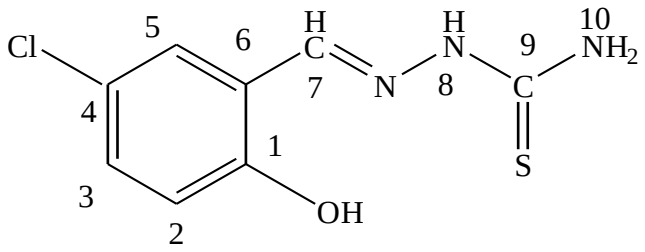
3.3 ^{1}H and ^{13}C NMR Spectroscopy

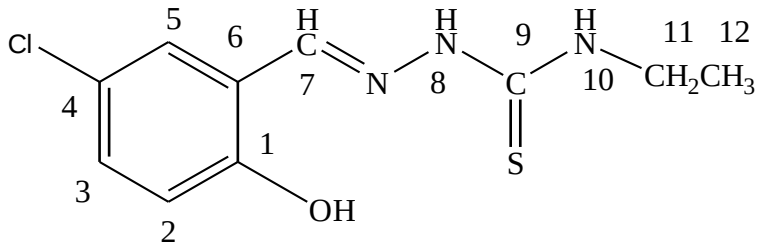
Table 4: ^{1}H and ^{13}C NMR Chemical Shifts (ppm) of **L1** and **C1**



Ligand L1 **Complex C1**

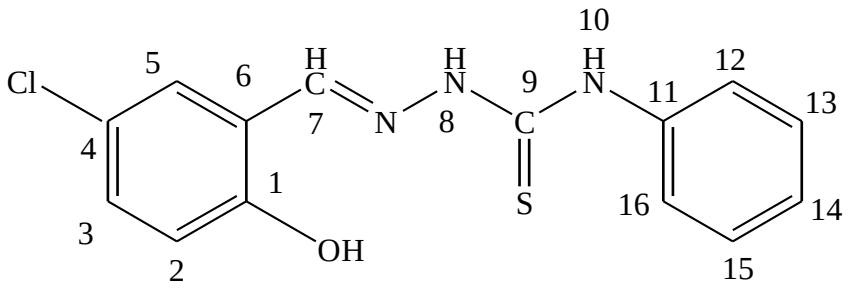
Atoms	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**
1.	10.20	155.65	-	161.65
2.	8.26	123.96	7.60	112.83
3.	7.16	118.20	6.84	110.57
4.	-	125.95	-	136.19
5.	8.10	122.86	7.36	105.57
6.	-	130.92	-	144.95
7.	8.59	137.88	8.39	157.40
8.	11.93	-	-	-
9.	-	178.34	-	164.56
10.	11.24	-	11.33	-

Table 5: ^{1}H and ^{13}C NMR Chemical Shifts (ppm) of **L2**, **C2** and **C20**



	Ligand L2		**Complex C2**		**Complex C20**	
Atoms	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**
1.	10.33	155.25	-	157.32	-	150.44
2.	8.03	123.38	7.67	131.87	7.90	131.87
3.	6.86	118.00	6.87	119.76	6.90	119.76
4.	-	126.21	-	132.38	-	132.83
5.	6.88	122.37	7.40	123.88	7.39	123.90
6.	-	130.12	-	136.92	-	131.87
7.	8.29	140.61	8.30	155.08	8.70	157.35
8.	11.39	-	-	-	-	-
9.	-	178.94	-	167.29	-	169.05
10.	11.24	-	11.43	-	11.42	-
11.	3.55	38.23	3.61	40.33	3.62	40.12
12.	1.15	29.67	1.16	38.20	1.28	38.82
-Bipy	-	-	-	-	-	152.32, 122.64, 121.32.

