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Thermo gravimetric and Antimicrobial analysis of 4-hydroxy-3-(3-(4-hydroxy-3,5-dimethoxyphenyl) acryloyl)-6-methyl-2H-pyran-2-one chalcone and their metal complexes

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Abstract

In the present paper, the some of first transition series metal complexes derived from 4-hydroxy-3-(3-(4-hydroxy-3,5-dimethoxyphenyl)acryloyl)-6-methyl-2H-pyran-2-one chalcone were synthesized from Dehydroacetic acid and 4-hydroxy-3,5-dimethoxy benzaldehyde (syringaldehyde). The ligand was characterized on the basis of elemental analysis, UV, IR, Mass, ^{1}H NMR and antimicrobial activity. All the complexes were characterized by elemental analysis, UV, magnetic susceptibility measurements, IR, TGA-DTA & antimicrobial activity. The ligand acts as a bidentate chelate and coordinates through two oxygen atoms of ligand i.e complex formed by 1:2 (metal: ligand) ratio. The thermal stability of the complexes was studied by thermogravimetry and the decomposition schemes of the complexes are given. The ligand and its metal complexes were screened for antimicrobial activity against *Bacillus Cereus, Bacillus Megaterium, Shigellaboydii and Escherichia Coli bacteria*, and *Saccharomyces Cerevisiae, Aspergillus Oryzae* and *Penicillium notatum fungi* were studied. Antimicrobial activity it is found that the complexes are more active than their parent ligand.

Keywords: Transition metal complexes; magnetic susceptibility; Chalcone; Oxygen donar ligand; TGA-DTA; Antimicrobial activity.

INTRODUCTION

There is rising curiosity in the pharmacological virtual of natural products is chalcones compose an essential sites of natural commodity. Chalcone are made up of open chain flavonoids it contains two aromatic or heteroaromatic moiety are fused by a three carbons having α β unsaturated carbonyl structure (*Balaji H. Jawale, et al., 2017;Patange, 2008*). The existence of a sensitive α, β unsaturated carbonyl moiety in chalcones is well known to be accountable for its antimicrobial effects (*Prasad YR, et al., 2008*). In present times a number of chalcones have been investigated for its cytotoxic, insecticidal, antiviral, enzyme inhibitory, anticancer chemo preventive and mutagenic effects (*Won SJ, et al., 2008; Yu DC, et al., 1982*). Numerous chalcones containing (-OH) hydorxy, (-OR)alkoxy functional sets in altered place have been stated to keep anti-infectious activity (*Liu XL, et al., 2008*), antiulcer actions (*Jeffrey JA, et al., 1996*), antifungal properties (*Lahtchev KL et al., 2008*), antioxidant effects (*Rao YK , et al., 2009*), vasodilatory action (*Ram VJ, et al., 2000*), antimitotic activity (*Khatib S, et al., 2009*), antimalarial propertis (*Papo N, et al., 2003*), antileshmanial action in addition to prohibition of organic peacekeepers relief, prohibition of leukotriene B4, prohibition of tyrosinase and prohibition of aldose reductase effects (*Balaji H. Jawale, et al., 2017;Patange, 2008*). Gratitude of these results encouraged us to prepare novel chalcones as an active model for antimicrobial agents.

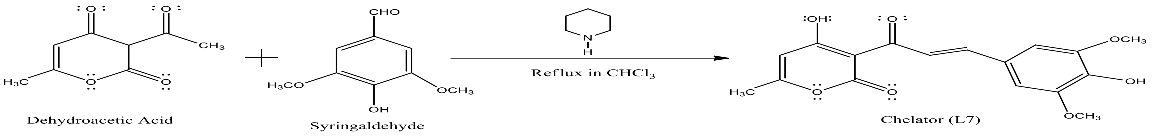
On brief investigation of literature shown that no research work has been completed on some metal in first transition series with complexing materials of the 4-hydroxy-3-(3-(4-hydroxy-3,5-dimethoxyphenyl)acryloyl)-6-

methyl-2H-pyran-2-one chalcone they are referred to Chelator derived from 4-hydroxy-3,5-dimethoxy benzaldehyde (syringaldehyde) and 3-acetyl-6-methyl-2H-pyran-2,4(3H)-dione (DHA). In this chapter, we are reveals the synthesis of novel chalcone, characterization carried out using modern tools. The transition metal [Cu (II), Ni (II), Co (II), Mn (II) and Fe (III)] complexes materials obtained from bidentate novel chalcone ligand having a carbonyl group openly connected to the α, β-unsaturated moiety derived from dehydroacetic acid and syringaldehyde.

