I J R B A T, Issue (XI) Vol (I) Jan 2023: 154-164
A Double-Blind Peer Reviewed & Refereed Journal
OPEN ACCESS
e-ISSN 2347 – 517X
Original Article
INTERNATIONAL JOURNAL OF RESEARCHES IN BIOSCIENCES, AGRICULTURE AND TECHNOLOGY
 www.ijrbat.in

SYNTHESIS,SPECTRAL AND THERMOANALYTICAL STUDY OF Fe(III) COMPLEXES OF GLICLAZIDE AND GLIMEPERIDE AN ORAL ANTIDIABETIC DRUGS

Mohammad Tawkir[1] and S.A. Iqbal[2]

[1]Dr. Khatri Mahavidyalaya, Tukum Chandrapur-442401(India)
[2]Cresent College of Engineering and Technology, Bhopal-462 001(India) ,
Corresponding Email: msheikh196@gmail.com, iqbalospc@yahoo.com

Communicated :10.12.2022 | Revision: 20.01.2023 & 24.01.2023 Accepted: 26.01.2023 | Published: 30.01.2023

ABSTRACT:
Gliclazide and Glimeperide complexes of Fe(III) was synthesized . Metal-Ligand ratio Calculated by Conductometric Titration using Monovariation method which was further confirmed by Job's Method of continuous variation.Elemental analysis confirmed the complexes found to have formula $(C_{15}H_{21}N_3O_3S)_2Fe{\cdot}2H_2O$, $(C_{24}H_{34}N_4O_5S)_2Fe{\cdot}2H_2O$.The complexes are assigned ionic confirmed by high molar conductance value..Geometry of complexes assigned Octahedral structure (Scheme-I and Scheme-II) has been discussed and suggested upon Elemental analysis and I.R.,X-Ray diffraction powder method.Thermal decomposition has been studied using Thermogravimetric (TGA) .Kinetic parameters were evaluated by *Freeman-Carroll and Sharp-Wentworth method.*

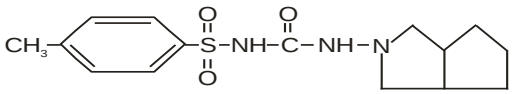
Keywords: - Hypoglycemic activity, Gliclazide, and Glimeperide complexes.

INTRODUCTION :

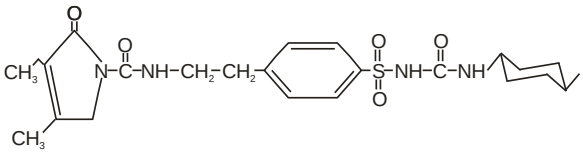
Diabetes is a deceptive disease and if not detected in early stage may cause even death. It is considered hereditary but actual genetic disorder is still a mystery. As of 2015, an estimated 415 million people had diabetes worldwide, with type 2 DM making up about 90% of the cases [1] and this represents 8.3% of the adult population, with equal rates in both women and men. As of 2014, trends suggested the rate would continue to rise. Diabetes at least doubles a person;s risk of early death.[2]. From 2012 to 2015,approximately 1.5 to 5.0 million deaths each year resulted from diabetes[3]. Diabetes is due to either the pancreas not producing enough insulin or the cells of the body not responding properly to the insulin produced. There are three main types of diabetes mellitus Type 1 DM results from the pancreas failure to produce enough insulin. This form was previously referred to as an insulin-dependent diabetes mellitus (IDDM) or ;juvenile diabetes[4], Type 2 DM begins with insulin resistance, a condition in which cells fail to respond to insulin properly. As the disease progresses a lack of insulin may also develop. This form was previously referred to as;non-insulin-dependent diabetes mellitus; (NIDDM) or adult-onset diabetes. The most common cause is excessive body weight and insufficient exercise. Gestational diabetes is the third main form, and occurs when pregnant women without a previous history of diabetes develop high blood sugar levels.Zinc-insulin was discovered as early as in 1921 and later it proved to be a very efficacious medicine in the treatment of diabetes mellitus. To avoid the daily pricks of hypodermic syringe, oral hypoglycemic agents were discovered which has revolutionized the treatment of diabetes. It is worthwhile to mention here that the majority of the essential metallic elements of biological importance are

http://doi.org/10.29369/ijrbat.2023.010.1.0026

transition metals, whose ability to form coordination complexes and chelates are the characteristic aspects of their chemistry[5-6].Iqbal et.al.[7-10] synthesized the complexes of sulphonyl urea and biguanidine and compared its hypoglycemic activity; found that the synthesized complexes are more potent than parent drug. Gliclazide is an oral hypoglycemic (antidiabetic drug) and is classified as a sulphonyl ureas. It is marketed as Glizid, Glyco and Reclide in India and diamicron in Canada. It is chemically 1-(3-azobicyclo[3,3,0] Oct-3yl)-3-(p-tolysulphonyl) ureas.. Glimeperide is a medium to long acting sulphonyl ureas antidiabetic drug. It is marketed as Amaryl by Sanofi-Avintis and GLIMY by Dr. Reddy's Lab. It is chemically 3-ethyl-4-methyl-N-(4-[N-(1r,4r)-4-methyl cyclohexylcarbonyl) sulphamoyl] phenethyl)-2-oxo-2,5-dihydro-1-H-pyrrole-1carboxamide. The general structure of.Gliclazide Glimeperide are as.



