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Synthesis and Characterization of Imine Derived from O-Amino Benzoic Acid and Its Metal Complexation

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Abstract **Original Research Article**

The work present in this paper concern the preparation, characterization and biological evaluation of Cu^{2+}, Ni^{2+}, Co^{2+} and Mn^{2+} coordinated compound of ligand obtained from o- amino benzoic acid and furfur aldehyde. For the purpose of Schiff base an amino group present in 0-aminobenzoic acid react with furfur aldehyde during the condensation of one mole of furfur aldehyde and one mole of o-amino benzoic acid. Schiff base have ability to chelates through –C=N- functional group with metals. The complex was formulated as ML_2 (2:1) type. Fourier transform infrared spectroscopy, solubility and melting point techniques are used to characterized Schiff base ligand and their complexes. Nitrogen, oxygen and Sulphur containing ligands are growing attention due to their vast biological activities and playing vital performance in inorganic field due to diversity of linking of ligand to transition metal. Schiff base metal complexes are identified to act as role for biological active agents like antifungal, anticonvulsant, antiviral, anticancer, antimicrobial and antibacterial agents.

Keywords: Schiff base, o-Amino benzoic acid, furfur aldehyde, metal complexes, Cu (II), Ni (II), Co (II), Mn (II), FTIR, chelation, C=N group, coordination compounds, biological activity, antimicrobial, anticancer.

1. INTRODUCTIN

Schiff base is a condensation product of amine with a carbonyl compound. Functional group Azomethine and Imine (-C=N-) were existed in the Schiff bases. Schiff base is prepared by the reduction of primary amine with ethanol which is a carbonyl compound. The reactions of the Schiff's bases is particular reaction for ethanol.

Under basic condition the formation of Schiff base, take place in the response of aromatic amines. Aniline is generally second hand for colored anil for these Schiff bases with an Ethanol.

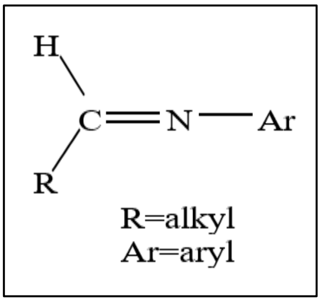

Fig 1.1: General reaction of Schiff base

Here R is an alkyl and aryl group. Schiff base that are appreciably abundantly strong and more immediately diverse, that include aryl substituent, at the same time as the ones, which include alkyl substituent,

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are unstable. Schiff bases id generated after the condensation of ethanol or a propanon with primary amine, which is a compound carrying azomethine group, R − C = N – R. Normally synthesis of Schiff bases typically occur in the acidic or basic conditioning or heating the solution (Xavier *et al.,* 2014). A ligand having no net electric charge with an electron pair and have a double bond of carbon- nitrogen. The synthesis of Schiff base is essentially a two-step reaction among the carbonyl group and the amino group. Firstly, a carbinolamine is formed which undergoes to dehydration. Both those step are interchangeable and commonly occur in the presence of acid-base catalyst (Mohamed *et al.,*2019). It is formed by the reaction of primary amine with a ethanol or ketone according to different schemes which is as follow.

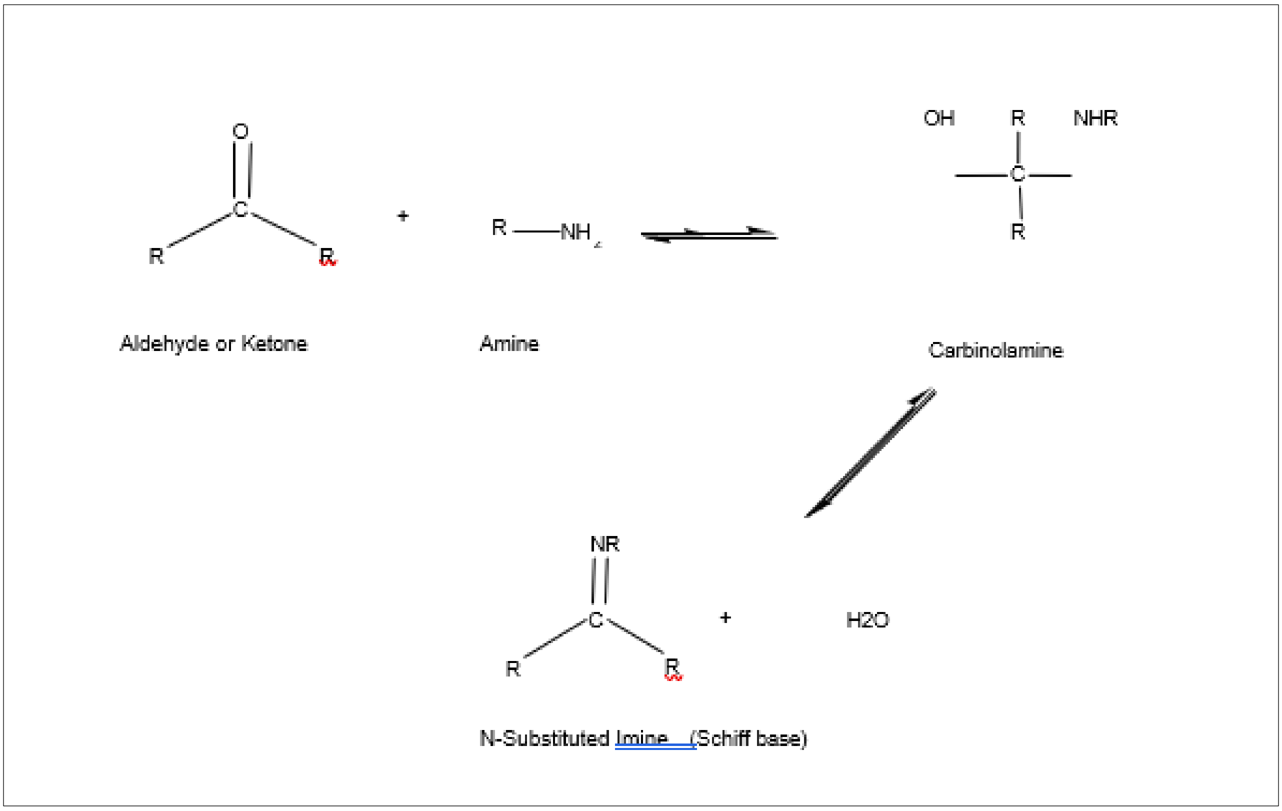


Figure 1.2: General Scheme for the formation of Schiff base

In this scheme, an aromatic or an aliphatic group denoted by R. The stability of aliphatic aldehyde azomethine ligand is less and are easily decomposed as compare to aromatic aldehyde azomethine ligand because of presence of strong conjugation arrangement which make it extra substantial. The synthesis of Schiff base take vicinity in a reversible manner and normally occur under heating or acid base catalysis (AlZoubi *et al.,*2016).

Schiff base metal complexes play a critical role as a biological active agents like anti-HIV, antifungal, antimicrobial, antiviral, anticancer, and antibacterial agents (Gwarm *et al.,*2012).

Schiff base compounds play a substantial role in the fields of coordination chemistry and material. Due to the fact those group have capacity to figure out durable complexes with wide variety of transition metallic ions (Djebbar-Sid *et al.,*2016). The major types of azomethine ligand which has the capacity to form very durable coordinated compounds with the transition metal (TM) ions are as follow (Arumurugun *et al.,*2010).

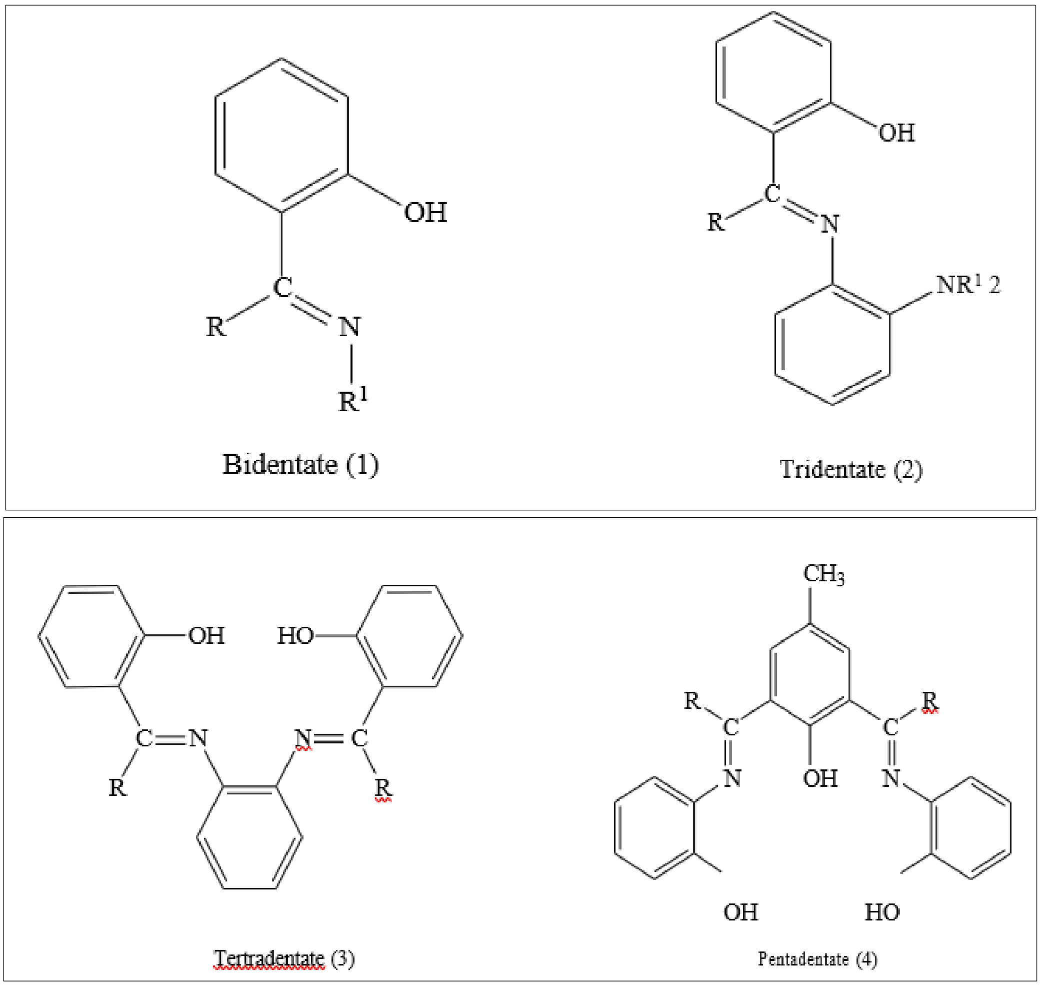


Figure 1.3: Important classes of Schiff bases

1.1 HISTORY OF SCHIFF BASE:

In 1864 Hugo Schiff recognized Schiff bases because the resultant product made from the reaction between primary amines and acetaldehyde or ketones. Schiff bases containing aromatic types had been extra strong than aliphatic types due to the conjugation scheme at the same time as aliphatic aldehydic Schiff bases are easily decomposed that is why these are evidently unstable (Maity *et al.,*2019).

In the past Schiff bases were synthesized by the Italian chemist in 1864. These Schiff bases are generally identified by an azomethine or imine group and typically synthesized by condensation reaction between primary amines with carbonyl group. An azomethine ligand is a N analogous of ketone or an aldehyde in which carbonyl group is replaced with the aid of azomethine group (Liu *et al.,*2018).

1.3. USES OF SCHIFF BASES:

The Schiff bases complex of metals has gain lots of the attention field of polymers, dyes and in many other biological applications. These metal complexes are used in the binding and splitting of DNA. Many of others complexes are also able to bind and split the DNA such as Cu, Ni, and Co complexes. Cu and Ni are transition metal complexes with luminous in color and odd empirical formula. These TM complexes are known as coordination complexes. Because of different chelating prospective, the Schiff bases and TM complexes are universal. they play a significant role in the analytical studies. They can be used as polymer stabilizers, catalysts and intermediates in biological synthesis. It is efficiently recycled for the cancer treatment. These bases and TM complexes are also advantageous into the pharmaceutical and agricultural industries. Schiff bases has extensive applications in chemical synthesis and analysis, in sensors and organic photovoltaic materials (Rani *et al.,*2015).

