Structural and Antimicrobial Investigation of Some New Nanoparticles Mixed Ligands Metal Complexes of Ethyl 6-Amino-4-(4-chlorophenyl)-5-cyano-2-methyl-4H-pyran-3-carboxylate in Presence of 1,10-Phenanthroline

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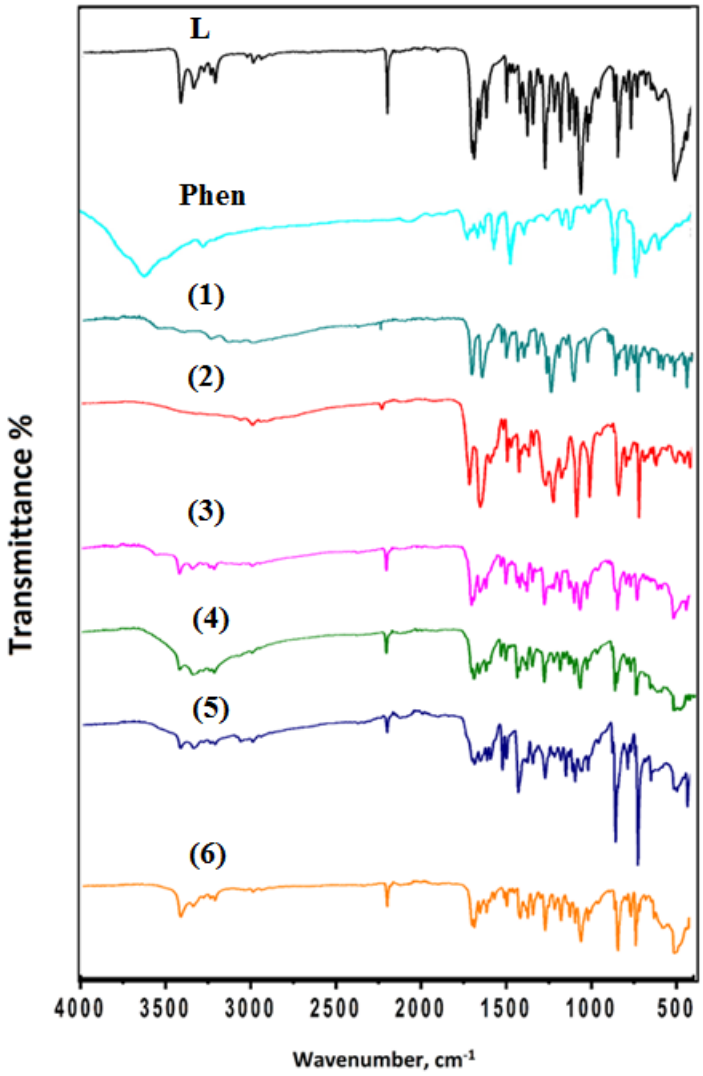


Figure S1. FT-IR spectra for **L**, **Phen** and their complexes.

