Sys Rev Pharm 2020; 11(5): 535 – 555
A multifaceted review journal in the field of pharmacy
E-ISSN 0976-2779 P-ISSN 0975-8453

Synthesis, Characterization and Spectroscopic Study of New Metal Complexes form Heterocyclic Compounds for Photostability Study

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Article History: *Submitted: 23.03.2020* *Revised: 15.05.2020* *Accepted: 24.06.2020*

ABSTRACT

In present project, new Schiff base of 4, 4'- (((1E, 1'E)-1,4-phenylenebis- (methane-ylylidene))-bis-(azane-ylylidene)) bis-(5-(4-chlorophenyl) -*4H* -1,2,4-triazole-3-thione) (L_3) has been synthesized by condensation of 4-amino-5-(4-chlorophenyl)-2,4-dihydro-3*H*-1,2,4-triazole-3-thione with benzene-1,4-dicarboxaldehyde. The new asymmetrical Schiff base (L_3) used as a ligand to synthesize a new complex with Co(II), Ni(II), Cu(II), Pd(II), and Pt(IV) metal ions by 1:2 (Metal: ligand) ratio. New ligand and their complexes have been exanimated and Confirmed by Fourier-transform infrared (FT-IR), Ultraviolet-visible (UV-visible), Proton nuclear magnetic resonance (1HNMR), carbon13 nuclear magnetic resonance (13CNMR), carbon-hydrogen nitrogen sulfur (C-H-N-S), thermal analysis (TG), atomic-absorption-flame (AAF), cond-uctivity and Magnetic susceptibility.

Examining new compounds through a calculation of photodegradation polystyrene films, assessed photo-stability activities. Results indicate Pt_2L_3 > Pd_2L_3 > Cu_2L_3 > Ni_2L_3 > Co_2L_3 > L_3 > PS. Polymer stability is given for this the analysis of the reduction of weight, molecular average, reveals a more stable polystyrene PS.

Keywords: New Schiff base, Condensation reaction, Photo-stability, Photodegradation, New complexes

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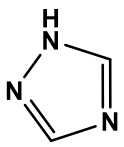
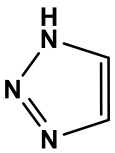
DOI: 10.31838/srp.2020.5.71

INTRODUCTION

Heterocyclic compounds are the main organic substrate class which contains a minimum of two different atom types in the ring [1-3]. The inorganic heterocyclic and ringed mixed rings without atoms are organic heterocyclics, as are heteroatoms and heteroatom as (N, O & S) [4]. More than half of all recognized chemicals have at least a heterocyclic phase, making them the largest class of organic compounds [5]. Heteroatom presence offers many physical and chemical properties of heterocyclic compounds. The heterocycles are common in nature and are of great importance for human life because many natural products such as vitamins, hormones, antibiotics, and pigments contain their structural units. This indicates that the concepts of biologically active molecules have gained significant interest. Heterocyclic nitrogen is a synthetic obstacle for a variety of natural products with physiological activity [6,7]. Triazole is a class of organic heterocyclic compounds, also known as pyrrodiazole. It comprises one class of five members of the diunsaturated ring structure consisting of three atoms, and two atoms of carbon at the non-adjacent site, Two triazole isomers [8-10]:

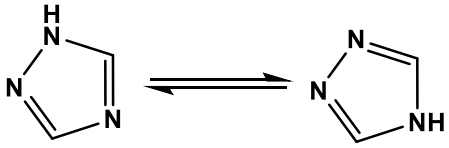


(1)



(2)

In two tautomeric forms, 1,2,4-triazoles exist. 1H and 4H-1,2,4- triazole are considered pharmaceutically essential [11]



The amine and the sulfur atom must be a perfect ligand of soft and hard nitrogen atoms. The terephthaldehyde interacts with this ligand, which is a new Schiff base ligand. Also, the chemical processes and operation of this new Schiff base can be researched extensively via the coordination of Different metal ions [12-15]. Our analysis of metal transition complexes is continuously interested. The new ligand (Schiff base) and complexes are synthesized, characterized, and tested by the measurement of the polystyrene film for photodegradation of evaluating new compounds in a photo-stability operation.

EXPERIMENTAL

Materials and methods

Sigma-Aldrich obtained all the chemicals and solvents used.

1- Synthesis of ethyl-4-chlorobenzoate (2)

Ethyl-4-chlorobenzoate was synthesized according to the present method scheme 1: 0.026 mmole of 4-chlorobenzoic acid (5 g) has been dis-solved in (40 ml) of EtOH (C_2H_5OH). Adding (4 ml) of H_2SO_4 conc. to the reaction was acidic. The reaction mixture was then heated for 4 hours under reflux. The remaining alcohol has been distilled and is cooled with a 10 % sodium bicarbonate solution followed by a saturated solution of sodium chloride, to eliminate vacuum-filtered residual acid. The ethyl-4-chlorobenzoate crystal was eventually produced [16].

2- Synthesis of 4-chlorobenzohydrizde (3)

4-chlorobenzohydrizde was synthesized according to the present method scheme 1: A total of (15 ml) of ethanol was used for dissolution of ethyl-4-chlorobenzoate (0.01, 1.76 gm). 80 % of (30 ml) hydrazine was added then heated and reflux 10 hours. A thin-layer chromatography (TLC) was used to track the reaction. The obtained solid was vacuum-dried and filtered. The obtained powder has a white crystal needle filled with ice-cold water [16].

3- Synthesis of potassium-2- (4-chlorobenzoylhydrazine-l-carbodithio-ate) (4)

Potassium-2- (4- chlorobenzoylhydrazine-l-carbodithio-ate) was synthesized according to the present method scheme 1: KOH (0.0135 mmol) Potassium hydroxide has been dissolved in absolute ethanol (30 ml). 4-chlorobenzoohydrides were then combined with0,0135 mmol of carbon-disulfide (CS_2) in the mixture understirring at room-temperature of 25 °C for (12 hours). Added (200 ml) diethyl ether to cool the reaction with stirred for 10 minutes. A filter was obtained to form solid, and the diethyl ether washed under vacuum.

4- Synthesis of 4-amino-5-(4-chlorophenyl)-2, 4-dihydro-*3H*-1, 2, 4-triazole-3-thione (5)

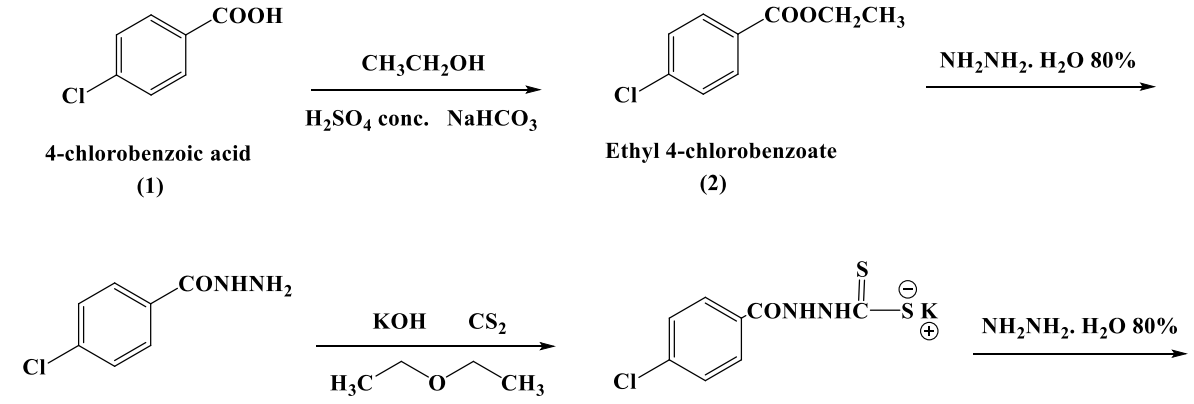
4-amino-5-(4-chlorophenyl)-2, 4-dihydro-*3H*-1, 2, 4-triazole-3-thione was synthesized according to the present method scheme 1: A-compound (4) (0.009mmol) has been added-slowly to (20 ml) of hydrazine Hydrate 80%. For six hours the mixture has refluxed. A color change is observed in the green reaction. Thin-layer chromatography (TLC) was used to monitor the reaction. Concentrated HCl (PH=3) acidified the contenting. The precipitation was applied to the compound under a vacuum.

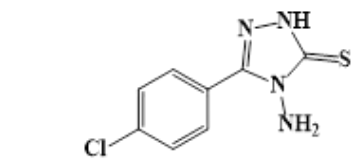
5- Synthesis of ligand 4, 4'- (((1E, 1'E)-1,4-phenylenebis- (methane-ylylidene))-bis-(azane-ylylidene))-bis-(5-(4-chlorophenyl)-*4H*-1,2,4-triazole-3-thione) (6) (L_3)

(L_3) was synthesized according to the present method scheme 1: A (5) (0.009 mmol) compound was dissolved and aggravated in absolute ethanol (30 ml). Terephthaldehyde has then been added (0.003 mmol). Added eight drops of Glacial acetic acid was acidic to the reaction. All mixture heated for l0 hours under reflux. Thin-layer chromatography (TLC) was used to monitor the reaction then filtered under vacuum to obtained powder [17,18].

6- Synthesis of transition metal complexes (7)

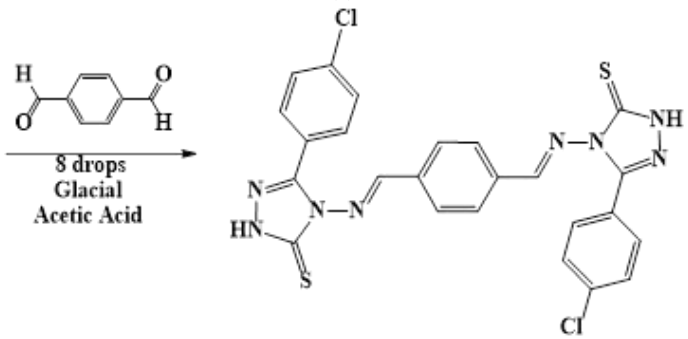
The transition metal Complexes of Co(II), Cu(II), Ni(II), Pt(II), and Pd(II) were synthesized from metallic salts of $CoCl_2.6H_2O$, $CuCl_2.2H_2O$, $NiCl_2.6H_2O$, $H_2PtCl_6.6H_2O$ and $PdCl_2$ with (L_3), in (2: I) As a ratio of metal to ligand according to the scheme 1. The final reaction had been heated for 4 hours under reflux. The precipitate was filtered and eventually washed from total ethanol by distilled water [19].





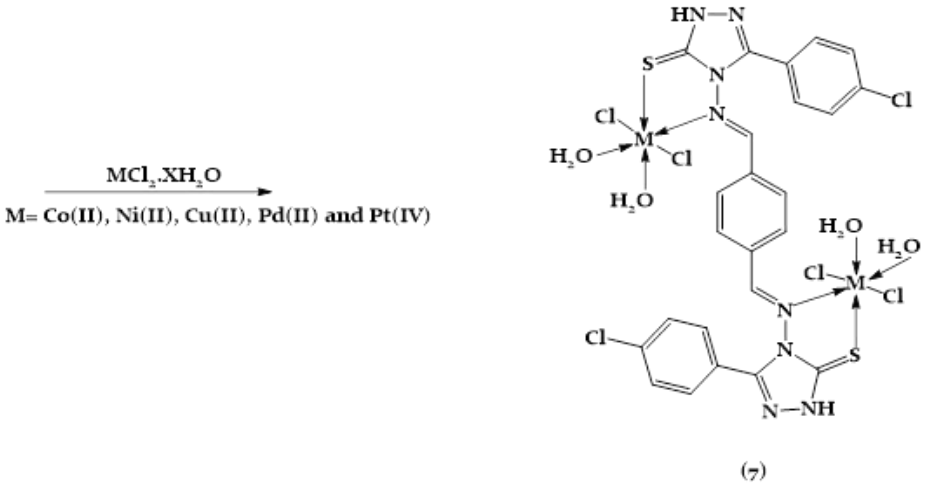
4-amino-5-(4-chlorophenyl)-2,4-dihydro-3H-1,2,4-triazole-3-thione

(5)



4,4'-(((1E,1'E)-1,4-phenylenebis(methaneylylidene))bis(azaneylylidene))bis(5-(4-chlorophenyl)-2,4-dihydro-3H-1,2,4-triazole-3-thione)

(6)



Scheme 1: new Schiff bases and their complexes, general synthetic path

RESULT AND DISCUSSION

Table (1) show the information indicative of new ligand from Schiff base and their complexes by in (2: I) As a ratio of metal to ligand, the ligands were burdened with metal, C.H.N.S. analyzes and atomic absorption(AA) alongside the new ligand from Schiff base physical properties and their complexes were present. The DMSO was soluble in all complexes.