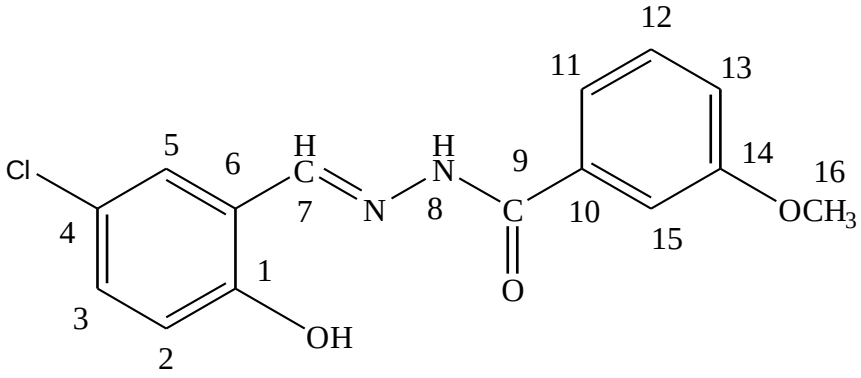
Table 6: ^{1}H and ^{13}C NMR Chemical Shifts (ppm) of **L3** and **C3**



Ligand **L3** Complex **C3**

Atoms	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**
1.	10.53	155.88	-	157.32
2.	8.15	127.00	7.76	132.56
3.	7.23	126.17	7.27	124.12
4.	-	138.52	-	140.46
5.	7.43	123.97	7.44	122.75
6.	-	128.60	-	128.70
7.	8.24	139.67	8.73	153.33
8.	11.78	-	-	-
9.	-	176.62	-	161.83
10.	10.29	-	9.73	-
11.	-	131.17	-	133.34
12.	6.87	121.84	6.88	121.97
13.	7.00	121.19	7.25	120.04
14.	7.48	122.70	7.67	122.27
15.	6.90	118.23	7.00	119.98
16.	7.53	127.90	7.70	129.00

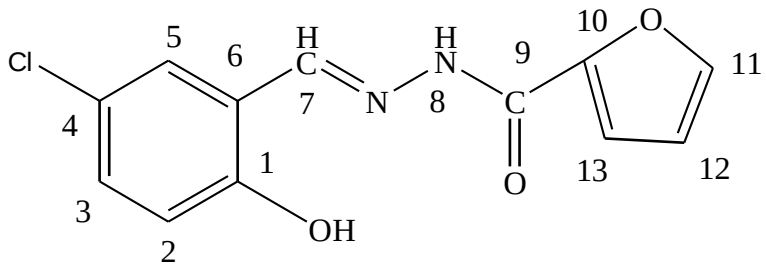
Table 7: ^{1}H and ^{13}C NMR Chemical Shifts (ppm) of **L4** and **C6**



Ligand L4 **Complex C6**

Atoms	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**
1.	9.32	159.25	-	160.00
2.	7.10	133.59	7.54	134.77
3.	6.93	130.41	6.95	133.39
4.	-	145.71	-	155.61
5.	7.40	120.00	7.81	122.17
6.	-	121.32	-	125.38
7.	8.43	134.10	8.91	158.62
8.	11.10	-	-	-
9.	-	162.71	-	169.58
10.	-	129.74	-	131.62
11.	7.12	118.70	7.00	118.87
12.	7.27	110.78	7.14	113.01
13.	7.33	112.90	7.40	121.08
14.	-	156.42	-	158.62
15.	7.38	117.80	7.44	121.02
16.	3.86	55.37	3.79	55.82

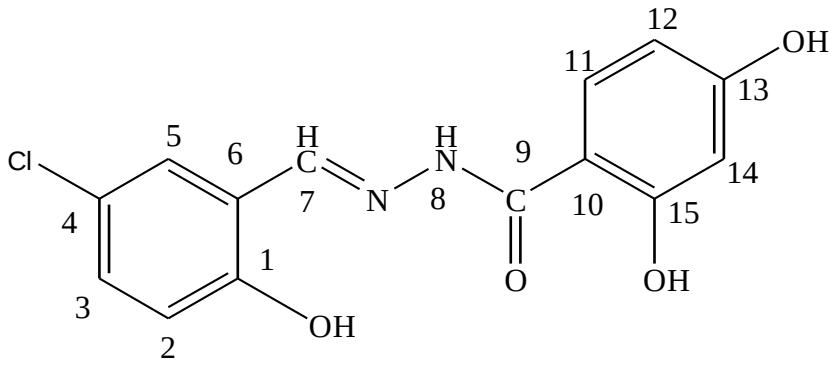
Table 8: ^{1}H and ^{13}C NMR Chemical Shifts (ppm) of **L5**, **C7** and **C9**