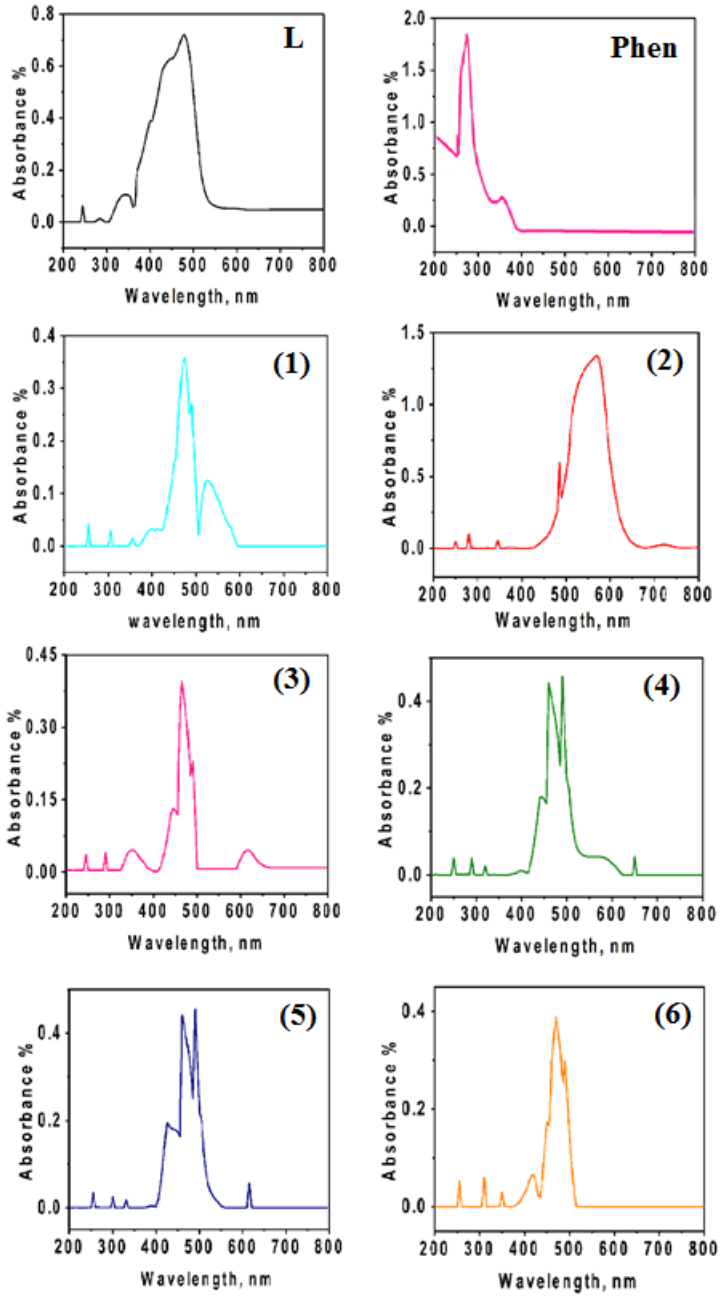


Figure S2. UV-vis. spectra for **L**, **Phen** and their complexes.

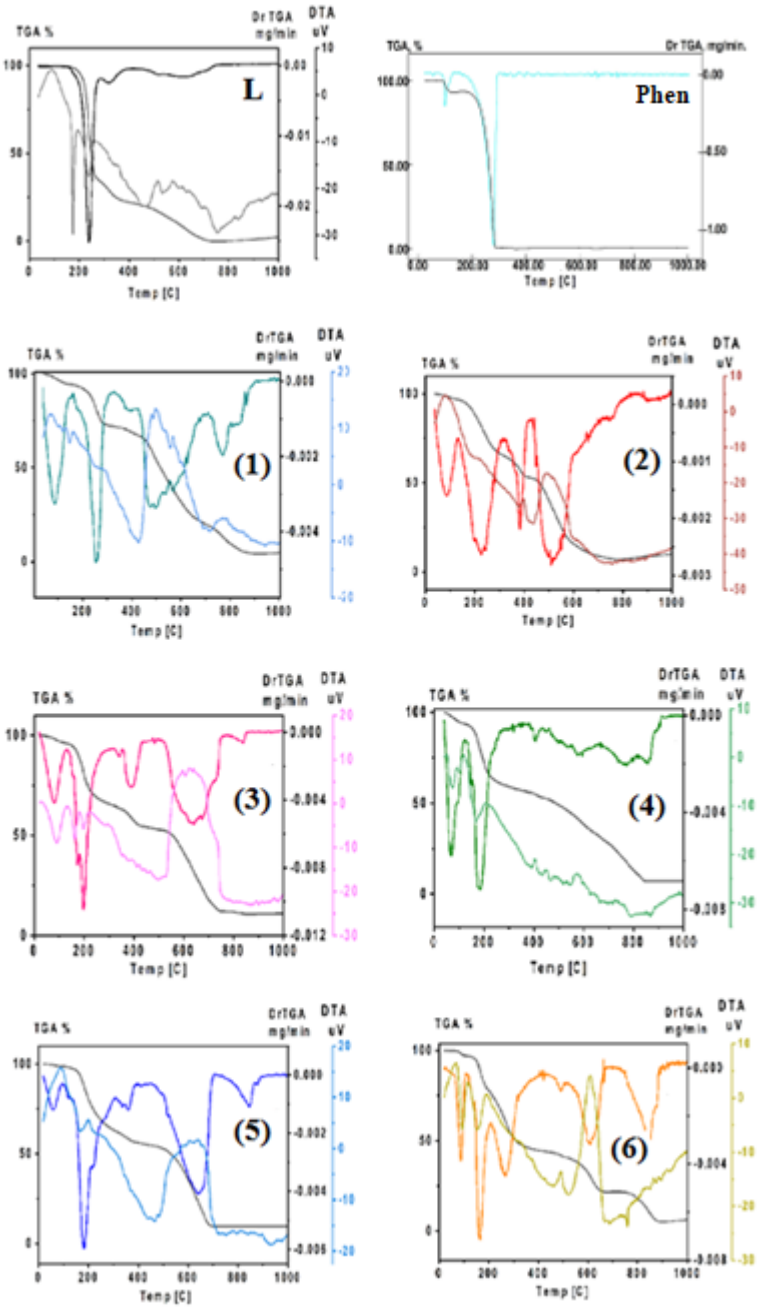
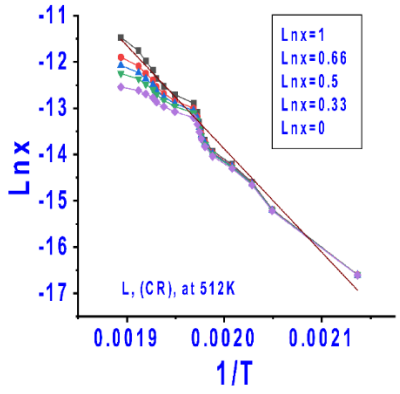