1.3.1. The coordinating ability of Schiff base:

The purpose of imine as coordinating ligands through making the bond to transition metals between N of imine and some other element that isn't carbon or hydrogen existent on the amine or aldehyde has offer their uses as corroding blockage on milden metallic steel in acidic medium

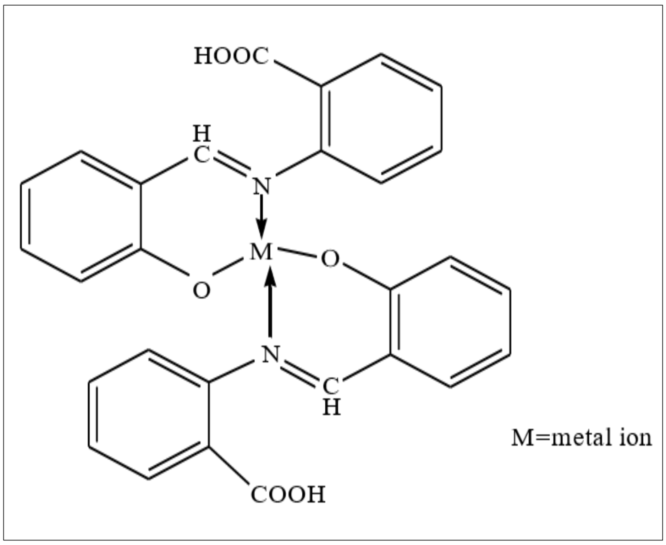


Fig 1.4 Coordinating ability of Schiff base

1.3.2. Biological Importance of Schiff base:

Imine are various substance which can be synthesized through the reaction of carbonyl group of aldehyde with amino group of aromatic amine for organic applications. Most of the Schiff bases are important due to their biologically importance such as antitumor activity, antiviral, antibacterial, antifungal, and anticancer (Arulmurugan *et al.,*2010).

1.3.2.1 Antibacterial activity of Schiff bases:

Ronad *et al.,* (2010) have been defined the activity of Schiff bases as an anti-bacterial agent. Schiff base attained from 2aminobenzoic acid and 3-dione, 2-Indoline or their Tins complexes exhibit Anti-bacterial interest towards Staphylococcus aureus.

It conveyed that compounds were active as compared to standard drug (Imipinem) but the activity is lesser than the standard drug. This activity became because of the existence of a phenyl group and hydroxyl group. So that this activity in the organo tin complexes because of polarity of a tin (IV) atoms and the cooperation with oxygen atom of ligand. TM complexes such as Co, Cu, Ni, Mn and Cr obtained from the compound 4-amino- 2,3dimethylby 2,6-Di-acetyl-pyridine -1-pyrozolin-5-onephenyl3-. It shows the Anti-bacterial or Anti-fungal activity in contrast to the Escherichia coli, Staphylo-coccus Aureus, Enterococcus Cloacae, Pseudomonas Aeruginosa, Bacillus megaterium and Micro-coccus Leteuos. Schiff bases 4-chloro-(2-morphiolinoethylimino) methanolchloro interested towards the gram positive and bacterial strains Gram Negative i.e. P. Fluorescence and E. coli through the technique of TMT. And it had been guarded for the antibacterial. And that antibacterial have got interest towards gram positive and negative bacterial strains. These bases are admitted as suitable antibacterial species. For example 2-[(2hydroxyphenyl) iminomethyl] phenol is helpful in opposition to tubercle bacillus. So Schiff bases and it complex of Metals were much greater due to the Sulphonic companyE.coli than Noxious S. Aureus (OH, CH2CH2CHandOCH3 S), capacity be interrelate bythe Double membranes (Mohamed *et al.,*2010). These all activities are related to the composition and characteristics of the complexes.

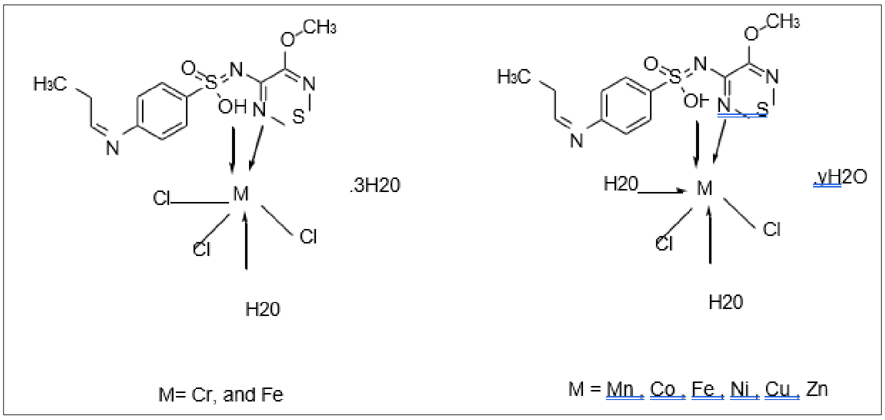


Figure 1.5 Schiff base as Anti-bacterial agent and its proposed metal complexes

1.3.2.2 Schiff base as an Antiviral agent:

Gossypol Schiff bases reveal extreme antiviral interest. In oxidation state the silver complexes confirmed the hindrance against the virus which named as cucumber mosaic. And these Schiff base glycine salicylaldehyde Ag(I), provided cooperative outcomes more than 70% towards the C. Musaic Virus. The imine 3hydroxyguanidines were tested towards mouse hepatitis virus exceptionally, which efficiently stop the viral replica by 50% (Leoni *et al.,*2018).

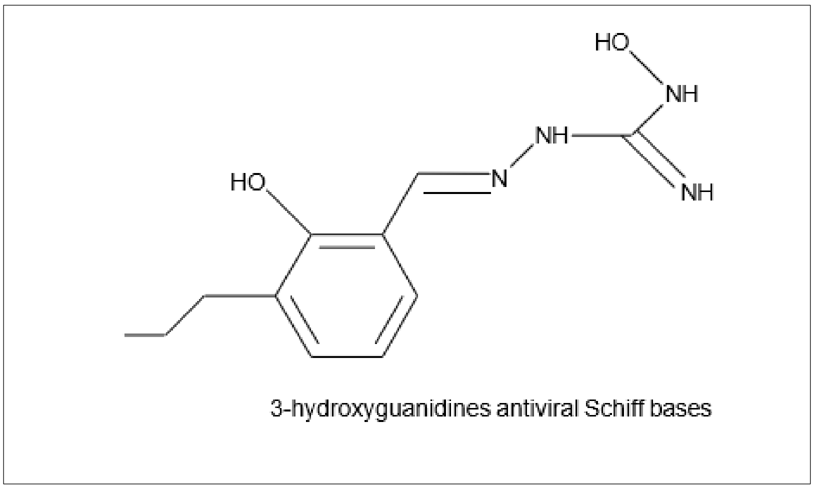
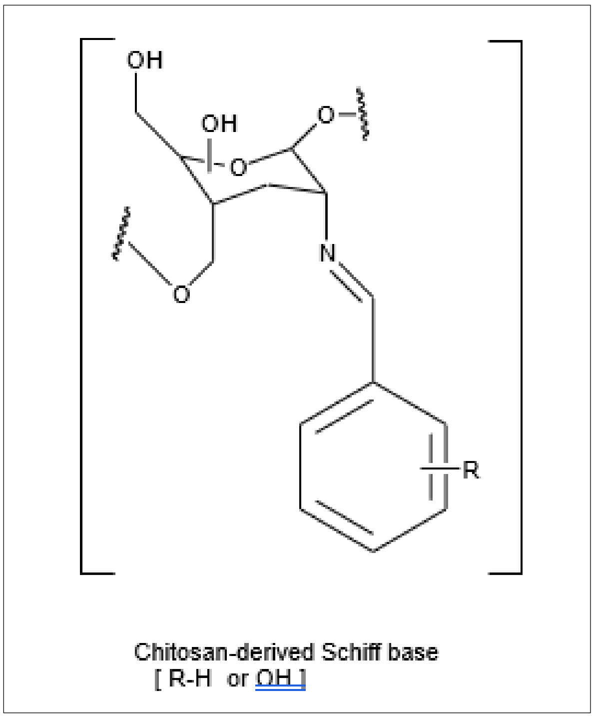


Figure 1.6 Schiff base as Anti-viral agent

1.3.2.3 Schiff base as an Antifungal agent:

The Chitosan ligand are applied as anti-fungal agent towards colletotrichum lagenarium and botrytiscinerea. All of the metallic polychelates are greater noxious. Complex neutral like Zn(II), Ni(II), Co(II), Cu(II) and with these Schiff Base obtained from a Nitro-aniline(L2) Aniline(L1)/p-/p-Aniline-Methoxy (L3) and 34- Amino-Anti-pyrineNitro-benzylidene- showcase antifungal activities. By measuring the motion of those Schiff base steel complexes, it assumed that each one metal complexes have enormous values of antifungal motion than their exposed Schiff base ligand within the identical laboratory conditions and amongst these highest antifungal movement determined for Cd complex (Maihub *et al.,*2018).



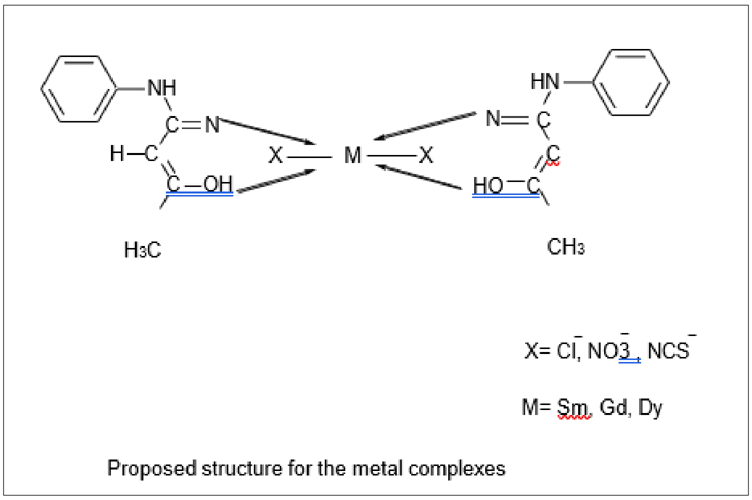


Figure 1.7 Anti-fungal substance and metal complex

1.3.2.4. Schiff base as Antitumor and cytotoxic activities:

Bala *et al.,* (2012) had described activity of Schiff base as an anticancer agent. By Benzyldi- thio-carbazatecondensations with the Salicyl-aldehyde tridentate base formed or their TM complex such as Zn, Sb, Cu revealed different chemotherapeutic properties. Other complexes i.e. Copper(II) revealed anticancer properties and these complexes have Schiff bases which acquired from Sbenzyldthiocarbazate and saccharinate.

Complex had lively in contradiction of to the (HL-60) cell line of Leukemic however simplest [(NNS)(Cusac)] turned into discovered to expose sturdy Cyto-toxicity closer to Ovarians most cancers cellular line S (3Caov). These activity were increased than that of same old Anti-cancers Drugs doxorubicin. Chromium(III) complex were extraordinarily a lot decrease chemotherapeutic then (VI) chromium culturing human cell. Schiff base complexes obtained from amines and 4-hydroxysalicylaldehyde have powerful anticancer pastime. Mycobacterium tuberculosis is treated by means of the usage of N-(salicylidene)-2- hydoxyaniline.

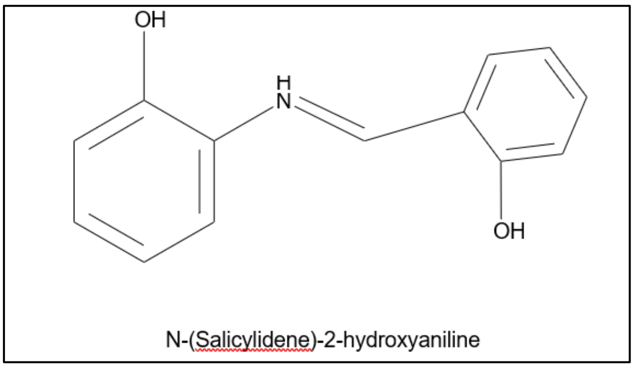
The platinum(II) complex water-soluble of the series of decreased Schiff base Amino acids as capacity Anti-cancer dealers or categorized as via EA, MS, IR, 1H NMR, or Molar conductance (Li *et al.,*2013).

1.3.2.5. Synthetic action on Insecticides:

The Schiff bases developed Sulfane Thiadizoles, salicylaldehyde and2-aldehydes-thio-phene or complex monitor malignance in in contradiction of insect. α Amino-acid take motion an in-between formation of the photo-stable Pyrthriod Insecticides. Flouri-nation anethanol the portion of the Schiff bases will increase activity of Insecto Acracicidal or interest. The Schiff base (Thia-diazole derivative through Salicyl-aldehyde andO-Vanillin) or these metallic complex thru(II) Moshowcase Insecticidal activity in competition to bollworm and upgrade cellular survival rate of mung bean sprouts.