Structure of Pure drug Gliclazide



Structure of Pure drug Glimeperide

Experimental

To find out Ligand-Metal Ratio (Mono-variation method)

Pure "Gliclazide"1.617 gm (0.005M) was dissolved in 100 ml of ethanol. 0.69 g(0.01M) Ferrous sulphate in 100 ml ethanol.10 ml Gliclazide solution was diluted to100 ml (ethanol) in a beaker.This was titrated conductometrically against ferrous sulphate solution taken in burette using fractions of 1ml.Conductance was recorded after each addition with proper stirring at temperature30±1^{0}C.Results were plotted in the form of a graph between corrected conductance and volume of metal salt. From the equivalent point in the graph (shown in **fig.**-1), ratio between ligand-metal was noted to be 2:1.

Pure "Glimeperide" 2.453g (0.005M) was dissolved in 100 ml of ethanol. 0.69 g(0.01M) Ferrous sulphate in 100 ml ethanol. 10 ml Glimeperide solution was diluted to 100 ml (ethanol) in a beaker. This was titrated conductometrically against ferrous sulphate solution taken in burette using fractions of 1ml.Conductance was recorded after each addition with proper stirring at temperature 30±1^{0}C. Results were plotted in the form of a graph between corrected conductance and volume of metal salt. From the equivalent point in the graph (shown in **fig.**-2, ratio between ligand-metal was noted to be 2:1.3. Formation of 2:1 (L $_2$ M) ratio was also confirmed by Job's method11ofcontinuous variation as modified by Turner and Anderson. 12 In this method Equimolarsolutionofmetalsalts(Iron and Cobalt) and ligand (Gliclazide. and Glimeperide) were preparedin250ml.standardflasks,separately. A set of 13 small beakers were arranged for each metal salt. Ligand solution was filled with volumes 12.0 to 0.0 ml. and metal salt solution was filled with volume 0.0 ml to12.0 ml in arranged beakers. Total volume was made to 12.0 ml. in each case and pH was adjusted by adding buffer solution (Potassium dihydrogen phosphate+sodium hydroxide). The set was kept for two hour to reach the equilibrium point. One cell of spectrophotometer were rinsed first with distilled water and then by ethanol. The cell was filled with alcohol and tested for 100% transmittance for wave length 300-650 nm than spectrophotometer was fixed on the required wavelength. One of the cell was used as a reference and other one for optical density. Absorbance was recorded for each solution.The graphs were plotted between corrected absorbance and mole metal lignad ratio. The composition of complex was determined from

http://doi.org/10.29369/ijrbat.2023.010.1.0026

graph (Table-1,2,**fig.**-3 & 4) and from these values the stability constant (logk) and free energy change (-ΔF),were also calculated by using formula Where, k = Stability constant, x =Conc. of complex and ΔG = -RT Ink respectively.

Synthesis of Complexes

The chemicals used in this synthesis were all of analytical grade (A.R.) and of highest purity. A weighed quantity of "Gliclazide and Glimeperide (2 mole) was dissolved separately in minimum quantity of 90% ethanol. The iron solution (1 mole) was prepared by dissolving it separately in the same solvent. Ligand solution was added slowly with stirring the solution of metallic salt atroom temperature maintain the PH between 6.0 to 6.5 by adding dilute NaOH solution. On refluxing the mixture for 3-4 hours andon ooling the complex was separated,which was filtered properly washed with ethanol and finally dried in vacuum and then weighed.

Instrumentation

The elemental analyses of the isolated complex was carried out using Coleman Analyzer at the Departmental Microanalytical Laboratory of Central Drug Research Institute (C.D.R.I) Lucknow,India.Iron analysis was carried out in Qualichem Laboratory Nagpur, India by Atomic Absorption Spectroscopy.The IR spectra of the ligand as well as of the complex was recorded on Perkin Elemer Spectrophotometer.Thermogravimetric analysis of complex was carried out in I.I.T, Bombay,India.

RESULT AND DISCUSSION.

Physico-chemical Characterstics of "Gliclazide"and Glimeperide-Iron complexes are given as:

Gliclazide-Iron complex- Molecular formula $[(C_4H_{11}N_5)_2Fe(OH_2)_2]SO_4$, Mol.wt: 443.92 gm; Colour: Dark brown; Yield:54.61%; M.P-250 °C, –ΔF= 15.91;Log K: 11.48;Anal. Calcd (%) for $[(C_4H_{11}N_5)_2Fe(OH)_2]SO_4$: C=21.53; H=4.93; N=31.40; SO_4^{--}= 28.92;Coordinated water =4.93; Fe=12.25;Found (%): C=21.40; H= 5.02; N=30.95; SO_4^{--} =28.50; Coordinated water= 4.33; Fe,=12.17.

Glimeperide-Iron complex-Molecular formula $(C_{24}H_{34}N_4O_5S)_2Fe{\cdot}2H_2O$,Mol.wt=:1073.079 g Colour:-Dark brown; Yield:=69.75%; M.P=:210 °C, –ΔF:= 14.8801425 cal/mole;LogK: 10.82108502 lit.mol $^{-1}$;Anal. Calcd (%) for $(C_{24}H_{34}N_4O_5S)_2Fe{\cdot}2H_2O$: C[=,53.81; H=6.10; N=,10.42; Coordinated Water= 3.65; Fe,=5.98;Found (%): C,=53.67; H= ,6.15; N=,10.43; ; Coordinatedwater=3.35;Fe=,5.20Stoichoimetryandanalyticaldataprovesthat,thecompositionofthe co$C_4H_{11}N_5)_2Fe(OH)_2]SO_4^{--}$ and $(C_{24}H_{34}N_4O_5S)_2Fe2H_2O$ which favors 2:1 (L_2M) ratio. The tentative structure (scheme-III and IV) assigned to the complex, on the basis of analyticaldata, which was further supported by IR, NMR, and XRD-data.