Figure S3. TG, DTG and DTA diagrams for **L**, **Phen** and their complexes.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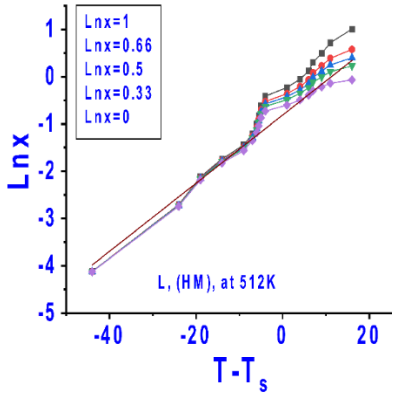
Lnx=0.5
Lnx=0.33
Lnx=0
L, (CR), at 512K
Lnx
1/T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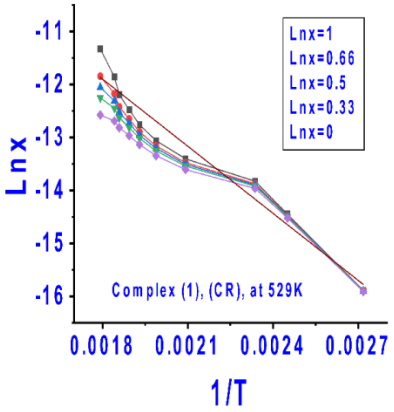
L, (HM), at 512K
Lnx
T-Ts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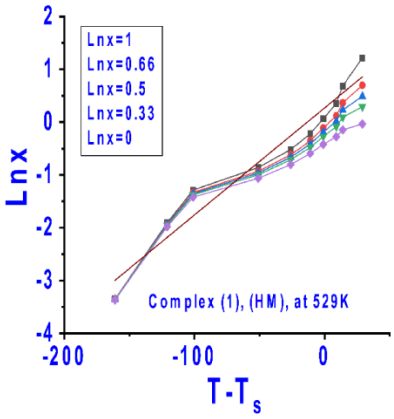
Complex (1), (CR), at 529K
Lnx
1/T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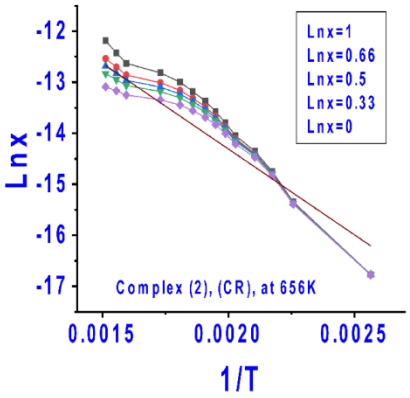
Complex (1), (HM), at 529K
Lnx
T-Ts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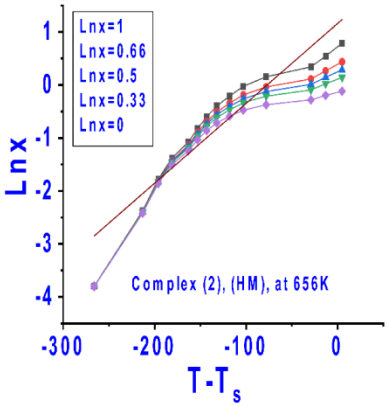
1/T
Complex (2), (CR), at 656K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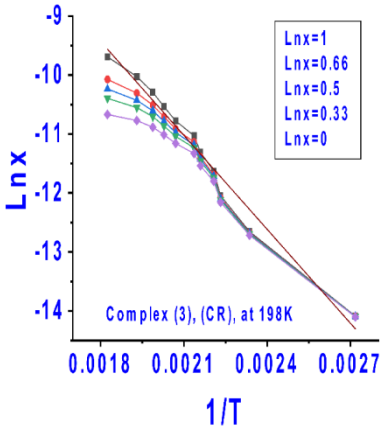
T-Ts
Complex (2), (HM), at 656K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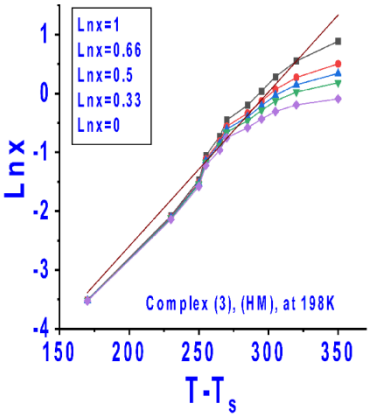
1/T
Complex (3), (CR), at 198K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T-Ts
Complex (3), (HM), at 198K

