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Synthesis, Characterization and Anti-Microbial Studies of Metal (II) Complexes of Schiff Base Derived from Condensation of 2-Thiophene Carboxyldehyde and 2- Aminothiophenol

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Abstract:
Schiff base ligand derived from condensation of 2- aminothiophenol and 2- thiophenecarboxyldehy was synthesized and used for the preparation of Cr(II), Mn(II) and Co(II), complexes. The synthesized ligand and complexes were analyzed by decomposition temperature, solubility, magnetic susceptibility, molar conductance and infrared spectra. The decomposition 0temperatures of the complexes is in the range of 128-221^{0}C. Molar conductance values are in the range of 6.07-9.10 ohm^{-1}cm^{2}mol^{-1}. New bands appeared in the IR spectra of the complexes in the range of 511-552 cm^{-1} and 438- 473 cm^{-1} which indicate υ (M-N) and υ (M-S) vibrations respectively. Magnetic susceptibility measurement indicated that all complexes are paramagnetic while solubility test revealed that all complexes and ligand are soluble in DMSO. The analytical data show the formation of 2:1 metal to ligand ratio for all complexes and suggested the formula [ML$_2$].nH$_2$O. The ligand and metal chelate have been studied for microbial activity using Co (well diffusion method against selected bacteria and fungi. The results signify that metal complexes inhibit more compared with Schiff base ligand against the same test organisms

Keywords: *2- aminothiophenol, 2- thiophenecarboxyldehy, amino acid, Schiff base, antimicrobial, mole fraction, solubility*

1. Introduction

Schiff base were first discovered in 1864 by a German chemist, Nobel Prize winner Hugo Schiff and named after his name. They are the products yielded from condensation reaction of primary amines and carbonyl compounds. When carbonyl compound (aldehyde or ketone) is condensed with a primary amine, a Schiff base is produced, which is a compound containing azomethine group, R-C=N-. Schiff base have the general structure of $R^3N = CR^1R^2$ (Fig. 1.1). Where R and R' are aryl, alkyl, cycloalkyl or heterocyclic groups, which may be variously substituted.

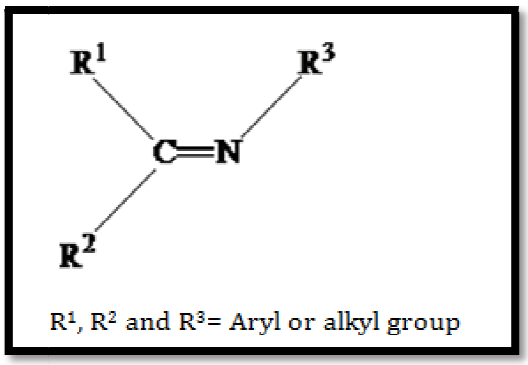

Figure 1: General Structure of Schiff Base

Schiff bases are considered as very important class of organic compounds, which have wide applications in many biological aspects. Transition Metal complexes of Schiff bases are thoroughly studied and also have applications in catalysis and organic synthesis. They are used as pigments and dyes, intermediates in organic synthesis, and as polymer stabilizers. The azomethine group present in the Schiff bases ligand is responsible for antitumor, antibacterial, antifungal and herbicidal activities.

Schiff base ligands are widely used as ligands due to the ease of their formation and remarkable versatility, and therefore, they have played an important role in the development of coordination chemistry as they readily form stable complexes with most of the transition metals. Schiff bases may be bidentate, tridentate, tetradentate or polydentate ligands capable of forming very stable cMetal complexes of Ni(II), Co(II), Cu(II), Mn(II), and Zn(II) with a Schiff base derived from 3-ethoxysalicyldehyde and 2-(2-aminophenyl) 1-H-benzimidazole were synthesized. The resulting complexes were characterized by elemental analysis, Magnetic moment measurement, conductivity measurement, IR, UV-Visible, ^{1}H NMR and mass spectra studies. An octahedral geometry was proposed to all the metal complexes. Antimicrobial activity of the ligand and its metal complexes were studied against two gram-negative of *Escherichia coli, Pseudomonas florescence* and two gram-positive bacteria of *Bacillus subitilis, Staphylococcus aureus*. The activity result showed that the metal complexes were more potent than the free ligand.

