Palladium(II) and platinum(II) mixed ligand complexes of metronidazole and saccharinate or benzisothiazolinonate ligands, synthesis and spectroscopic investigation

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1. Introduction

Nitroimidazole compounds, especially 5- and 2-nitroimidazoles, were the first hypoxic cell radio sensitizers to show clinical promise [1-3], because they were of high electron affinity and exhibited relatively low toxicity to non-hypoxic cells. 5-Nitroimidazole is widely used in the treatment of an aerobic infections and has been shown to act as a hypoxic cell sensitizer in vitro [4,5] and gives significant sensitization of tumor response in several model murine tumor systems [6].

Several metal chelates are known to possess antibacterial, anti-fungicidal, antiviral and anticancer activity. In several cases, the metal chelates have been found to be more antimicrobial than the chelating agents themselves [7]. Also it is known that some drugs act via chelation or by inhibitory metallo enzymes but for most of the drugs that act as potential ligands, a lot of studies are being carried out to ascertain how metal binding influences the activities of the drugs [8]. However, metal ions play an important role in bioinorganic chemistry thus metals such as Fe, Co, Ni, Cu, Zn, and Cd may exist in trace amounts in biological systems. Structural studies of the complexes of these metals with biological compounds are extremely important [9]. Although, many papers have been published on the transition metal complexes of metronidazole ligand (mnz) alone or with other ligands as Co-ligands [10-19]. There are relatively little works reported on the mixed ligands complexes of metronidazole [14-19]. We describe in this paper the synthesis and characterization of new mixed ligand complexes of Pd(II) and Pt(II) metronidazole complexes with saccharinate (sac) or benzisothiazolinonate (bit) ligands, (Chart 1).

Chart 1

ABSTRACT

Six palladium (II) and platinum (II) mixed ligand complexes of metronidazole (mnz) and saccharinate (sac) or benzothiazolinonate (bit) complexes of the type [ML₂(mnz)₂], M = Pd or Pt, L = sac or bit, have been prepared in moderate to high yield. The newly prepared complexes have been characterized by elemental (C,H,N,S) analysis, conductivity measurements, infrared and ¹H-NMR spectra. Characterization data showed that the mnz ligand in all of the prepared complexes is coordinated to metal center through the imidazole nitrogen atom. The (sac) anion ligand is coordinated through the endocyclic nitrogen atom, while the (bit) anion ligand is coordinated through the nitrogen atom in the palladium complex and through the oxygen atom of the carbonyl group in the platinum complexes. The geometry of the Pd (II) and Pt (II) complexes is square planar complexes.
2. Experimental
2.1 Materials and Methods:
All chemical compounds and solvents were supplied and used without further purification. IR spectra were recorded on Shimadzu 8400 S FTIR spectrophotometer as KBr disc in 4000-400 cm\(^{-1}\) range. NMR spectra (\(^1\)H-NMR) were recorded on Bruker av 400 NMR spectrometer in DMSO-d\(_6\) as a solvent. The conductivity measurement of the prepared complexes solutions (10\(^{-3}\)M) in DMSO was measured using digital conductivity meter CD 2005. Melting points were recorded on SMP-40 - Stuart Company and were uncorrected.

K\(_2\)PtCl\(_6\), PdCl\(_2\), metronidazole (mnz), benzisothiazolinonate (Hbit) and sodium saccharinate (Nasac), were purchased and used as supplied. sodium benzisothiazolininate (Nabit) [20] cis-[PtCl\(_2\)(DMSO)]\(_2\), trans-[PdCl\(_2\)(DMSO)]\(_2\) [21], trans-[PtCl\(_2\)(mnz)]\(_2\), trans-[PdCl\(_2\)(mnz)]\(_2\) [22], cis-[PtCl\(_2\)(mnz)]\(_2\) [23], were prepared by literature methods.

2.2 Synthesis of complexes (1-6)
2.2.1 Synthesis of trans-[Pd(sac)\(_2\)(mnz)]\(_2\) (1)
A solution of sodium saccharinate (Nasac) (0.123g, 0.6mmol) in EtOH (10ml) was added to a yellow suspension of trans-[PdCl\(_2\)(mnz)]\(_2\) (0.156g, 0.3mmol) in EtOH (10ml) with stirring, a yellow clear solution was formed. The mixture was refluxed for 3h to afford a clear solution, which was left to evaporate at room temperature to dryness. The resulting cream solid was washed with distilled water, and dried under vacuum (Yield: 0.082g, 94%, m.p (°C): 270).

trans-[Pd(bit)\(_2\)(mnz)]\(_2\) (2), was prepared and isolated by a similar method. cis-[Pt(sac)\(_2\)(mnz)]\(_2\) (5) and cis-[Pt(bit)\(_2\)(mnz)]\(_2\) (6) were prepared and isolated by similar methods starting with cis-[PdCl\(_2\)(mnz)]\(_2\) and Nasac or Nabit respectively.