Ligand L5 **Complex C7** **Complex C9**

Atoms	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**
1.	12.15	154.63	-	158.48	-	158.93
2.	7.93	127.84	7.93	134.64	7.55	133.69
3.	6.67	121.34	6.68	122.19	6.81	121.73
4.	-	146.13	-	147.62	-	145.93
5.	7.61	123.54	7.80	125.45	7.30	125.42
6.	-	126.11	-	133.30	-	133.69
7.	8.58	146.70	8.85	155.22	8.41	152.68
8.	11.11	-	-	-	-	-
9.	-	156.45	-	162.44	-	163.14
10.	-	131.31	-	144.90	-	145.62
11.	7.27	118.73	7.52	121.06	6.70	120.76
12.	6.90	112.72	7.20	113.14	6.50	112.06
13.	6.91	115.90	6.97	117.05	6.49	116.17
$-CHO_{(DMF)}$	-	-	-	-	8.01	162.88
$-CH_{3\ (DMF)}$	-	-	-	-	2.94	31.64
$-CH_{3(HMPA)}$	-	-	-	-	2.52	36.72

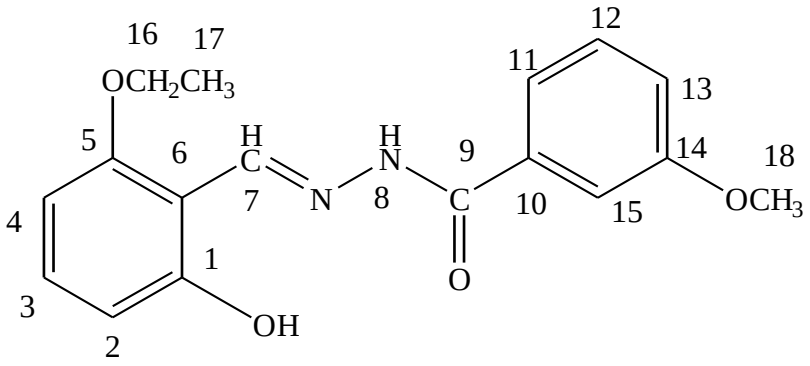
Table 9: ^{1}H and ^{13}C NMR Chemical Shifts (ppm) of **L6** and **C8**



Ligand L6 **Complex C8**

Atoms	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**
1.	12.20	156.54	-	158.01
2.	7.79	121.17	7.74	125.26
3.	6.31	103.37	6.39	108.73
4.	-	131.35	-	134.28
5.	7.64	118.78	7.74	120.80
6.	-	128.78	-	131.14
7.	8.61	146.44	8.91	163.56
8.	11.26	-	-	-
9.	-	165.80	-	170.08
10.	-	130.36	-	132.85
11.	6.36	106.41	6.40	104.90
12.	6.38	108.15	6.95	113.21
13.	10.28	162.75	10.32	161.00
14.	7.32	123.51	7.60	127.84
15.	11.95	163.47	11.33	165.20

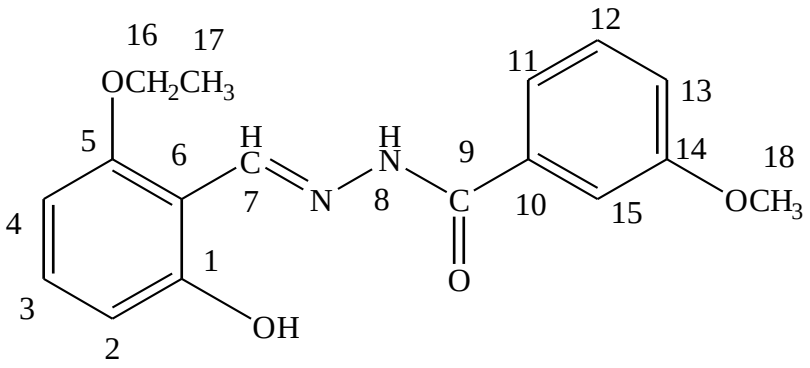
Table 10: ^{1}H and ^{13}C NMR Chemical Shifts (ppm) of **L7**, **C10, C11** and **C12**