Table 1: New Schiff Base (L_3) and its complexes (physical properties and analytical data).

Symbol	Color	M.P °C	Yield %	M.Wt	Micro Elemental Analysis Found (calc.)				Metal content % Found (calc.)	Chloride content % Found (calc.)
					C %	H %	N %	S %		
L	Dark orange	260	69	551.47	50.33 (50.29)	2.91 (2.79)	24.67 (24.45)	11.33 (11.17)	-----	-----
Co_2L	Brown	274	61	928.86	33.78 (33.59)	3.36 (3.23)	12.24 (12.06)	7.06 (6.89)	12.81 (12.69)	-----
Ni_2L	Brown	292 (dec.)	58	882.38	32.84 (32.64)	3.03 (2.72)	12.74 (12.69)	7.44 (7.25)	13.52 (13.30)	-----
Cu_2L	Brown	205	63	892.1	32.43 (32.28)	2.81 (2.69)	12.71 (12.55)	7.29 (7.17)	14.33 (14.25)	-----
Pd_2L	Dark orange	278	59	923.86	31.29 (31.17)	2.22 (1.95)	12.36 (12.12)	7.04 (6.93)	23.21 (23.04)	-----
Pt_2L	Bright yellow	300< (dec.)	62	1267.14	22.93 (22.52)	1.61 (1.56)	11.13 (10.95)	5.17 (5.00)	30.23 (30.19)	-----

The FT-IR spectrum of new Schiff base L and their complexes

The FT-IR spectrum characterized a new schiff base ligand and its complexes Table (2), Figures (1-7). The result show absorption bands υ: 3278 cm^{-1} (NH), 3102 cm^{-1} (C-H) ar., 2753 cm^{-1} (S-H), 1694 cm^{-1} (CH=N) azo-methane, 1600 cm^{-1} (C=C) and 1419 cm^{-1} (C=S) for the ligand [20,21]. In υ, 1691 cm^{-1} (CH=N) azo-methane [20], 1433 cm^{-1} (C=S), while the complexes exhibited bands. The band intensity shifting for ligand (L_3) attributed to the Ligand-Metal coordinate [22]. The new (Metal-N) and (Metal-S) bands and (Metal-Cl) bands at (200-590 cm^{-1}) are also apparent [23].

Table 2: FT-IR data of new Schiff base ligand and their complexes

Symbol	υ(C=N)	υ(C=S)	υ(M-N)	υ(M-S)	υ(M-Cl)
L	1693	1425	-----	-----	-----
Co_2L	1660	1423	540	468	310
Ni_2L	1695	1425	543	468	320
Cu_2L	1701	1423	540	464	337
Pd_2L	1695	1429	540	466	312
Pt_2L	1697	1429	557	451	300

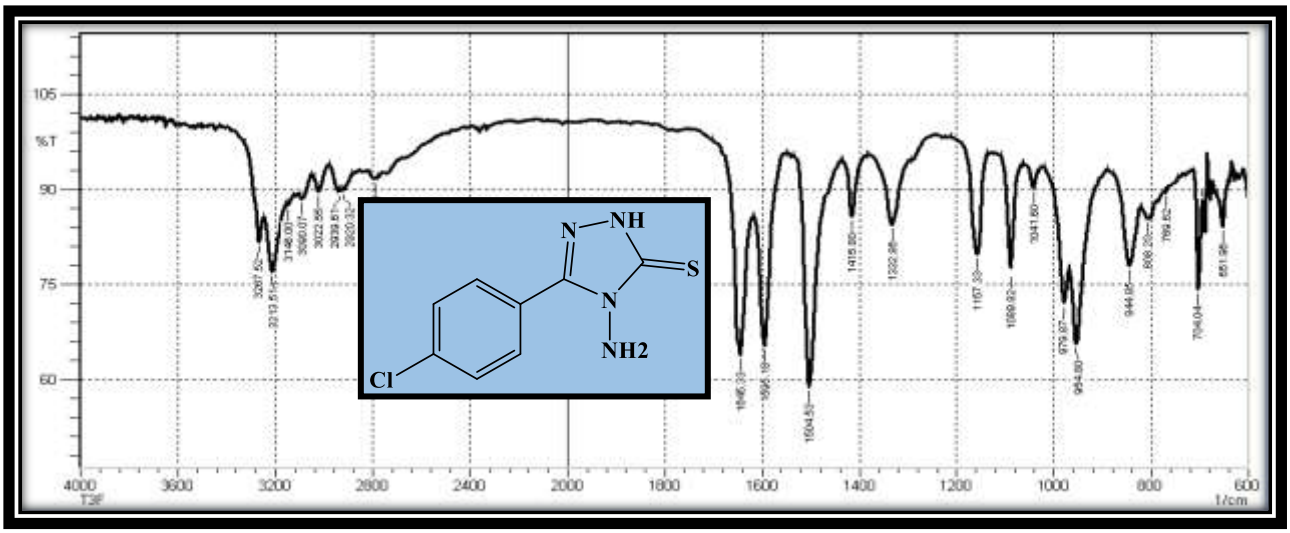


Figure 1: FT-IR spectrum of 4-amino-5-(4-chlorophenyl)-2, 4-dihydro-*3H*-1, 2, 4-triazole-3-thione

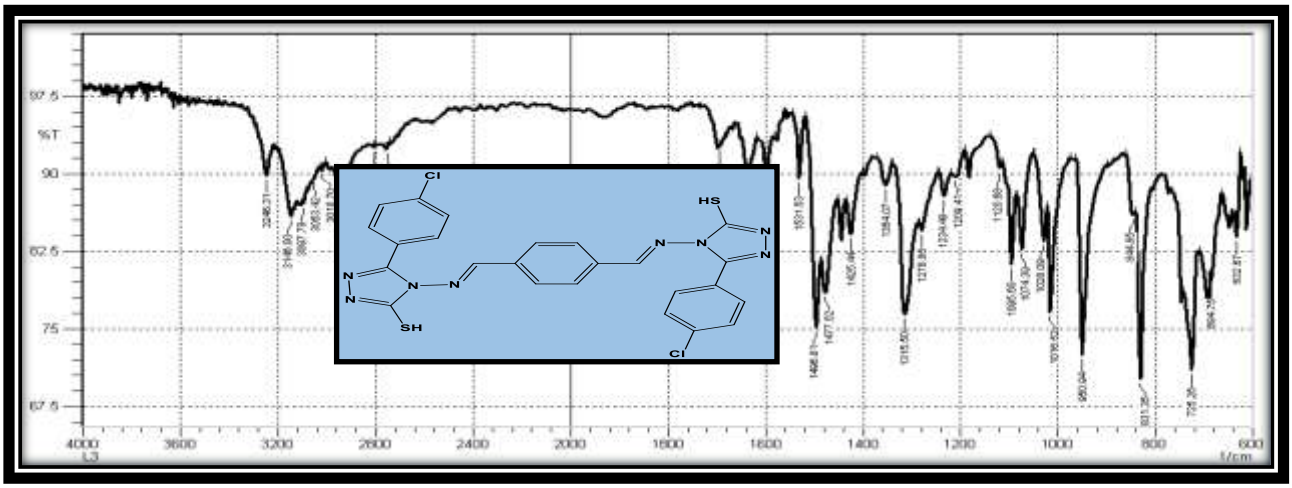


Figure 2: FT-IR spectrum of (L_3) 4, 4'- (((1E, 1'E)-1,4- phenylene-bis-(methane-ylylidene))-bis-(azane-ylylidene))-bis-(5-(4-chlorophenyl)-*4H*-1,2,4-triazole-3-thione)