SYNTHESIS OF CHELATOR

A chloroform solution having 0.01 mole of 3-acetyl-6-methyl-2H-pyran-2,4(3H)-dione (DHA), add few drops of piperidine base, then add alternately prepared solution 0.01 mole of 4-hydroxy-3,5-dimethoxy benzaldehyde (Syringaldehyde) in 20 ml chloroform, after this reaction mixture refluxed for 8-10 hours. After completion of reaction some of the chloroform-water azeotrope mixture separated out by purification. Crude precipitate is appearing means product are formed they separated on sluggish vaporization of the enduring $CHCl_3$. The subsequent crude precipitate was filtered, then washed with ethanol and recrystallized out with $CHCl_3$ solvent (*Patange V.N, et al., 2007; Munde A.S, et al., 2009*).

REACTION



PREPARATION OF METAL COMPLEXES WITH CHELATOR

A accurately way out 0.2mole of Chelator chalcone in RBF having 30 ml of $CHCl_3$ solvent and Chelator liquefied absolutely. Simultaneously prepared solution of 0.01 mole of transition metal salt in 20 ml of dehydrated methanol was formerly added drop by drop to the solution of the Chelator. The reactants mixture were refluxed for 2 to 3 hours with constant stirring and then the mixture cooled to see the appearance of precipitate which infrequently initiate to the cold reaction combination, if precipitate not occurred then 10% methanolic solution of NH_3 was added drop by drop to rise the P^H of reaction mixture till the metal chelate crude precipitates out absolutely. The crude precipitate was digested for half an hour. Finally solid metal chelate are obtained, they are separated out on slow evaporation then filtered it in hot form. It was washed through methanol and dried out in vacuum desiccator.

REACTION

$$\underset{\text{Chelator (L7)}}{2C_{17}H_{16}O_7} + \underset{\text{Metal chloride}}{MCl_n} \xrightarrow[\text{10\% Ammonia to PH maintain}]{\triangle} \underset{\text{Complex}}{[(C_{17}H_{15}O_7)_2M\ (H_2O)_2]}$$

GENERAL PROCEDURE FOR THE ANTIMICROBIAL ACTIVITY

The ligand and its metal complexes were screened for *in vitro* antibacterial activity against Gram-positive i.e. *Bacillus Megaterium, Bacillus Cereus* and Gram-negative i.e. *Escherichia Coli, Shigella boydii* by the paper disc plate method[39]. The compound were tested at concentrations of 1.0 mg ml^{-1} in DMSO (0.1ml) was placed on a paper disk (6mm in diameter) with the help of micropipette and compared with a known antibiotic, *viz. Ciprofloxacin* at the same concentrations. To evaluate the fungicidal activity of the ligands and the metal complexes, their effects on the growth of *Penicillium notatum, Saccharomyces Cerevisiae* and *Aspergillus Oryzae* were studied. The ligand and their corresponding metal chelates in DMSO were screened in vitro by the disc diffusion method[40]. The ligands and complexes were dissolved separately in DMSO to obtain concentration of 500 µg disc^{-1}. The linear growth of the fungus was recorded by measuring the diameter of the colony after 96 hr. The diameters of the zone of inhibition produced by the complexes were compared with *Griseofulvin*.

RESULT AND DISCUSSION

I) Physical And Analytical Results

The elemental evaluates indications 1:2 (metal : ligand) stoichiometry for each of the chelates. The investigative statistics of the Chelator and their transition metal chelates matched well through the general empirical formula $[M(L)_2(H_2O)_2]$, where M=Iron(III), Manganese(II), Cobalt(II), Nickel(II), Copper(II), L=$C_{17}H_{16}O_7$. The chelates were diverse coloured, stable in normal condition, they are insoluble in H_2O as well as common organic solvents but completely soluble in dimethylformamide and dimethylsulphaoxide *(Balaji H. Jawale, et al., 2017;Patange, 2008)*. Meanwhile a sole crystal of the every chelates could not be isolated from any common organic solvent, the probable structure was anticipated founded on investigative, modern spectral, magnetic measurements also thermal records.

Table I: Physicochemical records of Chelator and their transition metal complexes.

