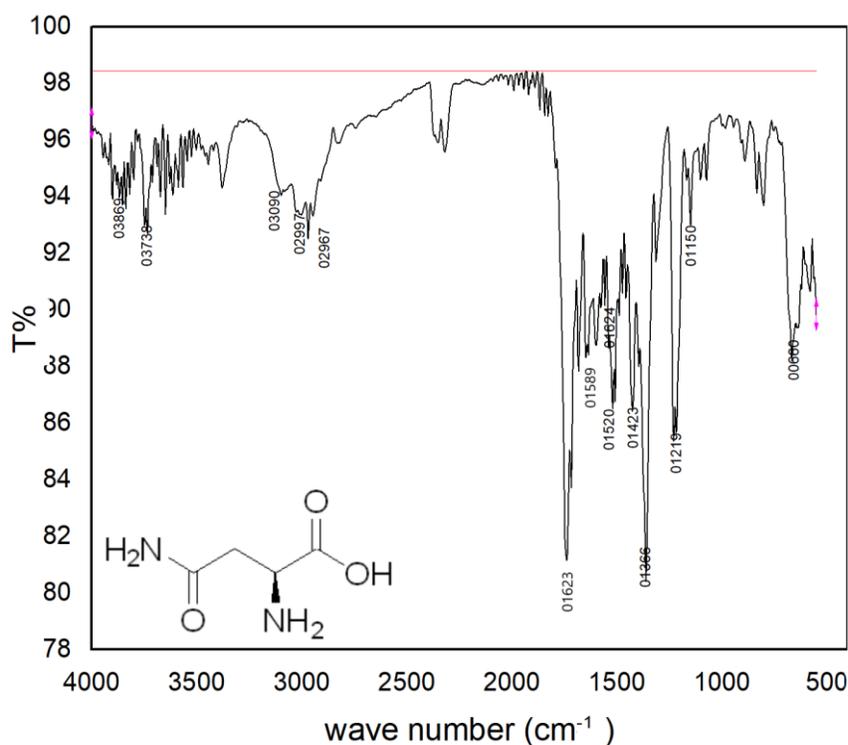


Synthetic antioxidants mitigate oxidative sperm DNA fragmentation: Synthesis, characterization, and functional evaluation of Schiff's base complexes