Figure 3: FT-IR spectrum of (Co_2L_3) complex

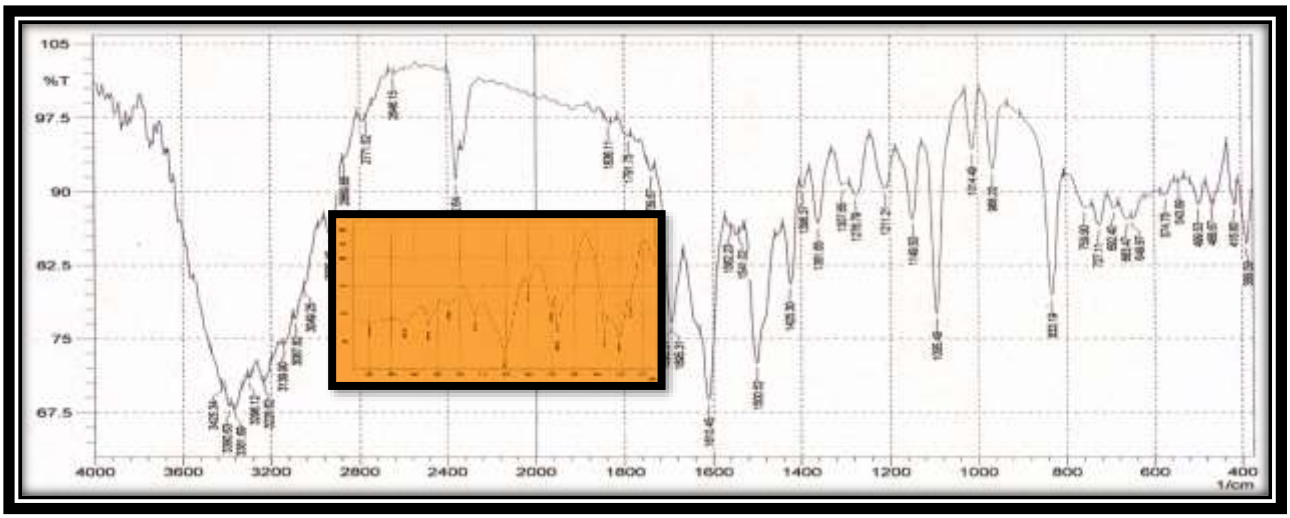


Figure 4: FT-IR Spectrum of (Ni_2L_3) Complex

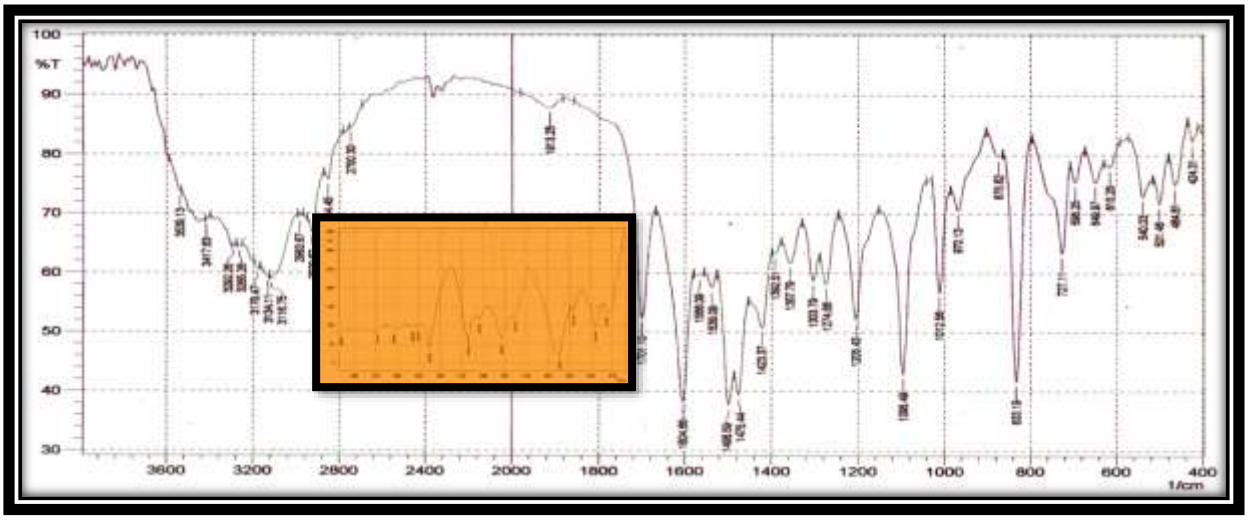


Figure 5: FT-IR Spectrum of (Cu_2L_3) Complex

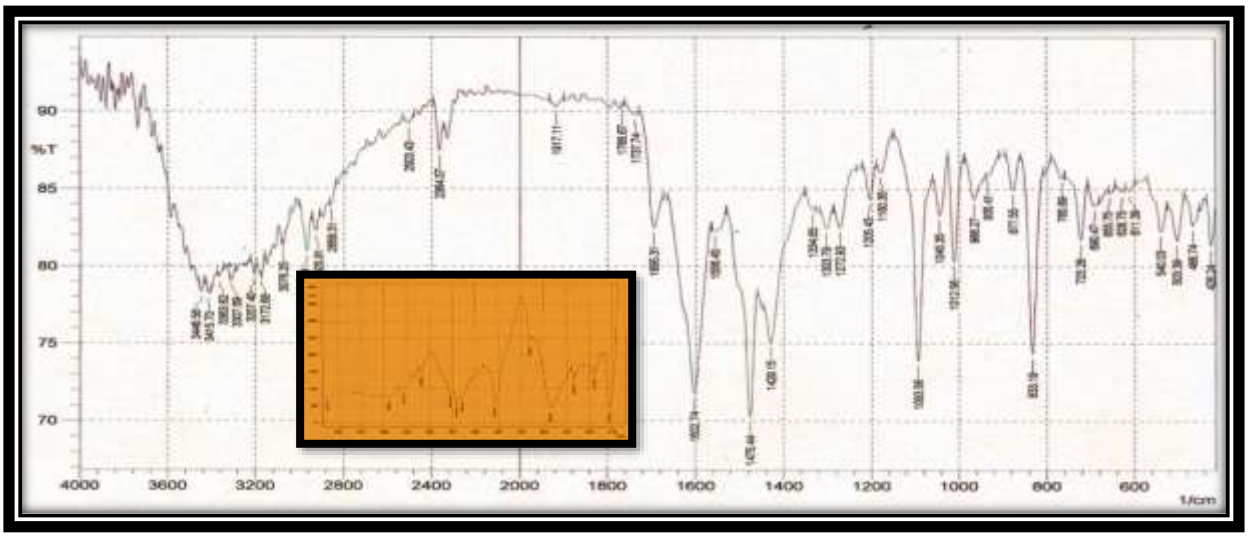


Figure 6: FT-IR Spectrum of (Pd_2L_3) Complex

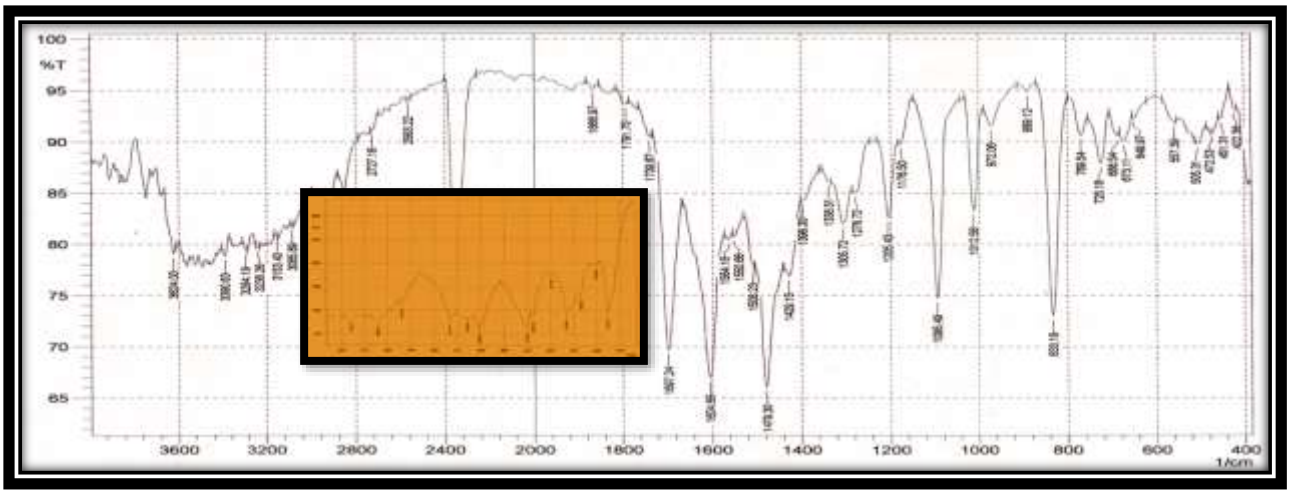


Figure 7: FT-IR Spectrum of (Pt_2L_3) Complex

^{1}H-NMR and ^{13}C-NMR spectrum of synthesized (L_3)
^{1}H-NMR spectrum of (L_3) shown in Figure (8-9), the signals at (δ, ppm): 14.01 (1H, s, SH) [24], 9.94 (IH, s, CH=N), 8.19 (4H, m, CH ar.), while the ^{13}C-NMR shown in Figure (10-11), signals at (δ, ppm): 148 (C- 1, 2, 4- triazole-ring), 157 (CH=N) (C azo-methane), 135 (C-Cl) group, 160 (C=S) thione group.

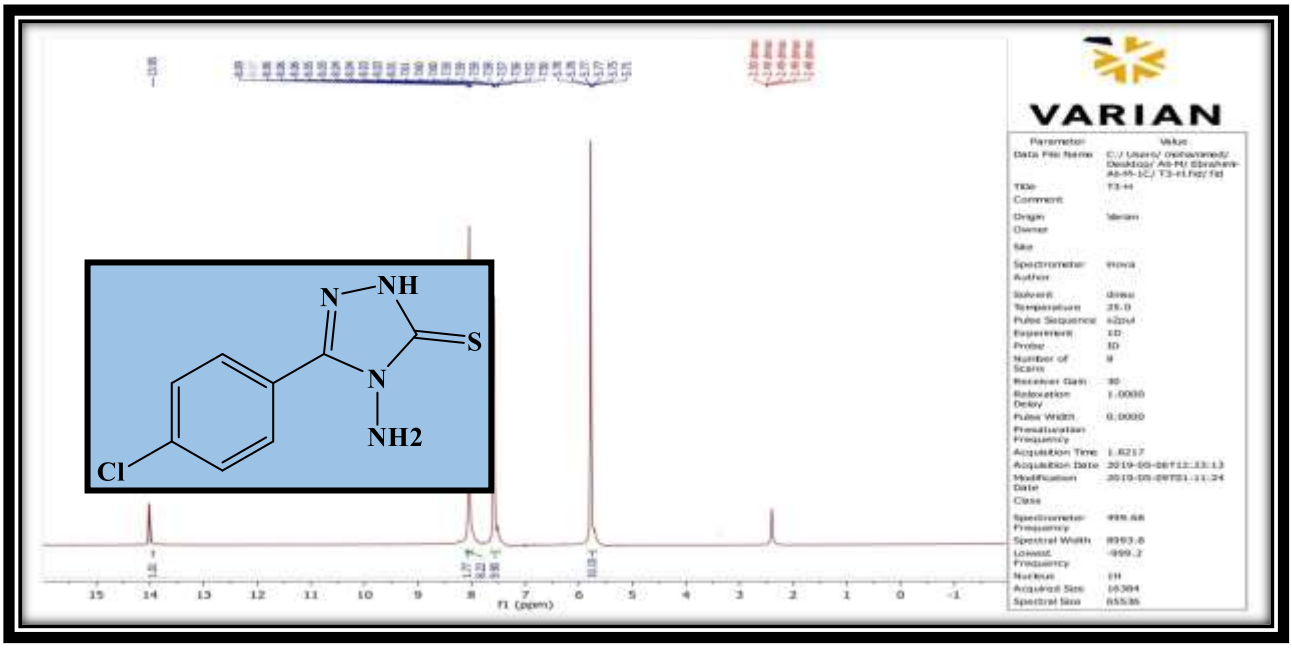


Figure 8: ^{1}H-NMR spectrum for 4-amino-5-(4-chlorophenyl)-2, 4-dihydro-*3H*-1, 2, 4-triazole-3-thione

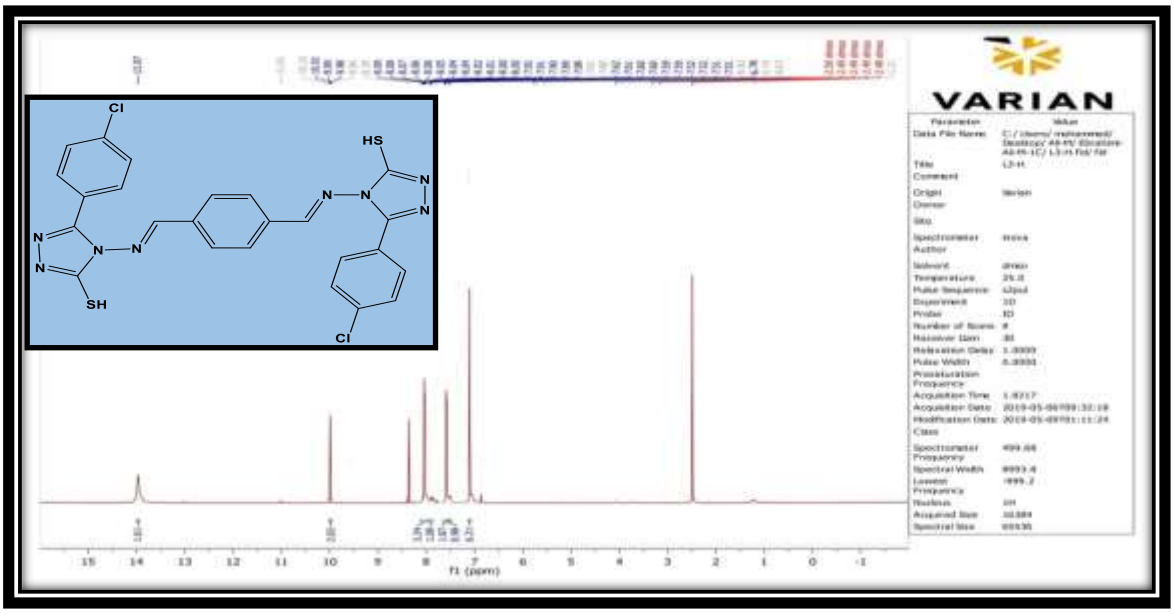


Figure 9: ^{1}H-NMR spectrum for (L_3) 4, 4'- (((1E, 1'E)- 1,4- phenylene-bis-(methane-ylylidene))-bis-(azane-ylylidene))-bis-(5-(4-chlorophenyl)-*4H*-1,2,4- triazole-3-thione)