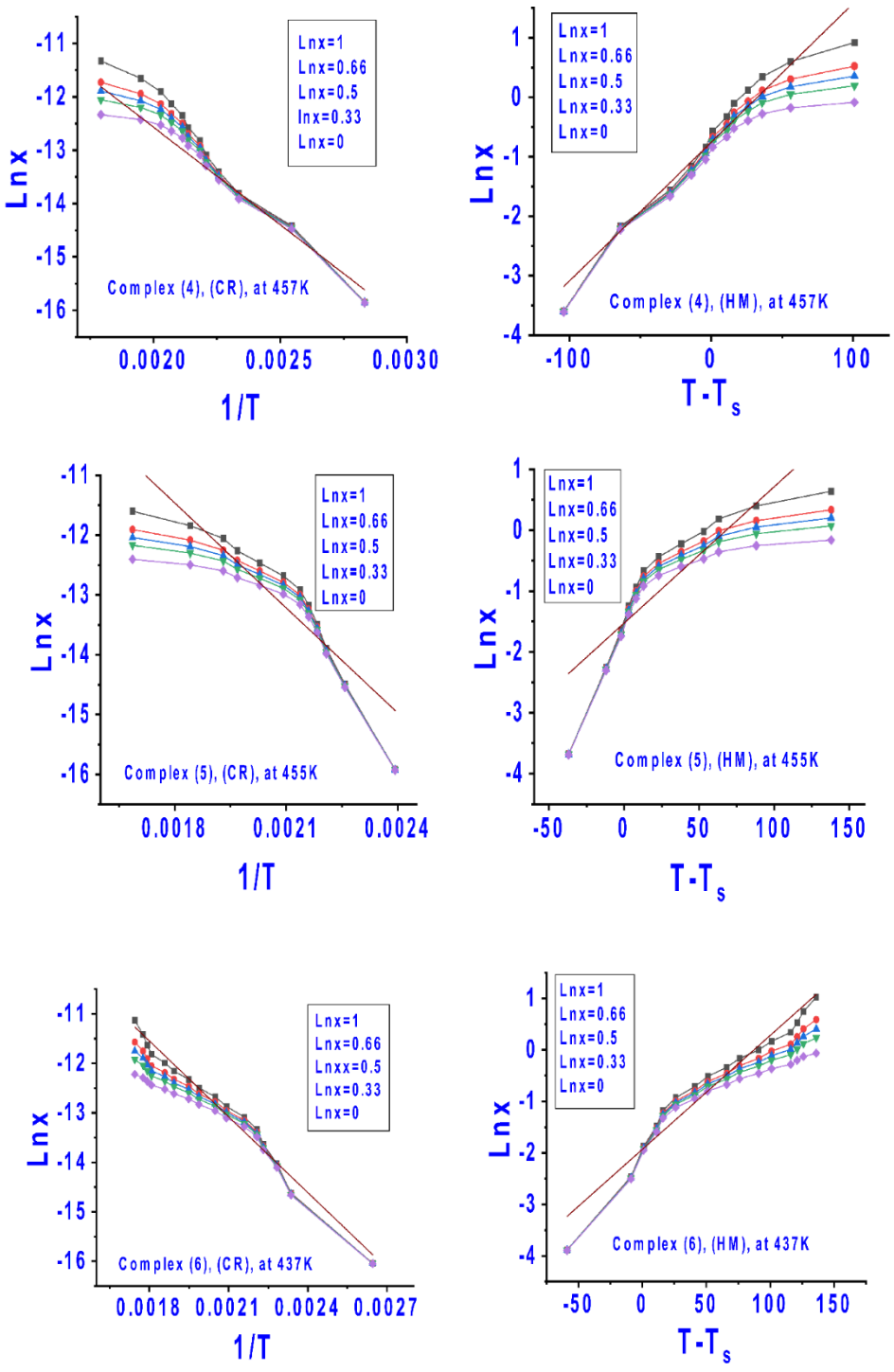

Figure S4. Kinetic parameters diagrams of **L**, **Phen** and their metal complexes.