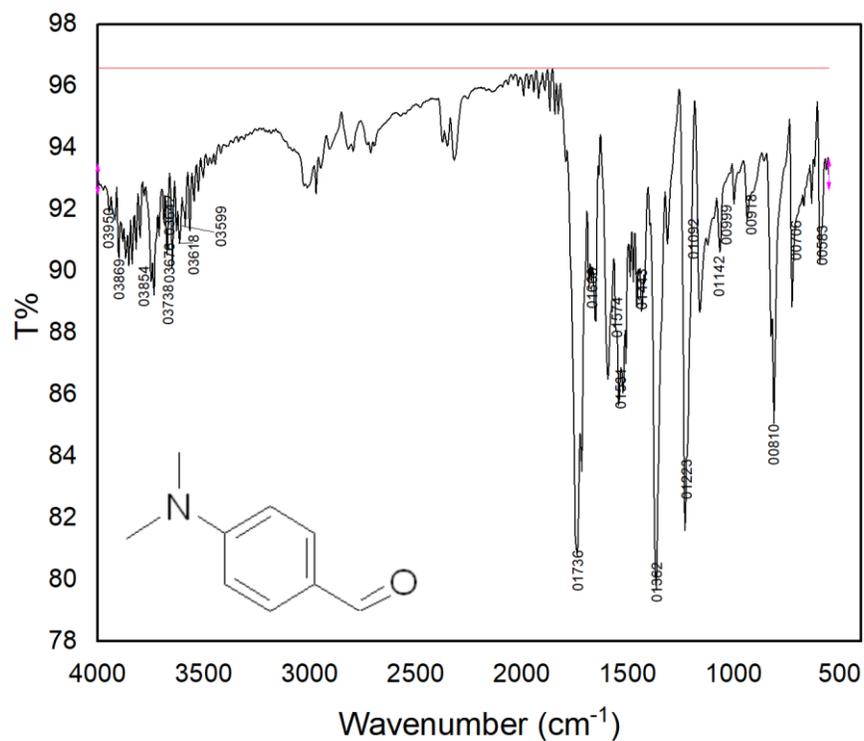
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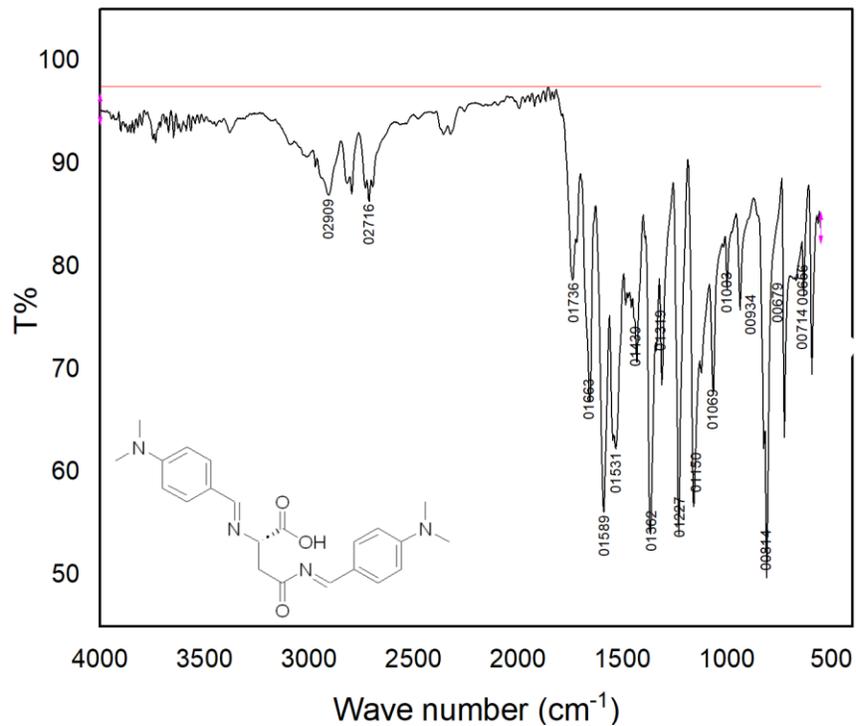
²Department of Basic Sciences, College of Medicine, University of Garmian, Kalar, Kurdistan Region-F.R. Iraq.



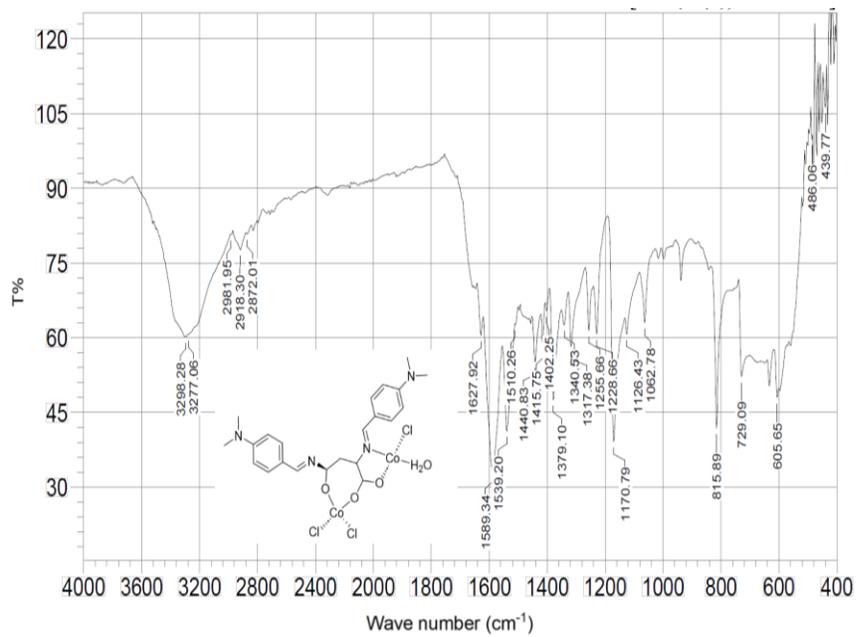
Supplementary **Figure 1** FT-IR spectrum of L-asparagine