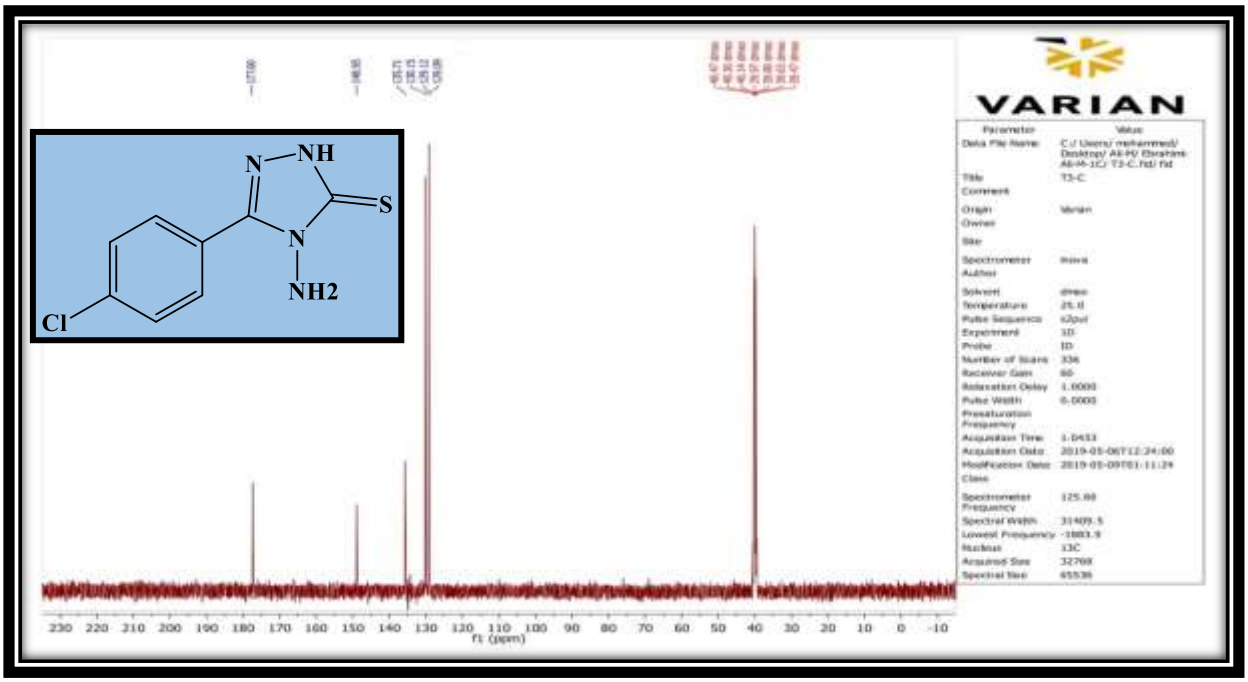


Figure 10: ^{13}C-NMR spectrum for 4-amino-5-(4-chlorophenyl)-2, 4-dihydro-*3H*-1, 2, 4-triazole-3-thione

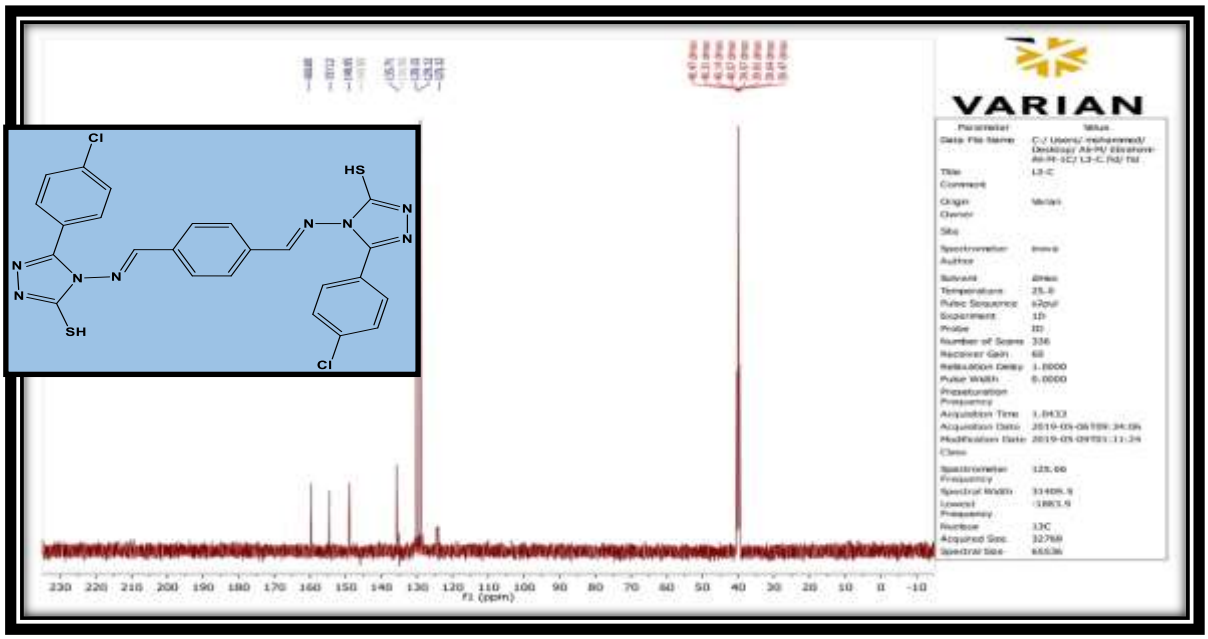


Figure 11: ^{13}C-NMR spectrum for (L_3) 4, 4'- (((1E, 1'E)- 1,4- phenylene-bis-(methane-ylylidene))-bis-(azane-ylylidene))-bis-(5-(4-chlorophenyl)- *4H*-1,2,4-triazole-3-thione)

Also, magnetic sensitivity and molar conduction are summarized in table 3.

Table 3: Molar conductivity and metal-complexes magnet susceptibility

Compound	Molar conductivity Ohm^{-1} cm^2 mole^{-1}	Magnetic susceptibility (B.M)	
		Cal.	Found
Co^2L	13.43	4.01	4.15
Ni^2L	9.98	2.78	2.88
Cu^2L	17.42	1.73	1.77
Pd^2L	15.83	0.03	0.01
Pt^2L	18.74	0.07	0.09

Electronic spectra (Uv.vis) of new Schiff base (L_3)
Three bands of absorption (238 nm, 42016 cm^{-1}), (350 nm, 28571 cm^{-1}), allocation to ($\pi\rightarrow\pi^*$), ($n\rightarrow\pi^*$) intra-light transitions, and (411 nm, 24330 cm^{-1}) intake allo-cated to ($n\rightarrow\pi^*$).

Electronic-spectrum (Uv.vis) of Cobalt-(II) complex
two bands of absorption at (650 nm, 15385 cm^{-1}) and (538 nm, 18587 cm^{-1}) were observed for the electronics spectrum (Co_2L_3) complex., That could be related to the transition [$^4T_1g\rightarrow^4A_2g$] (F) (ν_2) and [$^4T_1g\rightarrow^4T_1g$] (P) (ν_3) respectively, Octahedral geometry these clicks. Based on this assignment (ν_1) for d^7 of the diagram (Tanabe-sugarano) was calculated, the Estimated value of (ν_1) by transition $^4T_1g \rightarrow {}^4T_2g$ (F) to (7938) cm^{-1}. In addition to the 10 Dq, B, and β (Co_2L_3) values, respectively, it is (75550, 458, and 0,69). The sensitivity of the magnet and molar conductivity measurement suggested that the complex is (4.15) B.M.

Electronic-spectrum (Uv.vis) of Nickel-(II) complex
There are two (698 nm, 14327 cm^{-1}) and (460 nm, 21739 cm^{-1}) transitions, respectively, of [$^3A_2g \rightarrow {}^3T_1g$] (F) ($\nu_2$) and [$^3A_2g \rightarrow {}^3T_1g$] (P) ($\nu_3$), respectively. Transformations of the (Ni_2L_3) complex are shown as the electronic spectrum. The bands show a Ni (II) ion octahedral geometry. Transition [$^3A_2g \rightarrow {}^3T_2g$] (F) can be attributed to (ν_1) to (11677) cm^{-1}. The magnetism value (2.88) B.M coincides with the octa-hedral configuration of Ni (II) ions, while the nonionic characterization of these structures results in conductance calculation.

Electronic-spectrum (Uv.vis) of copper-(II) complex
The chloroform complex electronics spectrum (Uv.vis) of (Cu_2L_3) tends to be low energy in a shallow band of 14285 cm^{-1} and high strength of [$^2Eg \rightarrow {}^2T_2g$] and[L → Cu] (C.T) respectively. (Cu_2L_3) magnetism-moment (1.77) B.M is respectively, and the calculation of non-electoral cond-

uctivity. The Cu (II) data indicate that the complex octahedral (Cu_2L_3) exists.

Electronic-spectrum (Uv.vis) of palladium-(II) Complex

Three bands of absorption at (472 nm, 21186 cm^{-1}), (390 nm, 25641 cm^{-1}) and (340nm, 29412 cm^{-1}) for the spectrum of light brown (Pd_2L_3), each with the product of [$^1A_1g \rightarrow {}^1B_1g$], [$^1A_1g \rightarrow {}^1E_1g$] and [L → Pd] (C.T) respectively. Such strips' locations conform well to the geometry of tick square planers. However, the magnetism moment value for this complex is (0.01) B.M while the calculation of the behavior of these complexes ticks the non-ionic moment.

Electronic-spectrum (Uv.vis) of platinum-(IV) complex

The electronic spectrum (UV.Vis) of (Pt_2L_3) was assigned to [$^1A_1g \rightarrow {}^3T_1g$], [$^1A_1g \rightarrow {}^3T_2g$] and [L → Pt] (C.T) respectively, at the ranges (508 nm, 19685 cm^{-1}), (460 nm, 21739 cm^{-1}), and (410 nm, 24390 cm^{-1}). The current (Pt_2L_3) (d^6) complex structure (0.24) B.M agrees with the octa-hedral structure around Pt (IV) is the magnetism moment value. According to the existence of such complexes, the cond-uctance test ticks the non-ionic.

Thermal-analysis (TG) of the (L_3) (new Schiff base) and their complexes

TG and DTA [25] compound thermal tests were applied in Table (4) at a heating range of nitrogen gas (N_2) (25 -800) °C temperature heat (l0 °C / min) and in the figure. (12-17).

Table 4: New Schiff base ligand and its complexes thermal decomposition data

Compound	Molecular Formula M.Wt	Step	Temp. range of the decomposition (TG) °C	Suggested Formula of loss	Mass loss %	
					Cal.	Found
L	$C_{24}H_{16}Cl_2N_8S_2$ 550.03	1 2 3	0 – 221 221 – 352 352 – 595	Cl $2C_6H_4$, 2CH C_6H_6, $2C_2N_3H$	6.45 32.36 38.9	6.07 32.74 39.77
Co^2L	$C_{26}H_{30}Co_2Cl_6N_8S_2O_5$ 928.86	1 2 3	0 – 162 162 – 354 354 – 595	H_2O, EtOH $2C_6H_4$, 2CH, 3Cl	6.89 30.62 28.79	6.97 31.22 27.71
Ni^2L	$C_{24}H_{24}Ni_2Cl_6N_8S_2O_4$ 882.38	1 2 3	0 – 267 267 – 411 411 – 595	C_6H_4, 2CH, 2Cl $2C_6H_4$ 3Cl, $4H_2O$	19.60 17.22 20.22	19.48 17.42 21.34
Cu^2L	$C_{24}H_{24}Cu_2Cl_6N_8S_2O_4$ 892.1	1 2 3	0 – 295 295 – 378 378 – 595	C_6H_4, 2CH, Cl C_6H_4, Cl C_6H_4, 2Cl	15.44 12.49 16.47	17.21 11.31 17.20
Pd^2L	$C_{24}H_{18}Pd_2Cl_6N_8S_2O$ 923.86	1 2 3	0 – 290 290 – 410 410 – 594	$2C_6H_4$, 2CH, Cl, H_2O C_6H_4, C_2N_3H, Cl C_2N_3, 4Cl	25.05 19.53 22.83	23.23 17.70 21.92
Pt^2L	$C_{26}H_{22}Pt_2Cl_{10}N_8S_2O$ 1271	1 2 3	0 – 160 160 – 330 330 – 594	– OH – CH_2CH_3, C_6H_4, 2CH, 2Cl $2C_6H_4$, 6Cl	1.33 15.81 28.71	1.48 16.70 27.07