A Schiff base derived from p-hydroxybenzaldehyde and 4-aminobenzoic acid. The transition metal complexes of Ni(II), Cu(II), Co(II), Cd(II), Zn(II) and Cr(III) were prepared separately with the Schiff base, which were used as ligand. Several physical tools, in particular; elemental analysis, molar conductivity, magnetic susceptibility, infrared spectroscopy (IR), electronic absorption spectroscopy (ESR) to investigate the chemical structure of the prepared transition metal complexes. The elemental analysis data show the formation of 1:2 [M^1:2L] and 1:3 [M^2:3L] complexes of the formula of $M^{2+}L_2$ and $M^{3+}L_3$, respectively where M^{2+}=Ni(II), Cu(II), Co(II), Cd(II), Zn(II) and M^{3+}= Cr(III) and L=Schiff base (SB). The molar conductance (conductivity) measurements revealed that all the complexes are non-electrolyte in nature. The infrared (IR) spectral studies indicated the binding sites of the Schiff base ligand with the transition metal ions. The magnetic susceptibility measurements and electronic spectral results supported the predicted coordination geometry of the complexes and magnetic properties (para or dia-magnetic nature) of the complex compounds. The free Schiff base and its complexes have been tested for their antimicrobial activities against several human pathogenic (two gram-positive and two gram-negative) bacteria. The results obtained shows that the complex compounds exhibit moderate to strong antimicrobial activity compared with kanamycin and ampicillin.

Mn(II), Co(II), Ni(II), Cu(II) and Zn(II) complexes with a tridentate Schiff base were prepared by condensation of ethyl 2-amino-4,5,6,7-tetrahydro-1-benzothiophene-3-carboxylate with 4-hydroxypent-3-en-2-one were synthesized and characterized by elemental analysis, molar conductance measurements, magnetic susceptibility, UV-Vis, IR, EPR and NMR spectral data,

2. Materials and Methods

Reagents are of analytical grade purity and were obtained from Sigma Aldrich chemical limited. The glass wares used were washed thoroughly with detergent, rinsed with distilled water and dried in an oven. Melting point and decomposition temperature were determined using Gallenkamp melting point apparatus. Molar conductivity measurement was carried out using Jenway conductivity meter model 4010, while magnetic susceptibility measurement was done on MBS MKI magnetic susceptibility balance at 25^{o}C. IR spectral analysis was carried out using FTIR Cary 630 (Agilent Technology) model in the range of 4000 - 400cm^{-1}. Bacterial and fungal isolates were obtained and identified at the Department of Microbiology, Kano University of Science and Technology, Wudil.

2.1. Methods

2.1.1. Preparation of Schiff Base

The Schiff base were prepared by mixing a solution of 2-aminothiophenol (2.50g, 0.1 mole) in 25ml of ethanol with 2- thiophenecarboxyldehyde (2.24g, 0.1mole) in the same solvent. The reaction mixture was left under refluxed for 2 hours. The solid yellow product formed was separated by filtration, purified by crystallization from ethanol, and then dried in a desiccator over anhydrous calcium chloride.

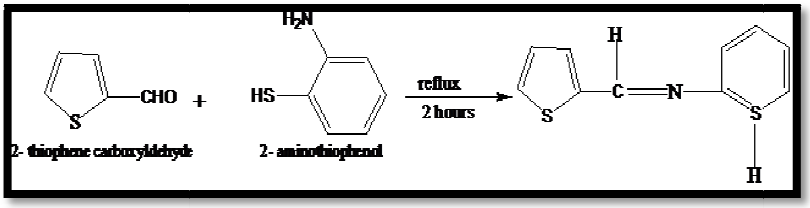

Figure 2: Preparation of the Schiff base

2.1.2. Preparation of the Metal Complexes

Themetalcomplexof Schiff base was prepared by the addition of a solution of appropriate metal chloride (1mmol) in an ethanol water-mixture (1:1, 25ml) to the solution of schiff base (0.219g, 2mmol) in the same solvent (25ml). The resulting mixture was stirred under reflux for 1hour upon the complex precipitated and collected by filtration and washed with a 1:1 ethanol-water mixture.