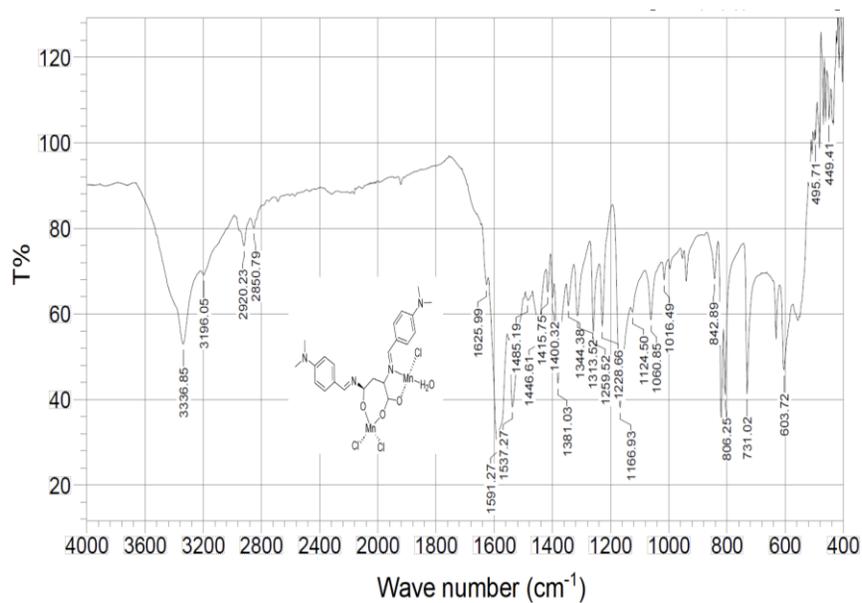
Supplementary **Figure 2** FT-IR spectrum of 4-(dimethylamino) benzaldehyde



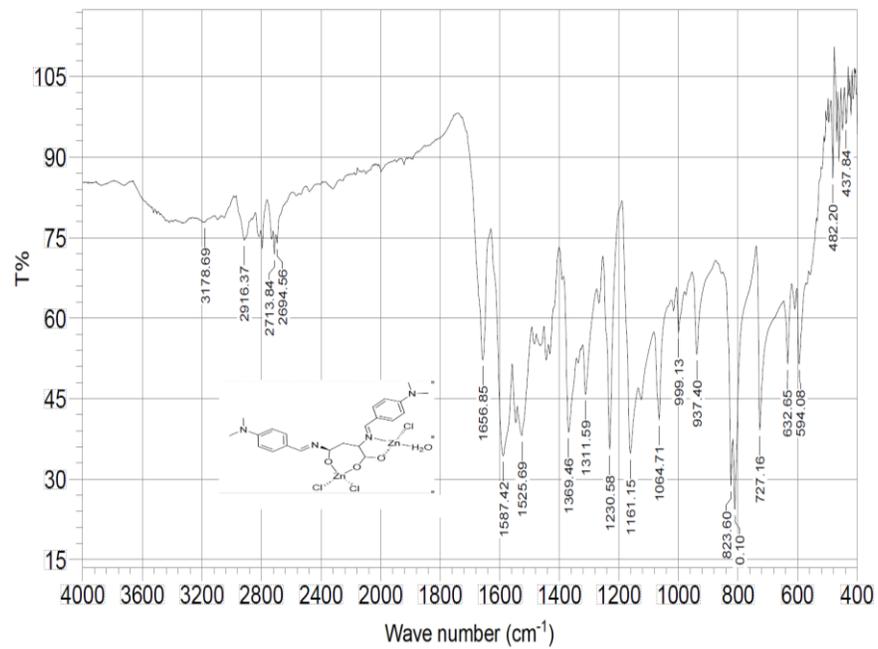
Supplementary **Figure 3** FT-IR spectrum of the ligand [L]



