Synthesis, Spectroscopic Studies and Biological Activities of Mixed Metal (III) Complexes of Uracil with 1, 10-Phenanthroline

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Abstract:
New complexes of the [M(Ura)(Phen)(OH$_2$)Cl$_2$]Cl.2H$_2$O type, where (Ura) uracil ; (Phen) 1,10-phenanthroline hydrate; M (Cr$^{3+}$ , Fe$^{3+}$ and La$^{3+}$) were synthesized from mix ligand and characterized. These complexes have been characterized by the elemental micro analysis, spectral (FT-IR., UV-Vis, $^1$HNMR, $^{13}$CNMR and Mass) and magnetic susceptibility as well the molar conductive mensuration. Cr$^{3+}$, Fe$^{3+}$ and La$^{3+}$ complexes of six–coordinated were proposed for the insulated for three metal(III) complexes for molecular formulas following into uracil property and 1,10-phenanthroline hydrate present. The proposed molecular structure for all metal (III) complexes is octahedral geometries. The biological activity was tested of metal(III) salts, ligands as well as metal(III) complexes to the pathogenic bacteria as well as the antifungal activity has been studied.

Key words: Uracil, 1, 10-Phenanthroline hydrate, Metal complexes, Spectral studies, Biological activities.

Introduction:
Uracil (Ura) a colorless, a planar, and crystalline organic compound of the pyrimidine family. The Ura is one of four nitrogenous bases back to RNA molecule: Ura is cytosine (derivative to pyrimidine), adenine and guanine (derivative to urine). Ura is also a component of coenzymes that act in conjunction with enzymes in operation of carbohydrate metabolism [1-2]. Primarily posted discovery in 1900, secluded from before hydrolysis of leaven nuclei which is located in cows thymus and spleen, herring sperm [3]. Ura can be used for drug receipt and as a pharmaceutical as materials [4-5], such as 5-fluouracil is an anticancer drug used to masquerade as Ura during the nucleic acid replication process [6], as well as orotic acid (vitamin B$_{13}$) is the basic intermediate in synthesis of nucleic acids. The being only precursor at the way to form all pyrimidine nucleotides in living creatures. Vitamin "$B_{13}$" plays as a primary role at metabolism of vitamin "$V_6$" (folic acid)
and vitamin B<sub>12</sub>(cobalamin), as well as orotic acid has attracted increasing interest in the field medicine [7]. Considerable interest is being evinced in the phenomenon of metal chelation in biological systems. Many of metal ions transition metal complexes with Ura such as the interaction of Fe(II), Co(II), Ni(II), Cu(II), Zn(II) and Cd(II) with Ura [8] and its derivatives complexes [9]. In lanthanide complexes at different kinds from multi ligand, the metal may be investigated altitude coordination number allowing structural formula the variation responsibility them significant characteristics and their uses in diagnostic medicinal and laser technology [10].

1,10-phenanthroline (Phen) is a well-known complexing agent which forms a multitude of coordination with various metal ions [11]. Complexes of Phen at metal ions(III) are pointed out their high composition constants in aqueous solution and sometimes to high molar absorbance. It is worth mentioning the tris-phen iron (II) complex that finds interest as an indicator at oxidimetry result to its high molar absorbance, its high stability in strongly acid solutions and its reverse high oxidation potential. So Phen use in analytical chemistry as an oxidation-reduction indicator is extensive [12]. Phen ligand and its derivatives have resulted in many interesting structures and applications in biological activities [13-14]. Metal complexes which contain diimine ligands like bipyridine and Phen have acquired significant results of their many-sided roles accordingly constructing blocks into installation of metallo-dendrimers and molecular scaffolding into supramolecular collecting and in analytical chemistry, catalysis, electrochemistry, ring-opening qualified change the situation polymerized as well biochemistry [15-16].