2.2.2 Synthesis of trans-[Pt(sac)\(_2\)(mnz)]\(_2\) (3)
A solution of sodium benzisothiazolinolate (Nabit) (0.025g, 0.164mmol) in EtOH (10ml) was added to a yellow suspension of trans-[PdCl\(_2\)(mnz)]\(_2\) (0.050g, 0.082mmol) in EtOH (10ml) with stirring. The mixture was refluxed for 4h, to afford a clear lemon solution within 25 min, then change to a yellow suspension after an hour. The yellow product was filtered off, washed with distilled water, and dried under vacuum (Yield: 0.034g, 50%, m.p (°C): 265).

3. Results and Discussions
3.1 Synthesis of complexes (1-6)
Treatment of trans-[MCl\(_2\)(mnz)]\(_2\) (M= Pd(II) or Pt(II)) with two equivalents of sodium saccharinate (Nasac) or sodium benzisothiazolinolate (Nabit) in ethanol as a solvent afforded complexes of the types trans-[M(sac)\(_2\)(mnz)]\(_2\) (1,3) or trans-[M(bit)\(_2\)(mnz)]\(_2\) (2,4) in 50 to 94 % yield by chloride exchange under normal conditions as showed in Scheme 1. The reaction of cis-[PtCl\(_2\)(mnz)]\(_2\) complex with two moles of (Nasac) or (Nabit) afforded cis-[Pt(sac)\(_2\)(mnz)]\(_2\) (5) and cis-[Pt(bit)\(_2\)(mnz)]\(_2\) (6) respectively (Scheme 2).

Scheme 1: Preparation of trans-[M(sac)\(_2\)(mnz)]\(_2\) (1,3) or trans-[M(bit)\(_2\)(mnz)]\(_2\) (2,4)
The prepared complexes are air stable in the solid state and insoluble in common solvents such as methanol, ethanol, acetone, diethyl ether or dimethyl sulfoxide, or dimethyl formamide. The prepared complexes have been characterized by infrared spectroscopy, $^{1}$H NMR spectra, molar conductance, and elemental analysis (CHNS). The elemental analyses are listed in Table 1, they agreed well with the calculated data of the complexes. The molar conductance values of the freshly prepared complexes measured in DMF are within the range of non-electrolytes values [24].

### Table 1. Color, m.p. (°C), and elemental analysis of the prepared complexes (1-6)

| NO. | Complexes          | Color       | m.p. (°C) | Yield % | $\lambda_{\text{max}}$ (DMSO) (Onm$^{-1}$ cm$^{-1}$) | Elemental analysis Found(cal.) % |
|-----|-------------------|-------------|-----------|---------|---------------------------------|--------------------------------|
| 1   | trans-[Pd(sac)$_2$(mnz)$_2$] | Gray        | 285       | 77      | 11.21                           | C 38.21 (38.41) H 3.47 (3.22) N 14.03 (13.78) S 7.98 (7.89) |
| 2   | trans-[Pd(bit)$_2$(mnz)$_2$] | Orange      | 137       | 82      | 10.90                           | C 41.98 (41.69) H 3.77 (3.50) N 15.23 (14.96) S 8.46 (8.56) |
| 3   | trans-[Pt(sac)$_2$(mnz)$_2$] | Creamy White| 270       | 94      | 2.90                            | C 34.25 (34.63) H 3.18 (2.91) N 12.71 (12.43) S 7.29 (7.11) |
| 4   | trans-[Pt(bit)$_2$(mnz)$_2$] | pale Yellow | 265       | 50      | 4.37                            | C 37.41 (37.28) H 3.34 (3.13) N 13.67 (13.38) S 7.49 (7.65) |
| 5   | cis-[Pt(sac)$_2$(mnz)$_2$] | White       | 304       | 90      | 13.09                           | C 34.25 (34.63) H 3.08 (2.91) N 12.68 (12.43) S 4.38 (4.11) |
| 6   | cis-[Pt(bit)$_2$(mnz)$_2$] | Yellow      | 225       | 91      | 16.61                           | C 37.66 (37.28) H 3.04 (3.13) N 13.17 (13.38) S 7.70 (7.65) |