Supplementary **Figure 4** FT-IR spectrum of $[Co_2(L)3Cl.H_2O]$ complex



Supplementary **Figure 5** FT-IR spectrum of $[Mn_2(L).3Cl.H_2O]$ complex

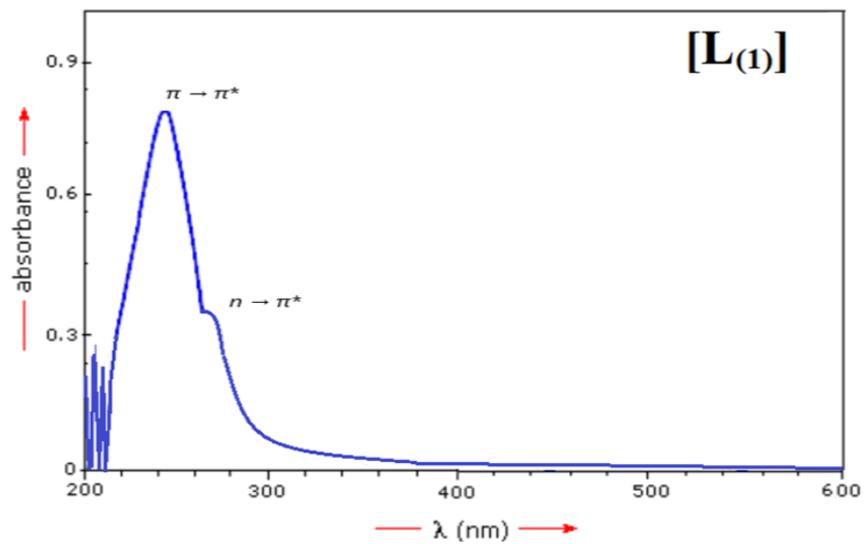


Supplementary **Figure 6** FT-IR spectrum of [Zn₂(L).3Cl.H₂O] complex.

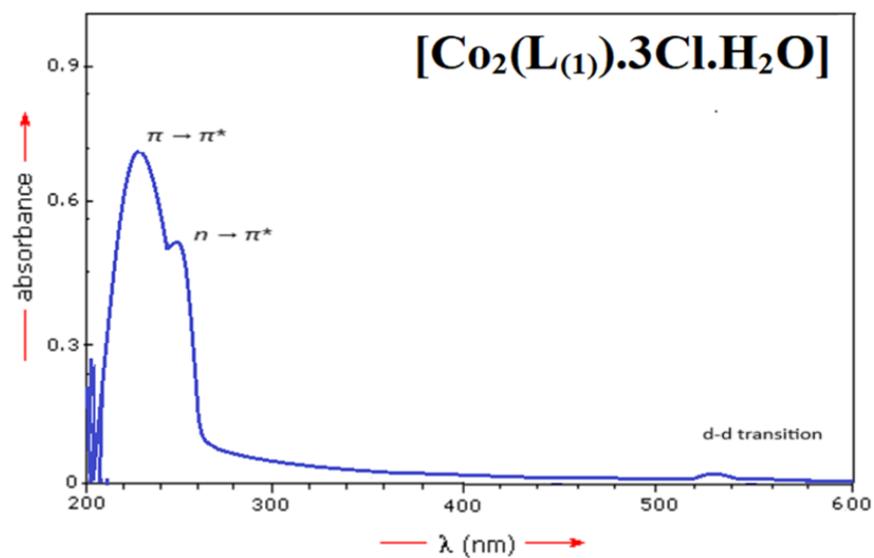
Supplementary **Table 1** FT-IR spectral data of the [L] Ligand [NO₃] type, and its complexes