1.3.2.6. Schiff base activity as Plant growth regulator:

N-acetylated compounds display improvement constraint activities seedlings barley, wheat and rye. The Schiff base display great interest on the hormone of plant alongside these root growth on Auxins. The Schiff bases on the Ester or Carboxylic acids showcase great activities as the plant hormone growth. Schiff bases of thiodiazole have fine plant growth regulator activities in the direction of auxin and cytokine



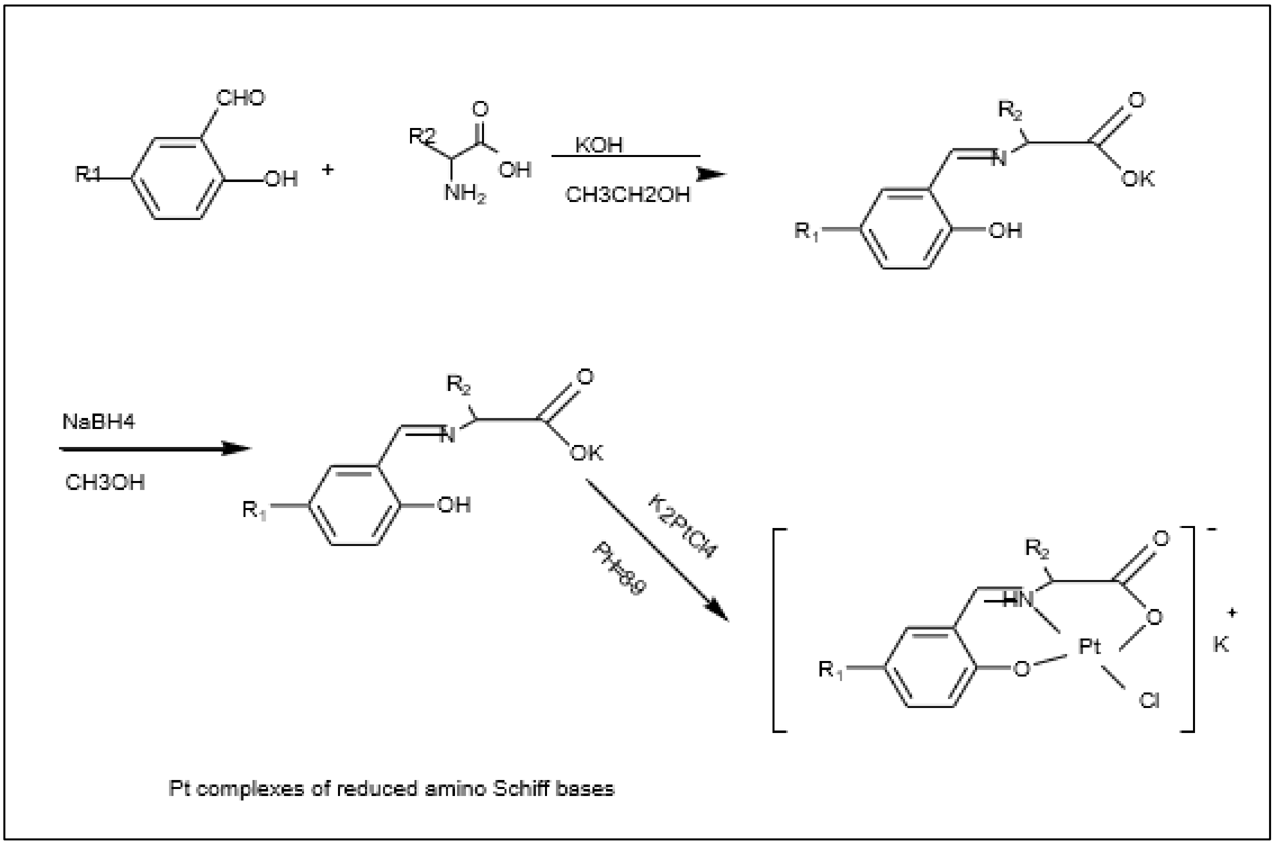


Figure 1.8 Schiff base as Anti-cancer agent

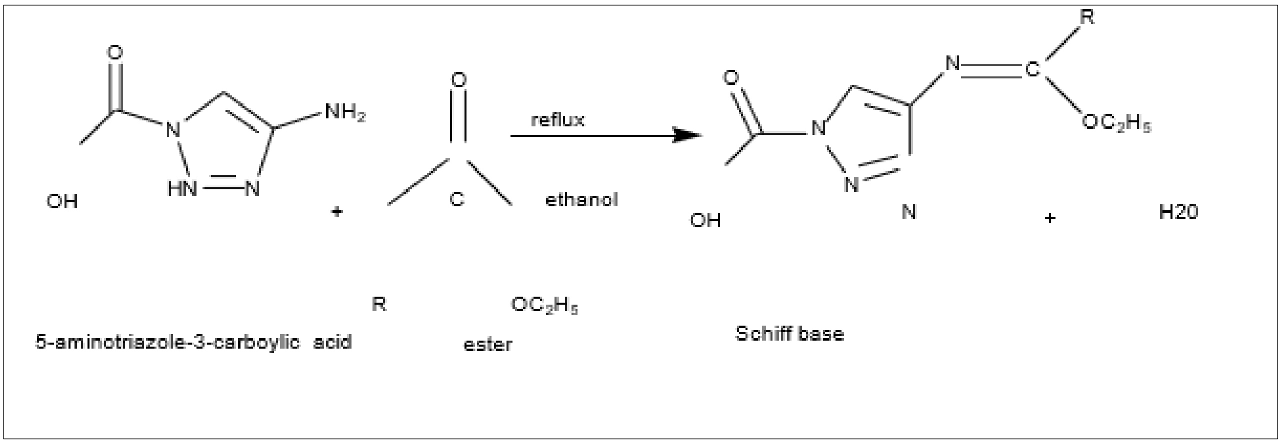


Figure 1.9 Schiff base as plant regulator

1.3.2.7. Additional Therapeutic Activity:

Numerous these Schiff base had allergic inhibitors, Anti-inflammatory activities of reducing scavenging radical, Anti-oxidative or Analgesic movements. Thiazole obtained schiff base display Analgesic or Anti-inflammatory activities. The Schiff bases of the Chito- sanorCarboxy-methyl-Chito-san reveals theAnti-oxidant interest along with super-oxide and Hydroxyl scavenges. The Furan semi-carbzones Metal Complex indicates notable vermifugeor ache relieving activity.

1.3.2.8 Schiff base as an Antioxidant activity:

Currently, synthetic antioxidants are substantially used due to the fact they are efficacious and much less expensive than herbal antioxidants.

Presently a number of metallic complex had scrutinized a Affective scavenger of the ROSs, performing as an Anti-oxidant agent. Zn (II) or single crystals X-rays of the Cu (II) complex implying tri-dentate ′-donor O, ON, the Schiff bases N-salicyli-dene-β-Alanine (2-) acquired formed Salicyl aldehyde or β-Alanine had defined (Vanco *et al.,*2008). Schiff bases N′-N,bis (Salicylidene) (HS)Thiourea 2T or their Zn (II) Ni

(II) orCu (II), complex was synthesized through using approach pf Xinde. (Xinde *et al.,*1996).

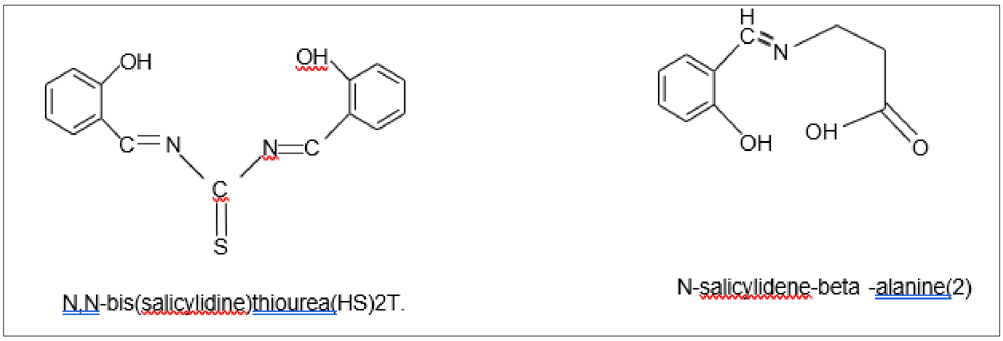


Figure 1.10 Schiff base as Anti-oxidant

1.3.2.9 Schiff base as Anti-Inflammatory agents:

These Schiff base attained from amino-antipyrine (4-amino1-2-, 5dimethylphenylpyrazole- one) or Benz-aldehyde by-product become analyzed for its anti-inflammatory (El sheriff *et al.,*2011). The outcomes exhibited auspicious anti-inflammatory interest which will be beneficial to be used in the remedy of inflammatory illnesses. The effects of this observe study can also deliver on the evolution of brand new healing operative beneficial in fighting illnesses by inflammation and oxidative stress (Alam *et al.,*2012).

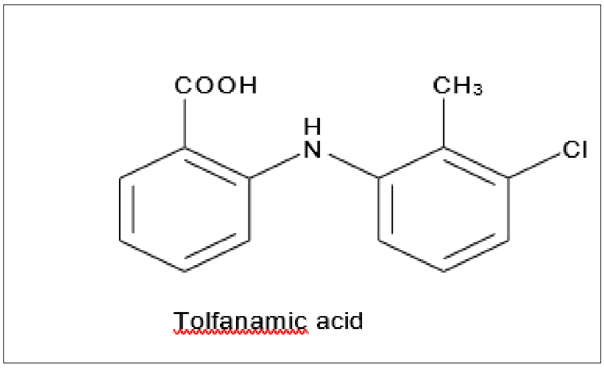


Figure 1.11 Schiff base Anti-inflammatory agent

1.3.3. Application of Schiff bases as catalyst:

A massive amount of the Schiff bases complex of metallic ions display extreme Catalytic activities implemented important factor in the particular reaction improving these yielding products cautiousness. These suitable method of Synthesis or thermal stabilities of the Schiff bases ligand had contributing remarkably of these attainable implementation in the catalyst as the Metal complex (Sutar and Gupta, 2008).

1.3.3.1 The application for the aldol reaction:

Aluminium Schiff base complexes have been relevant as the catalysis of the reactions among benzaldehydesor5-methoxy-oxazoles make optical energetic oxazoline-cis adducting (Evans *et al.,*2001).

Furthermore, maximum Aldol condensation reactions 1-3dibenzoylmethanes by form- aldehyde catalysis via Tetra-dentate hydroxyl cobalt(III) the Schiff bases complex beneath impartial times (Maruyama *et al.,*1995).

1.3.3.2 Another application for the Henry reaction:

The quantity of these the Schiff base obtained formed Cinchona Alkaloids had been advanced Chiral ligand of copper(II)which catalysis unsymmetrical reaction of Henry. Reformed catalysis ought to increase Henry response each aldehydes (Aliphatic and Aromatic) through Nitro-methane and nitro ethane. These reactions may want to impart the b-nitro chiral Alcohol adduct through excessive selectivities-enantio (Wei *et al.,*2011). THF became quite the finest choice for these reactions in phrases of productiveness and enantiomer-selectivity (Wei *et al.,*2011).

1.3.3.3 Applications for the Hydrosilylation of ketones:

The Schiff base complex of Zinc attained from 3,butylsalicyldehyde 5-ditert-and amino acids had been analyzed for catalysis of an un-symmetrical hydro-silylation of the ketones, or these result exhibited the tremendous yielding well really worth have been acquired, which can be the wonderful instances catalysis un-symmetrical hydrosi-lylation of the ketone catalysis by complex of zinc in simplicity of the functioning, sensitive reaction responses condition and smooth segregation (Zhou *et al.,*2012).

1.3.4 Antifertility and Enzymetic activity of Schiff bases:

Schiff bases of the complex 2-carboxaldehyde pyridine or their derivative had defining their exhibitionhighing notable oxidase activities dismutase. Lately, interlinkage DNAs by complex [Croxidized varieties of benzothiazolines have flourescence. Cadmium (II) and Zinc (II) complex byS2N2-the Schiff bases ligand were conversant classes of fluorescence compound, or attentive derivatives of these substituent at suspended rings of phenyl allow a measuring wavelength of emissions. Yeast of Baker's carry the benzo-furan by-product those take measure Anti-oxidant prevent hemorrhaging necrosis liver in the rats and in E. nutrients RED cells of hemolysis.

1.3.5 The Schiff Bases urease inhibitory activities:

Schiff bases complex of metal of transition acquired from metallic acetates (Mn(II) M ¼ and Ni(II) or or Cd (IICo(II)) orN0N, -bis -1(salicylidene), (SALPD) 3-propane-diaminate and N- N0-bis acetate (2hydroxy-naphthyl-methenyl-imino), three-Propanedia-Minate (NAP-TPD) was synthesizing and crystalgraphically recognized. These inhibitory activity of the ureases was appraised. Mn(II) complicated exhibited the wonderful activities inhibitory byeight.30 of IC 50 ± zero.93mM, which have become fairly advanced than these of these correlate ligands or manipulate ions. These inspection on strong constant or these structural activities affiliation of the complexes decided on that the complexes interconnect by these enzymatic in entire complicated paperwork ideally free ionics (Shi *et al.,*2007).