Infra-red Spectral Studies of "Gliclazide"-Iron complex

Assignments of the infra-red spectral bands are based on literature. 13-16 IR spectrum(Fig.5) shows important bands due to IR(υ,cm -1 , KBr, υ (M-N) 500 ± 20 cm $^{-1}$, ν(N-Hwagging in ligand as well as complex) 770 ±10 cm $^{-1}$, υ (C-N-C) 1215±10 cm $^{-1}$, υ (-C=N)1620±10 cm $^{-1}$ (C=N Stretching frequency. The most significant difference in the IRspectrum of the ligand and the complex was the shift of (C=N) stretching frequenciestowards lower frequencies due to metal-ligand coordinationand frequency of chelatering, (amine salt) 2360±10cm $^{-1}$, υ (C-H) 2910±20 cm $^{-1}$, υ (NH 3 frequency in ligand andcomplex,similar toamino acid), 3020±10cm $^{-1}$ υ (N-H) 3200-3400 cm $^{-1}$, υ(coordinated water molecules) 3550±20 cm $^{-1}$.

Infra-red Spectral Studies of "Glimeperide"-Iron complex

Assignments of the infra-red spectral bands are based on literature. **13-16** IR

http://doi.org/10.29369/ijrbat.2023.010.1.0026

spectrum (Fig.6) shows important bands due to IR(υ,cm -1 , KBr, υ (M-N) 500±20 cm -1 , ν(N-H wagging in ligand as well as complex) 2833±20 cm $^{-1}$, υ (C-N-C) 1250±10 cm $^{-1}$, υ (-C=N) 1560±10 cm $^{-1}$ (C=N Stretching frequency. The most significant difference in the IR spectrum of the ligand and the complex was the shift of (C=N) stretching frequencies towards lower frequencies due to metal-ligand coordinationand frequency of chelate ring, (amine salt) 2360±10cm $^{-1}$, υ (C-H) 2910±20 cm $^{-1}$, υ (NH $_3$ frequency in ligand and complex,similar to amino acid), 3020±10cm $^{-1}$ υ (N-H) 3182-3420 cm $^{-1}$, υ (coordinated water molecules) 3420±20 cm $^{-1}$.

Thermal Study of "Gliclazide"and Glimeperide-Iron complex [17-18]

Thermogram results of Gliclazide-Fe and Glimeperide-Fe and TGA data of these complexes revealed that the Metformin-Fe complex lost nearly 60 to 80% of its weight when temperature was raised to 783^{0}K ,while GLM-Fe sample lost nearly 60 to 80% of its weight when the temperature was raised to 783^{0}K.This initial weight loss may be due to solvent or moisture entrapped in the complexes.Thermogram of both the complexes have exhibited three stages of decomposition after loss of water molecules.The first stage of decomposition represents degradation of side chain attached to aromatic nucleus in complexi.e.CH_3 group SO_2group,C_6H_4group,second stage of decomposition may be assigned to removal of side chain or NH-group NCO-group and pyrollidine ring.Third stage of decomposition may be assign to collapse of main chelate ring with formation of metal oxide as residue.The degradation of complexes with their corresponding % mass lost are summarized in the table 1 and 3. The Thermogravimetric Analysis of Metformin and Glimeperide –Fe complexes have been carried out..The data of the thermogravimetric analysis of complexes was analysed using *Sharp-Wentworth and Freeman-Carroll* method.These methods are used to determine the kinetic parameters like activation energy(Ea) and order (n) of the composition reaction.By using*Sharp-Wentworth andFreeman-Carroll* method different Thermodynamic parameters table 1 and 2 have been calculated such as entropy change,free energy change,Frequency factor and apparent entropy change etc.however the thermal data (table 4) and kinetic plots (fig7 and 8) are given.Moreover, *Freeman-Corrolland Sharp-Wentworth* methods were applied for evaluation of kinetic parameters as follow:

Freeman-Carroll Method (F.C)-Following relation was derived

$\frac{\Delta log\frac{dw}{dt}}{\Delta log\, Wr} = n - \frac{E_a}{2.303R}.\frac{\Delta\frac{1}{T}}{\Delta log\, Wr}$, Where, $\frac{dw}{dt}$ = rate of change of weight with time,Wr = Wc-W

W_c = Wt. loss at completion of reaction, W = Total wt. loss up to time't', E_a = Energy of activation, n = Order of reaction, The plot between the term $\frac{\Delta log\frac{dw}{dT}}{\Delta \log Wr}Vs\frac{\Delta\frac{1}{T}}{\Delta \log Wr}$, was found to be linea ydiscarding few points (Fig.4). From the slope $E_a$was calculated and intercept on Y-axis as order of reaction (n).

Sharp-Wentworth Method(S.W)- Following relation was derived

$\frac{\Delta log\frac{dc}{dT}}{(1-c)} = log\frac{A}{B} - \frac{Eq}{2.303\,R}.\frac{1}{T}$, Where, $\frac{dc}{dT}$ = Rate of change of fraction of weight with change in temperature.β = Linear heating rate $\frac{dT}{dt}$, By plotting the graph between$\frac{\Delta log\frac{dc}{dT}}{(1-c)}$Vs $=\frac{1}{T}$,was found to be linear by discarded few point (Fig.5).