Ligand/ Complexes	F.W.	M.P. (^{0}C)	Yield %	Colour	Found (Caltd.), %			
					M	C	H	O
Ligand HL $C_{17}H_{16}O_7$	332	219	82	Yellow	-	61.22 (61.44)	4.76 (4.85)	33.70
$C_{34}H_{30}FeO_{14}$	718	300<	60	Golden	7.66 (7.77)	56.80 (56.84)	4.181 (4.21)	31.07 (31.18)
$C_{34}H_{30}CuO_{14}$	726	260	35	Celadon	8.72 (8.75)	56.21 (56.24)	4.11 (4.16)	30.71 (30.85)
$C_{34}H_{30}CoO_{14}$	721	272	70	Orange	8.09 (8.17)	56.55 (56.60)	4.10 (4.19)	30.97 (31.04)
$C_{34}H_{30}MnO_{14}$	717	300<	66	Brown	7.61 (7.66)	56.80 (56.91)	4.16 (4.21)	31.20 (31.22)
$C_{34}H_{30}NiO_{14}$	721	252	58	Green Yellow	8.09 (8.14)	56.60 (56.62)	4.17 (4.19)	30.95 (31.05)

II) ^{1}H NMR Spectrum Of Chelator

The ^{1}H nuclear magnetic resonance spectrum of free Chelator in deutarated chloroform at normal temperature appearances the resulting signals. δ2.72 (singlet, due to 3H for $-CH_3$ proton in dehydroacetic acid moiety), 3.97 (singlet, due to 6H,on 2 $-OCH_3$ proton of side chain aryl moiety), 5.97(singlet, due to 1H, for C_5-hydrogen of DHA moiety), 5.98 (singlet, due to 1H, on–OH proton aryl ring), 7.28 (singlet, due to 2H, for side chain Ar-H adjacent methoxy group), 7.95 (doublet, due to 1H, β proton of α β unsaturated moiety on Chelator), 8.22 (doublet, due to 1H, α proton of α β unsaturated moiety on Chelator) and 18.17 (singlet, due to 1H, for phenolic –OH proton of DHA moiety) *(R.Gren, 1971; S.Forsen, et al., 1960; V.Drevenkar, et al., 1983)*.

III) Mass Spectra Of Chelator

Mass spectral figures confirmed the structure of the newly synthesized Chelator as showed by the mother ion peaks equivalent to its empirical mass, the mass spectrum of Chelator.

IV) Infrared Spectra Of Chelator And Its Chelates

The FTIR spectrum of free Chelator appearances specific bands at 3390cm^{-1} for ν (OH) stretching of the aromatic side chain substituted moiety, 3100cm^{-1} ν(OH) of the intramolecular phenolic O-H stretching of the DHA moiety, 1716cm^{-1} ν(C=O) stretching of lactone carbonyl in between DHA ring, 1639cm^{-1} ν(C=O) stretching of α β unsaturated carbonyl group, 1248cm^{-1} ν(C-O) stretching of phenolic in DHA moiety individually (*Ramarao N., et al., 1985; Carugo O., et al., 1990;Balaji H. Jawale, et al., 2017;Patange, 2008*). In the FTIR spectrum of each transition metal chelates, none of the any band was detected in the IR frequency area of 3200-3000cm^{-1}. This indicates absence of ν(OH) of the intramolecular phenolic O-H stretching of the DHA moiety at 3100cm^{-1} proposes successive deprotonation of the phenolic functional group and chelation of phenolic oxygen to the transition metal ion. This was also sustained by an rising IR frequencey in ν(C-O) stretching of phenolic in 3-acetyl-6-methyl-2H-pyran-2,4(3H)-dione (DHA) moiety (*Rao P.V., et al., 2003;Balaji H. Jawale, et al., 2017;Patange, 2008*) by 15-45cm^{-1}. The ν(C=O) stretching of α β unsaturated carbonyl group was moved to lesser energy by respect to the free Chelator, signifying the contribution of the α β unsaturated carbonyl group in the complexation (*Ramarao N., et al., 1985; Carugo O., et al., 1990*). On the other hand a wide-ranging band representative of ν(OH) of complexation water molecules was detected in between the IR frequency region 3570 and 3200cm^{-1}. In case of Chelator and its transition metal complexes exhibited a conspicuous band in IR frequency at 1379 representative of ν(C-O-C) linkage and 994cm^{-1} *trans* –CH=CH- absorption in α β olephinic. The occurrence of different bands in the IR frequency region 600-450cm^{-1} can be allotted to ν (Metal-Oxygen) vibration (*Balaji H. Jawale, et al., 2017;Patange, 2008;Nakamoto K., 1970*).