### 3.2 Infrared spectroscopic studies

The infrared data of the free ligands and their prepared complexes are listed in Table 2 and Fig. 1, 2. The infrared spectra of the metronidazole complexes showed the $\nu$(C=N) stretching within the range of 1544-1566 cm$^{-1}$, which shifted to higher frequencies, in all complexes due to the coordination of imidazole nitrogen atom to the metal ions [12-19]. The vibration frequency of the $\nu$(C=O) band appeared within the range of 1670-1683 cm$^{-1}$ for the complexes 1, 3 and 5. The $\nu$(C=O) stretching was shifted to high frequency region compared to that of the free saccharinate ligand, indicates that the carbonyl group doesn't participate in the coordination to metal ions[25-27]. The $\nu$(SO$_2$)$_{ax}$ and $\nu$(SO$_2$)$_{sy}$ stretching appeared within (1151-1159) cm$^{-1}$ and (1246-1255) cm$^{-1}$ range shifted slightly wave number side relative to that in the free ligand, indicating non-coordination of the SO$_2$ group with the metal ion [25,26].

In the trans-[Pd(bit)$_2$(mnz)$_2$] (2), the $\nu$(C=O) stretching vibration observed at (1649) cm$^{-1}$, indicates that the carbonyl group don't's involved in coordination to the Pd(II) ion, as compared with that of the free Nabit which appeared at (1591) cm$^{-1}$ [26-29]. Whereas the vibration frequency of the $\nu$(C-O) band in the platinum complexes (4 and 6) appeared at (1153) and (1149) cm$^{-1}$, indicating that (C-O) group participate in coordination with Pt(II) ion [26-29].
Table 2: Selected IR stretching vibration bands (cm$^{-1}$) of the free ligands and their complexes.

| NO. | Compounds   | $\nu$(OH)   | $\nu$(C-H) | $(\nu(C=O)$ | $\nu$(C=N) | $\nu$(SO$_2$) | $\nu$(CNS) | M-N | M-O |
|-----|-------------|-------------|------------|-------------|-------------|--------------|------------|-----|-----|
|     |             | Ar. | Alph. | Ar. | Alph. | Ar. | Alph. | Ar. | Alph. | Ar. | Alph. |
| 1   | Mnz         | 3221s | 3099s | 2956w | ---- | 1535s | ---- | ---- | ---- | ---- | ---- |
| 2   | Nasac       | ---- | 3099w | ---- | 1645s | 1450m | 1257s | 1149s | 1336m | 966m | ---- |
| 3   | Nhilt       | ---- | 3061w | ---- | 1591m | 1435s | ---- | 1317m | 877m | ---- | ---- |
| 4   | trans-[PdCl$_2$(mnz)$_2$] | 3429s | 3110w | 2991w | ---- | 1562s | ---- | ---- | ---- | 432w | ---- |
| 5   | cis-[PdCl$_2$(mnz)$_2$] | 3461s | 3144m | 2953w | ---- | 1558s | ---- | ---- | ---- | 428w | ---- |

Table 3: $^1$H NMR chemical shifts (δ ppm) for the prepared complexes (1-6) measured in DMSO-d$_6$