Fig.5: FC kinetic Plot of Gliclazide-Fe Complex using TGA Data (FC=Freeman and Carroll)

From the slope activation energy(E_a) and Entropy (-ΔS) were calculated. The enthalpy of activation (ΔH) and Gibbs free energy were calculated by well- known method.

$E_a = Slope \times 2.303\ R$,

$$\Delta S = \left[intercept - \log\frac{K\,R}{h\,\emptyset\,E}\right] \times 2.303\,T$$

http://doi.org/10.29369/ijrbat.2023.010.1.0026

$\Delta G = \Delta H - T\Delta S$, and $\Delta H = Ea - RT$

The kinetic parameters [13] were Calculated by above method are given as Gliclazide"-Iron complex $[(C_4H_{11}N_5)_2Fe(OH_2)_2]SO_4$: E_a=62.80 KJ/mole by S.W method and 63.83 Kj/mole by F.C method, ΔS= -21.77 KJ/mole, ΔG= 65.37KJ/mole, n (order of reaction)=0.92.The high value of activation energies reflect the thermal stability of complex. The entropy of activation is found to have negative values in complex which indicates the decomposition reaction process with lower rate than the normal ones and also gives indication towards more ordered structure.

DISCUSSION :

For supporting the proposed structure (Scheme-I and II) of iron complex with "Gliclazide"and Glimeperide ,initially mono-variation method was conducted that indicates 1:2 metal-ligand ratio which was further confirmed by Job's method of continuous variation.Analytical data agrees to the molecular formulae $[(C_4H_{11}N_5)_2Fe(OH_2)_2]SO_4^{--}$.and $(C_{24}H_{34}N_4O_5S)_2Fe{\cdot}2H_2O$ The proposed structure of Fe-complex of "Gliclazide and Glimeperide " was further supported from spectroscopic IR method.The result of IR method is signal at frequency 500±20 cm^{-1}, which is due to linkage of metal-nitrogen.Presence of water molecule is confirmed by getting a medium signal at frequency 3550±20$cm^{-1}$and which was also confirmed by TGA analysis.Thermal analysis has been studied by giving their relative thermal stability, by applying the Sharp-Wentworth and Freeman-Carroll methods;Energy of activation (E_a), Kinetic parameter viz. -ΔS, ΔF and order of reaction (n) were determined[19-25].

CONCLUSION :

In present study we have synthesize complex of anti-diabetic drug with Iron. The structure,which is supported by spectral, kinetics parameters which gives the detailed information of the new structure of coordination chemistry. Moreover, in our previous work we have carried out comparative study for hypoglycemic activity of parent drug and its complexes with various transition metals and found that the complexes are more potent than pure drug. If by doing some clinical action it can be used for human and it will be a new drug for diabetic patients.

REFERENCES:

Shi Y, Hu FB (June 2014). "The global implications of diabetes and Cancer". Lancet. 383 (9933): 1947–8. doi:10.1016/S0140-6736(14) 60886 2. PMID 24910221.

"Diabetes Blue Circle Symbol". International Diabetes Federation. 17 March 2006. Archived from the original on 5 August 2007.

"Diabetes Fact sheet N°312". WHO. October 2013. Archived from the original on 26 August 2013. Retrieved 25 March2014.

Kitabchi AE, Umpierrez GE, Miles JM, Fisher JN (July 2009). "Hyperglycemic crises in adult patients with diabetes". Diabetes Care. 32 (7): 1335–43. doi:10.2337/dc09-9032. PMC 2699725 . PMID 19564476.

Ripsin CM, Kang H, Urban RJ (January 2009). "Management of blood glucose in type 2 diabetes mellitus" (PDF). American Family Physician. 79 (1): 29–36. PMID 19145963.

The top 10 causes of death Fact sheet N°310". World Health Organization. October 2013. Archived from the original on 30 May 2017.

Iqbal, S.A.; Jose, S.; Zaafarany, I. Orient. J. Chem., 2012,28, 613-618, 2012.

Prakash,O,; Krishan, B,: George, J.Orient. J. Chem.,2013,29, 823-828.

Krishan, B,; Prakash,O,; Mossalamy, E.H.EL, Orient. J. Chem., 2013,29,381-388.

http://doi.org/10.29369/ijrbat.2023.010.1.0026

Krishan, B,; Iqbal, S.A.J. of Chem.. 2014,http://dx.doi.org/10.1155/2014/378567

Job,P.Annales de Chimie, 1928, 10, 113.

Turner, S.E.; Anderson, R.C. J. Of Am. Chem. Soc., 1949, 71(3), 912–914.

Rao, C. N. R., Academic Press, NY, USA, 1963.

Bellamy, L.J., Matheun and Co. Ltd. UK, 1964.

Weissberger, A., 11, Wiley-interscience, New York, USA, 1956.

Nakamotto, K, John Willey and Son's, NY,10, 1963.

Freeman,E. S.; Carroll, B, J.of Phy.l Chem., 1958,62(4), 394–397.

Sharp, J. H.; Wentworth, S. A., Analytical Chem., 1969,41(14), 2060– 2062.

Tawkir, Mohd., Khairou, K,; Zaafarany, I,Orient.J. Chem., 2012, 28(4),1697-1710.

Jitin,W.,Huaging,X, and Zhang,X : Thermochemical Acta,488(1-2),39-42(2009)

Lingala P.S.,Juneja H.D.,Paliwal L.J. : Thermans Gorakhpur,245-247(2000).

Ozawa T:Thermal Analysis,7,601(1985).