Therefore, the all above spectral data concluded that the Chelate chelated through the transition metal ions, they acts as mono deprotonated bi-dentate and the complexation happens through the α β unsaturated carbonyl oxygen and phenolic oxygen of 3-acetyl-4-hydroxy-6-methyl-2H-pyran-2-one(enol form of DHA moiety).

Table.II. Specific IR frequencies of Chelator and its transition metal complexes

Ligand/ Complexes	**ν (OH) (side chain phenyl moiety)**	**ν (OH) (dehydroacetic acid moiety)**	**ν (C=O) (lactone)**	**ν (C=O) (acetyl carbonyl)**	**ν (C-O) (phenolic)**	**ν (C=C) (trans)**	**ν (M-O)**
Ligand HL $C_{17}H_{16}O_7$	3390	$3100_{(s)}$	$1716_{(s)}$	$1639_{(m)}$	$1248_{(w)}$	$994_{(s)}$	-
$C_{34}H_{30}FeO_{14}$	3338	-	$1701_{(m)}$	$1643_{(w)}$	$1204_{(s)}$	$994_{(w)}$	$541_{(s)}$ $495_{(s)}$
$C_{34}H_{30}CuO_{14}$	3370	-	$1693_{(s)}$	$1647_{(s)}$	$1266_{(w)}$	$965_{(w)}$	$544_{(w)}$ $448_{(s)}$
$C_{34}H_{30}CoO_{14}$	3201	-	$1690_{(s)}$	$1643_{(s)}$	$1246_{(s)}$	$972_{(m)}$	$552_{(s)}$ $486_{(s)}$
$C_{34}H_{30}MnO_{14}$	3387	-	$1670_{(m)}$	$1640_{(w)}$	$1238_{(m)}$	$1000_{(s)}$	$579_{(m)}$ $534_{(s)}$
$C_{34}H_{30}NiO_{14}$	3358	-	$1699_{(s)}$	$1653_{(s)}$	$1225_{(s)}$	$999_{(s)}$	$532_{(s)}$ $519_{(s)}$

V) Magnetic Moment And UV Analysis

The UV scans of Iron(III), Manganese(II), Cobalt(II), Nickel(II), Copper(II) complexes were logged in dimethylformamide solvent. Three $^6A_{1g}\rightarrow{}^4T_{1g}(G)$, $^6A_{1g}\rightarrow{}^4T_{2g}(G)$ and $^6A_{1g}\rightarrow{}^4E_g(G)$ types electronic transition occurred on the basis of ultraviolet spectrum at 14465 cm^{-1}, 21317 cm^{-1} and 24252 cm^{-1} of the Iron chelate respectively, proposing an octahedral confirmation of Iron(III), which was also definite by magnetic moment (5.92 μ_B) *(Balaji H. Jawale, et al., 2017;Patange, 2008;LeverA. B. P., 1968)*. The scans of the Copper(II) coordination compound involved of a wide-ranging band at 14219cm^{-1} given to the $^2E_g\rightarrow{}^2T_{2g}$ electronic transition of a distorted octahedral configuration *(Eichhorn G. L.,et al.,1953)*. Along with this transition, the band detected at 25327 cm^{-1} arises as of INCT (intra ligand charge transfer). The UV scans of the Cobalt(II) coordination compound displayed three electronic transition at 9478 cm^{-1} given to $^4T_{1g}(F)\rightarrow{}^4T_{2g}(F)$, 18649 cm^{-1} signifying to $^4T_{1g}(F)\rightarrow{}^4A_{2g}(F)$ and finally 21549cm^{-1} which are arises to $^4T_{1g}(F)\rightarrow{}^4T_{1g}(P)$, correspondingly *(Balaji H. Jawale, et al., 2017;Patange, 2008)*, representing octahedral geometry nearby the Cobalt(II) ion. This geometry again confirmed by magnetic measurement of the Cobalt(II) coordination compound was 4.48 μ_B. The UV spectrum of the Manganese(II) coordination material obtained three electronic absorption at 18351cm^{-1} are predictable to $^6A_{1g}\rightarrow{}^4T_{1g}(G)$, 19759 cm^{-1} are assigned to $^6A_{1g}\rightarrow{}^4T_{2g}(G)$ and lastly 23151 cm^{-1}, which signifying to $^6A_{1g}\rightarrow{}^4T_{1g}$, $^4E_{1g}(4G)$ bands individually *(Balaji H. Jawale, et al., 2017;Patange, 2008)*, showing an octahedral confirmation over the Manganese(II) coordination material. Finally we concluded the Manganese(II) coordination material are octahedral geometry on the basis of UV outcomes, supplementary definite by magnetic measurement (5.72μ_B). The electronic absorption scans of the Nickel(II) coordination compound showed three electronic transition $^3A_{2g}\rightarrow{}^3T_{2g}(F)$, $^3A_{2g}\rightarrow{}^3T_{1g}(F)$ and $^3A_{2g}\rightarrow{}^3T_{1g}(P)$, with respect to UV bands at 9350cm^{-1} , 15700cm^{-1} and 22469cm^{-1} respectively. These electronic transition values, along with the magnetic measurement value (3.28 μ_B), suggesting an octahedral configuration of the Nickel(II) coordination compound *(LeverA. B. P., 1968)*. The obtained values of ultraviolet scans and magnetic measurements conclude the stability of the complexes and tracks the order in terms of transition metal ions Cu(II)>Ni(II)>Co(II) *(Balaji H. Jawale, et al., 2017;Patange, 2008)*.