Figure 3: Preparation of Metal (II) Complex

2.2. Solubility Test

The solubility test of the Schiff base and the metal complexes was carried out in some solvents, ethanol, methanol, dimethylsulphoxide (DMSO), dimethylformamide (DMF), n- hexane, diethyl ether, chloroform and distilled water. Small amount of Schiff base and metal(II) complexes were each added into the test tube followed by addition of the solvent. Their solubility was observed after shaking the test tube.

2.3. Melting Point/Decomposition Temperature

The melting point of the Schiff base and the decomposition temperature of the metal complexes were carried by taking small amount of each into a capillary tube. The tube was inserted into the Gallenkamp apparatus, the temperature at which the ligand melts and that which the complexes decompose were taken and recorded

2.4. Conductivity Measurement

0.003M solutions of the metal complexes were prepared in DMSO and the molar conductance was determined by Janway, 4010 conductivity meters. All measurements were carried out at room temperature; the molar conductance value was obtained from the relation

Molar conductance =

Where C = Molar concentrations

K = specific conductance

2.5. Magnetic Susceptibility Measurement

The magnetic susceptibility of the metal complexes was obtained from magnetic susceptibility balance. Each separate sample of the metal complex was placed into a capillary tube and then inserted into the magnetic susceptibility balance; the readings was then recorded. The gram magnetic moment is calculated using the relation.

$$X_g = \frac{CL\ (R - R_\circ)}{10^9 M}$$

2.6. Determination of Percentage of Water of Crystallization in the Complexes

About 0.2g of each of the metal complexes was measured into a watch glass of known weight and placed in an oven at 110^0C until a constant weight was obtained. The percentage composition of water in the complex was calculated using the below formula:

2.7. Determination of Percentage of Metal Ions in the Complexes

2.7.1. Digestion of Metal Complex

About 0.2g of each of the metal(II) complex was placed in a 100cm^3 beaker containing 25cm^3 of distilled water to which 5cm^3 of concentrated acid was added and then heated to about dryness. The contents in the beaker were allowed to cool to room temperature and 25cm^3 of distilled water was added and the mixture was stirred before the filtrate was collected which contains the metal ions.

2.7.2. Estimation of Chromate in Chromate(II) Complex

The filtrate of the digested chromate(II) complex was diluted to 100cm^3 with distilled water. Pyridine was added until the colour changed to intense blue followed by 0.5g of ammonium thiocyanate with stirring and then allowed to stand for few minutes, chromate was precipitated as dipyridine chromate(II) thiocyanate $[Cr(C_5H_5N)_2]$ $(SCN)_2$ which was filtered, washed and dried.

2.7.3. Estimation of Manganese in Manganese (II) Complex

Water was added to the filtrate obtained from the digested manganese (II) complex to 100cm^{3}level in 250cm^3 conical flask. Dilute ammonia was added to neutralize the filtrate followed by 10g ammonia Chloride, excess diammonium hydrogen phosphate $(NH_4)_2HPO_4$ and few drops of 1:3 hydrochloric acid. The solution was heated to 90-95^{0}C followed by drop wise addition of dilute aqueous ammonia with constant stirring until a precipitate began to form. The addition of ammonia was stop immediately while the heating and stirring continued to ensure that the precipitate formed crystallize as $MnNH_4PO_4H_2O$. Few drops of aqueous ammonia were added with stirring for completion of precipitation. The beaker

and its content were allowed to cool to room temperature, then the precipitate was filtered and washed with 1% ammonium nitrate solution. The product was heated to constant weight.