Ligand L7 **Complex C10** **Complex C11** **Complex C12**

Atoms	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**
1.	12.04	159.27	-	160.00	-	159.44	-	162.31
2.	7.52	134.21	7.55	130.55	7.69	132.54	7.58	130.00
3.	6.62	112.87	6.97	112.92	6.83	112.75	7.01	112.42
4.	6.85	116.22	7.00	117.29	7.28	119.58	7.32	118.12
5.	-	147.52	-	148.02	-	151.49	-	156.19
6.	-	119.06	-	121.22	-	125.45	-	121.52
7.	8.64	148.41	8.91	156.75	8.49	153.82	8.94	159.30
8.	10.96	-	-	-	-	-	-	-
9.	-	162.56	-	169.02	-	170.06	-	169.00
10.	-	129.79	-	126.06	-	129.19	-	125.55
11.	7.10	118.97	7.46	120.92	7.32	121.28	7.46	120.37
12.	6.83	115.26	7.19	116.00	7.02	118.00	7.23	117.77
13.	7.02	117.75	7.45	118.70	7.60	121.06	7.49	120.35
14.	-	147.07	-	149.85	-	148.63	-	147.60
15.	7.42	121.04	7.46	122.08	8.04	124.34	7.60	125.22
16	4.36	64.14	4.04	64.85	4.08	65.60	4.08	64.35
17	3.10	14.76	3.13	15.26	3.85	15.07	3.83	14.72
18	3.40	55.37	3.33	55.81	4.02	55.42	4.06	55.27
$-CH_{3(HMPA)}$	-	-	-	-	2.95	36.60	-	-
$CHO/CH3_{(DMF)}$	-	-	-	-	-	-	7.95/2.89	162.19

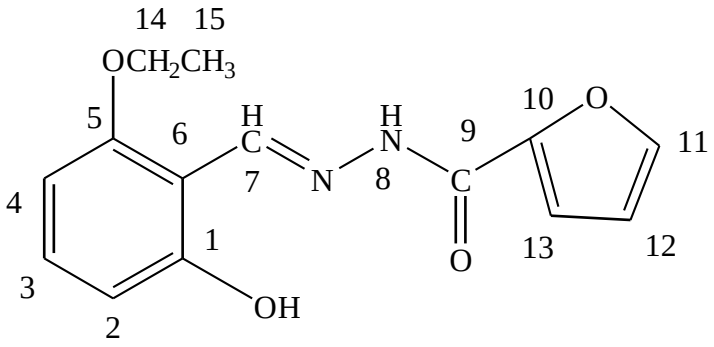
Table 11: ^{1}H and ^{13}C NMR Chemical Shifts (ppm) of **C13, C14** and **C4**



Complex C13 **Complex C14** **Complex C4**

Atoms	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**
1.	-	159.83	-	159.33	-	159.30
2.	7.53	131.88	7.60	130.05	7.58	131.36
3.	7.18	113.00	7.20	112.44	7.17	112.42
4.	7.39	120.92	7.30	120.73	7.47	121.52
5.	-	148.13	-	131.38	-	147.61
6.	-	122.08	-	121.57	-	120.37
7.	8.88	156.75	8.92	156.23	8.93	156.19
8.	-	-	-	-	-	-
9.	-	169.07	-	168.58	-	168.54
10.	-	130.55	-	125.57	-	130.00
11.	7.25	119.34	7.24	120.41	7.30	120.70
12.	7.12	116.00	7.01	118.16	7.02	118.68
13.	7.23	118.68	7.16	118.70	7.21	118.11
14.	-	150.00	-	147.64	-	149.47
15.	7.44	126.06	7.47	122.22	7.56	125.54
16	4.02	64.85	4.07	64.79	4.11	64.35
17	3.31	15.26	2.87	14.76	3.17	14.72
18	3.77	55.76	3.87	55.30	3.83	55.27
Imidazole/ Methanol	7.96	121.22 79.82	-	-	3.38	48.58

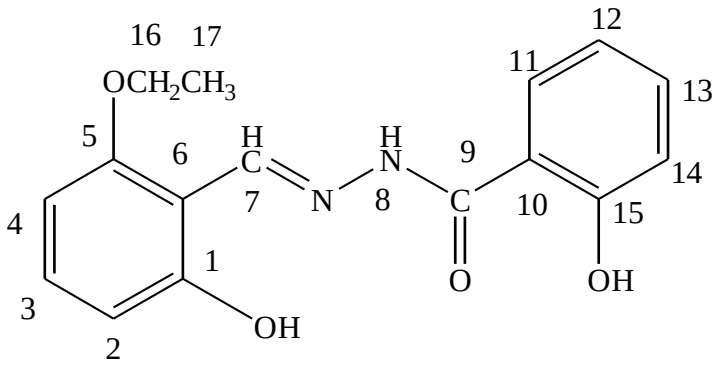
Table 12: ^{1}H and ^{13}C NMR Chemical Shifts (ppm) of **L8**, **C5** and **C17**