1.3.5.1 Dyes applications:

Complex of the Azo-methine chromium, complexes of cobalt the Schiff bases, asymmetrical complexes 1:2 chromiums dye allow speedy shades to food applications, Leathers, wools or many others. The Azo groups had metallic complex were utilized in textilpoly-ester. Few Metal complex were uses dye mass poly fibers. Complex of cobalt of a Schiff base (salicylaldehyde with diamine) has a better mild resistance and storage functionality and does no longer devalue in the acidic gases (CO2). The Novel tetra dentate Schiff base take movements as a chromogenic reagent for resolution of Nickels in the some of the natural meals specimens.

1.3.6 The Schiff bases complex of the Oxygen Affinity:

The Oxygen desorption absorption techniques of rectangular planars Co(II), Mn(II),or Ni(II) complex acquired formed reaction of condensation ethylene diamine byo-hydroxy-aceto- phenoneand salicyl aldehyde, Acetyl Acetone in the DMF or chloro-form solvent had been examined. These sorptions techniques had been initiated inside presencesor lack of (Pyridine) Axial-base in the 1:1 M ratios of the (pyridine:metallic(II) complex). The Complex in the DMFs represent exceptional oxygen affection that of the chloroforms solvent. Cobalt(II) complex exhibited splendid sorption techniques contrasted to Ni(II) and Mn(II) complex. These presences of the pyridines axials bases noticeably, enhances Oxygen affection. These sorts of the materials may carried out as the catalysis in the addition reactions of oxidative within Natural Chemistry petro-chemicals, this testable or was all via environmental friends (Emara *et al.,*2014).

1.3.7 Miscellaneous application:

Elzar-Abd (2001) had described these Spectroscopic depiction of the tetra-dentate the Schiff base by N2 donor atomssseted made through thesemolar condensation of1:2 of o-phenylene- di-amine by related ethanal, impart: N,N′-bis(1-naphthaldhyde2hydroxy-)-o-phenylene- diamine , N,N′- bis (o-hydroxy-aceto-phenone)-o-phenylene-diamine, N,N′-bis (salicylaldehyde)-o-phenylene-diamine, and these copper, nickel, or zinc complex. These spectroscopics depictions exposed these metals ion were bonded to these Schiff base through these phenolics Oxygen or Iminonitrogensor validates the rectangular-planars geometries for the ones complex. (Elzar- Abd2001).

1.4 AMINOBENZOIC ACID:

2-aminobenzoic acid is an aromatic acid with formulation C6H4(NH2) (CO2H) and has a sweetish satisfaction from. Anthracitic acid contains a benzene ring, ortho-substituted with a carboxylic acid and an amine. The compound is amphoteric because of containing both primary and acidic functional group. In natural form it is white strong solid, even though materialistic samples might also appear yellow. The anion [C6H4 (NH2)(CO2)]−, derived by the deprotonation of anthranilic acid, is referred to as anthranilate. Anthranilic acid became previously expected to be a nutrition and was stated to as diet L1 in that relation, however it is currently acquainted to be non important in human nutrients.

1.4.1 Structure of 2-aminobenzoic acid:

Actually it is an amino acid. In stable form normally consists of each the amino-carboxylic acid and the zwitterionic ammonium carboxylate appearance, and has a monoclinic crystal shape with area group P21. It is triboluminescent.

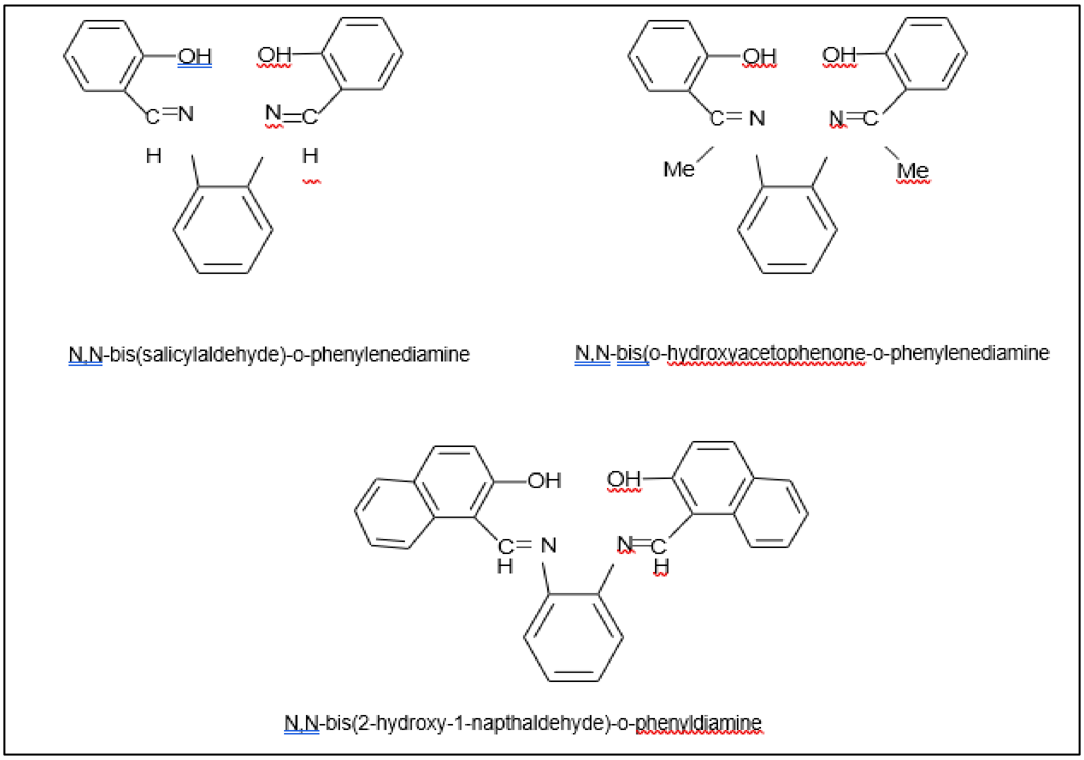


Figure 1.12 Miscellaneous application of symmetrical Schiff bases

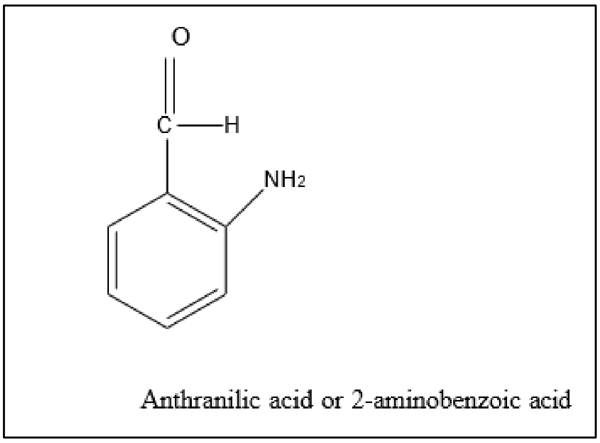


Figure 1.13 Structure of o-amino benzoic acid

1.4.2 Physical properties of anthranilic acid:

The Molar mass of anthranilic acid is 137g/mol with chemical formula C7H7NO2. The density is 1.412g/cm-3, the melting and boiling point is 146-148˚C, and 200˚C respectively.

1.4.3 Synthesis of antranilicacid:

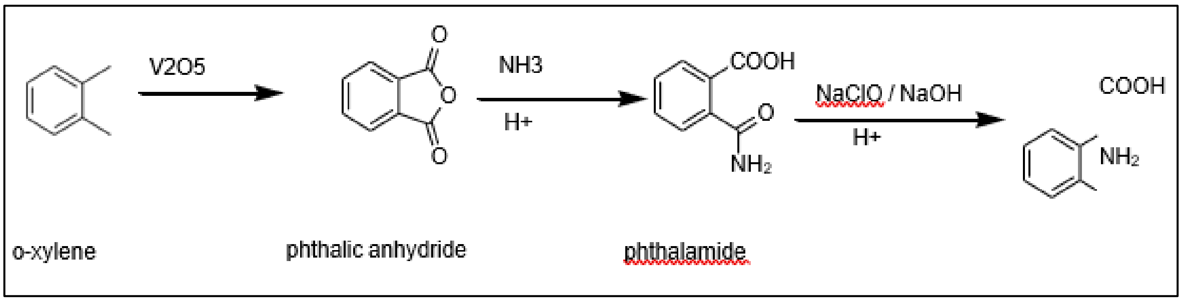


Figure 1.14 Synthesis of o-amino benzoic acid

1.4.4 Derivative of anthracitic acid:

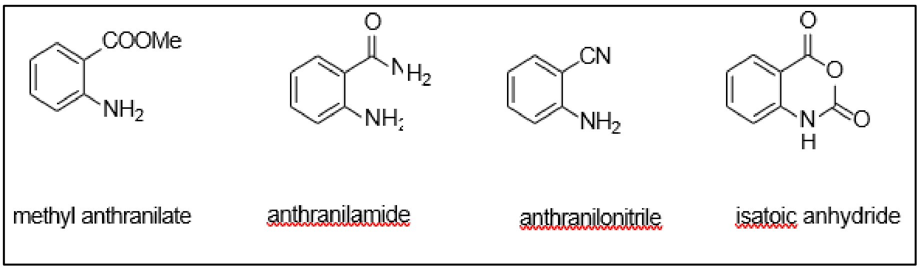
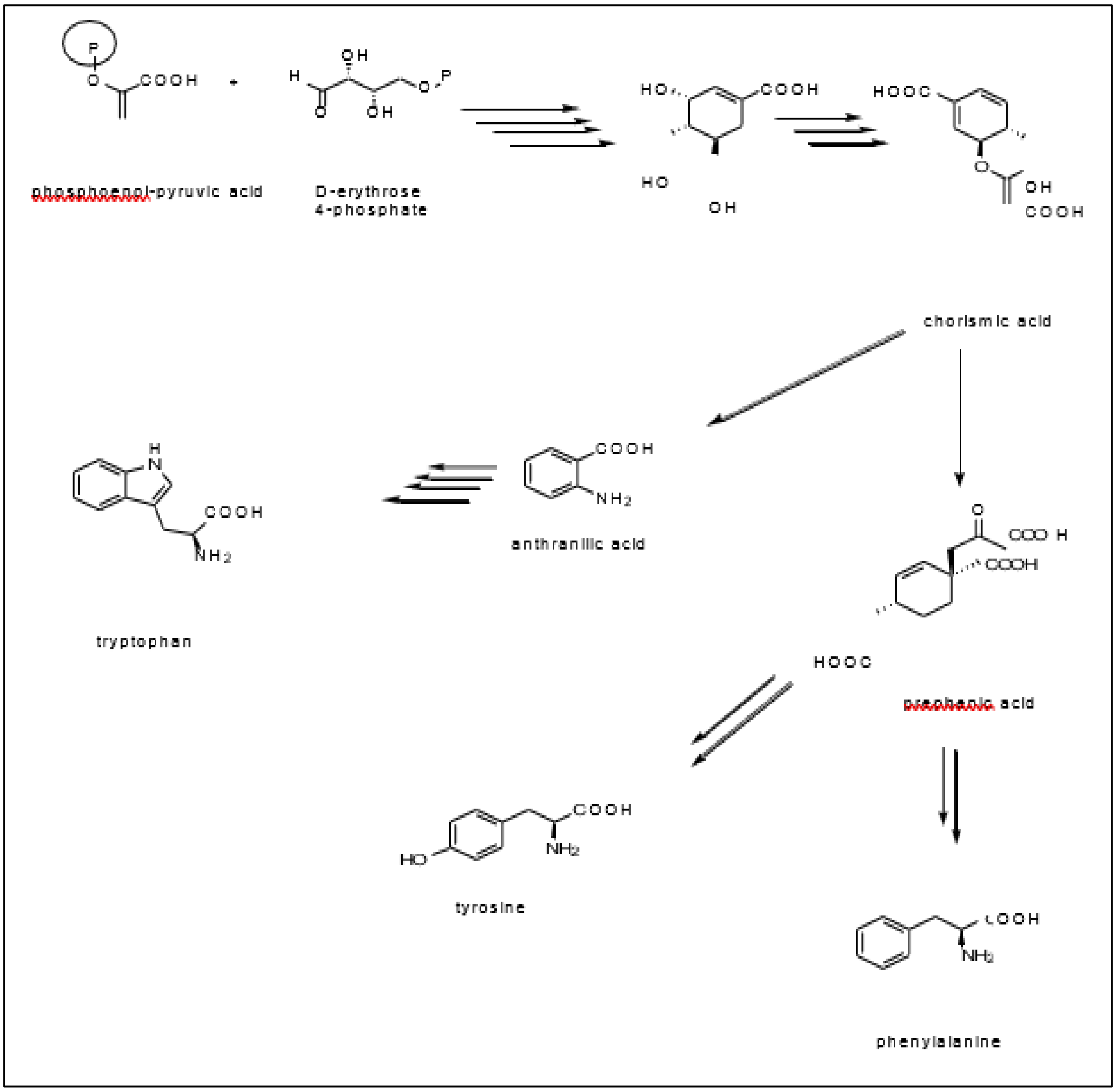


Figure 1.15 Derivative of anthranilic acid

1.4.5 Anthranilic acid biochemistry:

Anthranilic acid display crucial role within the anabolism and catabolism of the amino acid tryptophan. Those biochemical steps additionally encompass anabolism of phenylalanine tyrosine, along with formation of quinolinic acid , an outrider to the crucial energy carrying molecule NAD



Direct splitting of alanine form anthranilic acid and side chain deamination formed kynurenine. 3-hydroxyanthranilic acid leads to quinolinic acid which then formed nicotinamide.

