites of the azomethine group are shifted to either a high or low frequency, and this shift is a clear indication of symmetry between the nitrogen atom belonging to the group (C = N) and the gold ions and ruthenium (16)

### Magnetic studies

The sensitivity measurements for the Ru (III) and Au (III) ruthenium complexes are characterized by the magnetic DIAA properties indicating that the hybridization is d2sp3 and the shape of the Au (III) octahedral complexes (17).

### Ultraviolet radiation spectrum UV.Vis

Fixed UV. vis spectra of Ru (III) and Au (III) complexes in DMSO solution within the range of 200-800 nm as in the table:

(Table-2) Electronic spectrum analysis for ligand and Its Metal Complexes , magnetic moments ,proposed structure and metal complexes

Compounds	$\lambda_{max}$	$\nu_{cm}^{-1}$	Transition
L1	322	31055	* $\pi$ - $\pi$
	364	27472	n- $\pi$ *
L2	313	31948	* $\pi$ - $\pi$
	354	28248	n- $\pi$ *
[Au (L1)2]Cl	278	35971	Ligand field
	444	22522	C.T
	618	16181	1A1g 1B1g
	677	14771	1A1g 1A2g
[Au (L2)2]Cl	335	29850	Ligand field
	447	22371	C.T
	616	16233	1A1g 1B1g
	679	14727	1A1g 1A2g
[Ru(L1)2Cl2]	265	37735	Ligand field
	320	31250	C.T
	542	18450	1A1g 1T2g
[Ru(L4)2Cl2]	263	38022	Ligand field
	327	30581	C.T
	542	18450	1A1g 1T2g
[Ru(L1)(L4)]Cl3	254	41322	Ligand field
	343	29154	C.T
	541	18484	1A1g 1T2g

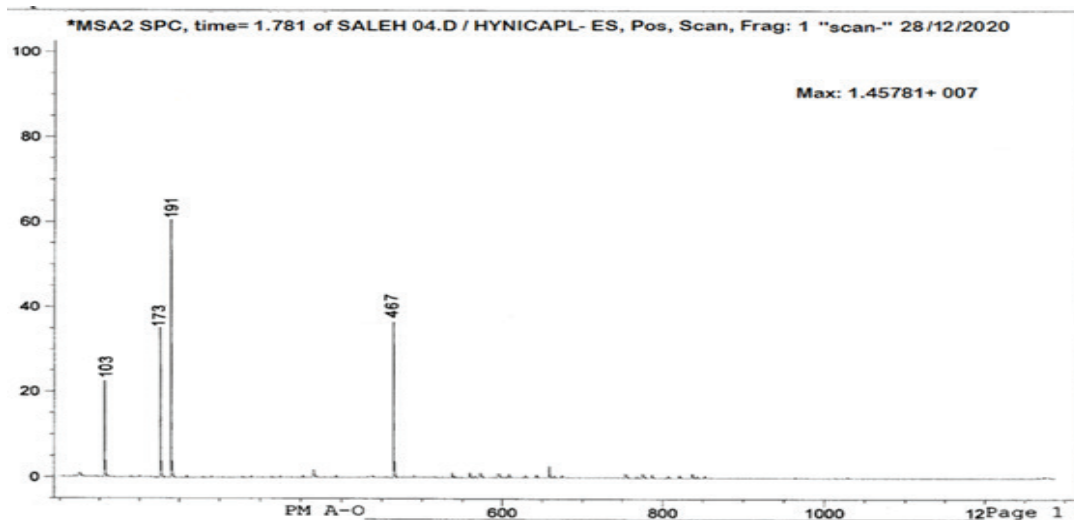
The absorption spectra of the azomethene group of 280 - 242 nm, which belong to the Likandian domain, which did not change at complexity (18), and 343-320 nm signals attributed to the charge transfer, appeared due to the electron transfer from ligands to the metal's orbit (19).

Also, transfers appeared at 542 back to transfers of ruthenium complex, that is, d-d-transfer, it was suggested that the octahedral figure (20). as for the gold complexes, the gold complex showed transfers

to the ligand domain within the range of 335 - 218, the cargo transfers within 459-320, and the gold complex d-transfer within 679-574. All this confirms that the shape is a square level (21).

- Mass Spectra

The mass spectrum explains the basic critical LC Mass (M.), which is the partial ion package that validates the proposed formula equivalent to a mass that appeared for ruthenium at 869 and Mix Ru at 987.51 m/z (22).