Pancholi H.B.,Patel M.M.:Thermochemica Acta;191(227-233)(1991)

Pancholi H.B.,Patel M.M.:Thermochemica Acta;194,1-7(1992).

Freeman,E.S.,Carroll,B.J.:Phys.Chem.,62,394(1958).

http://doi.org/10.29369/ijrbat.2023.010.1.0026

Table 1:Thermogravimetric data of Gliclazide Iron complex by sharp-wentworth method

Temp. (°C)	Temp (°K)	$\frac{1000}{T}$	% Mass Loss	Change in Wt. 'c' grams	1-c	$\frac{dc}{dt}$	$log\frac{dc}{dt}$	$log(1-c)$	$\frac{log\left(\frac{dc}{dt}\right)}{(1-c)}$	Weight (%)
30	303	3.30033	0.245	0.00001	0.99999	0.00002	-4.70728	-0.00001	-4.70735	99.755
50	323	3.09598	0.398	0.00002	0.99998	0.00002	-4.63060	-0.00001	-4.63070	99.602
70	343	2.91545	0.496	0.00003	0.99997	0.00003	-4.59133	-0.00001	-4.59146	99.504
90	363	2.75482	0.555	0.00003	0.99997	0.00003	-4.55288	-0.00001	-4.55302	99.445
110	383	2.61097	0.609	0.00003	0.99997	0.00003	-4.49332	-0.00001	-4.49347	99.391
130	403	2.48139	0.693	0.00004	0.99996	0.00004	-4.37947	-0.00002	-4.37964	99.307
150	423	2.36407	0.881	0.00005	0.99995	0.00007	-4.17867	-0.00002	-4.17888	99.119
170	443	2.25734	1.355	0.00008	0.99992	0.00011	-3.96320	-0.00003	-3.96351	98.645
190	463	2.15983	2.207	0.00012	0.99988	0.00017	-3.76829	-0.00005	-3.76876	97.793
210	483	2.07039	3.474	0.00020	0.99980	0.00027	-3.56096	-0.00008	-3.56166	96.526
230	503	1.98807	5.583	0.00031	0.99969	0.00058	-3.23726	-0.00014	-3.23827	94.417
250	523	1.91205	11.417	0.00064	0.99936	0.00097	-3.01522	-0.00028	-3.01716	88.583
270	543	1.84162	19.458	0.00109	0.99891	0.00117	-2.93350	-0.00048	-2.93671	80.542
290	563	1.77620	24.622	0.00138	0.99862	0.00151	-2.81991	-0.00060	-2.82382	75.378
310	583	1.71527	31.852	0.00179	0.99821	0.00185	-2.73371	-0.00078	-2.73862	68.148
330	603	1.65837	39.21	0.00220	0.99780	0.00187	-2.72906	-0.00096	-2.73509	60.790
350	623	1.60514	41.035	0.00231	0.99769	0.00187	-2.72720	-0.00100	-2.73350	58.965
370	643	1.55521	41.543	0.00234	0.99766	0.00189	-2.72369	-0.00102	-2.73006	58.457
390	663	1.50830	41.915	0.00236	0.99764	0.00191	-2.71990	-0.00102	-2.72632	58.085
410	683	1.46413	42.284	0.00238	0.99762	0.00193	-2.71537	-0.00103	-2.72184	57.716
430	703	1.42248	42.713	0.00240	0.99760	0.00195	-2.71031	-0.00104	-2.71684	57.287
450	723	1.38313	43.2	0.00243	0.99757	0.00197	-2.70517	-0.00106	-2.71176	56.800
470	743	1.34590	43.71	0.00246	0.99754	0.00200	-2.69977	-0.00107	-2.70642	56.290
490	763	1.31062	44.251	0.00249	0.99751	0.00202	-2.69378	-0.00108	-2.70050	55.749
510	783	1.27714	44.852	0.00252	0.99748	0.00206	-2.68593	-0.00110	-2.69272	55.148

http://doi.org/10.29369/ijrbat.2023.010.1.0026

Table 2:- Thermogravimetric data of Glimeperide Iron Complex by Freeman and Carrol Method