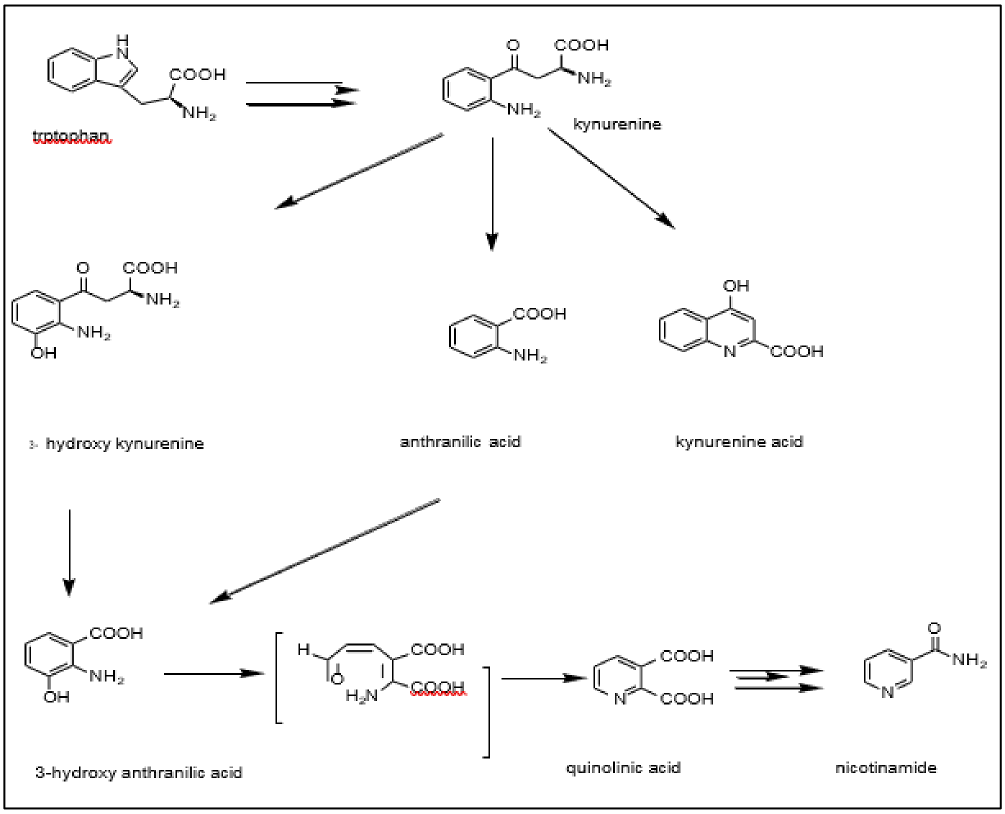


Figure 1.16 Biochemistry of Anthranilic acid

1.5 THE FURFURALS:

The Furfurals was the natural compounds having formulae C4H3OCHO. It was drab liquids, despite the fact that materialistic specimens are frequently brown. An aldehyde institution is attached to the wide variety of 2 function of the furans. It was shaped via de-hydration of the sugar, passed off some agriculturals by way of using products, alongside saw dust, oat, corncobs, or wheat brans. These furfurals originated from Latin word the furfur, because of this brans, mentioning their conventional origin.

1.5.1 Physical properties of furfural:

The molar mass and density is96.085 g/ mol and 1.1601 g/ mL respectively with the chemical formula C5H402g/Ml. it melts at -37˚C and boils at 162˚C

1.5.2 Mechanism of Furfural synthesis:

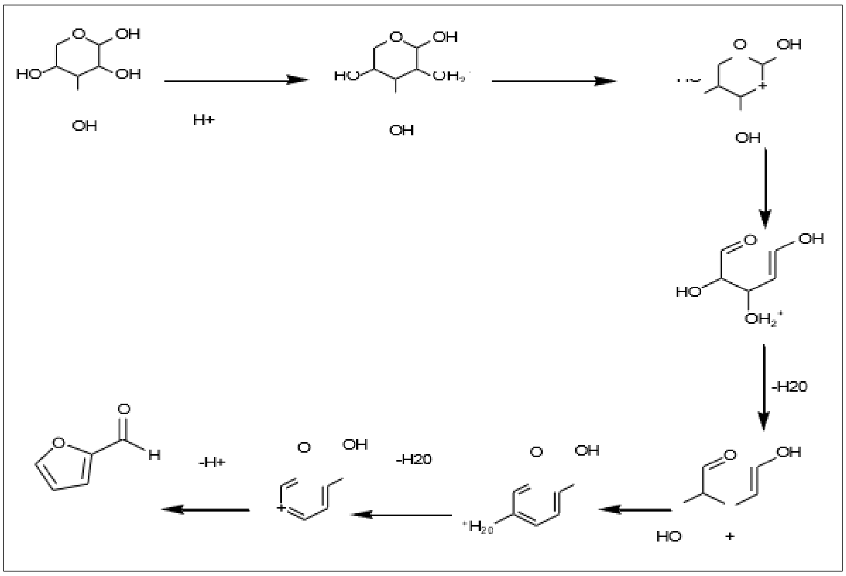
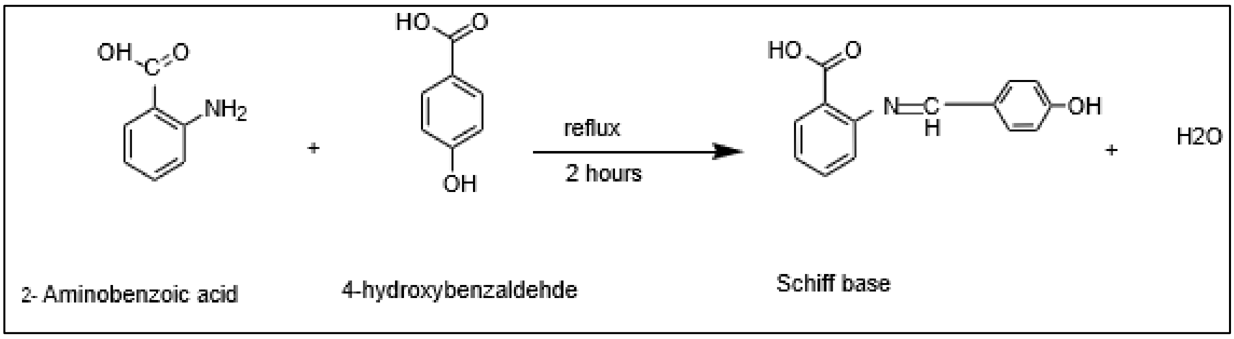


Figure 1.17 Mechanism of Furfural synthesis

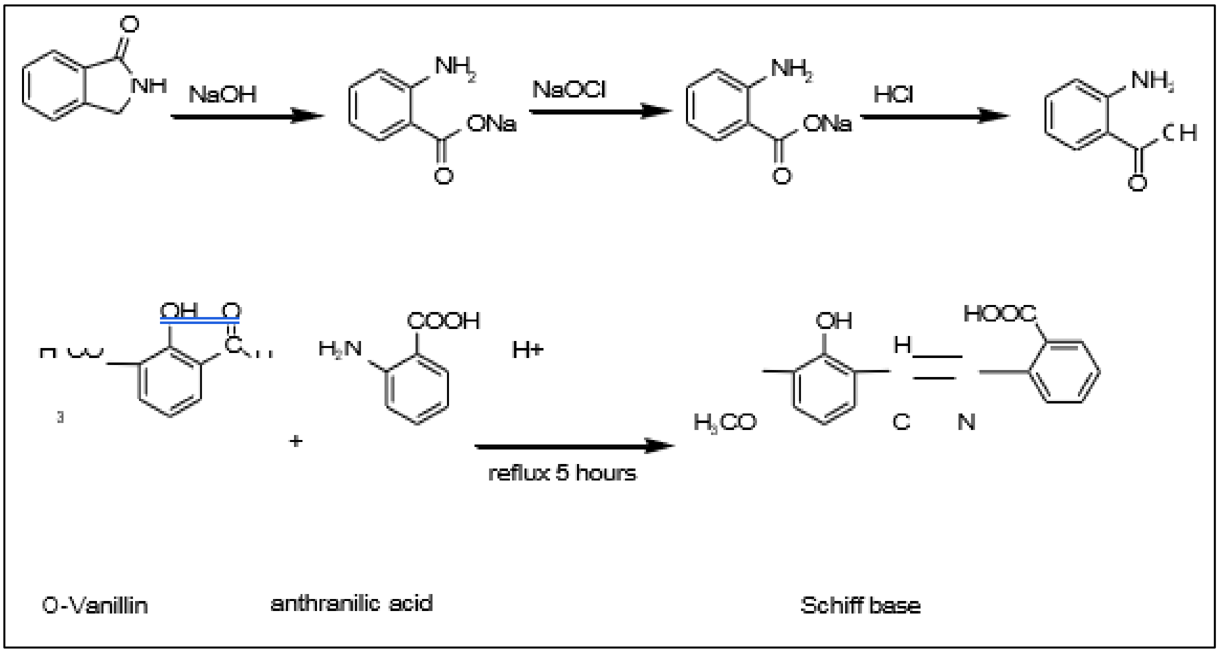
2. LITERATURE REVIEW

In recent literature, the synthesis of tridentate ligand were synthesized by Vadivel (Vadivel *et al.,* 2016). The ethanoic solution were prepared by using 2-aminobenzoic acid and 4hydroxybenzaldehyde and reflux for the 2 hours approximately. The hot precipitates were than cooled down and gives orange color precipitates which were than filtered and wash with hexane. After washing the resultant product were allowed to dry in air. After drying in air again the resultant product were than recrystallized from hot ethanol to dry by silica gel.



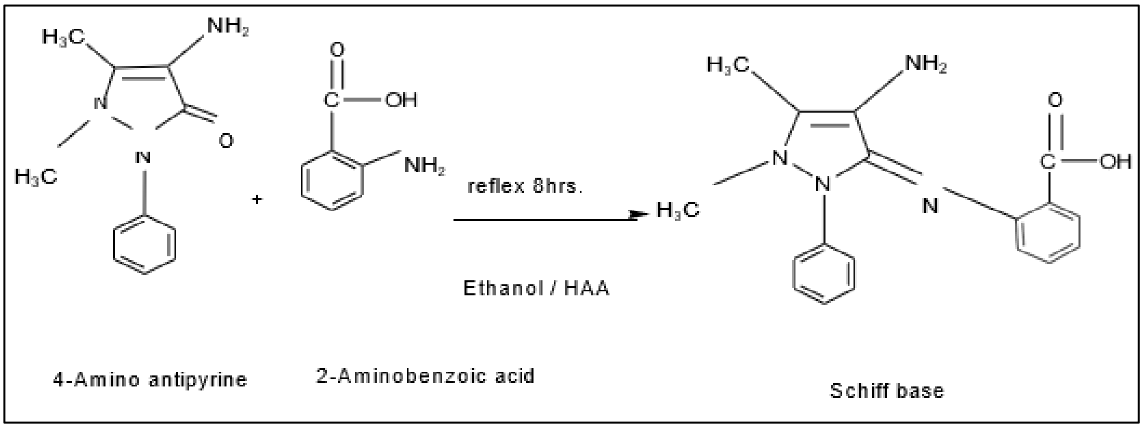
Scheme 2.1 Synthetic reaction of Schiff base

Another researcher were described the production of these bases by using method of homogenized thanolic solution of o-Vanillin and anthranilic acid (Rai *et al.,*2011). The synthesis of the Schiff base were carried out by refluxing the metallic salts of Fe, Co and Mn with bases BHMBH in ethanolic medium for 3 to 4 hours to obtained the desired product. The sodium acetate were added followed by the addition of pyridine in warm solution to make the medium alkaline slightly. Then the hot solution were stir for 20 minutes and cool down. After cooling the obtained precipitates were filter and washed with hexane.