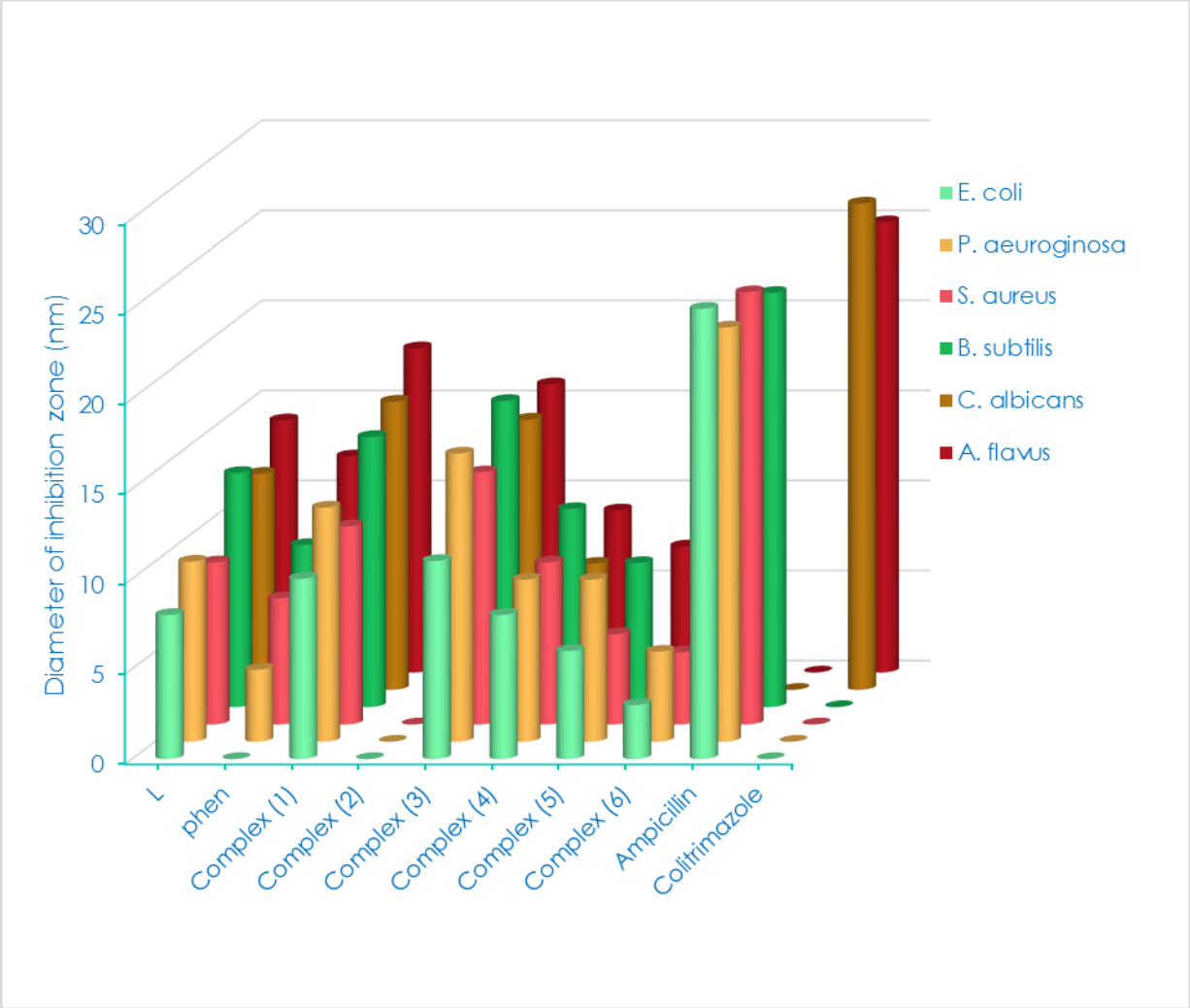

Figure S5. Statistical representation for biological activity for **L**, **Phen** and their metal complexes.