Temp. (°C)	% Mass Loss	Change in Wt. (gm.)	Time in Sec.	$\frac{dw}{dt}$	$\frac{dw}{log\ dt}$	wr = wc-w	log wr	T(K)	$\frac{1}{T}(K^{-1})$	$\frac{log\frac{dw}{dt}}{log w_r}$	$\frac{\frac{1}{T}}{log w_r}$	$\alpha = \frac{wt}{wc}$	$\frac{1-(1-\alpha)^{1-n}}{1-n}$	$T^3 \times 10^{-7}$	$\frac{g(\alpha)}{T^3 \times 10^7}$	$\frac{1}{T} \times 10^{-3}$	$log\left(\frac{g(\alpha)}{T^3}\right)$
30	1.409	0.00011	90	0.000364	-3.439	0.00252	-2.5983	303	0.00330	1.324	-0.0013	0.0172	0.0173	2.7818	0.0001	3.3003	-126.7674
50	4.647	0.00037	150	0.000605	-3.218	0.00226	-2.6451	323	0.00310	1.217	-0.0012	0.0567	0.0583	3.3698	0.0010	3.0960	-73.6311
70	7.842	0.00062	210	0.000724	-3.140	0.00201	-2.6968	343	0.00292	1.164	-0.0011	0.0956	0.1004	4.0354	0.0024	2.9155	-50.0050
90	9.498	0.00076	270	0.000841	-3.075	0.00188	-2.7262	363	0.00275	1.128	-0.0010	0.1158	0.1229	4.7832	0.0030	2.7548	-38.6091
110	11.052	0.00088	330	0.000992	-3.003	0.00175	-2.7558	383	0.00261	1.090	-0.0009	0.1347	0.1445	5.6182	0.0035	2.6110	-30.4482
130	13.032	0.00104	390	0.001158	-2.936	0.00160	-2.7966	403	0.00248	1.050	-0.0009	0.1589	0.1727	6.5451	0.0042	2.4814	-23.8597
150	15.212	0.00121	450	0.001305	-2.884	0.00142	-2.8465	423	0.00236	1.013	-0.0008	0.1854	0.2047	7.5687	0.0050	2.3641	-18.7704
170	17.172	0.00137	510	0.001382	-2.859	0.00127	-2.8969	443	0.00226	0.987	-0.0008	0.2093	0.2343	8.6938	0.0056	2.2573	-15.0602
190	18.241	0.00145	570	0.001422	-2.847	0.00118	-2.9270	463	0.00216	0.973	-0.0007	0.2224	0.2509	9.9253	0.0056	2.1598	-12.6289
210	18.795	0.00149	630	0.001452	-2.838	0.00114	-2.9435	483	0.00207	0.964	-0.0007	0.2291	0.2596	11.2679	0.0053	2.0704	-10.8778
230	19.203	0.00153	690	0.001479	-2.830	0.00111	-2.9561	503	0.00199	0.957	-0.0007	0.2341	0.2660	12.7264	0.0049	1.9881	-9.4743
250	19.563	0.00156	750	0.001506	-2.822	0.00108	-2.9675	523	0.00191	0.951	-0.0006	0.2385	0.2717	14.3056	0.0045	1.9120	-8.3074
270	19.915	0.00158	810	0.001532	-2.815	0.00105	-2.9789	543	0.00184	0.945	-0.0006	0.2428	0.2773	16.0103	0.0042	1.8416	-7.3190
290	20.262	0.00161	870	0.001563	-2.806	0.00102	-2.9905	563	0.00178	0.938	-0.0006	0.2470	0.2829	17.8454	0.0039	1.7762	-6.4759
310	20.662	0.00164	930	0.001601	-2.796	0.00099	-3.0042	583	0.00172	0.931	-0.0006	0.2519	0.2894	19.8155	0.0037	1.7153	-5.7397
330	21.162	0.00168	990	0.001647	-2.783	0.00095	-3.0220	603	0.00166	0.921	-0.0005	0.2580	0.2975	21.9256	0.0035	1.6584	-5.0851
350	21.772	0.00173	1050	0.001703	-2.769	0.00090	-3.0447	623	0.00161	0.909	-0.0005	0.2654	0.3075	24.1804	0.0034	1.6051	-4.5004
370	22.499	0.00179	1110	0.001771	-2.752	0.00084	-3.0735	643	0.00156	0.895	-0.0005	0.2743	0.3196	26.5848	0.0033	1.5552	-3.9769
390	23.399	0.00186	1170	0.001870	-2.728	0.00077	-3.1120	663	0.00151	0.877	-0.0005	0.2853	0.3347	29.1434	0.0033	1.5083	-3.5003
410	24.678	0.00196	1230	0.002014	-2.696	0.00067	-3.1733	683	0.00146	0.850	-0.0005	0.3008	0.3566	31.8612	0.0034	1.4641	-3.0428
430	26.552	0.00211	1290	0.002209	-2.656	0.00052	-3.2824	703	0.00142	0.809	-0.0004	0.3237	0.3896	34.7429	0.0036	1.4225	-2.5884
450	29.109	0.00232	1350	0.002392	-2.621	0.00032	-3.4968	723	0.00138	0.750	-0.0004	0.3549	0.4364	37.7933	0.0041	1.3831	-2.1434
470	31.533	0.00251	1410	0.002465	-2.608	0.00013	-3.9003	743	0.00135	0.669	-0.0003	0.3844	0.4828	41.0172	0.0045	1.3459	-1.7832
490	32.576	0.00259	1470	0.002504	-2.601	0.00004	-4.3679	763	0.00131	0.596	-0.0003	0.3971	0.5035	44.4195	0.0045	1.3106	-1.5738

http://doi.org/10.29369/ijrbat.2023.010.1.0026

Table 3: Thermogravimetric Data and Decomposition Temperature Range ofGliclazide-Fe and Glimeperide-Complexes

GLM-Complexes	Loss of crystalline water molecule		Decomposition step, temperature range (°C), mass loss (%)						Mass of residue left over (%)
			First Step		Second Step		Third Step		
	Temp. range (°C)	Mass loss (%)	Temp. range (°C)	Mass loss (%)	Temp. range (°C)	Mass loss (%)	Temp. range (°C)	loss)	
Gliclazide-Fe	40-120	5.94(F) 5.86(C)	120-250	28.72(F) 23.18(C)	250-350	70.44(F) 47.74(C)	350-510	81.344(F) 100.0(C)	3.55(F) 0.00(C)
$(GLM)_2Fe{\cdot}2H_2O$	40-125	3.28(F) 3.11(C)	125-270	19.91(F) 31.39(C)	270-410	26.67(F) 73.20(C)	410-510	33.11(F) 100.0(C)	0.42(F) 0.00(C)

F=Found C=Calculated

Table 4: Thermogravimetric data of of Gliclazide-Fe and Glimeperide-Fe Complexes heating rate of 10°C/min.