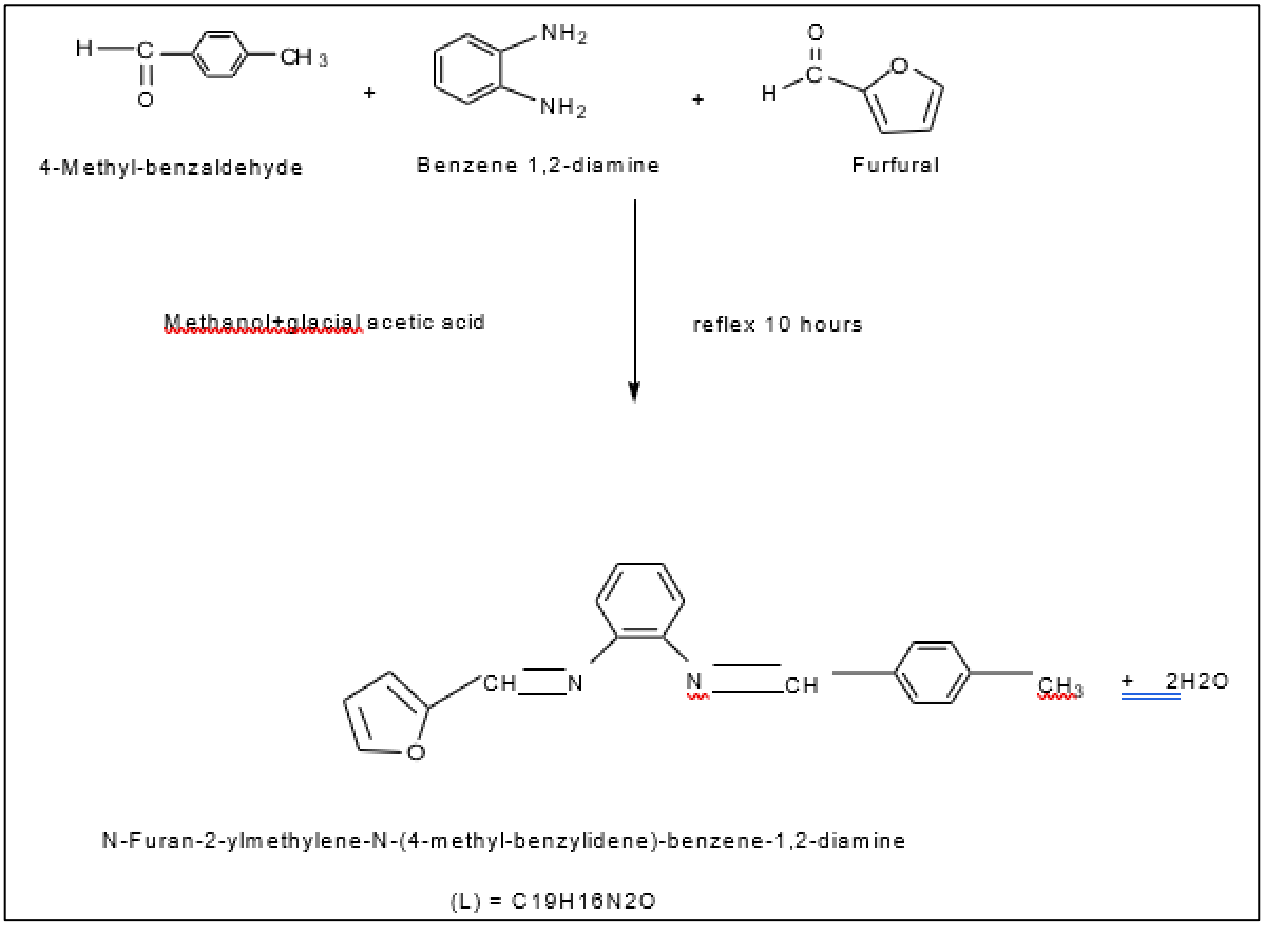
Scheme 2.2 Synthesis of Schiff base by O-vanillin and anthranilic acid and their metal complexes

The Bidentate ligand were synthesized by Sampath K. *et al.,* in 2017. They synthesis the Schiff bases by 4-Aminoantipyrine and 2-aminobenzoic acid. Initially the 4-Amino antipyrine were added in ethanolic solution and then 2-aminobenzoic acid were added in the ethanolic solution of 4-Amino antipyrine by the addition of glacial acetic acid. The mixture were than reflux subsequently for 6 hours. The mixture were cooled down with ice. After cooling the greyish white precipitate were separated filtered and recrystallized from ethanol. Then resultant product were dried in vacuum.



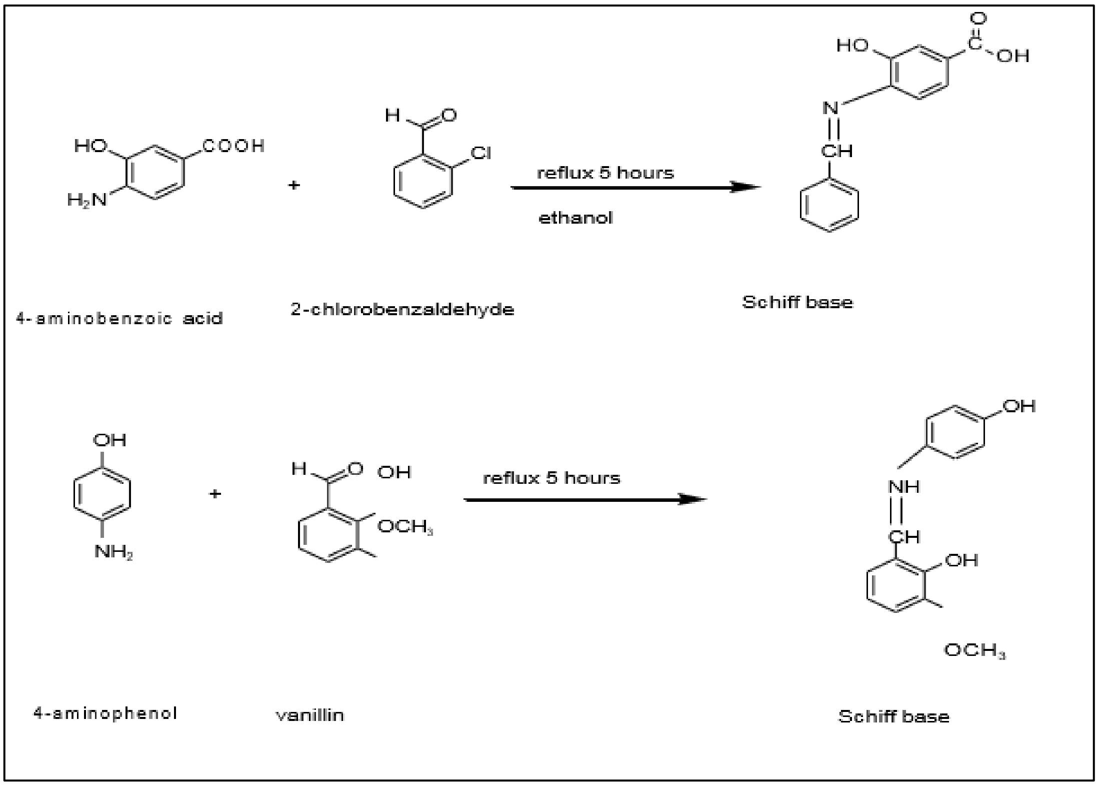
Scheme 2.3 Representation of production of bidentate ligand and its complexes.

In past few years, (Raman *et al.,*2014) used the furfural method to synthesize the Schiff bases. They synthesized the Schiff bases through the reaction of furfural and ophenylenediamine, p-methylbenzaldehyde. A methanoic solution of p-methyl benzaldehyde and furfural were added in the solution of o-phenylenediamine and followed by the accumulation Glacial acetics acids for reflux the mixtures for the 8 hours. The obtained product were then cooled in ice, which is then converted into pale brown precipitates. The obtained precipitates were then filtered and dried with the anhydrous CaCl.



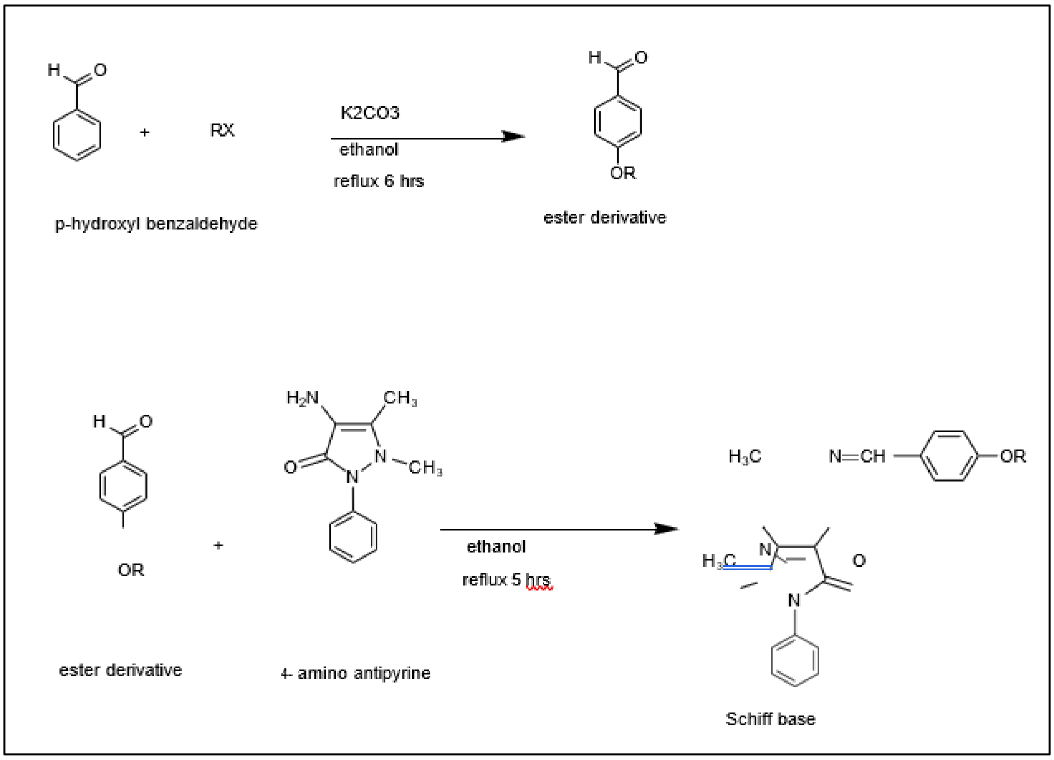
Scheme 2.4 Synthesis of Ligand and its metal complexes

Verma *et al.,* 2004 define production of these bases through the reaction of Salicylic Acid 4- amino or 4-amino-phenol with 2-chlorobenzaldehyde and Vanillin in the presence of ethanolic soln. and refluxed. The warm solution is then cooled and dried for further characterization.



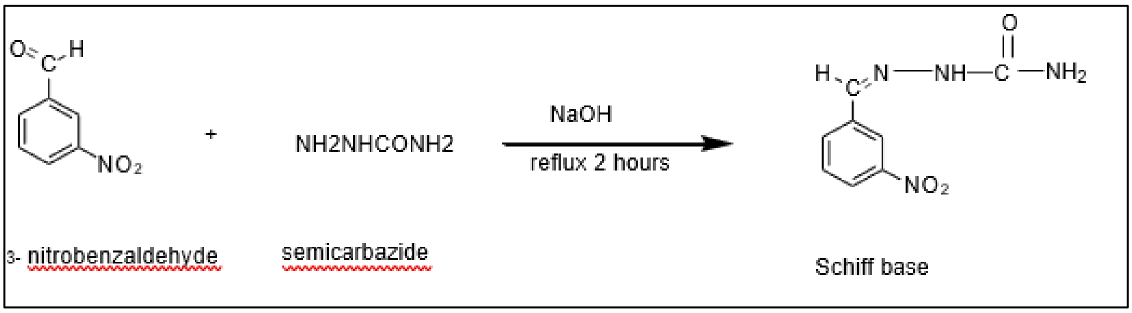
Scheme 2.5 Synthetic reaction of Schiff base

Kumar *et al.,* (2017) described the production of Schiff base. In first level via the usage of Williamson ether synthesis approach ether derivatives for benzaldehyde from p-hydroxyl benzaldehyde were synthesized. Ether by-product is then reacted in ethanolic solution with 4amino antipyrine and 2-aminobenzimidazole, refluxed for five hours and then 1 or 2 drop of glacial acetic acid were added. The obtained solution were separated by filtrations and then washed with anhydrous ethanol.