In the present paper, the synthesis, physical spectroscopic properties of the Cr<sup>3+</sup>, Fe<sup>3+</sup> and La<sup>3+</sup> complexes of mixed ligands (Ura and Phen) and the present work deals with the study of the antibacterial and antifungal of these reported compounds.

Materials and Methods:
Chemical: Uracil and 1,10-Phenanthroline hydrate were purchased, metals(III) chloride as well solvents solution of (Merck, B.D.H. and Riedel). The reagents have been utilized without moreover refining.

Instruments: The measured molar conduct values (Λm) at DMF solution to the metal (III) complexes were measured at 25°C with (10<sup>-3</sup>M) solution of the samples which uses PW9527 Digital Conductivity Meter (Philips). The infrared (FT.IR) spectra have been registered at (4000-400 cm<sup>-1</sup>) rang of ligands and (4000-200) cm<sup>-1</sup> rang of metal complexes on a Shimadzu IR-470 Spectrum used KBr and CsI pellts. The electric spectrum from the complexes in DMF solution (10<sup>-3</sup>) were followed during 25 °C in the (300-700) nm rang for a Shimadzu-U.V-160 Ultraviolet spectrometer at 1.000±0.001 cm matched quartz cell. The C, H as well N elements to the complexes have resulted in many interesting structures and applications in biological activities [13-14]. Metal complexes which contain diimine ligands like bipyridine and Phen have acquired significant results of their many-sided roles accordingly constructing blocks into installation of metallo-dendrimers and molecular scaffolding into supramolecular collecting and in analytical chemistry, catalysis, electrochemistry, ring-opening qualified change the situation polymerized as well biochemistry [15-16].
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bruker500mhz in DMSO-d$_6$ with TMS as the internal standard. Mass spectra were recorded by the 5975C VL MSD with Triple –Axis Detector by the analyzer Quadrupole at 230 $^\circ$C.

**Synthesis metal (III) complexes** : The next public steps were adopted into the composition of the complexes:

- **Uracil solution**: Dissolve [0.112gm,1mmol] in 5ml warm water and added [0.04gm,1mmol] of the sodium hydroxide.

- **1,10- Phenanthroline hydrate solution**: Dissolve [0.198gm,1mmol] in 5ml methanol.

**Synthesis of complexes**: The complexes were prepared by adding of the Phen solution as well Ura solution to the hot water solution to the particular metal chlorides of CrCl$_3$.6H$_2$O [0.267gm, 1mmol] FeCl$_3$ [0.162gm, 1mmol], and LaCl$_3$.7H$_2$O [0.371gm, 1mmol] in the stoichiometric ratio metal: ligand (M:Ura:Phe). The mixtures were heated on a water bath to reflux for 12 hours except Cr$^{3+}$ complex for 24 hour at 70 $^\circ$C. The metal complexes were crystal residues observed. The precipitated complexes then were refined off and washed with ether followed by drying at room temperature and analyzing employing standard methods.

**Study of biological activity**: The activity of microbes from the metal(III) salts, ligands as well metal(III) complexes were examined by agar well – spread method. The antibacterial action of the metal (III) salts, ligands and the identical complexes were checked with each other against Gram positive bacteria (G+ve), (Staphylococcus and Bacillus) and Gram negative bacteria(G+ve), (E.Coli and *Pseudomonas*) and the antifungal activity against the pathogenic Candida (Yeast) by means of nutrients agar well - diffusion method.

The solvent utilized for working exam samples and level was DMSO, which was considered the best solvent in biological effects study [17] and sample of (1 - 200 $\mu$g/ml) were utilized. antimicrobial activity of any compound were estimated by means of the well-diffusion method. 1cm$^3$ at a 24h broth the culture including 106CFU/cm$^3$ was placed in sterilized Petri-dishes.Molten nutritious agar (15cm$^3$) was kept in ca.45 $^\circ$C and teeming in the Petri-dishes and pliable into stiffen. Other holes of 6mm diameter were punctured accurately employing a sterilized cork borer and these were perfectly stuffed for the exam solutions. The dishes were brood into 24h within 37 $^\circ$C.