2.7.4. Estimation of Cobalt in Cobalt (II) Complex

About 8cm^3 of distilled water was added to the filtrate obtained from digested cobalt(II) complex. Then 0.7g of ammonium thiocyanate was added to the mixture and boiled, 20cm^3 of pyridine was added after which the source of heat was removed immediately. The solution was stirred for 5 seconds and allowed to cool to room temperature. Shiny red crystals of the complex separated. The precipitate was filtered, washed with distilled water dried and weight as dipyridine cobalt(II) thiocyanate $[Co(C_5H_5N)_2]$ $(SCN)_2$.

2.8. Determination of the Metal to Ligand Ratio in the Complex Compounds Using Job's Method of Continuous Variation

The number of coordinated Schiff base ligand in the metal ion were determined by Job's method in which 3 millimolar solution of the ligand and the metal(II) chloride were separately prepared. The following ligand to metal salt (mL); 1:15, 3:13, 5:11, 7:9, 9:7, 11:5, 13:3, 15:1 was taken from the ligand solution and each of the metal complexes. A total volume of 16ml was maintained (in the above order) throughout the process and mole fraction of the ligand was calculated in each mixture. The solutions of the metal chloride (blank) were scanned to obtained wave length of maximum absorption (λ_{max}) for each metal ion. The spectrophotometer was set at λ_{max}before taking the absorbance value. A plot of absorbance against mole fraction of the ligand, the number of coordinated ligands was determined using the following relation:

$$n = \frac{X_i}{1 - X_i}$$

Where:

n = number of coordinated ligands at maximum absorbance

X_i = mole fraction at maximum absorbance

2.9. Determination of Empirical Formular

The composition of each complex was determined from the known percentage of the metal ion and water content in the complex. The percentage composition of the ligand was obtained by adding percentage composition of the metal and water in the complex and subtracted from 100 to get that of ligand. The empirical formula of each of the complex was calculated using the percentage composition of the species involved.

2.10. Anti-bacterial Studies

The antibacterial activity of the Schiff base ligand and its metal complexes was carried out by using bacterial isolates of *Staphylococcus aureus,streptococcus pneumoniae,* and *Escherichia coli*. The suspension of each microorganism was smeared on the surface of the solidified Muller-Hinton Agar (MHA) already poured into petri dishes. The Schiff base and the metal Complexes were separately dissolved in DMSO so as to have three distinct concentrations (60µg/disc, 30µg/disc and 15µg/disc) through serial dilution and placed on the surface of the culture media, incubated at 37^{o}C for 24 hours. Activities were determined by measuring (mm) the diameter of the zone of inhibition and compared with a standard drug (Ciprofloxacin).

2.11. Anti-fungal Studies

The antifungal activity of the Schiff base ligand and that of its metal complexes were tested against three pathogenic fungi; *Candida albicans,Aspergillusflavus, and Aspergillusfumigatus,* using disc diffusion method. Ketoconazole was used as standard fungicide and DMSO was used as a negative control. The fungal suspension was smeared on the solidified Potato Dextrose Agar (PDA) already poured into petri dishes. The Schiff base and the metal Complexes were separately dissolved in DMSO to have three different concentrations (60µg/disc, 30µg/disc and 15µg/disc) per well. They were placed on the surface of the culture media and allowed to stand at room temperature for good 48 hours. Activities were determined by measuring (mm) the diameter of the zone of inhibition and compared with the standard.

3. Results and Discussions

3.1. Results

Results of the physical properties, characterization and microbial activities of the prepared Schiff base ligand and its metal (II) complexes are presented in the following tables.