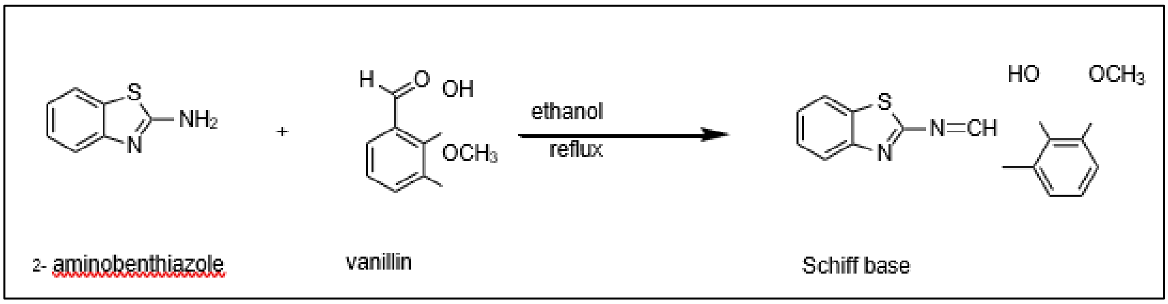
Scheme 2.6 Schiff base synthetic compounds pathway

Neha *et al.,* (2015) reported the production of 3-nitrobenzaldehydesemicarbazone ligand. First of allsemicarbazide and sodium hydroxide were dissolved in a warm ethanolic soln. of 3nitrobenzaldehyde, shake properly with continuous stirring at 78˚C for 7 hours. Yellow precipitates were obtained which is then filter and oven dried.



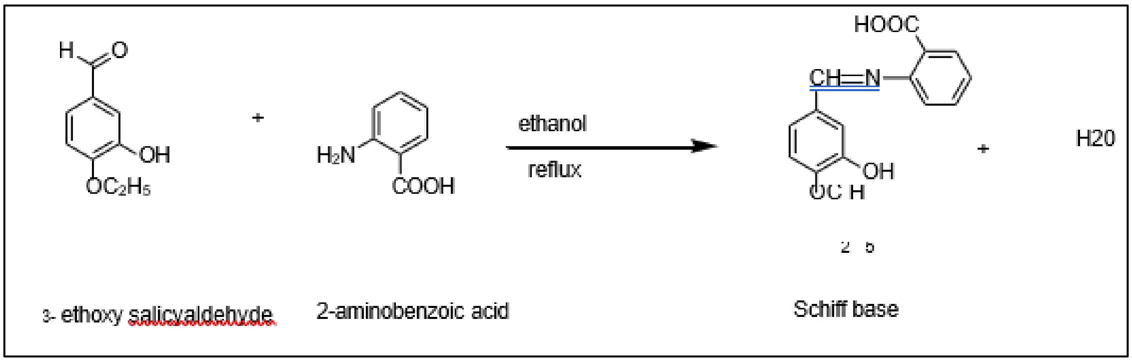
Scheme 2.7 Synthesis of 3-nitrobenzaldehydesemicarbazone and its metal complexes

Neela-kantan *et al.,* (2008) had defined XRD and spectral activity of complexes such as Mn(II), Co(II), Cu(II), Ni(II) and Zn(II) o--2-vanillidene-amino-benzo-thiazole. These Schiff bases obtained from o-vanillidene-2-aminobenzothiazole. Metal complexes in vitro bioactivity had been studied against Gram -ive and Gram +ive bacteria microorganism Yeast (S. Cerevisiae) and Fungus (A. Niger). Many of these metals compound showed biological higher activity (Neela-kantan *et al.,*2008).



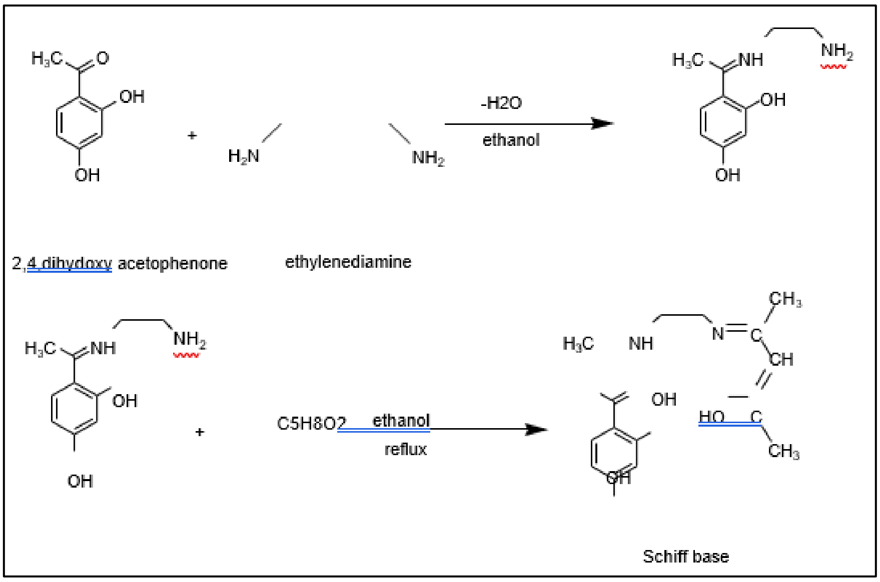
Scheme 2.8 Synthetic reaction of o-vanillidene-2-aminobenzothiazole Schiff base

Mounika *et al.,* (2010) described synthesis of the Schiff base of Salicylidene 3-ethoxy Amino- benzoic acids froming the responses salicylaldehyde 3-ethoxy or more than one- aminobenzoic acid and its Co(II), Ni(II), Zn(II) and Cu(II) or complex steel. The resultant compounds was tested for the Anti-fungal or Anti-bacterial activity.



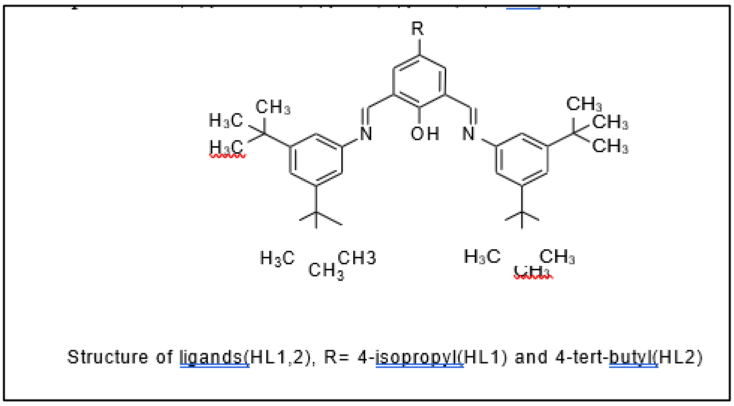
Scheme 2.9 Production of Schiff base

Ajibadeor (2015) had described microbial or phytochemicals studying of metal complexes such as Co(1 1), Cu(1 1), Zn(1 1) and Ni(1 1) of asymmetrical Schiff base, 4-[((4E)-2- (E)[1ethyli-dene-(2,4-di-hydroxy-phenyl)]aminoethyl) Amino]2-pentan-one (H21 1) obtained from 2′,4′-, 4-pentanedione dihydroxyacetophenoneethylenediamine, and a couple of, in the ethanolic answer, refluxed and the reaction combination separated by filtration, dried and washed with anhydrous ethanol.



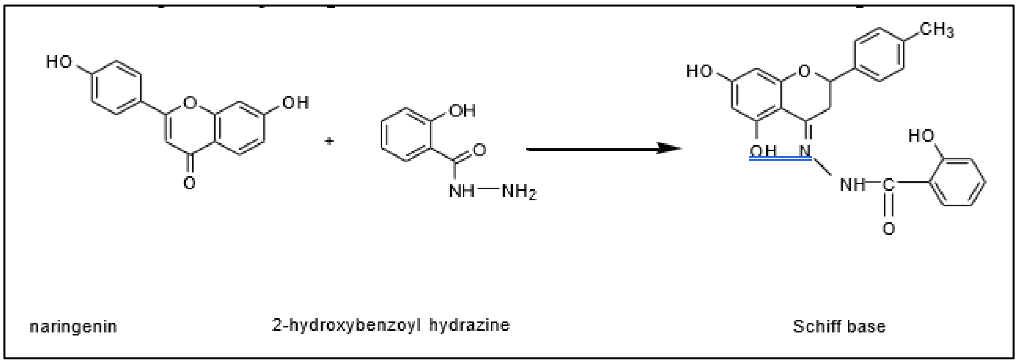
Scheme 2.10 Pathway of Schiff base formation

Ceyhan *et al.,* (2011) had defined formation , depiction, or antibacterial or flavonoids activity of the Schiff bases ligand 4,4′-(2- five-isopropyl- hydroxy-benzene-1,diyl3-) bis[methyl-dinenitrilol]-bis (2,di-tert-6-butylphenol) (HL1), 4,4′-(2- five tertbutyl benzene hydroxy--1,3diyl) bis [methyl-dienenitrilo] bis (2,6-di-tert-butylphenol) (HL2) and their transition metal complexes Cu(II), and Pd(II), Co(II), Ru(III). Ni(II),



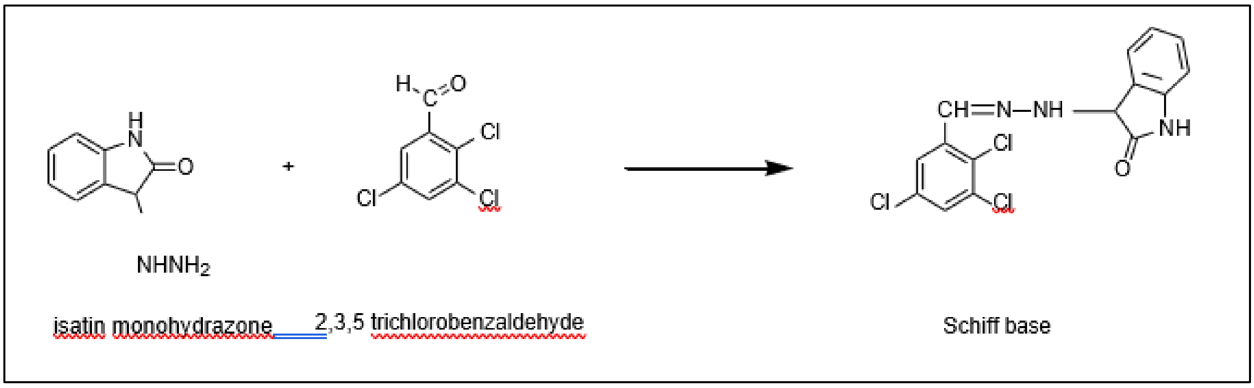
Scheme 2.11 Schiff base ligand

Li *et al.,*2007 has describe formation of Schiff base, naringenin-2-hydroxybenzoyl hydrazine with the aid of the reaction of naringenin and 2-hydroxybenzoyl hydrazine in the ethanoic solution and refluxed. The warm solution is cooled and separated by using the suction filtration, dried and used for making metallic complexes.