**Results and Discussion**:

The analytical informations and some of the physical characteristics are collected in Table (1). La$^{3+}$ - complex is colorless, while, the Cr$^{3+}$ and Fe$^{3+}$ - complexes are colored. The complexes dissolvable in water, DMF and DMSO, but slight dissolvable in CH$_3$Cl, CCl$_4$, CH$_3$OH, C$_2$H$_5$OH and C$_6$H$_6$, while non soluble in ether. The elemental analysis information (Table.1) of metal(III) complexes are proportionate for their generic form like 1:1:1 mixed ligand complexes to the species [M(Ura)(Phen)(OH$_2$)Cl$_2$]Cl.2H$_2$O. The molar conduct values of the complexes during DMF in$10^{-3}M$ concentricity and the type of electrolyte for each compound could be determined [18].
The υ(C=O) band at 1735 cm\(^{-1}\) and (C=C) mode were evidenced, but in the complexes evidenced one band with complexes in (1712-1720) cm\(^{-1}\) with disappearance of the second band. The υ(C=O) band at 1670 cm\(^{-1}\) and 1643 cm\(^{-1}\) in free Ura, the small variation in the band situation of the 4-keto group of Ura in the complexes may be due to the hydrogen bonding [23].

It can be concluded that in metal (III) complexes Ura acts as chelating ligand, the coordination that occurs with the oxygen to the 2-keto group of the Ura with metals (III).

The υ(C=N) and (C=C) mode were observed at 1558 cm\(^{-1}\) to the spectra of free Phen ligand are showed to be shifted to lower wave number around (1454-1496) cm\(^{-1}\) to the spectrum from complexes. A negative shift into that vibrational mode at complexes referenced the coordination out of nitrogen donor from Phen with M (III) ions [24].

The presence of characteristic bands to the coordinated of the metal – oxygen with 2-keto group of the Ura in the (450-480) cm\(^{-1}\) to metal (III) complexes, which that Ura is monodentate in all the complexes, while the Phen ligand acts as a bidentate ligand all the complexes by coordinating through the metal –
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nitrogen with nitrogen group to the Phen in the (490-500) cm⁻¹ to metal (III)-complexes [25]. The U(M-Cl) bands are tentatively assigned in the lower region in the (351-366) cm⁻¹ [26].

Table 2: FT-IR Spectral Data of the Ligands and their Complexes

| Compound                  | ν(OH) | ν(NH) | ν(Cl) | ν(C=O) | ν(C=N=O) | δ(NH₁) | δ(NH₂) | ν(C=O) | ν(C=O) | ν(M-O) | v(M-Cl) |
|---------------------------|-------|-------|-------|--------|----------|---------|---------|--------|--------|--------|---------|
| C₆H₄N₂O₂                  |       | 310br.| 1716w | 1670w  | 1508w    | 1419w   | 1419w   |        |        |        |         |
| C₆H₄N₂O₂.H₂O             | 3416s.| 310br.| 1712s | 1670w  | 1519s    | 1421s   | 1440w   | 547w   | 435w   | 366w   |         |
| Cr(Urea)[Phen]OH₂Cl₂Cl₂.H₂O| 3416s.| 310br.| 1712s | 1665w  | 1512s    | 1441s   | 1454s   | 542w   | 428w   | 354w   |         |
| Fe(Urea)[Phen]OH₂Cl₂Cl₂.H₂O| 3396s.| 311br.| 1716s | 1665w  | 1508w    | 1441s   | 1454s   | 542w   | 428w   | 354w   |         |
| La(Urea)[Phen]OH₂Cl₂Cl₂.H₂O| 3396s.| 311br.| 1716s | 1665w  | 1508w    | 1441s   | 1454s   | 542w   | 428w   | 354w   |         |