Ligand L8 **Complex C5** **Complex C17**

Atoms	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**
1.	11.12	153.38	-	156.05	-	154.42
2.	8.03	127.65	7.93	144.72	7.87	133.33
3.	6.78	122.22	7.28	125.90	6.94	121.75
4.	7.45	123.16	7.21	121.78	7.11	122.69
5.	-	140.14	-	146.97	-	145.05
6.	-	128.60	-	147.75	-	150.07
7.	8.24	140.11	8.86	149.41	8.67	153.66
8.	11.28	-	-	-	-	-
9.	-	173.33	-	161.62	-	177.87
10.	-	133.12	-	135.75	-	132.28
11.	7.16	118.17	7.03	121.00	7.12	119.98
12.	6.95	112.84	6.69	112.69	6.53	113.00
13.	7.01	115.19	7.25	116.31	7.18	117.02
14.	4.28	63.34	4.07	64.64	4.35	64.03
15.	3.16	15.56	3.16	14.74	3.15	15.67
-Bipy	-	-	-	-	8.64, 8.90,	156.78, 125.14, 112.32

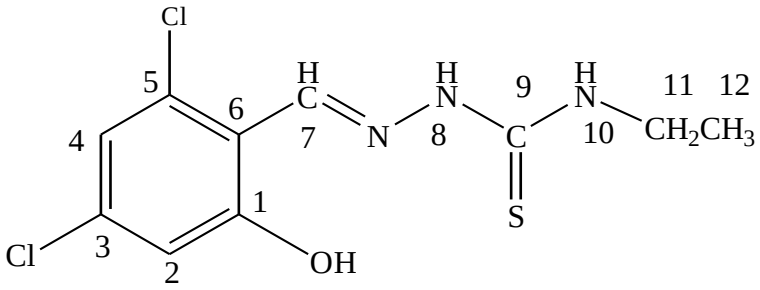
Table 13: ^{1}H and ^{13}C NMR Chemical Shifts (ppm) of **L9** and **C15**



Ligand L9 **Complex C15**

Atoms	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**
1.	11.29	156.92	-	158.63
2.	8.13	121.17	7.78	129.17
3.	6.87	116.12	7.28	118.94
4.	7.36	121.75	7.46	121.90
5.	-	138.11	-	134.20
6.	-	128.60	-	130.12
7.	8.24	144.44	9.10	147.64
8.	10.98	-	-	-
9.	-	167.78	-	169.16
10.	-	133.12	-	135.72
11.	6.38	118.71	6.90	120.50
12.	6.95	109.12	7.15	113.28
13.	6.87	115.19	7.24	117.02
14.	6.44	118.64	7.01	125.55
15.	11.55	162.11	11.39	160.28
16.	4.36	62.32	4.18	64.41
17.	3.55	20.21	3.37	21.19

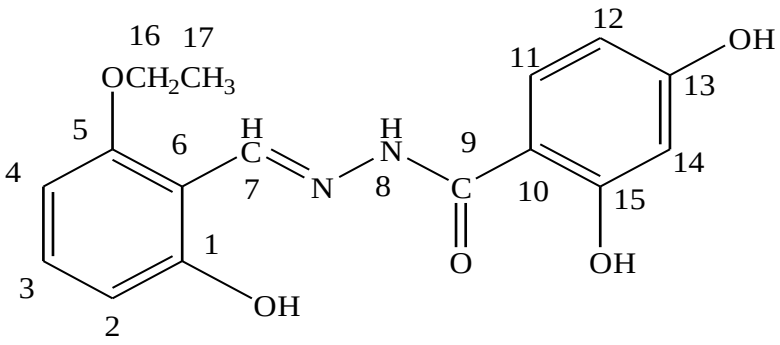
Table 14: ^{1}H and ^{13}C NMR Chemical Shift (ppm) of **L10** and **C21**



Ligand L10 **Complex C21**

Atoms	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**
1.	10.46	147.23	-	149.43
2.	8.32	121.67	8.33	121.37
3.	-	125.82	-	125.49
4.	7.16	122.21	7.22	123.06
5.	-	128.77	-	129.43
6.	-	132.16	-	138.09
7.	8.44	139.30	8.71	155.75
8.	11.18	-	-	-
9.	-	179.48	-	175.00
10.	8.62	-	9.00	-
11.	3.29	40.23	3.40	64.72
12.	2.00	28.12	2.52	30.78
-Bipy N,N-dioxide	-	-	8.90, 8.41	152, 140, 125,