Table III: Magnetic and Ultraviolet-visible spectral data of Chelator and its complexes.

Ligand/ Complexes	**μ_{eff}/μ_B**	**ν /cm^{-1}**	**Band assignment**	**Geometry**
Ligand HL $C_{17}H_{16}O_7$	-	32442 40545	INCT[a] INCT	-
$C_{34}H_{30}FeO_{14}$	5.92	14465 21317 24252	$^6A_{1g}\rightarrow{}^4T_{1g}(G)$ $^6A_{1g}\rightarrow{}^4T_{2g}(G)$ $^6A_{1g}\rightarrow{}^4E_g(G)$	Octahedral
$C_{34}H_{30}CuO_{14}$	1.98	14219 25327	$^2E_g\rightarrow{}^2T_{2g}$ INCT	Distorted Octahedral
$C_{34}H_{30}CoO_{14}$	4.48	9478 18649 21549	$^4T_{1g}(F)\rightarrow{}^4T_{2g}(F)$ $^4T_{1g}(F)\rightarrow{}^4A_{2g}(F)$ $^4T_{1g}(F)\rightarrow{}^4T_{1g}(P)$	Octahedral
$C_{34}H_{30}MnO_{14}$	5.72	18351 19759 23151	$^6A_{1g}\rightarrow{}^4T_{1g}(G)$ $^6A_{1g}\rightarrow{}^4T_{2g}(G)$ $^6A_{1g}\rightarrow{}^4T_{1g}$, $^4E_{1g}(4G)$	Octahedral
$C_{34}H_{30}NiO_{14}$	3.28	9350 15700 22469	$^3A_{2g}\rightarrow{}^3T_{2g}(F)$ $^3A_{2g}\rightarrow{}^3T_{1g}(F)$ $^3A_{2g}\rightarrow{}^3T_{1g}(P)$	Octahedral

VI) Thermal Decomposition Investigation Of Metal Complexes

The Cu(II), Ni(II) and Co(II) chelates of Chelator were selected for a thermal decomposition investigation. The thermogravimetric curve of the complexes of Chelator form three decay phases. In the TG curve of Cu(II) complex of Chelator, the molecular weight beating initiate from 60ºC and an disposed slope from 145-175ºC through a molecular weight beating of 6.5% (caltd., 6.85%), point out the deduction of two chelated water molecules, an endotherm in between the temperature range 140-190ºC(ΔTmin=165ºC) in differential thermal analysis relates to dehydration phase *(Balaji H. Jawale, et al., 2017;Patange, 2008)*. A molecular weight beating 28.5% (calcd.,28.9%), an exotherm (ΔTmax =295ºC) in differential thermal analysis may be related to the elimination of non-chelated portion of the Chelator means syringaldehyde ring beside through β carbon [$C_{10}H_{12}O_3$] in thermogravimetric curve up to 332ºC. Now the third stage agrees to decay of chelated portion of the Chelator in between the temperature range of 365-830ºC through a weight beating 49.5% (caltd.,50.22%) *(Balaji H. Jawale, et al., 2017;Patange, 2008)*. A comprehensive endotherm is detected for this phase. The weight of the absolute remains matches to the stable CuO, 16.0 % (caltd.,16.48%).