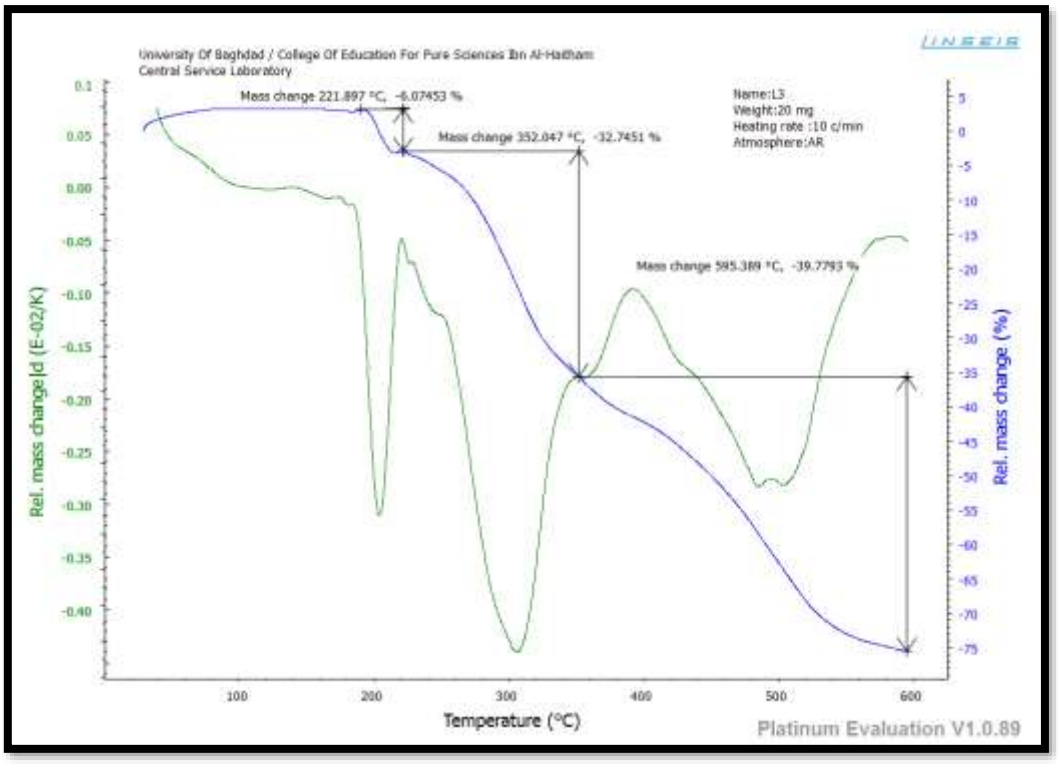


Figure 12: Thermo-graphs (TGA and DTA) of Ligand (L_3)

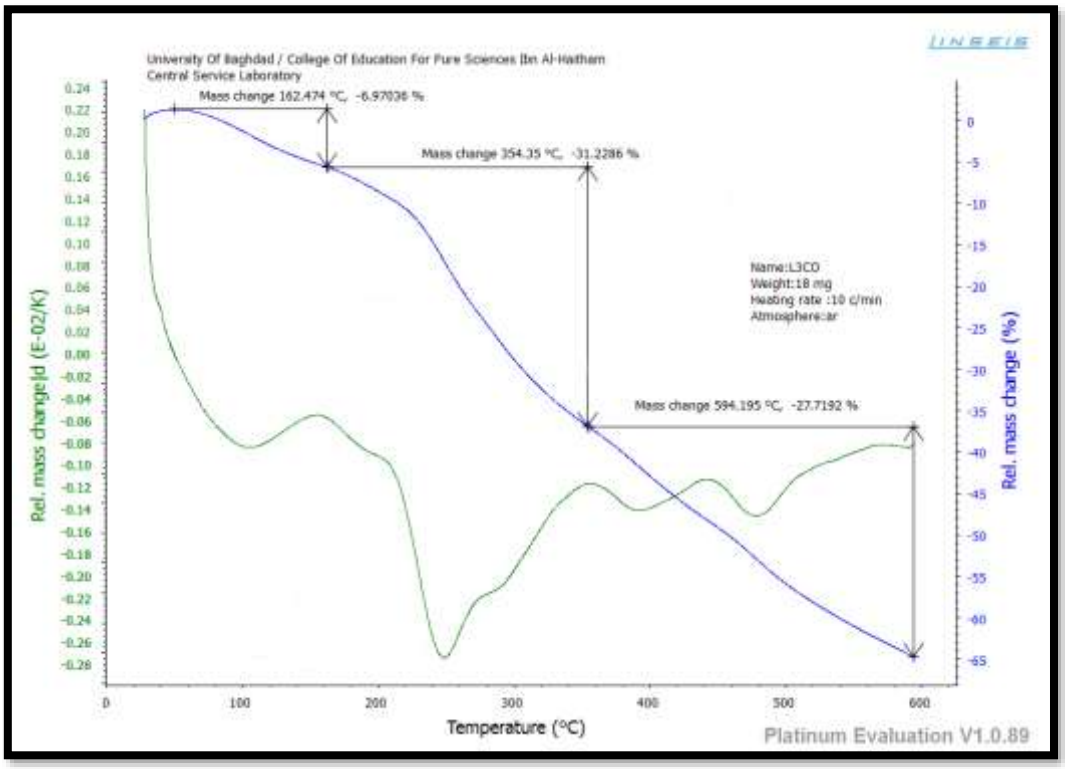


Figure 13: Thermo-graphs (TGA and DTA) of complex (Co_2L_3)

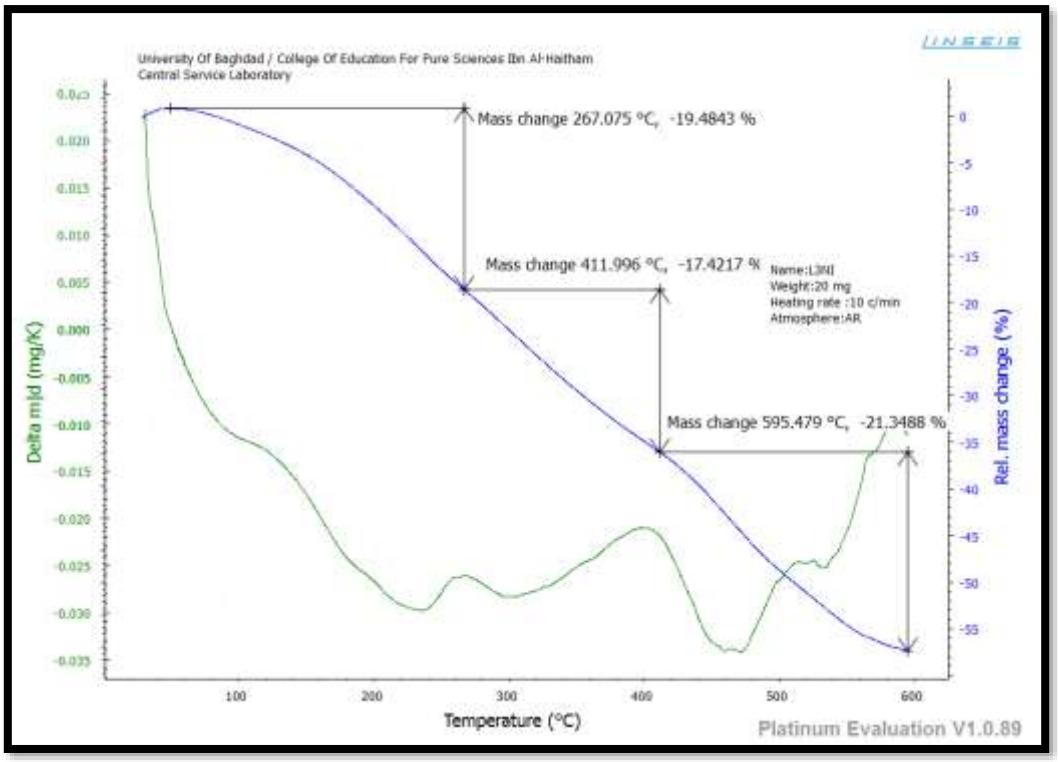


Figure 14: Thermo-graphs (TGA and DTA) of complex (Ni_2L_3)

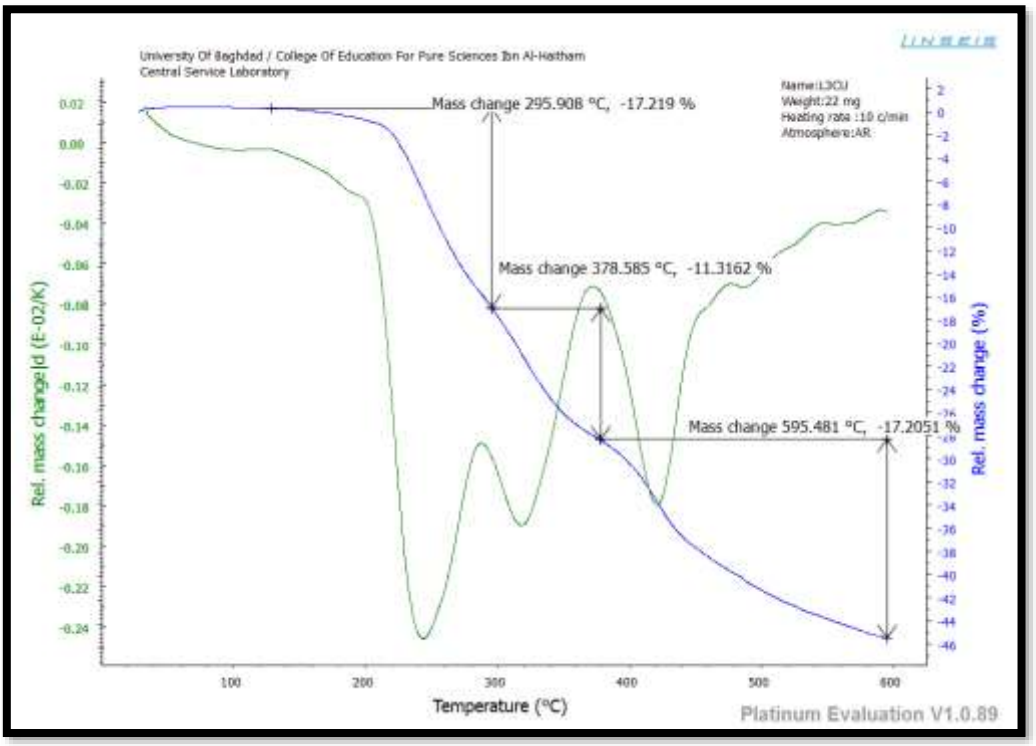


Figure 15: Thermo-graphs (TGA and DTA) of complex (Cu_2L_3)