Table S1. Selected FT-IR bands for **L**, **Phen** and their metal complexes.

Compounds	ν(O-H); H_2O	ν(N-H)	ν(C≡N)	ν(C=N)	ν(M-O) and *ν*(M-N)
L	3408s	3263m, 3223m	2192vs	**-**	**-**
Phen	3380mbr	-	-	1586ms	**-**
(1)	3379vw	3226w, 3320vw	2229w	1519m	719vs, 505s
(2)	3321vw	3321vw, 3135vw	2227m	1516s	722vs, 516m
(3)	3406s	3269w, 3226w	2192m	1517m	721s, 506m
(4)	3405w	3327m, 3229m	2192m	1518m	725vs, 507m
(5)	3405m	3330m, 3231w	2193m	1515s	719vs, 629m
(6)	3405s	3331m, 3283m	2193m	1507m	732vs, 507m

Keys: s=strong, w=weak, v=very, m=medium, br=broad, *ν*=stretching.

Table S2. Maximum temperature (T_{max}, °C) and mass loss of the decomposition steps for **L**, **phen** and metal complexes**.**

Compounds	Decomposition	T_{max} (°C)	Mass loss (%)		Lost species
			Calc.	Found	
L	1st step	239	62.63	62.95	CH_4+2C_2H_2+2CO+C_3H_4+0.5Cl_2
	2nd step	318, 520	37.37	36.94	C_4H_2+0.5N_2+HCN
	Total loss		100	99.89	
Phen	1st step	95	9.08	8.98	H_2O
	2nd step	278	90.92	90.87	2C_4H_2+ 2C_2H_2+N_2
	Total loss		100	100	
(1)	1st step	85	6.09	6.00	2.5H_2O
	2nd step	255	29.27	29.11	6C_2H_2+2NO
	3rd step	477,770	57.59	57.41	7C_2H_2+NO+CO_2+2Cl_2+HCN
	Total loss		92.95	92.52	
	Residue		7.04	7.48	Cr
(2)	1st step	87	3.74	3.70	1.5H_2O
	2nd step	226	44.55	44.88	6C_2H_2+2NO+1.5Cl_2
	3rd step	383,511	44.00	45.15	7C_2H_2+HCN+NO+CO_2+0.5Cl_2
	Total loss		92.29	93.73	
	Residue		7.71	6.27	Fe
(3)	1st step	79	3.90	3.73	1.5H_2O
	2nd step	198	31.24	30.99	6C_2H_2+N_2+O_2
	3rd step	388	10.27	10.14	Cl_2
	4th step	640	43.74	43.41	7C_2H_2+2CO+HCl+N_2
	Total loss		89.15	88.27	
	Residue		10.85	11.73	CoO
(4)	1st step	68	6.34	6.28	2.5 H_2O
	2nd step	183	40.46	39.68	6C_2H_2+Cl_2+O_2+N_2
	3rd step	405	44.91	47.19	7C_2H_2+HCN+NO+CO_2+0.5Cl_2
	Total loss		91.71	93.15	
	Residue		8.27	6.85	Ni
(5)	1st step	58	1.33	1.33	0.5H_2O
	2nd step	182,358	42.33	41.8	6C_2H_2+2NO+Cl_2
	3rd step	639	46.97	47.16	7C_2H_2+CO+CO_2+N_2+HCl
	Total loss	844	90.63	90.29	
	Residue		9.37	9.71	Cu
(6)	1st step	87	2.61	2.66	H_2O
	2nd step	163,268	57.99	57.58	8C_2H_2+HCl+Cl_2+2CO+N_2
	3rd step	491	17.99	18.00	3C_2H_2+CO+H_2O
	4th step	607	11.90	12.39	C_2H_2+CO+N_2
	Total loss		90.49	90.63	
	Residue		9.51	9.36	Zn