Compound	Colour	% yield	M.P (^{o}C)	D.Temp (^{o}C)
Ligand	Yellow	79	128	-
$[CrL_2]$	Orange	57	-	194
$[MnL_2]$	Brown	56	-	201
$[CoL_2]$	Black	61	-	188

Table 1: Physical Properties of Ligand and Its Metal (II) Complexes
Where; L= $C_{11}H_9NS_2$, M.P = Melting Point, D. Temp.= Decomposition Temperature

Solvents	Ligand	[CrL_2]	[MnL_2]	[CoL_2]
Water	IS	IS	IS	IS
Methanol	S	S	S	S
Ethanol	S	S	S	S
n-hexane	IS	IS	IS	IS
Chloroform	S	IS	SS	SS
Diethylether	S	SS	S	SS
DMF	S	S	S	S
DMSO	S	S	S	S

Table 2: Solubility Test of Schiff base Ligand and its Metal Complexes

L = $C_{11}H_9NS_2$
DMSO =Dimethylsulfoxide,
DMF =Dimethylformamide,
CCl_4 = Carbontetrachloride
S = Soluble
SS = Slightly Soluble
IS = Insoluble

Compounds	V(C=N) cm^{-1}	V(M-S) cm^{-1}		V(M-N) cm^{-1}	V(C-S-C) cm^{-1}	V(C-S)cm^{-1}
Ligands	1689	-		-	852	-
[CrL_2]	1678	473		543	873	739
[MnL_2]	1607	438		511	840	742
[CoL_2]	1640	452		552	829	706

Table 3: IR Spectra of the Schiff base and its Metal(II) Complexes

L= $C_{11}H_9NS_2$

Complexes	Electrical Conductivity (ohm^{-1} cm^{-1})×10^{-6}	Molar Conductance ($ohm^{-1}cm^2mol^{-1}$)
[CrL_2]	41.1× 10^{-6}	9.1
[MnL_2]	37.81 × 10^{-6}	8.39
[CoL_2]	18.23× 10^{-6}	6.07

Table 4: Conductivity Measurement Data of 10^{-3} M Metal(II) Complexes in DMSO

L= $C_{11}H_9NS_2$

Complex	μ_{eff} (B.M)	Magnetic Property	Number of Unpaired Electrons
[CrL_2]	4.38	Paramagnetic	6
[MnL_2]	5.50	Paramagnetic	5
[CoL_2]	4.90	Paramagnetic	3

Table 5: Magnetic Susceptibility Data of Metal(II) Schiff base Complexes

L= $C_{11}H_9NS_2$

Complex	Weight Lost (g)	Percentage (%)	Number of Water of Crystallization
[CrL_2]	0.022	11.00	3
[MnL_2]	0.024	12.00	3
[CoL_2]	0.015	7.50	2

Table 6: Determination of Water of Crystallization in the Complexes

Complex	Percentage (%)
[CrL_2]	10.36
[MnL_2]	10.88
[CoL_2]	13.01

Table 7: Percentage (%) of Metal ion in the Metal (II) Schiff base Complexes

L= $C_{11}H_9NS_2$

Compound	% of Metal	%of Ligand	% of Water	Metal: Ligand Ratio	Empirical Formular
Cr(II) complex	10.36	78.64	11.00	1:2	[CrL_2].$3H_2O$
Mn(II) complex	10.88	77.12	12.00	1:2	[MnL_2].$3H_2O$
Co(II) complex	13.01	79.49	7.50	1:2	[CoL_2].$2H_2O$

Table 8: Empirical Formula of the Complexes

L= $C_{11}H_9NS_2$

Cr^{2+}:L Ratio	Mole Fraction	Absorbance
1:15	0.0625	0.1010
3:13	0.1875	0.1172
5:11	0.3125	0.1715
7:9	0.43715	0.2704
9:7	0.5625	0.2567
11:5	0.68754	0.3019
13:3	0.8125	0.1347
15:1	0.9375	0.1092

Table 9: Mole Fraction of the Ligand and the Absorbance values for Cr^{2+} ion at 545nm