No.	Compounds	$\nu(\text{NH}_2)$	$\nu(\text{O-H})$	$\nu(\text{C-H})$ Ring	$\nu(\text{C=O})$	$\nu(\text{C=N})$	$\nu(\text{M-O})$	$\nu(\text{M-N})$
	L-asparagine	3386-3373(s)	-	-	1623(s)	-	-	-
	4-(dimethylamino)benzaldehyde	-	-	3050(m)	1736(s)	-	-	-
	C ₂₂ H ₂₆ N ₄ O ₃	-	3400(m)	3100(m)	1663(s)	1645(s)	-	-
1	C ₂₂ H ₂₉ Cl ₃ Co ₂ N ₄ O ₄	-	3298(br)	2981(m)	-	1593(s)	468(m)	439(w)
2	C ₂₂ H ₂₉ Cl ₃ Mn ₂ N ₄ O ₄	-	3336(br)	2920(m)	-	1591(s)	464(m)	603(w)
3	C ₂₂ H ₂₉ C ₁₃ N ₄ O ₄ Zn ₂	-	3178(br)	2916(m)	-	1587(s)	482(m)	437(w)

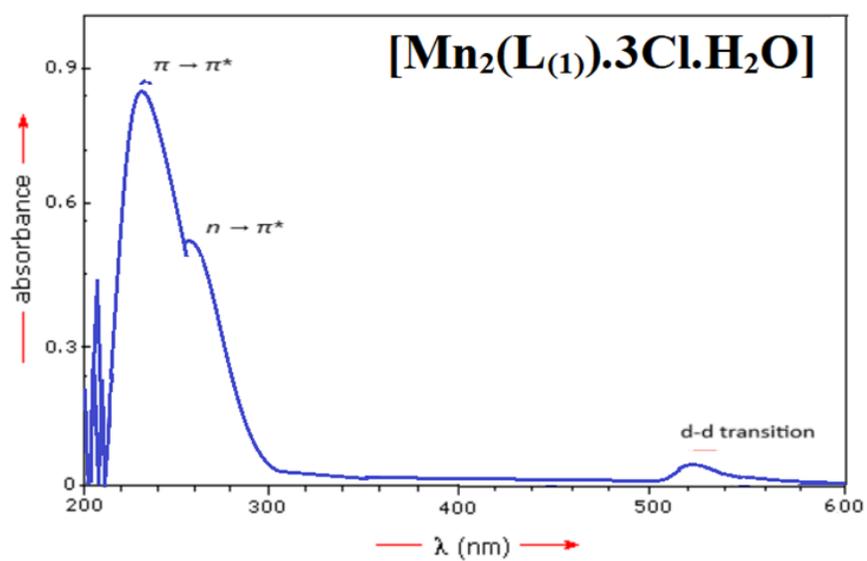
br = broad, s = strong, m = medium



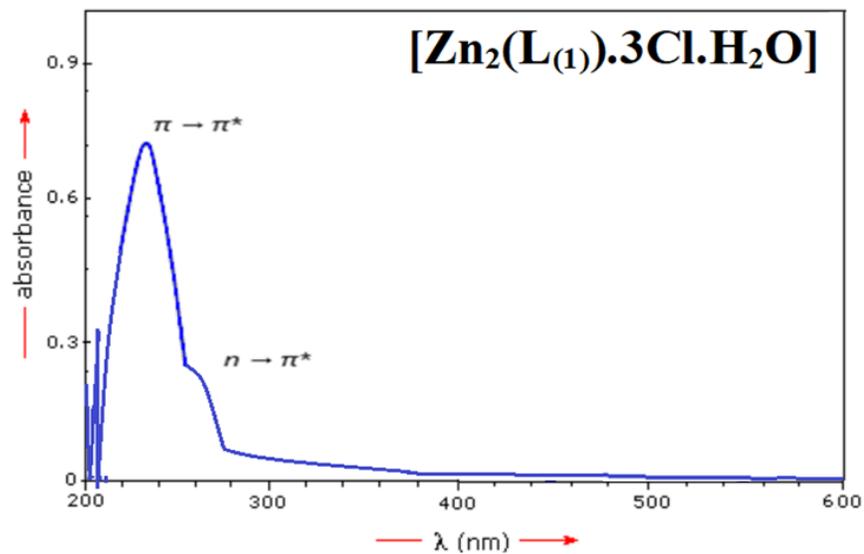
Supplementary **Figure 7** The electronic spectrum of the ligand[L], [NO₃] Type



Supplementary **Figure 8** The UV-visible spectrum of the $[\text{Co}_2(\text{L}).3\text{Cl}.\text{H}_2\text{O}]$ complex



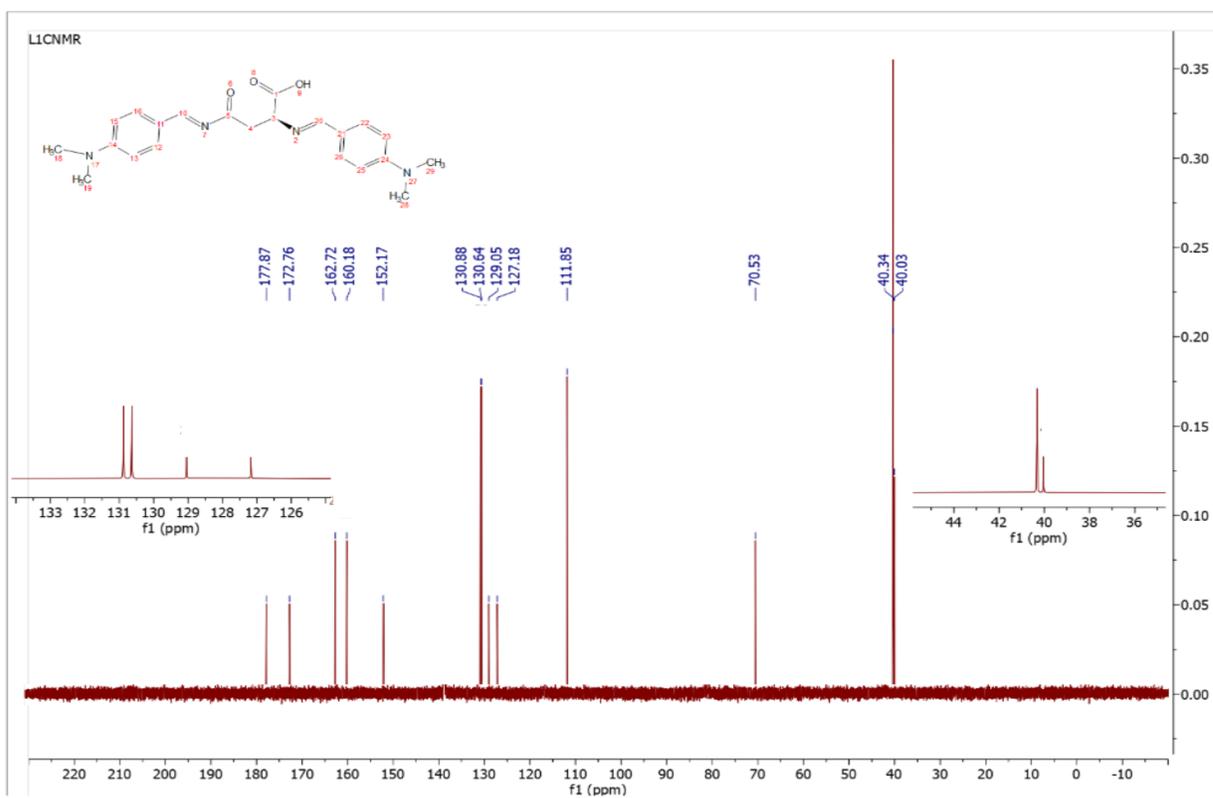
Supplementary **Figure 9** The UV-visible spectrum of the $[\text{Mn}_2(\text{L}).3\text{Cl}.\text{H}_2\text{O}]$ complex