$$\begin{tikzcd}[Cu(C_{17}H_{16}O_7)_2(H_2O)_2] \arrow[r, "145\text{-}175^0C", "-2H_2O"'] & [Cu(C_{17}H_{16}O_7)_2] \arrow[r, "210\text{-}332^0C", "-2C_9H_{10}O_3"'] & [Cu(C_8H_6O_4)_2] \arrow[d, "365\text{-}830^0C"', "C_{16}H_{12}O_7"] \\ & & CuO\end{tikzcd}$$

Venkateshwar Rao et al. *(Venkateshwar Rao P., et al., 2005)* in its thermal decomposition investigation of Cu(II) chelate of Schiff bases of 3-acetyl-6-methyl-2H-pyran-2,4(3H)-dione (Dehydroacetic acid) stated that, the chelate eliminates two water molecules in two stages. Two endotherm are detected in the differential thermal analysis peak, which found in between the temperature range 164 and 171 ºC.

The TG/DSC summary of Ni(II) complex of Chelator show empirical weight losses 6.8% (caltd.,7.2%) is detected in between the temperature range 120 and 195ºC. An endotherm in between the temperature range 130 and 175ºC (ΔTmin = 152.5ºC), resemble to elimination of two chelated water molecules *(Balaji H. Jawale, et al., 2017;Patange, 2008)*. The second stage disintegration is 27.8% (caltd., 26.52%) molecular weight beating in between the temperature range 230 and 405ºC. Credited to the elimination of non-chelating fragment of the Chelator ($C_{10}H_{12}O_3$), a comprehensive exotherm in between the temperature range 190-390ºC (ΔTmax = 230.5ºC) in differential thermal analysis *(Balaji H. Jawale, et al., 2017;Patange, 2008)*. The empirical weight beating remains and follows relaxed disintegration of enduring fragment of the Chelator by 48.5% weight damage in between the temperature range 420 and 810^{0}C. A wide-ranging endotherm is detected for this phase. The weight of the last residue 18.2%, does not resembles with any stoichiometric final product.

$$\begin{tikzcd}[Ni(C_{17}H_{16}O_7)_2(H_2O)_2] \arrow[r, "120\text{-}195^0C", "-2H_2O"'] & [Ni(C_{17}H_{16}O_7)_2] \arrow[r, "230\text{-}405^0C", "-2C_9H_{10}O_3"'] & [Ni(C_8H_6O_4)_2] \arrow[d, "420\text{-}810^0C"', "C_{16}H_{12}O_7"] \\ & & \text{Residue}\end{tikzcd}$$

The thermal decomposition investigation of mixed ligand complexes of multidentate heterocycles through Ni(II) imides executed by Mishra *(Mishra A.P., et al., 2005)* directed empirical mass beating at 175 ºC equal to two chelated water molecules which is definite by an endotherm in differential thermal analysis curve at the similar point proposing the occurrence of chelated two water molecules.

The TG/DSC summary of Co(II) chelate of Chelator spectacle no empirical mass beating up to 148°C. The empirical weight beating of 7.5% (caltd. 7.8%) is detected in between the temperature range 160 and 200°C. An endotherm between the temperature 150-210°C (ΔTmin = 185°C), match to the deduction of two coordinated water molecules (*Balaji H. Jawale, et al., 2017;Patange, 2008*). The next phase disintegration is in the temperature 250-395°C with 27.8% (caltd. 28.33%) molecular weight loss. A wide-ranging exotherm in between the temperature range 245 and 380°C (ΔTmax =307°C) in differential thermal analysis, indicated to the elimination of non-chelating portion of the Chelator ($C_{10}H_{12}O_3$). The third stage agrees to decay of chelated portion of the Chelator in between the temperature range of 400-800°C through a weight beating Chelator 49.90% (caltd., 50.21). A widespread endotherm is detected for this phase. The weight of the absolute remains relates to CoO, 14.8% (caltd. 14.9%).

$$\begin{tikzcd}[Co(C_{17}H_{16}O_7)_2(H_2O)_2] \arrow[r, "160\text{-}200^0C", "-2H_2O"'] & [Co(C_{17}H_{16}O_7)_2] \arrow[r, "250\text{-}395^0C", "-2C_9H_{10}O_3"'] & [Co(C_8H_6O_4)_2] \arrow[d, "400\text{-}800^0C"', "C_{16}H_{12}O_7"] \\ & & CoO\end{tikzcd}$$

Geetha Parameshwaran (*Geetha Parameshwaran, et al., 1993*) in there thermal investigation of cobalt(II) chelates of Cinnamaldehyde, anthranilic acid listed that, the coordinated compounds does not possess water molecules of hydration. Nonetheless a molecular weight beating in between the temperature range 110 and 180°C for the reason that of chelated water molecules. The thermogravimetric curve of cobalt(II) coordinated materials spectacles very sharp particular step decay process. They indicated that this performance may be as of the fast decay of the coordinated materials.