s = sharp  br. = broad  w = weak

Fig1. FT-IR spectrum of Cr⁹³⁺ complex

Ultraviolet-Visible Spectroscopy:
The electronic spectrum to the ligand and metal (III)-complexes were listed at DMF as indicated in Table 3. and Figure 2. For each of ligands and Cr³⁺ complex. The Ultraviolet-Visible spectrum to the free ligand Ura displayed two absorption bands at 270nm (37037cm⁻¹) and 320nm (31250 cm⁻¹) referred to (π→π*) and (n→π*) transition of the carbonyl group, however the later to the conforming transition of N=C=O chromophore [27] and the spectrum of the free ligand (Phen) display absorption peak in 270 nm (37037cm⁻¹), 301 nm (32222.6 cm⁻¹) and 324 nm (30864 cm⁻¹), that indicated into (π→π*) , (n→π*) and (n→π*) transition Consecutively, which transmits the pyridine rings [28].

The electronic spectra of six coordinated Cr³⁺ complex exhibited two absorption bands 654nm (15290cm⁻¹) and 443nm (22573 cm⁻¹) due to 4A₂g → 4T₁̂g(F) and 4A₂g → 4T₂̂g(F) respectively and the two band expected 322nm (31055 cm⁻¹) and 269 nm (37174cm⁻¹), overlaps with the ligand bands or charge transfer (LMCT) [29]. The chromium (III)-complex shows μₑff values 3.87 B.M. conforming to three unpaired electrons, which suggests a high spin to octahedral stereochemistry [30].

The electric spectrum of the Fe³⁺ complex shows three absorption bands at 450nm (22222.0cm⁻¹) due to ⁶A₁g → ⁴T₂g(G) and the four absorption bands at 364 nm (274723 cm⁻¹) due to the presence of a charge transfer (LMCT),

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which obscures the low intensity d – d absorption bands and 345nm, 328nm and 270nm(28985, 30487.0 and 37037.0cm\(^{-1}\)) which assigned to ligand field (L.F). The magnetic moment amount of this complex was got 6.31B.M., which was very near the value of octahedral spatial structure of high spin state [31].

In the spectrum of the La\(^{3+}\) - complex of six coordinated exhibited one absorption band at 403nm (24813.0 cm\(^{-1}\)) in the UV-Vis region caused by charge transfer (LMCT) at 269 nm (37174.0 cm\(^{-1}\)) and 322nm (31055.0 cm\(^{-1}\)) and 325nm (30769 cm\(^{-1}\)) in the UV-Vis region overlaps with the ligand bands [32]. Figure 3. suggests the framework and 3D-geometrical structure of the metal (III) - Complexes.

### Table 3 : Electronic Spectra to the Ligands and Complexes

| Ligands and complexes | \(\lambda_{\text{max}}\) (nm) | Wave Number \(\nu\) (cm\(^{-1}\)) | \(E_{\text{max}}\) | Assignment |
|-----------------------|---------------------------|---------------------------------|-----------------|------------|
| \(\text{C}_4\text{H}_4\text{N}_2\text{O}_2\) | 270 | 37037.0 | 1213 | \(\pi \rightarrow \pi^*\) |
|                        | 320 | 31250.0 | 1126 | \(\pi \rightarrow \pi^*\) |
| \(\text{C}_4\text{H}_8\text{N}_2\text{H}_2\text{O}\) | 270 | 37037.0 | 1135 | \(\pi \rightarrow \pi^*\) |
|                        | 301 | 33222.5 | 845  | \(\pi \rightarrow \pi^*\) |
|                        | 324 | 30864.0 | 1139 | \(\pi \rightarrow \pi^*\) |
| \(\text{Cr(Ura)}\text{(Phen)}\text{(OH)}_2\text{Cl}_2\text{Cl}_2\text{H}_2\text{O}\) | 269 | 37174.0 | 1176 | L.F |
|                        | 322 | 31055.0 | 919  | L.F+ C.T |
|                        | 443 | 22573.0 | 63   | \(\epsilon_{A_1g} \rightarrow \epsilon_{T_2g}(F)\) |
|                        | 654 | 15290.0 | 30   | \(\epsilon_{A_1g} \rightarrow \epsilon_{T_2g}(F)\) |
| \(\text{Fe(Ura)}\text{(Phen)}\text{(OH)}_2\text{Cl}_2\text{Cl}_2\text{H}_2\text{O}\) | 270 | 37037.0 | 1265 | L.F |
|                        | 328 | 30487.0 | 1508 | L.F |
|                        | 345 | 28985.0 | 1619 | L.F |
|                        | 364 | 27472.0 | 1013 | C.T |
|                        | 450 | 22222.0 | 20   | \(\epsilon_{A_1g} \rightarrow \epsilon_{T_2g}(G)\) |
| \(\text{La(Ura)}\text{(Phen)}\text{(OH)}_2\text{Cl}_2\text{Cl}_2\text{H}_2\text{O}\) | 269 | 37174.0 | 1067 | L.F |
|                        | 325 | 30769.0 | 483  | L.F |
|                        | 403 | 24813.0 | 61   | C.T |
|                        | 891 | 11223.0 | 2    | \(f \rightarrow f\) |