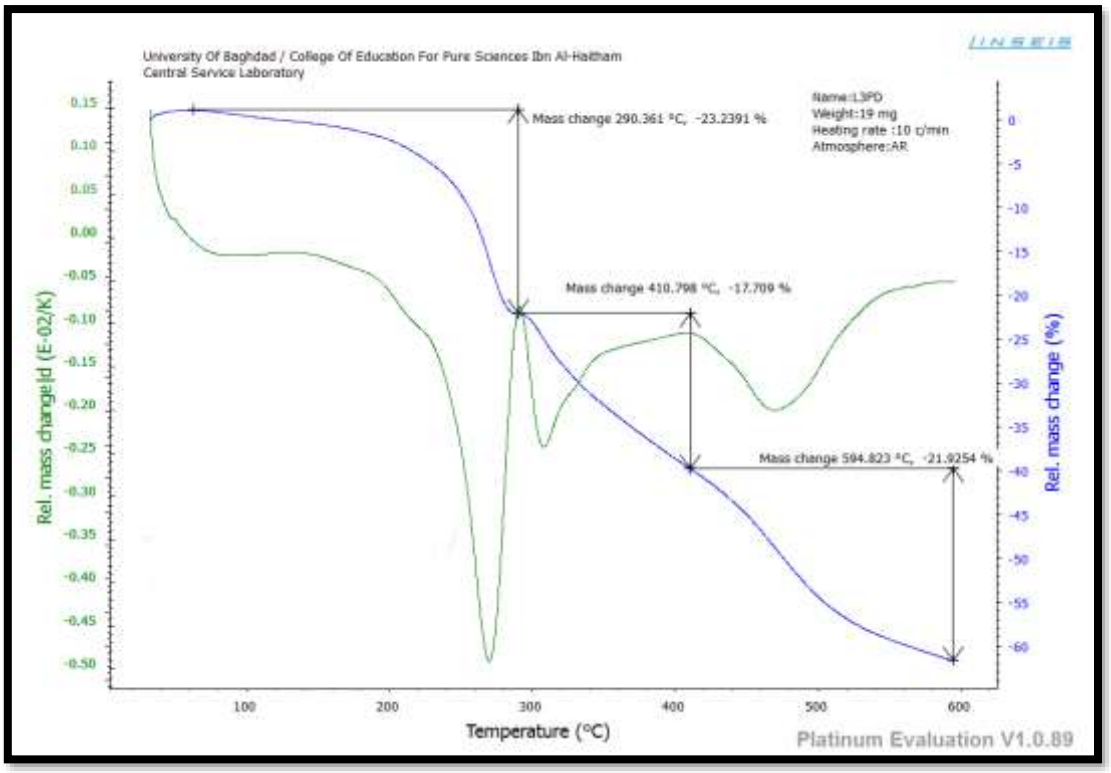


Figure 16: Thermo-graphs (TGA and DTA) of complex (Pd_2L_3)

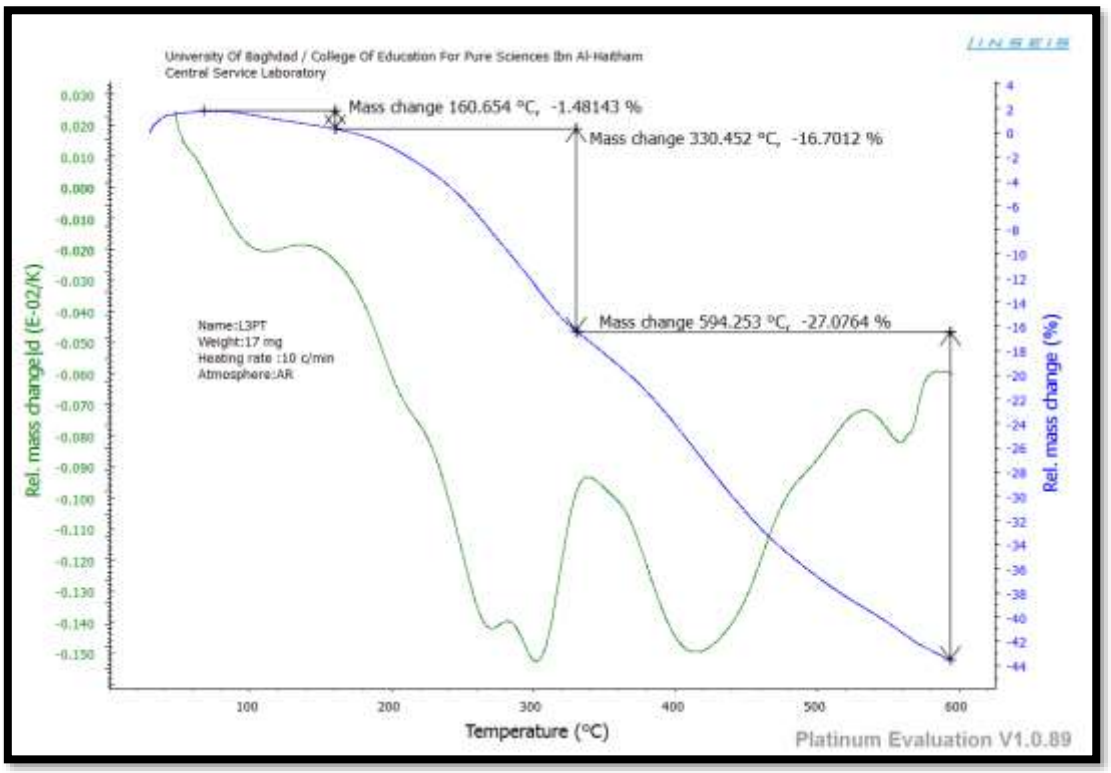


Figure 17: Thermo-graphs (TGA and DTA) of complex (Pt_2L_3)

Photo-stability

Polystyrene was used as a film to tested photostability in five metal complexes Cu(II), Co(II), Ni(II), Pd(II) and Pt(IV) with 4, 4'- (((1E, 1'E)-1, 4- phenylene-bis-(methane-ylylidene))-bis(azane-ylylidene))-bis-(5-(4-chlorophenyl) -*4H*-1, 2, 4-triazole-3-thione) (L_3). Specifically, the FT-IR spectrum shows the strength band is weakened by the radiation due to oxidation growth; in the formation of hydroxyl group it is due to large-band occurrences in the 3600–3200 cm^{-1} band (see figure 20).

Figures (18-19) showing an exposure ray rate of (I_{CO}) and (I_{OH}) Indices increased by the sensitivity raying duration relative to Polystyrene without addition, showing Cu(II), Co(II), Ni(II), Pd(II) and Pt(IV) metals. The most efficient photo stabilizes were observed with Pt (IV).

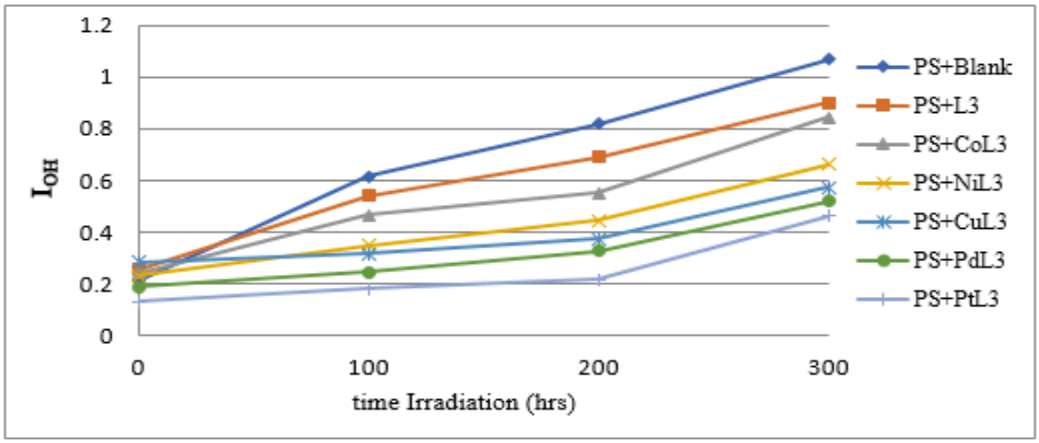


Figure 18: I_{OH} hydroxy index versus polystyrene film time irradiation (40 μm) (0.5 W / v) additional

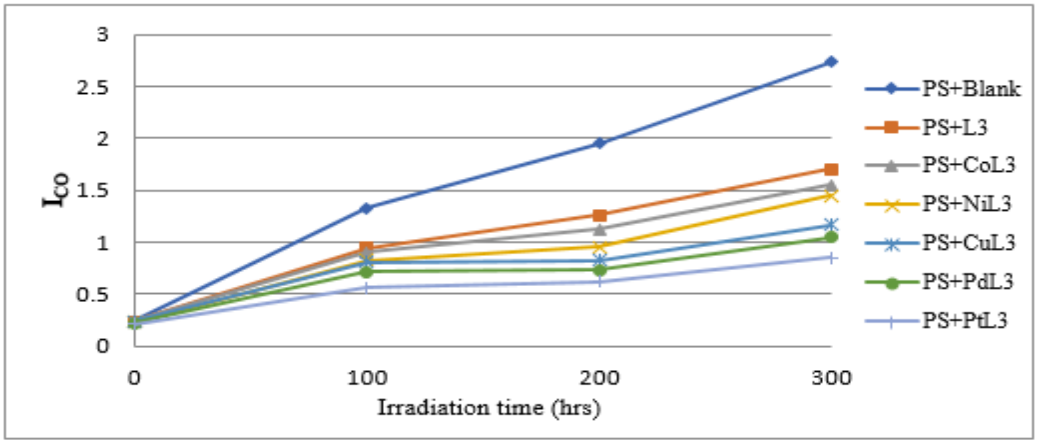


Figure 19: I_{CO} carbonyl index versus polystyrene film (40 μm) time irradiation extra (0.5 w / v) additional

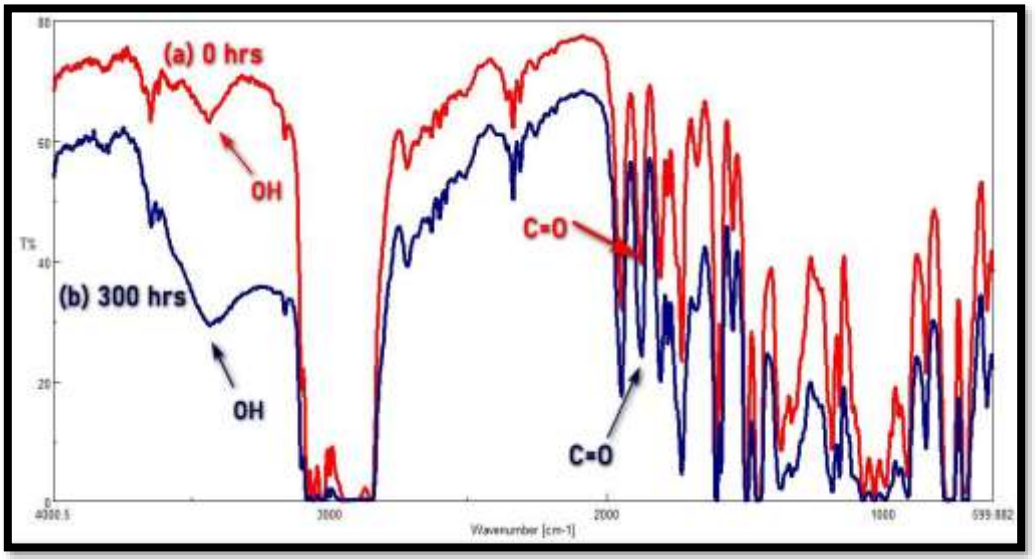


Figure 20: FT-IR polystyrene film spectrum (a) before and (b) after 300 hours of irradiation

Limit the adequacy of the weight loss stabilization process

Figure (21) shows the highest stability efficacy Pt(IV) due to decreased weight loss in order

PS > L_3 > Co_2L_3 > Ni_2L_3 > Cu_2L_3 > Pd_2L_3 > Pt_2L_3

Polystyrene Film Degradation, Molecular Weight Reduction, and Volatilization (M.wt) from Loss of Weight. [26,27].