L= $C_{11}H_9NS_2$

Mn^{2+}: L Ratio	Mole Fraction	Absorbance
1:15	0.0625	0.2118
3:13	0.1875	0.3240
5:11	0.3125	0.4106
7:9	0.43715	0.4892
9:7	0.5625	0.5160
11:5	0.68754	0.6697
13:3	0.8125	0.7211
15:1	0.9375	0.2248

Table 10: Mole Fraction of the Ligand and the Absorbance Values of Mn^{2+} Ion at 620nm

L= $C_{11}H_9NS_2$

Co^{2+}:L Ratio	Mole Fraction	Absorbance
1:15	0.0625	0.2130
3:13	0.1875	0.2251
5:11	0.3125	0.2460
7:9	0.43715	0.2738
9:7	0.5625	0.3461
11:5	0.68754	0.3901
13:3	0.8125	0.2110
15:1	0.9375	0.1901

Table 11: Mole Fraction of the Ligand and the Absorbance Values for Co^{2+} Ion at 560nm

L= $C_{11}H_9NS_2$

Isolates	Compounds	Zone of Inhibition (µg/ml) 60 30 15	Standard
Staphylococcus aureaus	Ligand $[CrL_2]$ $[MnL_2]$ $[CoL_2]$	9 8 7 11 9 8 10 7 6 14 11 8	29
Streptococcus pnemoniae	Ligand $[CrL_2]$ $[MnL_2]$ $[CoL_2]$	8 6 6 14 11 7 13 10 8 10 6 6	19
Eschericia coli	Ligand $[CrL_2]$ $[MnL_2]$ $[CoL_2]$	11 9 7 12 8 6 14 11 9 12 10 7	24

Table 12: Antibacterial Activity of the Schiff Base and Its Metal (II) Complexes

L= $C_{11}H_9NS_2$

Isolates	Compounds	Zone of Inhibition (µg/ml) 60	30	15	Standard
Aspergillus fumigates	Ligand	18	16	10	
	$[CrL_2]$	18	15	12	
	$[MnL_2]$	18	16	11	31
	$[CoL_2]$	20	15	12	
Aspergillusflavus	Ligand	13	10	7	
	$[CrL_2]$	16	10	8	
	$[MnL_2]$	15	11	8	
	$[CoL_2]$	15	13	9	26
Candida albicans	Ligand	11	8	6	
	$[CrL_2]$	6	6	6	
	$[MnL_2]$	14	11	8	
	$[CoL_2]$	11	6	6	29

Table 13: Antifungal Activity of the Schiff Base and Its Metal (II) Complexes

L= $C_{11}H_9NS_2$

3.2. Discussion

The Schiff base ligand was prepared by condensation of 2- aminothiophenol and 2- thiophenecarboxyldehyde to obtain yellow crystal with high yield (75%) and melting point of 128^{o}C (table 3.1). The metal complexes, Cr(II), Mn(II) and Co(II), complexes were synthesized and found to be of various colors with percentage composition of 61%, 56%, and 58% The decomposition temperature of the metal complexes range from 188^{0}C-221^{0}C showing that the decomposition temperature of the metal (II) complexes is higher than that of melting point of the ligand indicating that complexation has taken place.

The solubility test carried out on the Schiff base showed that the Schiff base was soluble in methanol, ethanol, DMSO, DMF, diethylether, and chloroform but insoluble only in water and n-hexane. However, the metal (II) complexes were soluble in ethanol, methanol, DMSO and DMF, but insoluble in water and n-hexane while slightly soluble in diethylether and chloroform (Table 2).

The infrared spectral results of the ligand show a band at 1689 cm^{-1} assigned to azomethine υ (C=N) vibration, this confirms condensation between amino group of 2- aminothiophenol and aldehyde group of 2-thiophenecarboxyldehyde in the formation of Schiff base (Lekha*et. al.,* 2013). The infrared spectral data of the Schiff base ligand and its metal complexes were listed in Table 3.