Fig.2. UV spectra of ligands and Cr\(^{3+}\) - complex
Fig. 3. The Proposed Structure and 3D-geometrical structure of the Complexes [M(Ura)(Phe)(OH₂)Cl₂]Cl₂H₂O, (M = Cr⁺³, Fe⁺³ and La⁺³)

**¹H NMR spectra ¹³C NMR spectra studies:**

The ¹H NMR spectra of a DMSO-d₆ solution as solvent of the complexes in Table 4. and Figure 4. For Cr⁺³ complex. Shows multiplet signal at δ(5.275-9.211 ppm) refers to aromatic protons (10H). On the other hand, the signals at δ(10.784-11.136 ppm) (2H) are due to proton of (NH) of Ura group of the metal(III) complexes [33-34]. The signal characteristic to the NH of Ura ring appeared in the same position indicating that the NH group of Ura ring did not participate in coordination. Thus the ¹H NMR results further supports the IR inferences. Whereas, the signal at δ2.5 ppm referred to DMSO-d₆. The presence of water molecules in the complexes is confirmed by the appearance of a new signal around δ(3.3-3.5 ppm), attributed to H₂O protons [35].

The ¹³C NMR spectra data of the metal(III) complexes. and Figure 5. For Cr⁺³ - complex. The two peaks at δ(150.00 and 162.791 ppm) were assigned to the (C₂ and C₄) of carbonyl group of the Ura ring [33]. There is a simple change in carbonyl group of the Ura ring in all of the complexes, where the two carbonyl groups remained unchanged at the complex formation, also support the authenticity of the proposed structures of the three complexes. The signals to the carbon of Ura ring and Phen ring are shifted from δ(99.109-149.823) ppm and the signal at δ 40.296 ppm referred to DMSO-d₆ [36].

**Table 4: ¹H NMR spectra data of the of the three complexes**

| Compounds                  | Chemical shift, (δ) ppm | Assignment                   |
|----------------------------|-------------------------|-------------------------------|
|                            | (5.424-9.211)s          | ¹0H, aromatic rings of Ura    |
|                            | (5.275-7.219)s          | and Phen                     |
| Cr(C₁₆H₁₈N₄O₅).Cl₃        | 11.069                  | s.2H, NH, Ura ring            |
| Fe(C₁₆H₁₈N₄O₅).Cl₃        | 10.784                  |                               |
| La(C₁₆H₁₈N₄O₅).Cl₃        | 11.069                  |                               |
|                            | 11.095m                 |                               |
|                            | 10.788s                 |                               |
|                            | 11.095m                 |                               |
Mass spectra:

The mass spectra of Table 5. and Figure (6-8) are for each of Cr$^{3+}$, Fe$^{3+}$ and La$^{3+}$ complexes, respectively. Displayed peaks refered in the molecular ions m/z at 505, 508 and 592 M$^+$ into Cr$^{3+}$, Fe$^{3+}$ and La$^{3+}$ complexes, Consecutively. That datum is at good convention for the suggest molecular formulation into the complexes. The mass spectral data backing the structures of transition metal complexes. The fragmentation type to the complexes does not display the loss of one for chlorine and two water molecules, It is exist outside the coordination field one for chlorine and two water molecules [28]. The fragmentation patterns of the studies for Cr$^{3+}$, Fe$^{3+}$ and La$^{3+}$ complexes, respectively, obtained from the mass spectra are given in Table 5. The suggested molecular formula of these complexes was provened through resembling their molecular formula weights with m/z values.
### Table 5: Mass spectra data of the important mass peaks for the complexes

| Complexes      | Mass assignments                           | M    | m/z    |
|----------------|--------------------------------------------|------|--------|
| Cr(C₆H₁₆N₄O₅Cl₃)| [CrC₆H₁₆N₄O₅Cl₃]⁺                         | 439  | 439    |
|                | [CrC₆H₁₅N₃O₄Cl₂]⁺                         | 395  | 395    |
|                | [CrC₆H₁₅NOCl]⁺                             | 350  | 350    |
|                | [CrC₆H₁₄ClO]⁺                              | 293  | 293    |
|                | [CrC₆H₁₃Cl]⁺                               | 243  | 243    |
|                | [CrC₆H₁₂OCl]⁺                              | 195  | 195    |
|                | [CrC₆H₁₁OCl]⁺                              | 131  | 131    |
|                | [CrC₆H₁₂Cl]⁺                               | 107  | 107    |
|                | [CrC₆H₁₈Cl]⁺                               | 83   | 83     |
|                | [CrC₆H₁₇Cl]⁺                               | 71   | 71     |
| Fe(C₆H₁₆N₄O₅Cl₃)| [FeC₆H₁₆N₄O₅Cl₃]⁺                         | 505  | 505    |
|                | [FeC₆H₁₅N₃O₄Cl₂]⁺                         | 449  | 449    |
|                | [FeC₆H₁₅NOCl]⁺                             | 400  | 400    |
|                | [FeC₆H₁₄ClO]⁺                              | 350  | 350    |
|                | [FeC₆H₁₃Cl]⁺                               | 302  | 302    |
|                | [FeC₆H₁₂OCl]⁺                              | 228  | 228    |
|                | [FeC₆H₁₁OCl]⁺                              | 180  | 180    |
|                | [FeC₆H₁₂Cl]⁺                               | 120  | 120    |
|                | [FeC₆H₁₃Cl]⁺                               | 96   | 96     |
|                | [FeC₆H₁₂Cl]⁺                               | 68   | 68     |
| La(C₆H₁₆N₄O₅Cl₃)| [LaC₆H₁₆N₄O₅Cl₃]⁺                         | 579  | 579    |
|                | [LaC₆H₁₅N₃O₄Cl₂]⁺                         | 524  | 524    |
|                | [LaC₆H₁₅NOCl]⁺                             | 477  | 477    |
|                | [LaC₆H₁₄ClO]⁺                              | 424  | 424    |
|                | [LaC₆H₁₃Cl]⁺                               | 368  | 368    |
|                | [LaC₆H₁₂OCl]⁺                              | 258  | 258    |
|                | [LaC₆H₁₁OCl]⁺                              | 119  | 119    |
|                | [LaC₆H₁₂Cl]⁺                               | 83   | 83     |
|                | [LaC₆H₁₃Cl]⁺                               | 71   | 71     |