| NO. | Complexes | $^1$H (ppm) |
|-----|-----------|-------------|
| 1   | trans-[Pd(sac)$_2$(mnz)$_2$] | 8.20 (s. 2H, OH); 8.03 (s, 2H, CH-N); 7.88 (m, 2H, H-sac); 7.58 (m, 2H, H-sac); 7.54 (m, 2H, H-sac); 6.41 (m, 4H, CH$_2$-O); 2.47 (S, 6H, CH$_3$) |
| 2   | trans-[Pd(bit)$_2$(mnz)$_2$] | 8.03 (s, 2H, CH-N); 7.63 (m, 2H, H-bit); 7.39 (m, 4H, H-bit); 7.21 (m, 4H, H-bit); 5.03 (s, 2H, OH); 4.36 (m, 4H, CH$_2$-N); 3.69 (t, $^3J_{HH}$ = 8.00 Hz, 4H, CH$_2$-O); 2.51 (S, 6H, CH$_3$) |
| 3   | trans-[Pt(sac)$_2$(mnz)$_2$] | 8.17 (s, 2H, OH); 8.04 (s, 2H, CH-N); 7.91 (m, 2H, H-sac); 7.79 (m, 4H, H-sac); 4.46 (t, $^3J_{HH}$ = 8.00 Hz, 4H, CH$_2$-O); 2.46 (S, 6H, CH$_3$) |
| 4   | trans-[Pt(bit)$_2$(mnz)$_2$] | 8.70 (s, 2H, OH); 8.03 (s, 2H, CH-N); 7.67 (m, 4H, H-bit); 7.41 (m, 2H, H-bit); 7.23 (m, 2H, H-bit); 4.38 (m, 4H, CH$_2$-N); 3.65 (m, 4H, CH$_2$-O); 2.47 (S, 6H, CH$_3$) |
| 5   | cis-[Pt(sac)$_2$(mnz)$_2$] | 8.55 (s, 2H, OH); 8.03 (s, 2H, CH-N); 7.72 (m, 2H, H-sac); 7.65 (m, 2H, H-sac); 7.59 (m, 4H, H-sac); 4.36 (t, $^3J_{HH}$ = 8.00 Hz, 4H, CH$_2$-O); 3.69 (m, 4H, CH$_2$-O); 2.46 (S, 6H, CH$_3$) |
| 6   | cis-[Pt(bit)$_2$(mnz)$_2$] | 8.43 (s, 2H, OH); 8.03 (s, 2H, CH-N); 7.66 (m, 4H, H-bit); 7.41 (m, 2H, H-bit); 7.22 (m, 2H, H-bit); 4.36 (t, $^3J_{HH}$ = 8.00 Hz, 4H, CH$_2$-N); 3.69 (q, $^3J_{HH}$ = 4.00 Hz, 4H, CH$_2$-O); 2.47 (S, 6H, CH$_3$) |
Conclusions

Treatment of \( \text{trans-}[\text{MCI}_2(\text{mnz})_2] \) (\( \text{M} = \text{Pd(II)} \) or \( \text{Pt(II)} \)) with two equivalents of sodium saccharinate (Nasac) or sodium benzisothiazolinate (Nabit) in ethanol afforded complexes of the types \( \text{trans-}[\text{M(sac)}_2(\text{mnz})_2] \) or \( \text{trans-}[\text{M(bit)}_2(\text{mnz})_2] \) in high yield by chloride exchange under normal conditions. The reaction of \( \text{cis-}[\text{PtCl}_2(\text{mnz})_2] \) complex with two moles of (Nasac) or (Nabit) afforded \( \text{cis-}[\text{Pt(sac)}_2(\text{mnz})_2] \) \( 5 \) and \( \text{cis-}[\text{Pt(bit)}_2(\text{mnz})_2] \) \( 6 \) respectively. The (mnz) ligand in all complexes is coordinated through the nitrogen atom. The (sac) anion is coordinated through the nitrogen atom, while the bit anion ligand is coordinated either through the carbonyl oxygen atom, or through the nitrogen atom. The geometry of the Pd (II) and Pt (II) complexes is square planar complexes.