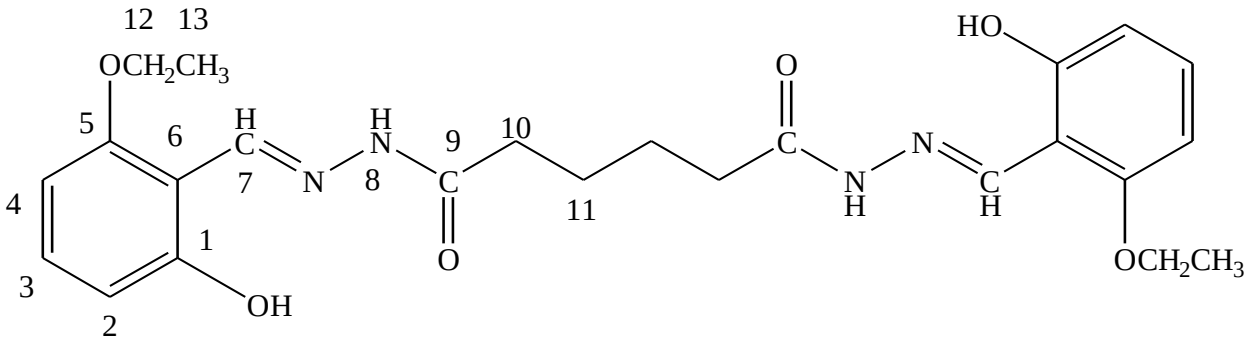
Table 15: ^{1}H and ^{13}C NMR Chemical Shift (ppm) of **L11** and **C16**



Ligand L11 **Complex C16**

Atoms	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**
1.	11.37	155.34	-	158.01
2.	7.21	122.27	7.57	126.72
3.	6.48	113.32	6.49	108.73
4.	-	131.35	-	133.26
5.	7.73	118.60	7.87	120.00
6.	-	123.74	-	128.28
7.	8.67	145.53	8.70	164.42
8.	11.11	-	-	-
9.	-	165.08	-	173.31
10.	-	124.48	-	132.85
11.	6.46	106.15	6.50	108.83
12.	6.78	107.11	6.95	113.00
13.	10.18	162.75	10.08	163.64
14.	7.64	116.66	7.60	117.48
15.	11.69	163.47	11.70	165.92
16	3.31	64.12	3.11	65.02
17	3.87	13.00	3.68	14.57
-Bipy	-	-	8.54, 9.02	154.00, 126.72

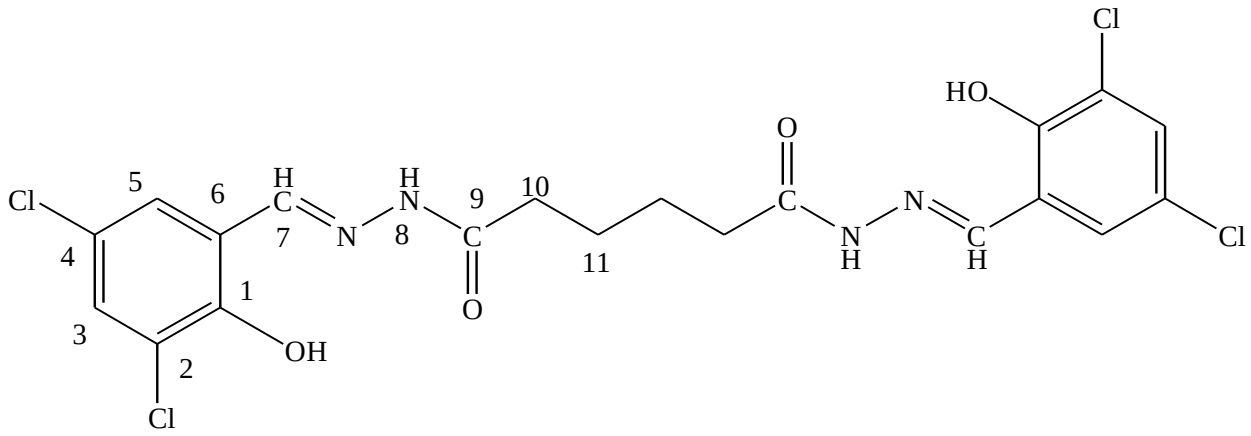
Table 16: ^{1}H and ^{13}C NMR Chemical Shifts (ppm) of **L12**, **C18, C22** and **C23**