(Figure 1 mass spectrum of ruthenium at 869

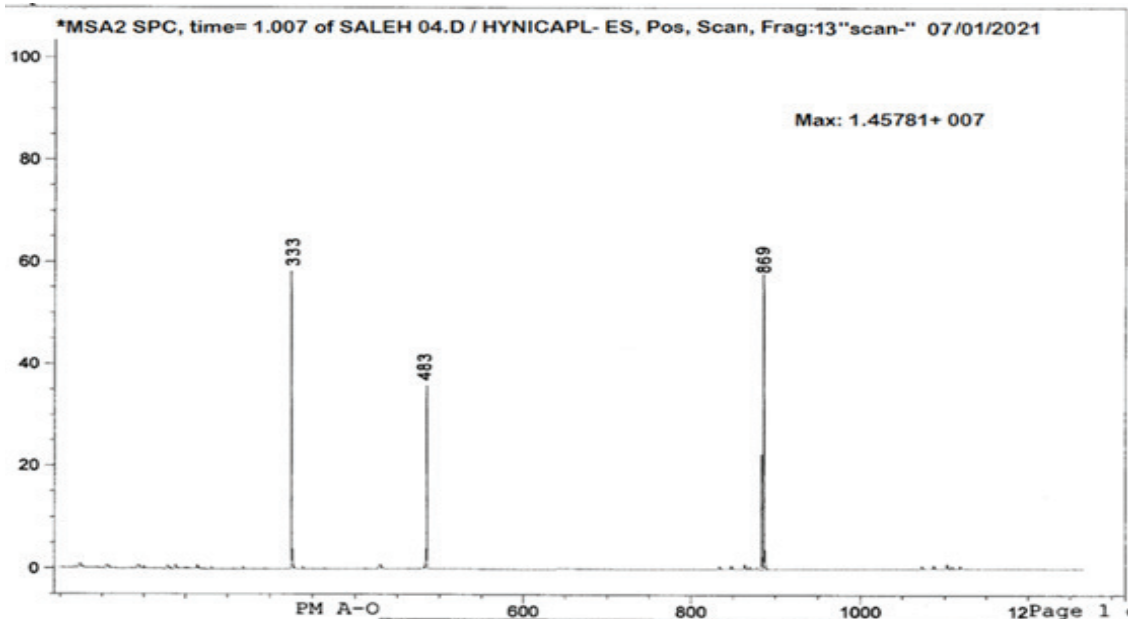


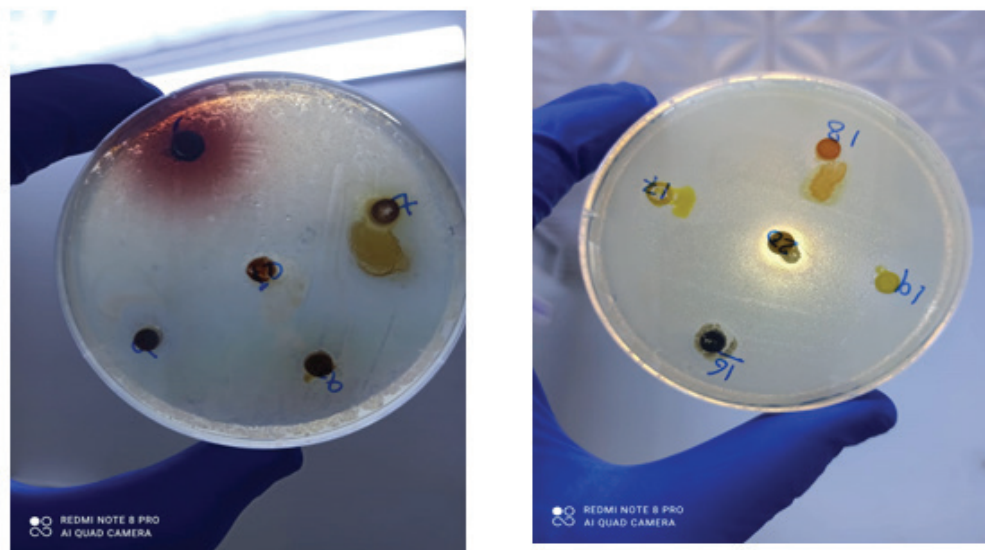
Figure 2 mass spectrum of ruthenium at 987.51 m/z

**Figure 2 mass spectrum of ruthenium at 987.51 m/z**

Bioactive

The effect of the bioactivity of ligands and complexes prepared with Au (III) and Ru (III) ions

on pathogenic methicillin-resistant staphylococci has been studied, with inhibition values showing good standards for each other and with little ( 23 ) concentration.



**Figure 3 The effect of the bioactivity of ligands and complexes prepared with Au (III) and Ru (III) ions on pathogenic methicillin-resistant staphylococci**

**Gene expression and molecular diagnosis**

DNA (S-aureus) was studied and recovered. After confirming that isolation was required in the study, RNA was recovered for samples treated with chemicals with the sample of (Control). Besides,

the extent of gene expression was then measured and determined by the PCR examination, where the ligands and complex were very efficient in reducing the amount of gene expression of the NORAs up to Max gene and had a clear and strong effect in reducing the value of gene expression (24) as in table(3) .

**Table 3: The amount of gene expression of the NORAs up to Max gene and had a clear and strong effect in reducing the value of gene expression (24)**

Sample	2(-ΔΔct)	Fold of expression	Conclusion
L1	0.002	500	Down- regulation
L2	0.0003	333.33	Down- regulation
N1	0.325	3.07	Down- regulation
N2	46.85	45.85	Down- regulation
N3	0.031	32.25	Down- regulation
N4	0.146	6.84	Down- regulation
N5	0.389	2.57	Down- regulation

## Conclusion

Based on the diagnostic spectroscopic results of the ligands and the complexes under study, the carbonyl group C = O of aldehyde was established to be associated with the amine group in amines and formed the ligands and was then held with the transition elements Au and Ru and formed two-clawed complexes at a ratio of 2: 1. The shape of the gold complexes was Flat Square and ruthenium complexes for octahedral surfaces. The prepared complexes and ligands showed good impact and activity against bacteria used and had clear and strong gene expression in reducing bacterial resistance by decreasing the specific virulence factor NOR A of MARS bacteria.

**Ethical Clearance:** The Research Ethical Committee at scientific research by ethical approval of both MOH and MOHSER in Iraq

**Conflict of Interest:** None

**Funding:** Self-funding

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