References

[1] Urtasun, R.; et al. (1976). Radiation and high-dose metronidazole in supratentorial glioblastomas. New England Journal of Medicine. 294 (25):1364–1367.
[2] Thomlinson, R.H.; Dische, S.; Gray, A.J. and Errington, L.M. (1976). Clinical testing of the radiosensitiser Ro-07-0582 III. Response of tumours. Clinical Radiology, 27 (2):167–174.
[3] Dische, S.; Gray, A.J. and Zanelli, G.D. (1976). Clinical testing of the radiosensitiser Ro-07-0582 II. Radiosensitisation of normal and hypoxic skin. Clinical Radiology, 27 (2):159–166.
[4] Foster, J.L. and Willson, R.L. (1973). Radiosensitization of anoxic cells by metronidazole. The British Journal of Radiology, 46 (543):234–235.
[5] Asquith, J.C.; Watts, M.E.; Patel, K.; Smithen, C.E. and Adams, G.E. (1974). Electron affinic sensitization: V. Radiosensitization of hypoxic bacteria and mammalian cells in vitro by some nitroimidazoles and nitropyrazoles. Radiation Research, 60 (1):108.
[6] Fowler, J.F. and Denekamp, J. (1979). A review of hypoxic cell radiosensitization in experimental tumors. Pharmacology & Therapeutics, 7 (3):413–444.
[7] Srivastava, R.S. (1981). Synthesis, Characterization and fungi toxicity of Bidentinate High-spin six coordinate 3d metal complexes with N-(5-phenyl-3-4-thiadiazol – 2-yl) acetabenzamide. Inorganica Chimica Acta, 55:1.71–1.74.
[8] Behrens, N.B.; Diaz, G.M. and Goodgame DML. (1986). Metal complexes of the antibiotics Nalidixic acid. Inorganica Chimica Acta, 125:21-26.
[9] Canpolat, E.; Kaya, M. and Gur, S. (2004). Synthesis, Characterization of Some Co(III) Complexes with Vic-Dioxime ligands and their antimicrobial properties. Turkish Journal of Chemistry, 28:235–242.
[10] Su C-C, Hwang T-T, Wang OY-P, Wang S-L, and Liao F-L. (1992). Bonding properties of copper (II) imidazole chromophores: electronic and molecular structure of tetrakis (imidazole) bis (tetrafluoroborato) copper (II) bis (hexamethylphosphoramidate). Transition Metal Chemistry, 17 (2):91.
[11] Mendiola, M.A.; Masaguer, J.R. and Molloida, C. (1992). Iron (II) Chloride Complexes with some 2-aminobenimidazole ligands. Synthesis and Reactivity In Inorganic and Metal-Organic Chemistry, 22 (77):955-969.
[12] Obaleyte, J. A. and Lawal, A. (2007). Synthesis, characterization and antifungal studies of some metronidazole complexes. Journal of Applied Sciences and Environmental Management, 11 (4):15–18.
[13] Betanzos-Lara, S.; Gracia-Mora, I.; Granada-Macías, P.; Flores-Alamo, M.; Barba, and Behrens, N. (2013). Synthesis, characterization, and biological activity of cobalt (II), nickel (II), copper (II), and zinc.
(II) complexes of secnidazole. *Inorganica Chimica Acta*, **397**:94–100.

[14] Skovtt K.A. and Farrell N.P. (1990). Radiosensitization by metal complexes of 4(5)-1-nitroimidazole. *International Journal of Radiation Biology, **57***(5):947–958.

[15] Farrell, N.; Carneiro, T.M.G.; Einstein, F.W.B.; Jones, T. and Skov, K.A. (1984). Synthesis and characterization of nitroimidazole complexes of platinum and palladium and the crystal and molecular structure of trans-dichlorobis(misonidazole) platinum (II). *Inorganica Chimica Acta, **92***(1):61–66.

[16] Macdonald, F.M. and Sadler, P.J. (1991). Studies of the cis-trans isomerism of some square-planar platinum (II) nitroimidazole complexes. *Polyhedron, **10***(12):1443–1448.

[17] Rochon, F.D.; Melanson, R. and Farrell, N. (1993). Structures of the nitroimidazole platinum group metal complexes cis-amminedibromo-[1-((2-hydroxyethyl) amino) carbonyl methyl]-2-nitroimidazole] platinum (II) and trans-dichlorobis(1-hydroxyethyl-2-methyl-5-nitroimidazole) palladium (II). *Acta Crystallographica Section C: Crystal Structure Communications, **49**(10):1703–1706.

[18] De Bondt, H.L.; Blaton, N.M.; Peeters, O.M. and De Ranter, C.J. (1994). trans-Dichlorobis (metronidazole) palladium (II).[PdCl2(C6H5N2O2)2]. *Acta Crystallographica Section C: Crystal Structure Communications, **50**(2):180–181.

[19] Callaghan, V.; David, M.J.; Goodgame L. and Robert, R.T. (1983). Platinum and other metal complexes of 2-methyl-5-nitrobenzimidazole. *Inorganica Chimica Acta, **78***(L1-L4).

[20] Al-Jibori, S.A.; et al. (2015). Palladium (II) benzisothiazolinate (bit) complexes with amino-, acetylamino-, heterocyclic and phosphine co-ligands. Crystal structure of [Pd (bit)2(κ2-dppe)]·2EtOH. *Inorganica Chimica Acta, **436**:8.

[21] Price, J.H.; Williamson, A.N.; Schramm, R.F. and Wayland, B.B. (1972). Palladium (II) and platinum (II) alkyl sulfoxide complexes. Examples of sulfur-bonded, mixed sulfur-and oxygen-bonded, and totally oxygen-bonded complexes. *Inorganic Chemistry, **11**(6):1284.