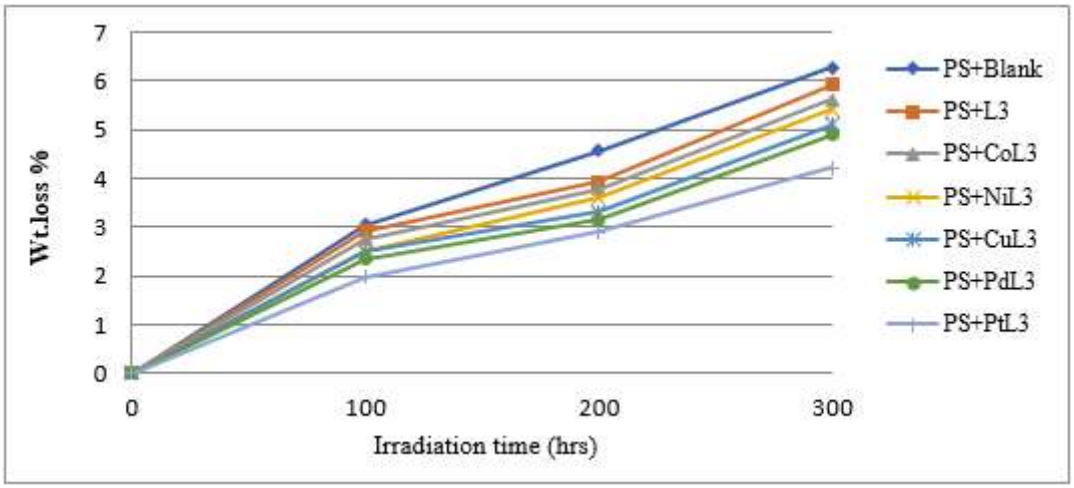


Figure 21: Extra thickness (0.5 w / v) loss of irradiation weight for PS films (40μm)

Molecular weight during photolysis variations of polystyrene films

Figure (22) indicates that polystyrene degradation contributed to a lower level of polystyrene and indicates a rapid initial decline in Mv due to a large chain break at a separate location in the polystyrene chain. Mv plot against exposure demonstrates additional time of film (0,5% w / v) irradiation [28][29]. The total number of chain scissors using S (Eq. 8) where

Mv,0 = mean of M.wt viscosity at experiment start.

Mv,t = M.wt average irradiation-time viscosity.

$S = Mv,0 / Mv,t - 1$ (8)

Table (5) show the variation of (Mv) extra thick-ness (0.5 w / v) with time (PS) (40 μm) film irradiation

Table 5: Distinction of (Mv) extra thick-ness (0.5 w / v) with time (PS) (40 μm) film irradiation

Compound	Irradiation time (hrs.)			
	0	100	200	300
PS+Blank	278439	233169	169218	93192
PS+L3	293861	244517	181139	102866
PS+CoL3	305422	263120	201389	133821
PS+NiL3	310791	278430	217160	137778
PS+CuL3	314933	281501	238710	144930
PS+PdL3	322575	290144	247114	168900
PS+PtL3	328116	299173	253319	178663

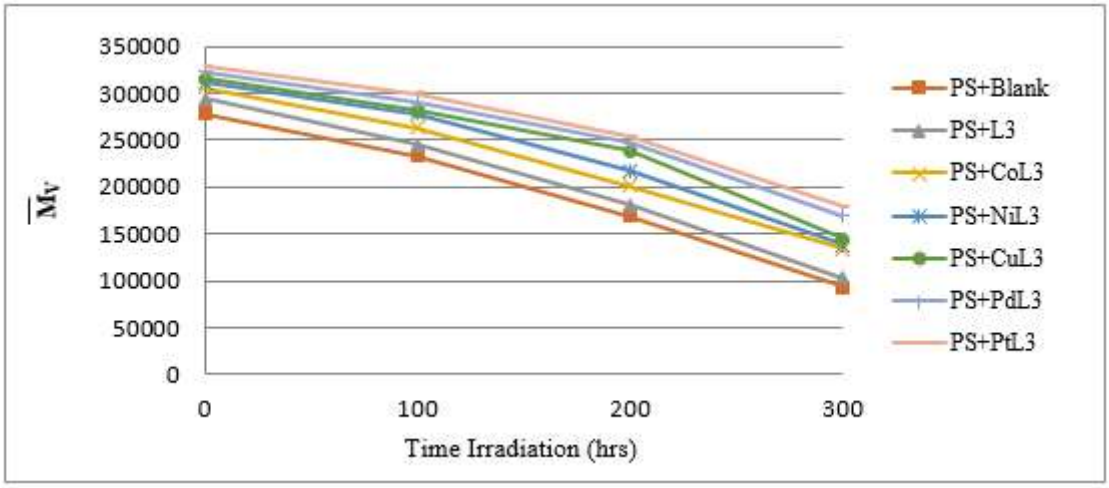


Figure 22: Mean viscosity difference M.wt ~~M~~v with increased irradiated time for PS films (40µm) with an extra thickness (0.5w / v)

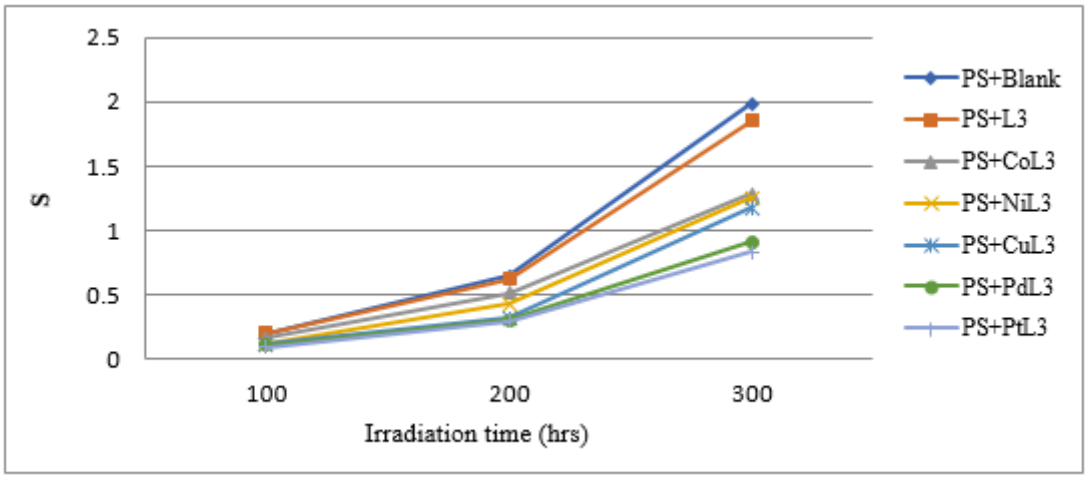


Figure 23: Distinction from central split (S) chain with extra thickness (0.5 W / v) times PS (40µm) film irradiation

The level of branching indicates an increase from data since cross-link can calculate the level of retrogradation (α) via (Eq. 9) are:

m = Primitive of M.wt.

$$\alpha = m \times S / Mv \quad (9)$$

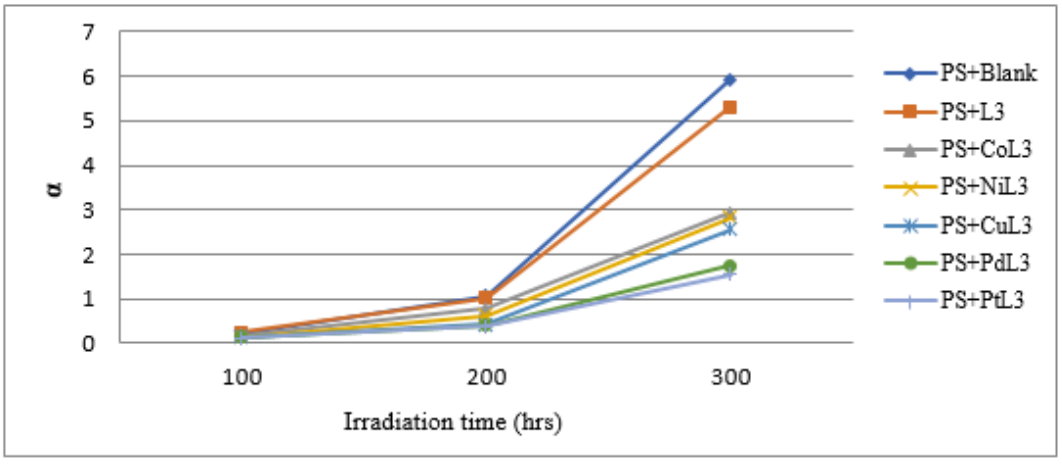


Figure 24: Value (α) disparity for the time radiation of (PS) (40µm) film (0.5 w / v) additional thickness

The degree of retrograde rate (α) versus the time of radiation as illustrated in Figure (25), the primary phases of polystyrene, α grade assembly (DP)[30] and the number of polystyrene monomeric unit (Eq.10) showing the degree of irradiation;

M_0 = the molecular-weight Mwt. of Monomer.

M_n = the molecular-weight Mwt. average number

$$DP_n = X_n = M_n / M_o \qquad (10)$$

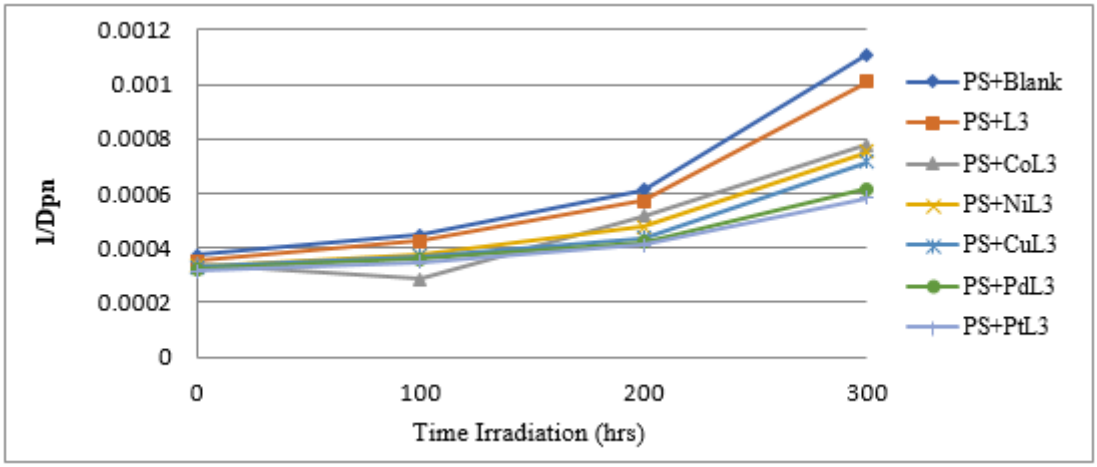
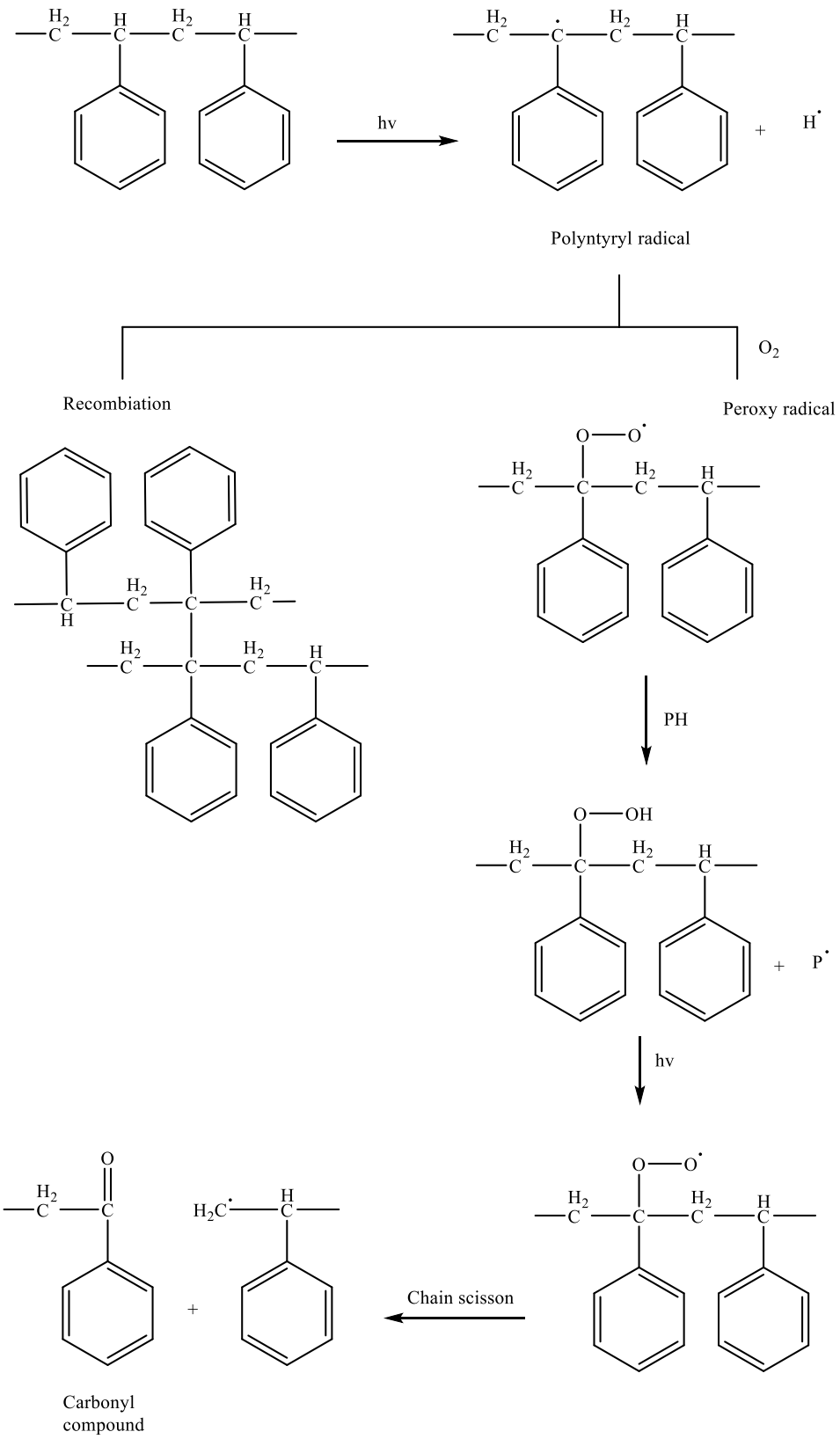