In the thermal analysis of cobalt(II) coordinated compound with 2-hydroxy-3-bromo-4-methoxy-5-methyl chalcone oxime, Bhave and Kharat (*Bhave N.S.,et al., 1997*) listed beating of two water molecules under 200°C on the base of endotherm curve in differential thermal analysis.

Fig. I: TG-DTA Curve of Cu(II) & Ni(II) Chelate of Chelator

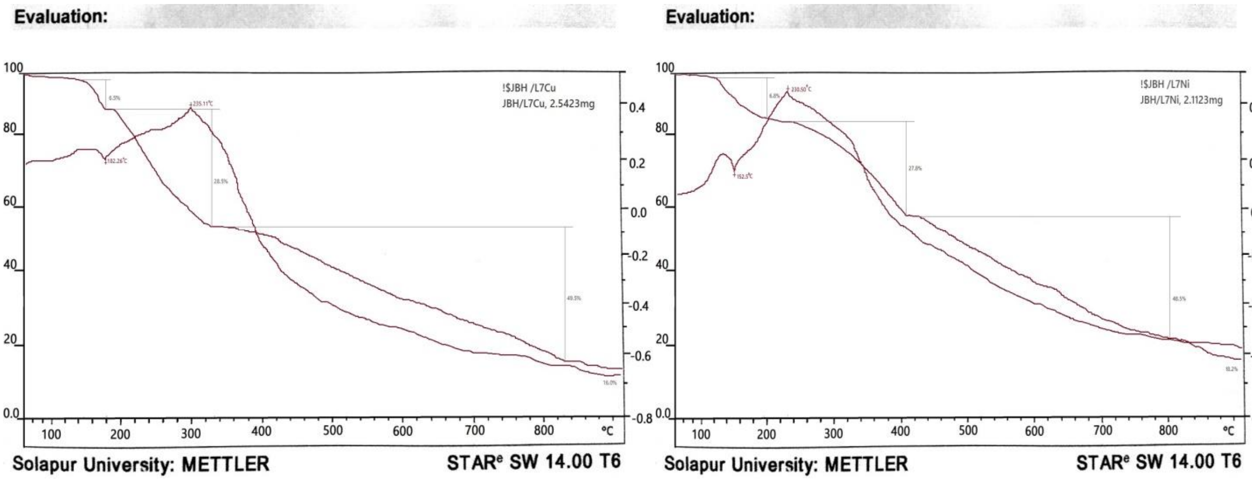
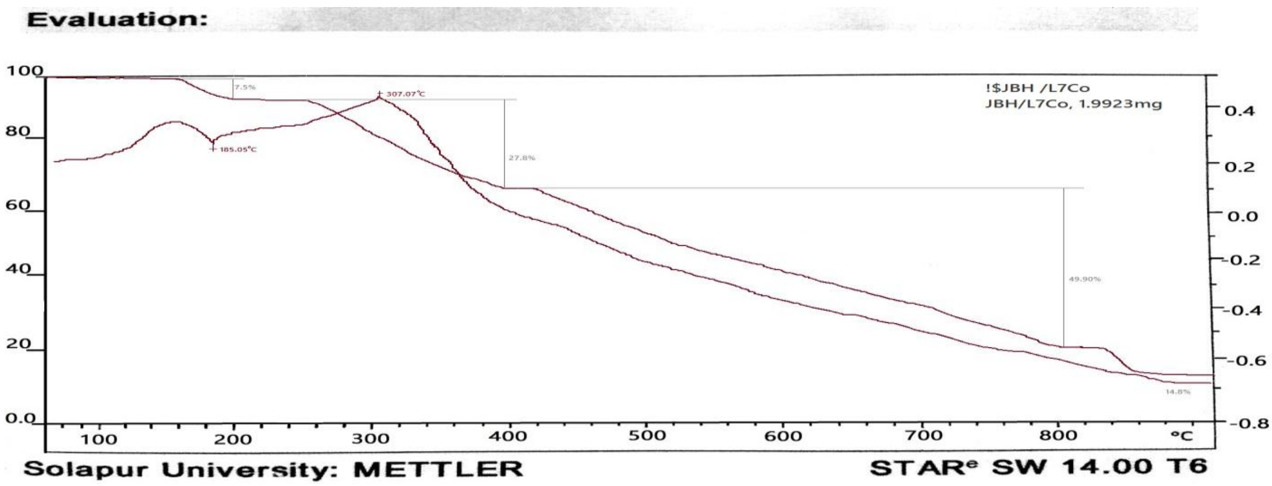