[22] Bharti, N.; et al. (2002). Synthesis, crystal structure, and enhancement of the efficacy of metronidazole against Entamoeba histolytica by complexation with palladium(II), platinum(II), or copper(II). *Helvetica Chimica Acta, **85**(9):2710.

[23] Bales, J.R.; et al. (1983). The preparation and isomerization of platinum metronidazole complexes: X-ray crystal and molecular structures of cis-and trans-dichlorobis [1-(2-hydroxyethyl)-2-methyl-5-nitroimidazole]-platinum (II). *Journal of the Chemical Society, Chemical Communications, **(8)**:432–433.

[24] Geary, W.J. (1971). The use of conductivity measurements in organic solvents for the characterization of coordination compounds, *Coordination Chemistry Reviews, **7**(1):81–122.

[25] Ulukaya, E.; et al. (2011). Anti-cancer activity of a novel palladium (II) complex on human breast cancer cells in vitro and in vivo. *European Journal of Medicinal Chemistry, **46**(10):4957.

[26] Guney, E.; Yilmaz, V.T.; Ari, F.; Buyukgungor, O. and Ulukaya, E. (2011). Synthesis, characterization, structures and cytotoxic activity of palladium (II) and platinum (II) complexes containing bis (2-pyridylmethyl) amine and saccharinate. *Polyhedron **30**(1):114–122.

[27] Guney, E.; Yilmaz, V.T. and Buyukgungor, O. (2010). Neutral and cationic palladium (II) and platinum (II) complexes of 2,2’-dipyridylamine with saccharinate: Syntheses, spectroscopic, structural, fluorescent and thermal studies. *Inorganica Chimica Acta, **363**(11):2416–2424.

[28] Griffith, D.M.; Haughey, A.; Chahal, S.; Müller-Bunz, H. and Marmion, C.J. (2010). Novel palladium (II) and platinum (II) complexes of biocidal benzisothiazolimine (Bit); X-ray crystal structures of co-crystallised Bit/BitO and cis-Pd (en)(Bi)–1H) 2H2O. *Inorganica Chimica Acta, **363**(10):2333–2337.

[29] Al-Jibori, S.A.; Hameed, W.J.; Al-Hayaly, L.J.; Wagner, C. and Hogarth, G. (2017). A comparative study of the coordination of saccharinate (sac), thiosaccharinate (tsac) and benzisothiazolinate (bit) ligands to trans-[PdCl2(H2NBz)2]: molecular structure of cis-[Pd(bit)2(H2NBz)2]. *Transition Metal Chemistry, **42**(1):79–84.
معقدات البلاديوم (II) والبلاتين (II) مع مزيج من ليكاندات المترونيدازول والسكارينيت أو البنزايزوثايازولينونيت، تحضير وتشخيص طفيّ
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ملخص
ست معقدات جديد البلاديوم (II) والبلاتين (II) الحاوية على مزيج من ليكاندات المترونيدازول والسكارينيت (Nasac) أو البنزايزوثايازولينونيت (Nabit) حيث (M= Pd(II) أو Pt(II)) و [trans-[MCl₂(mnz)₂]₂] و [cis-[PtCl₂(mnz)₂]₂] و [trans-[M(sac)₂(mnz)₂]₂] و [cis-[Pt(sac)₂(mnz)₂]₂] من تفاعل المعقدات [cis-[Pt(sac)₂(mnz)₂]₂] و [trans-[M(sac)₂(mnz)₂]₂] مع ليكاندات صوديوم سكارينيت (Nasac) و بينكلات صوديوم بنزايزوثايازولينونيت (Nabit) أو صوديوم بنزايزوثايازولينونيت (Nabit) و بنسبة منتج عالية. شُخصت المعقدات المحضرة باستخدام التحليل الدقيق للعناصر والموصلية المولارية ومطيافية الأشعة تحت الحمراء والرنين النووي المغناطيسي للبروتون.
يسلك ليكائد المترونيدازول في جميع المعقدات المحضرة سلوك ليكائد أحادي السن عن طريق ذرة النتروجين، وإن ليكائد (sac) يتناسق مع البلاتين (II) عن طريق ذرة النتروجين أيضاً في جميع المعقدات المحضرة، أما ليكائد (bit) فإنه يتناسق عن طريق ذرة النتروجين مع البلاديوم (II) عن طريق ذرة الأوكسجين للكاربونيل مع البلاتين (II).

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