Complexes	Decomposition Temp. (°C)	%Wt. loss	Ea(Kj/mole)		ΔS* (Kj/mole)	ΔF (Kj/mole)	Z	S*	n
			F.C.	S.W.					
Gliclazide-Fe	40-120	5.94	52.66	52.16	-43.48	-13.12178	269.2	-	0.99
	120-250	28.72	85.94	85.13	-82.05	-39.54421	258.2	44.2381	
	250-350	70.44	138.23	138.14	-102.2	-43.09237	247.6		
	350-510	81.34	149.33	144.25	-123.5	-56.23253	236.5		
$((GLM)_2Fe{\cdot}2H_2O$	40-125	3.28	52.66	52.26	-43.54	-13.42478	268.4	-44.781	0.99
	125-270	19.91	85.84	85.78	-82.98	-38.54321	269.2		
	270-410	26.67	137.13	135.14	-101.32	-43.35827	257.6		
	410-510	33.11	144.33	148.25	-122.50	-54.23253	246.5		

FC=Freeman and Carroll, SW = Sharp and Wentworth

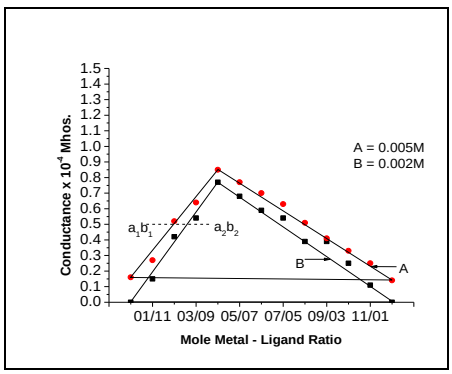


Fig.-1: Gliclazide with Ferrous Sulphate (Job's Method)

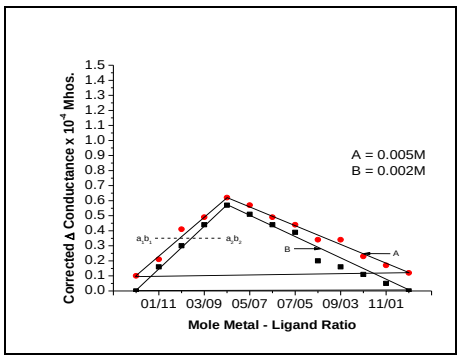


Fig.2-: Gliclazide with Ferrous Sulphate (Job's Method)

http://doi.org/10.29369/ijrbat.2023.010.1.0026

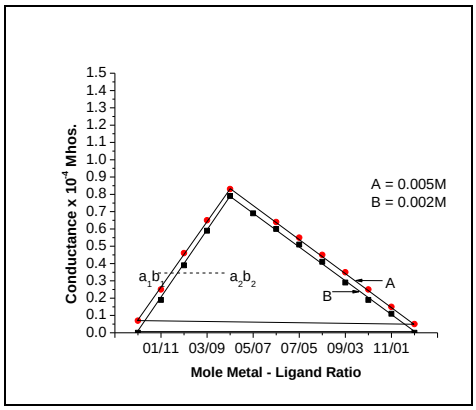


Fig-3: Glimeperide with Ferrous Sulphate (Job's Method)

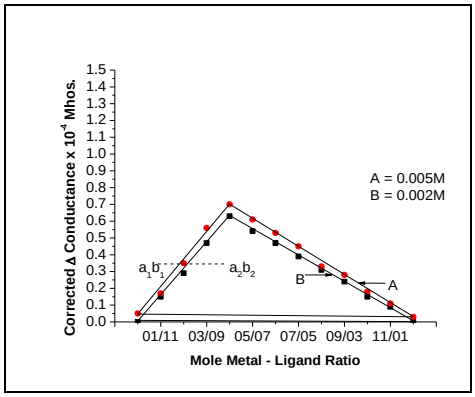


Fig.-4: Glimeperide with Ferrous Sulphate (Job's Method)

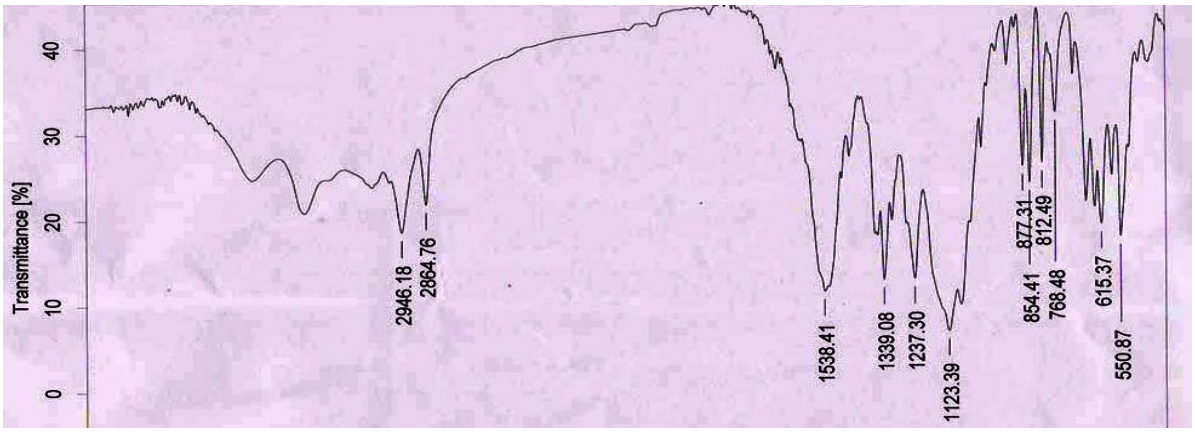


Fig.5:- IR Spectra of Gliclazide-Fe Complexes

C:\program files\opus_64\2011-2012\external\FTIR IMG-118\GLM-Fe.0 GLC-Fe SAIF IIT Bombay Date-02/02/2012