The molar conductance of each of the metal(II) complex was measured in dimethylsulfoxide (DMSO). The values obtained were in the range of 6.07-16.12 $ohm^{-1}cm^2mol^{-1}$ (table 4.4) which is relatively low, indicating the non-electrolytic nature of the metal complexes. The molar conductance ranges for non-electrolyte metal complexes in DMSO is 1-50 $ohms^{-1}cm^2mol^{-1}$

Magnetic susceptibility measurement values for Cr(II), Mn(II) and Co(II) complexes at room temperature are in table 4.5. The values for Cr(II), Mn(II) and Co(II) complexes indicated that they are all paramagnetic with both shows the present of unpaired electrons.

The metal-ligand ratio was determined by using Job's method of continuous variation (UV-Visible). The results were presented in Table 5 - 3.7. They revealed that the metal-ligand ratio was 1:2. Gravimetric analysis was used for the determination of the percentage of metal(II) ions in the complexes (Table 7). The metal (II) Schiff base complexes show variation in the co-ordination number of water molecules. Cr(II) and Mn(II) have three molecules of water each, while Co(II) has two water molecules. The empirical formulae of the complexes were determined from known values of percentage composition of metals, Schiff base and water of crystallization. The results revealed that the metal-ligand was 1:2 for all the complexes and suggested the formula $[ML_2].nH_2O$.