Fig.: TG-DTA Curve of Co(II) Chelate of Chelator



Antimicrobial Activity

The synthesized ligand and its coordination compounds were evaluated for their *in vitro* antimicrobial activity against Gram-negative (*Shigella boydii*, *Escherichia Coli*) and Gram-positive (*Bacillus Cereus, Bacillus Megaterium*) bacterial strains and against *Saccharomyces Cerevisiae* , *Penicillium notatum* and *Aspergillus Oryzae* antifungal strains.

Table IV: Antibacterial effect of Chelator and its transition metal chelates

Test Compound	**Inhibition zone diameter (mm)**							
	Bacillus Megaterium		***Bacillus Cereus***		***Shigella Boydii***		***Escherichia Coli***	
	Concentration, 0.5mg ml^{-1}	**Concentration, 1mg ml^{-1}**	**Concentration, 0.5mg ml^{-1}**	**Concentration, 1mg ml^{-1}**	**Concentration, 0.5mg ml^{-1}**	**Concentration, 1mg ml^{-1}**	**Concentration, 0.5mg ml^{-1}**	**Concentration, 1mg ml^{-1}**
Chelator $C_{17}H_{16}O_7$	**08**	**09**	**11**	**13**	**07**	**09**	**07**	**08**
$C_{34}H_{30}FeO_{14}$	09	11	15	16	11	13	-	-
$C_{34}H_{30}CuO_{14}$	11	13	20	22	-	-	12	14
$C_{34}H_{30}CoO_{14}$	07	09	16	18	13	15	11	13
$C_{34}H_{30}MnO_{14}$	-	-	19	21	11	12	10	12
$C_{34}H_{30}NiO_{14}$	08	10	-	-	10	12	-	-
Ciprofloxacin	**34**	**36**	**50**	**54**	**28**	**30**	**30**	**32**

The antibacterial record tells that transition metal chelates displayed enriched actions equaled to the free chalcone chelator. Such improved antibacterial effects of transition metal coordinated compound can be elucidated on the origin of chelation theory [45] in addition to overtone's conception[44].

Table V: Antifungal Effects of Chelator and its transition metal chelates.
[Yield of Mycelial dry weight in mg (% inhibition)]

Compound	**Aspergillus Oryzae**		**Saccharomyces Cerevisiae**		**Penicillium Notatum**	
	250 ppm	**500 ppm**	**250 ppm**	**500 ppm**	**250 ppm**	**500 ppm**
Chelator $C_{17}H_{16}O_7$	36(14)	22(16)	62(10)	48(12)	66(10)	52(12)
$C_{34}H_{30}FeO_{14}$	48(18)	18(19)	71(12)	52(14)	72(16)	69(18)
$C_{34}H_{30}CuO_{14}$	14(24)	08(26)	32(16)	22(18)	32(18)	21(20)
$C_{34}H_{30}CoO_{14}$	18(16)	12(18)	27(14)	24(16)	47(14)	32(16)
$C_{34}H_{30}MnO_{14}$	22(18)	14(20)	43(14)	36(15)	48(12)	39(13)
$C_{34}H_{30}NiO_{14}$	52(16)	44(18)	54(12)	32(14)	77(10)	65(12)
Griseofulvin	40	42	39	40	32	34

The inhibition of growing of trial fungous detected for all chelates was not caused by any transition metal ions or chalcone ligand only, however was by reason of increasing result of equally transition metal ion as well as chalcone ligand in the chelates.

CONCLUSION

It was detected that in mass outcomes mother ion equivalent to the empirical mass of Chelator seem strong band at (333 m/e), this was a strong sign for the formation of the Chelator. Melting points of the coordination compounds are comparatively high, proposing good thermal stability at room temperature. TG/DSC analysis of the selected coordination compounds provides information about decay form and also supports existence of complexation and lattice water molecules in metal coordination compounds. The complexes are biologically active and exhibit enhanced antifungal activities compared to their parent ligands, hence further study of these complexes in agriculture could lead to interesting results.

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