Figure 25: Distinction of 1 / DPn to the additional PS film irradiance thickness (40μm) (0.5w / v)

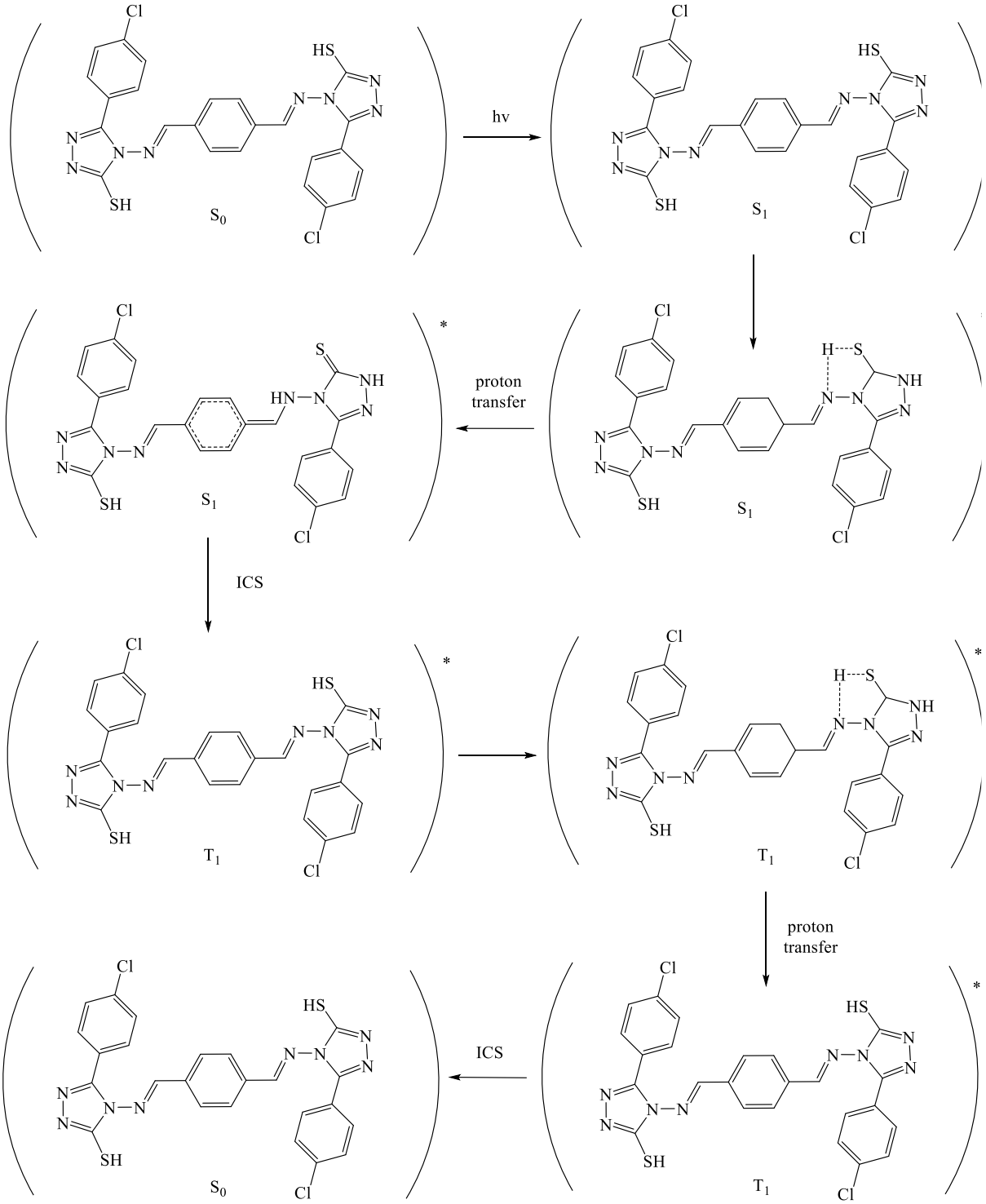
Reverse polymerizing (1 / DPn) compared with a reversed sample in front of a blank shows an increase in radiation time (1 / DPn) [31].

Mechanisms suggested by which the Polystyrene PS additives are stabilized

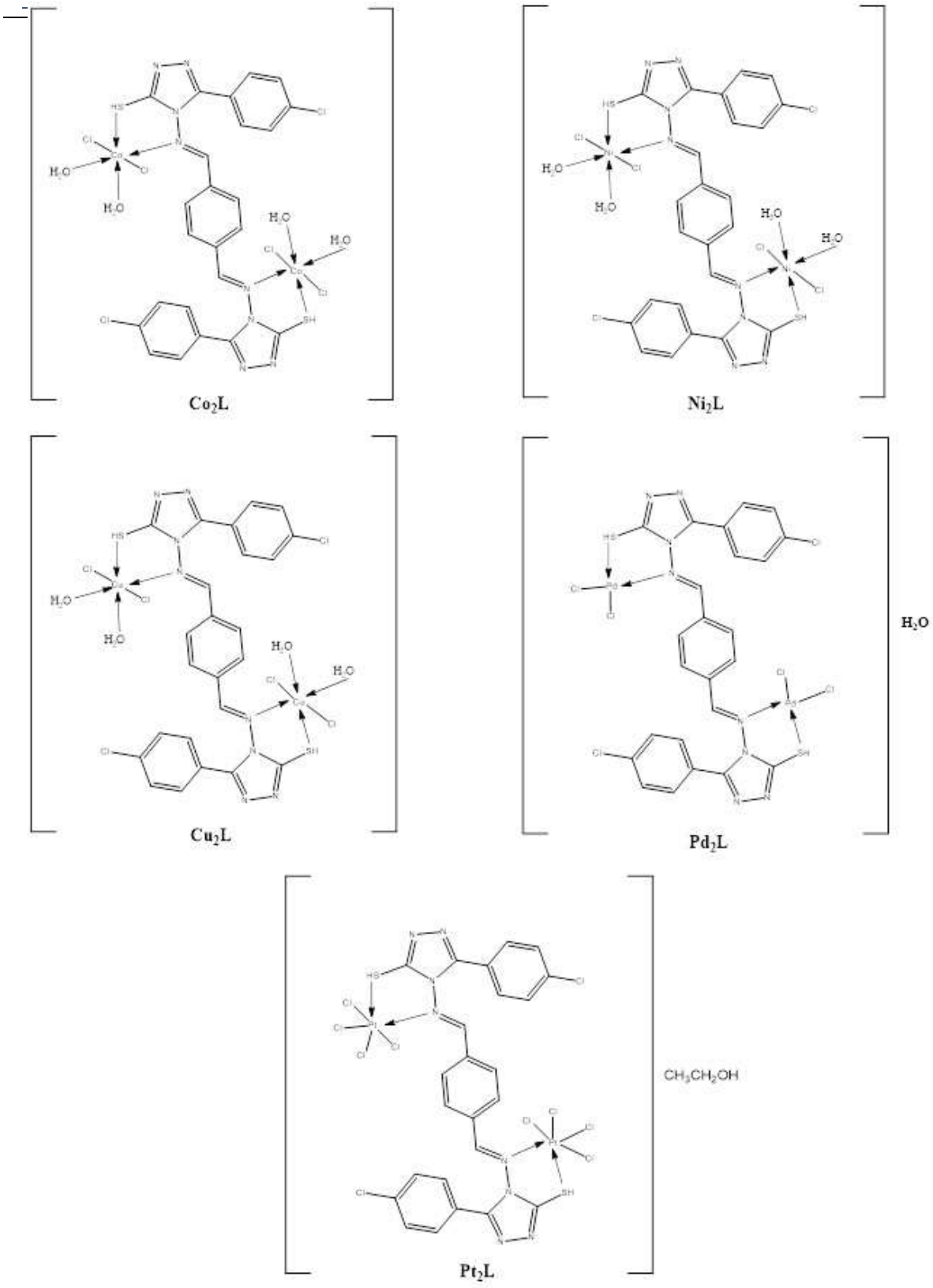
The ultra-violet-light derivative complexes in 1,2,4-triazole-3-thion induce radical scavenging and peroxide degeneration in polystyrene photography stability, and the 1,2,4-triazole-3-thion ring is critical in photo-stabilization if ultraviolet light absorption exposures lead to an ultraviolet energy decrease in the aromatic ring. The conservation of transmission energy between chelates and chromophore excitations (POO•) (Scheme 2, 3), may result in radical cavities in the complex of microphones. All this movement towards film stabilization by resonance. All commercial polymers are necessary to break down the polymer (C-C) bond result from degradation, when exposed to ultraviolet light permanently. Energy transfer highly impotent in polymers is directly linked to effects of stabilization of the photograph and photodegradation which can occur through the following process (i) inter-molecular transfer energy among photo stabilizer (acceptor) molecules and an exciting polymer (donor) molecule. (ii) Intramolecular energy transfer this process occurs between the molecules of polymer (acceptor) and another thrilling chain (dono) chromophore [32-35].



Scheme 2: Polystyrene photooxidation scheme.



Scheme 3: the UV absorption mechanism and energy dissipation as thermal in the Polystyrene Photo Station.



Scheme 4: Suggested structures for all complexes

CONCLUSION

In the present research work, we synthesized new Schiff base Ligand by condensation substituted [benzene-1,4-dicarboxaldehyde] with compound (5) whose name is [4-amino- 5- (4- chlorophenyl)- 4*H*- 1, 2, 4- triazole-3-thione]. This new Schiff base ligand was used to synthesized five metal complexes. The ratio (2:1) between metal to ligand is prevalent in preparing our complexes; The compound of ligand (L_3) Schiff-base (S.B) and complexes have been exanimated and confirmed by Fourier transform infrared

(FT-IR), *Ultraviolet-visible* (UV-visible), Proton nuclear magnetic resonance (^{1}HNMR), carbon^{13} nuclear magnetic resonance (^{13}CNMR), Magnetic susceptibility, carbon-hydrogen nitrogen sulfur (C– H– N- S), atomic-absorption-flame (AAF), cond-uctivity and thermal-analysis (TG). Coordinates between azomethane group ligand and metal ions and (C = S) groups of sulfurs. Photo-stability and stability for polymer polystyrène were then studied, given the stability of the ligand and complexes by order:

$Pt_2L_3 > Pd_2L_3 > Cu_2L_3 > Ni_2L_3 > Co_2L_3 > L_3 > PS$

The results of weight loss percentage data, mean molecular weight, show improved stability for polystyrene PS.

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