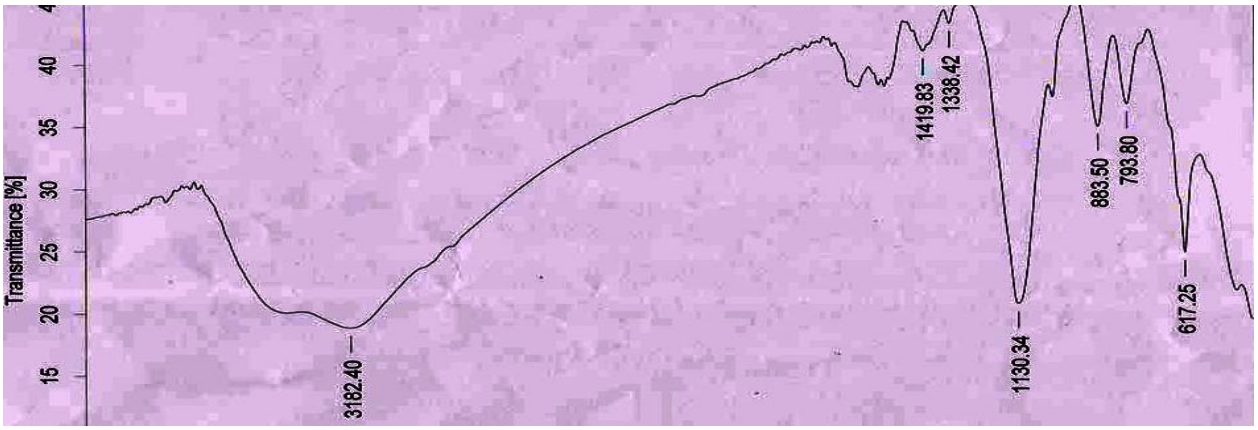
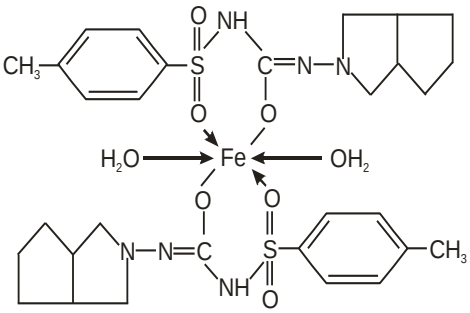


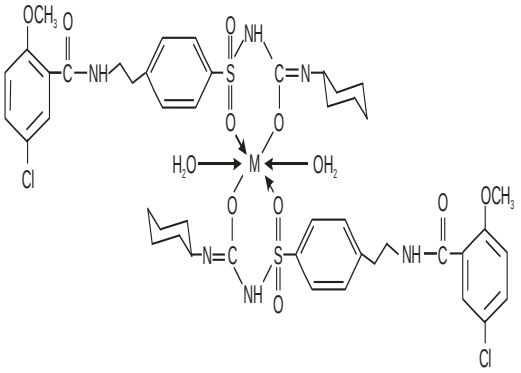
Fig. 6:- IR Spectra of Glimeperide-Fe Complexes

C:\program files\opus_65\2011-2012\external\FTIR IMG-118\GLM-Fe.0 GLM-FeSAIF IIT Bombay Date-02/02/2012

http://doi.org/10.29369/ijrbat.2023.010.1.0026



Scheme-I- Proposed structure ofGliclazide–IronComplex IronComplex (M=Fe)



Scheme-II: Proposed structure of Glimeperide-

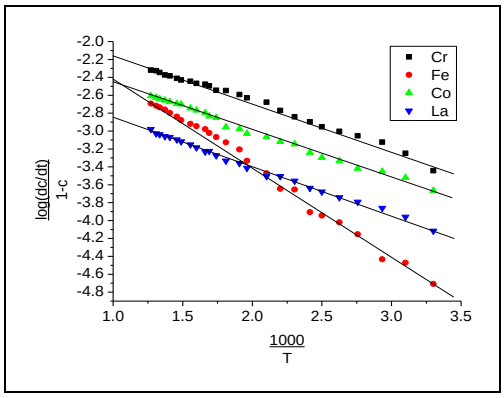


Fig. 7:SW kinetic Plot of Glimeperide Complexes using TGA Data(SW=Sharp Wentworth

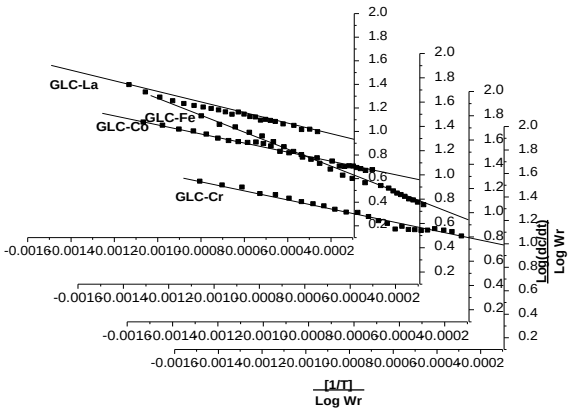


Fig. 8.: FC kinetic Plot of Gliclazide Complexes using TGA Data(FC=Freeman and Carroll)

http://doi.org/10.29369/ijrbat.2023.010.1.0026