Ligand L12 **Complex C18** **Complex C22** **Complex C23**

Atoms	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**
1.	11.58	154.70	-	155.24	-	156.07	-	155.14
2.	7.26	137.40	7.23	140.00	7.17	138.00	7.24	139.78
3.	6.71	115.22	6.93	121.32	6.54	117.82	6.95	118.43
4.	7.01	113.71	7.18	120.55	7.31	121.21	7.20	120.41
5.	-	145.88	-	147.63	-	141.19	-	149.28
6.	-	120.74	-	125.47	-	122.22	-	121.19
7.	8.33	148.93	8.71	149.42	8.86	161.00	8.73	162.21
8.	11.19	-	-	-	-	-	-	-
9.	-	167.82	-	175.00	-	176.26	-	174.80
10.	4.06	64.12	4.06	66.67	4.13	67.00	4.07	64.23
11.	3.44	14.70	3.44	14.75	3.57	15.19	3.40	14.61
12.	4.38	64.34	4.37	64.36	4.42	65.27	4.67	58.25
13.	3.16	14.74	3.33	18.56	3.29	14.72	3.28	25.21
$-CH_{3(HMPA)}$	-	-	-	-	2.64	37.63	-	-
$-CH_{3(DMF)}$	-	-	-	-	-	-	2.89	30.66
$-CHO_{(DMF)}$	-	-	-	-	-	-	7.95	162.14

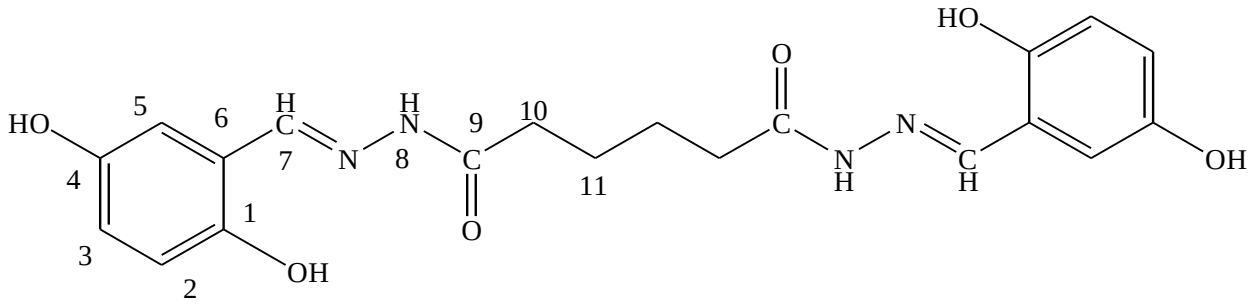
Table 17: ^{1}H and ^{13}C NMR Chemical Shifts (ppm) of **L13** and **C19**



Ligand **L13** **Complex C19**

Atoms	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**
1.	11.47	152.61	-	153.43
2.	-	130.54	-	131.96
3.	7.48	123.37	7.78	124.28
4.	-	121.84	-	123.87
5.	7.50	145.77	7.90	133.25
6.	-	128.82	-	131.96
7.	8.24	151.27	8.77	154.42
8.	11.95	-	-	-
9.	-	169.23	-	176.00
10.	3.36	43.22	3.35	56.03
11.	2.57	22.54	2.50	25.25

Table 18: ^{1}H and ^{13}C NMR Chemical Shifts (ppm) of **L14** and **C24**



Ligand L14 **Complex C24**

Atoms	**δ (^{1}H)**	**δ (^{13}C)**	**δ (^{1}H)**	**δ (^{13}C)**
1.	11.40	158.04	-	153.43
2.	7.37	110.40	6.44	132.75
3.	6.30	111.42	7.41	124.28
4.	-	131.22	-	123.87
5.	7.22	128.76	7.81	133.25
6.	-	142.24	-	131.96
7.	8.19	160.18	8.70	154.42
8.	11.02	-	-	-
9.	-	173.19	-	176.00
10.	3.45	40.05	3.54	56.03
11.	2.54	23.73	2.46	25.25