Supplementary **Figure10** The UV-visible spectrum of the $[\text{Zn}_2(\text{L}).3\text{Cl}. \text{H}_2\text{O}]$ complex

Supplementary **Table 2** The electronic spectral data of the Ligand [L] [NO₃] type and its complexes

No.	Compound	Band Position λ nm	Electronic transition(cm^{-1})	ϵ_{max} ($\text{dm}^3\text{mol}^{-1}\text{cm}^{-1}$)	Assignment	Geometrical shape	Ratio
	C ₂₂ H ₂₆ N ₄ O ₃	247	40486	770	$\pi \rightarrow \pi^*$	-	-
		278	35971	340	$n \rightarrow \pi^*$		
1	C ₂₂ H ₂₉ Cl ₃ Co ₂ N ₄ O ₄	225	44444	700	$\pi \rightarrow \pi^*$	Tetrahedral	2:1
		254	39370	490	$\pi \rightarrow \pi^*$		
		535	18691	88	$d \rightarrow d$		
2	C ₂₂ H ₂₉ Cl ₃ Mn ₂ N ₄ O ₄	230	43478	880	$\pi \rightarrow \pi^*$	Tetrahedral	2:1
		265	37735	480	$n \rightarrow \pi^*$		
		523	19120	100	$d \rightarrow d$		
3	C ₂₂ H ₂₉ Cl ₃ N ₄ O ₄ Zn ₂	238	42016	730	$\pi \rightarrow \pi^*$	Tetrahedral	2:1
		268	37313	270	$n \rightarrow \pi^*$		



Supplementary **Figure 12** ^{13}C -NMR spectrum of the ligand [L], $[\text{NO}_3]$ type

Supplementary Table 3 Magnetic moment data ($\mu_{\text{eff}} = \text{B. M}$) at 298 K for the complexes and the suggested structure of them

	Complexes	$X_g * 10^{-6}$ gram susceptibility	$X_m * 10^{-3}$ molar susceptibility	$X_A * 10^{-3}$ atom susceptibility	μ_{eff} (M.B) Expt.	μ_{eff} (B.M) Calc.	Proposed structure
	[Co ₂ (L).3Cl.H ₂ O]	10.52	6.701	6.349	3.7-4.3	3.89	Tetrahedral
	[Mn ₂ (L).3Cl.H ₂ O]	25.88	16.29	15.93	5.7-6.2	6.16	Tetrahedral

Supplementary Table 4 Some physical properties of the ligand and its complexes

No.	Chemical formula	M.wt. (g/mol)	Yield%	M.p. °C	Color	Conductivity	Behavior
1.	C ₂₂ H ₂₆ N ₄ O ₃	394.5	83.3	267	glassy	-	
2.	C ₂₂ H ₂₉ Cl ₃ Co ₂ N ₄ O ₄	637.7	90.5	288	orange	8.4	Non-electrolyte
3.	C ₂₂ H ₂₉ Cl ₃ Mn ₂ N ₄ O ₄	629.7	75.2	281	Yellow	22.1	Non-electrolyte
4.	C ₂₂ H ₂₉ Cl ₃ N ₄ O ₄ Zn ₂	650.6	88.6	296	Light yellow	8.7	Non-electrolyte