Fig. 6. Mass spectrum of Cr⁺³ – complex

Fig. 7. Mass spectrum of Fe⁺³ - complex
Biological study:
The conclusion gained into antibacterial and antifungal experience models studies through agar good – diffusion bioassay detect biological activity to the metal salts, ligands and metal complexes after 24h in Table 6 and Figure 9. In situation of Ura the antibacterial activity at E.Coli is higher activity like contrast to metal (III) salts, but Phen has a higher activity with E.Coli as compared to Ura, metal ions and metal complexes.
In case of the metals complexes, Fe$^{3+}$ and Cr$^{3+}$ - complexes shows higher inhibition area of 18 mm with Staphylococcus and E.Coli respectively, as compared to the metal salts, free ligands and other complexes. Phen and La$^{3+}$-complex that increased the value of inhibition of growth than were during the 24 hours.
In the case of Candida that represent a class of fungi type of yeast that has a clear impact with Phen and less effect with each of FeCl$_3$, LaCl$_3$ and La$^{3+}$ - complex, with no effect with the rest.
The consequences of biological checking reference that in several complexes are more effective than free ligands, increased activity of the complexes can exist, illustrated at the fundamental in chelation theory [37].

Table 6: Displayed the Inhibition Circle Dimeter at Millmiter into the Bacteria After 24 h

| Compounds             | Bacillus (G+ev) | Staphylococcus (G+ev) | Pseudomonas (G-ev) | E. Coli (G-ev) | Candida (Yeast) |
|-----------------------|-----------------|-----------------------|--------------------|---------------|-----------------|
| Control (DMSO)        | 5               | 5                     | 6                  | 5             | 0               |
| CrCl$_3.6$H$_2$O       | 9               | 12                    | 13                 | 15            | 0               |
| FeCl$_3$              | 7               | 12                    | 11                 | 11            | 12              |
| LaCl$_3.7$H$_2$O       | 12              | 0                     | 11                 | 15            | 13              |
| Uracil                | 0               | 11                    | 11                 | 16            | 0               |
| 1,10-Phen hydrate      | 9               | 16                    | 13                 | 14            | 14              |
| Cr-complex            | 9               | 17                    | 15                 | 18            | 0               |
| Fe-complex            | 13              | 18                    | 0                  | 13            | 0               |
| La-complex            | 14              | 9                     | 0                  | 15            | 11              |
Fig. 9. Shows the Antimicrobial Activity of metal salts and complexes Appear the Inhibition Zones Against Pathogenic Bacteria (E.coli, Pseudomonas, Streptococces and Bacillus) and the Antifungal Activity such as Candida(Yeast)

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 تحضير ودراسة طيفية وفعالية بايولوجية لمعقدات ثلاثية التكافؤ حاوية على الكاندات مختلطة من البوراسيل و10،1-فينانثرولين

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الخلاصة:
في هذا البحث حُضرت وشُخصت معقدات جديدة من نوع [M(Ura)(Phen)(OH$_2$)Cl$_2$]Cl.2H$_2$O، متكونة من مزيج لكاندات البوراسيل و 10،1-فينانثرولين المائي مع فلزات الكروم، الحديد واللانثانيوم الثلاثية التكافؤ. شُخصت المعقدات بوساطة تحليل العناصر، تحاليل اطياف ( الأشعة تحت الحمراء ، الأشعة فوق البنفسجية ، الرنين النووي المغناطيسي ، طيف الكتلة )، الحساسية المغناطيسية وقياس التوصيلية المولارية. أقترحت معقدات الفلز السداسية التناسق من معقدات الكروم، الحديد واللانثانيوم المعزولة مع صيغ جزيئية إعتمادًا على طبيعة البوراسيل و10،1-التركيب الجزيئي المقترح لجميع معقدات الفلز الثلاثية ذات هندسة ثمانية السطوح. وفحصت الفعالية البايولوجية للكاندات وفلزات 10،1-فينانثرولين المتعددة التي تم تجربتها.

الكلمات المفتاحية: البوراسيل، 10،1-فينانثرولين المائي، معقدات الفلز، دراسات طيفية، فعاليات بايولوجية.