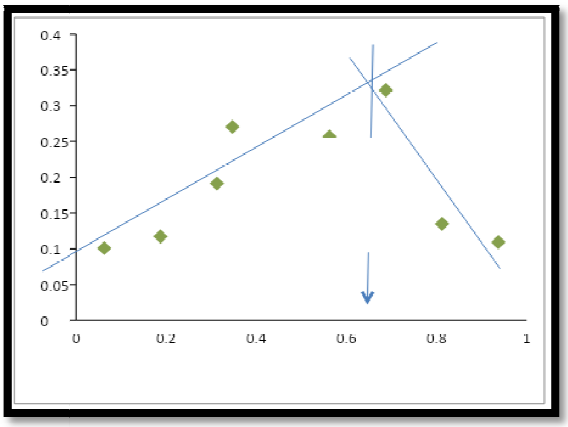

Figure 4: Cr^{2+} ion Absorbance Against Mole Fraction

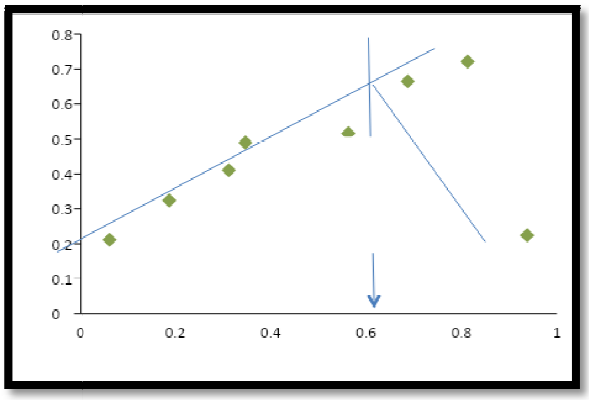

Figure 5: Mn^{2+} ion Absorbance against Mole Fraction

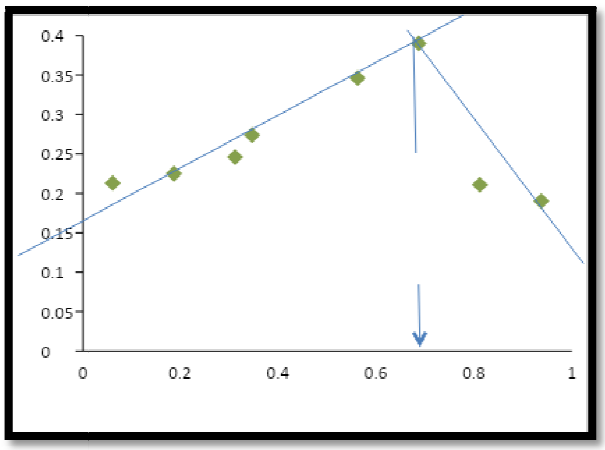

Figure 6: Co^{2+}Ion Absorbance against Mole Fraction

The antibacterial activity of the schiff base and metal complexes was carried out on three bacteria isolates, (*Staphylococcus aureus, Streptococcus pnemoniae and Eschericia coli)* using well diffusion method by taking DMSO as solvent (Table 12). The result shows that both the ligand and metal complexes are found to be moderately effective against all tested bacteria, but the metal complexes exhibit higher antibacterial activity than the Schiff base and the activity increase with increase in concentration, this is probably due to chelation in the metal complexes. The Schiff base show activity against *Staphylococcus aureus and Eschericia coli* at all concentrations, but found to be active only at (60µg and 30µg) concentrations against *Staphylococcus aureu.* Cr(II) complex was found to be effective only at high concentration (60µg) against *Streptococcus pnemoniae,* Co(II) complex was also effective at (60µg and 30µg) concentration, while the complex of Mn(II) is active at all concentrations. In *Eschericia coli*, the complexes of Mn(II) and Co(II) are active at all concentrations. Cr(II) complex is effective at (60µg and 30µg). However, in comparison to the standard drugs antibacterial activities of the Schiff base as well as the complexes is low.

Antifungal studies were carried out by well diffusion technique on potato dextrose agar against three fungal isolate *Aspergillusfumigatus, Aspergillusflavus*and *Candida albicans*(Table 13). The result of anti-fungal screening for the Schiff base and metal complexes revealed that the Schiff base and corresponding metal (II) complexes show an activity against *Aspergillusfumigatus*isolate and the activity increase with increase in concentration, Also, the Schiff base and the metal (II) complexes are all show high activity against *Aspergillusflavus*at all concentrations. In *Candida albicans*, the Schiff

base and the Mn(II) complex shows an appreciable activity at all concentrations. The Cr(II) complex is inactive at all concentrations while the Co(II) complex is active at (60µg) concentration only.

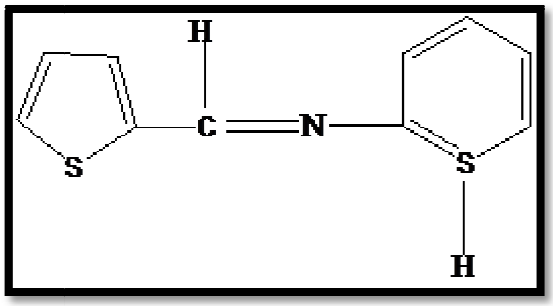

Figure 7: Proposed Structure of the ligand

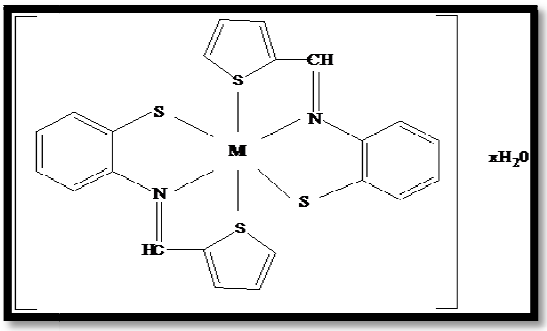

Figure 8: Proposed structure of the complex

4. Conclusion

The Schiff base and its metal complexes of Cr(II), Mn(II) and Co(II),) have been synthesized and studied by various analytical techniques. Job's method of Continuous variation shows that the metal-ligand ratio in all the complexes is 1:2. All the complexes are non-electrolytes in DMSO solvent. The decomposition temperature of the metal (II) complexes indicated that complexation has taken places. Based on electrical conductivity data, Cr(II), Mn(II), Co(II) Schiff base complexes are paramagnetic. The antimicrobial studies of the Schiff base and its metal(II) complexes reveals that the metal(II) complexesshow better activity when compared to that of the ligand

5. Acknowledgement

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