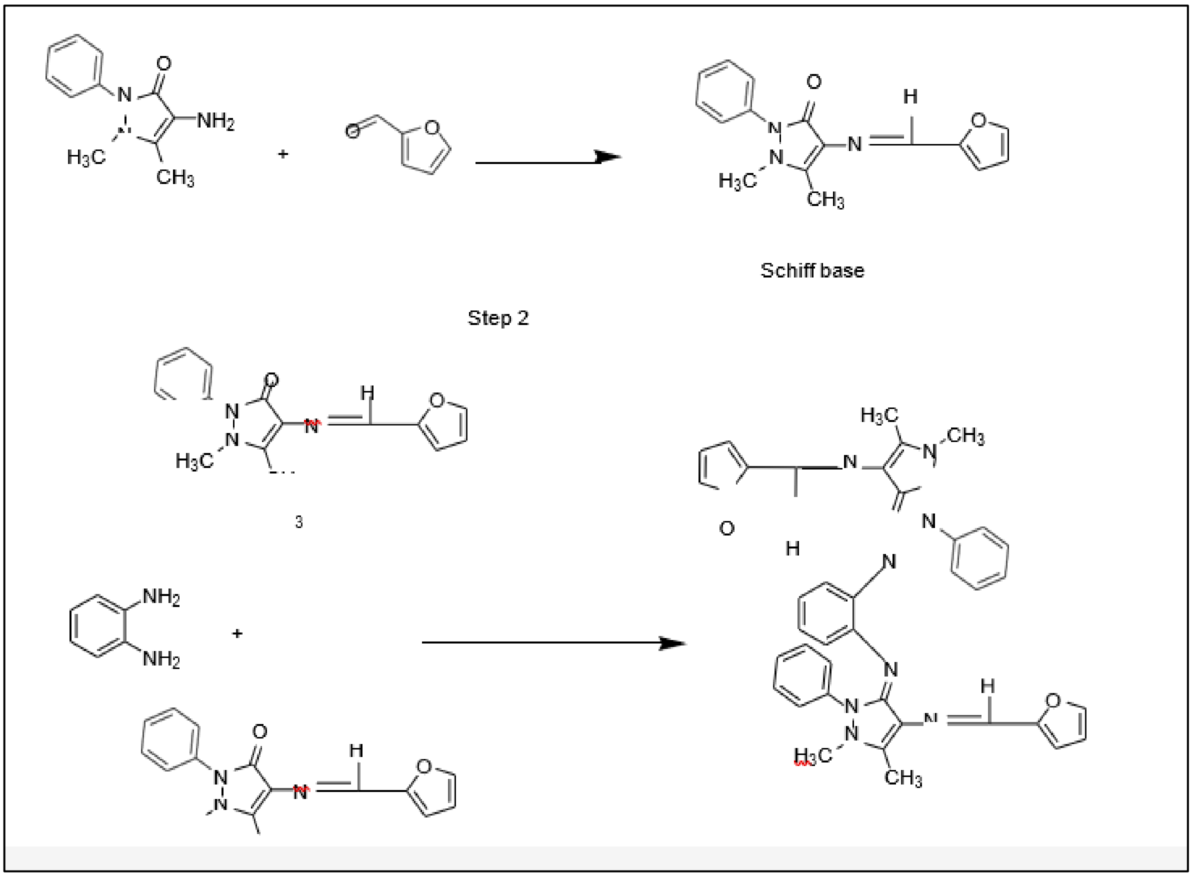
Scheme 2.12 Synthesis of naringenin-2-hydroxybenzoyl hydrzine

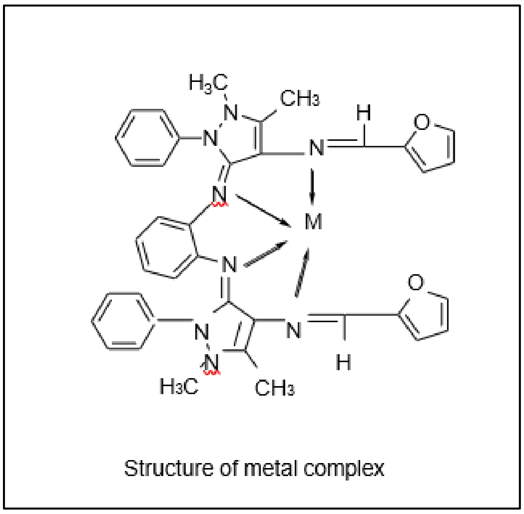
Raman *et al.,* (2011b) have described a Schiff base synthesized from the condensation reaction of Isatin mono-hydrazone with 2,3,5-tri-chloro-benz-aldehyde and its Cu(II),Zn(II), Ni(II), Co(II), and complex. The oxidative splitting activities of the complexes were deliberated the usage of pBR-322 DNA by manner of gel electrophoresis and exhibited better nuclease activity for Cu(II) complicated than distinctive complex; as a result of the collaborative interlinkage of metallic ions is an difficulty to interrupt up DNA.



Scheme2.13 Synthesis of Schiff base using isatin monohydrazone and 2,3,5- trichlorobenzaldehyde

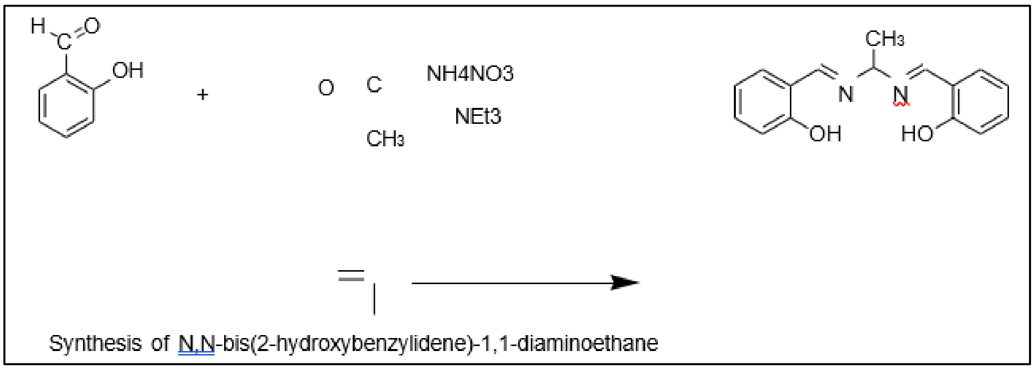
Suresh *et al.,* (2011) defined about the formation of Schiff base. To the ethanolic solution of 2,3 dimethyl-4-aminopyrazol, ethanolic solution of Furfural was added. The warm mixture stirred continuously, refluxed for 6 hours and cooled with ice which resulted within the formation of yellow crystal, then filtered it and recrystallized from ethanol. This strong solid intermediate became poured to the ethanolic solution of o-phenyld-iamine and refluxed for 30 hours which result in the formation of brown crystal. These crystal was separated, filtered, recrystallized and used for making metallic complexes.





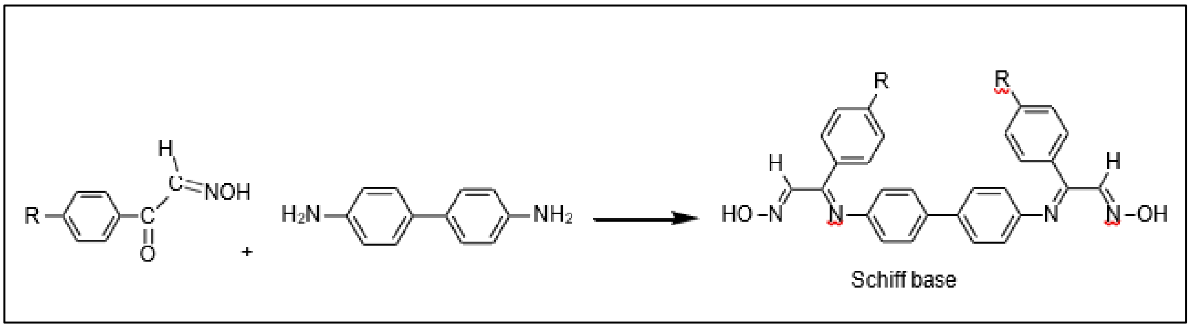
Scheme 2.14 Production of Schiff base and its metal complexes

Alaghazand (2013) had defined these spectroscopics depiction or potentiometric study of the tetradentates [N2-O2] the Schiff bases complex N,N′-bis(2-hydroxy-benzyli-dene)1,1di- amino-ethane. These structural property of these compound have been defined with the aid of the usage of IR, electron resonance EPR paramagnetic, 1H nuclear magnetic resonance (NMR), magnetic 2d, further to digital spectroscopy facts.



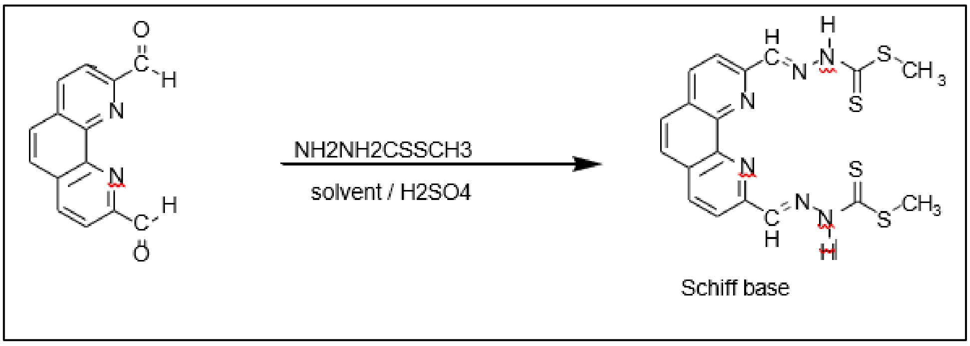
Scheme 2.15 The synthesis of N,N-bis(2-hydroxy-benzyli-dene)-1,1-dia-mino-ethane

Bootwala and (1996) had described the reconciliation or depiction of bi-nuclear Fe(II), Co(II), and Ni(II) complexes of Schiff base bis (2-hydroxyimino-1-(4-R-phenyl)- 1ethylidene) benzidine, R=H, Br, Cl, and CH3. The magnetic moments and digital spectra designate octa-hedral shapes for metallic complex.



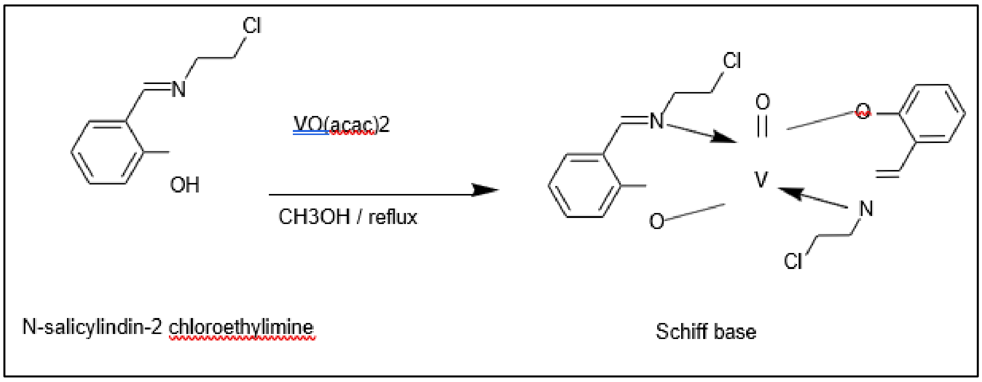
Synthesis of bis(2-hydroxyimino-1-(4-r-phenyl)-1-ethylidene) benzidine
Scheme 2.16 Synthesis of tetra dentate ligand of Schiff base

Arifuzzaman *et al.,* (2013) have been defined the fusion and depiction of the bidentate ligand of 1,to 10-phena-nthro-line-2,9-di-carbox-aldehyde by sulfur-containing Amines which includes 2aminothiophenol, S-arylalkyl/dithio-semi-carbazide or thiocarbazates.



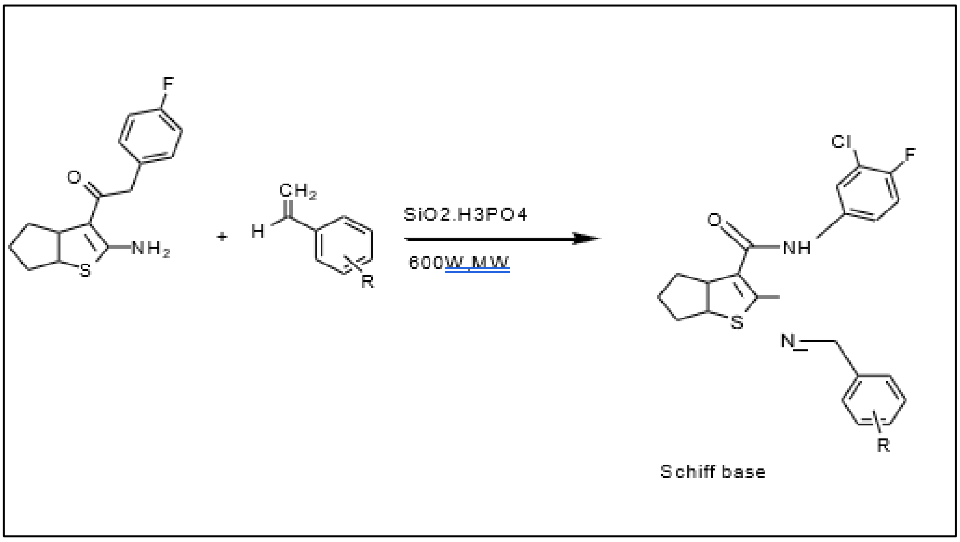
Scheme 2.17 Synthesis of Schiff base ligand

Grivani *et al.,* (2012) described formation of a new oxovanadium (IV) Schiff base complicated, VIVOD2 through condensation of the bi-dentate the Schiff bases ligand VO and D (acac)2 (D =Nsalicylidin2-chloro-ethylimine. During the epoxidation of cyclooctene the catalytic pastime of the oxovanadium (IV) complicated modified into tested which disclosed that the complex become more energetic and discriminate catalyst inside the epoxidation of cyclooctene in most advantageous situations.



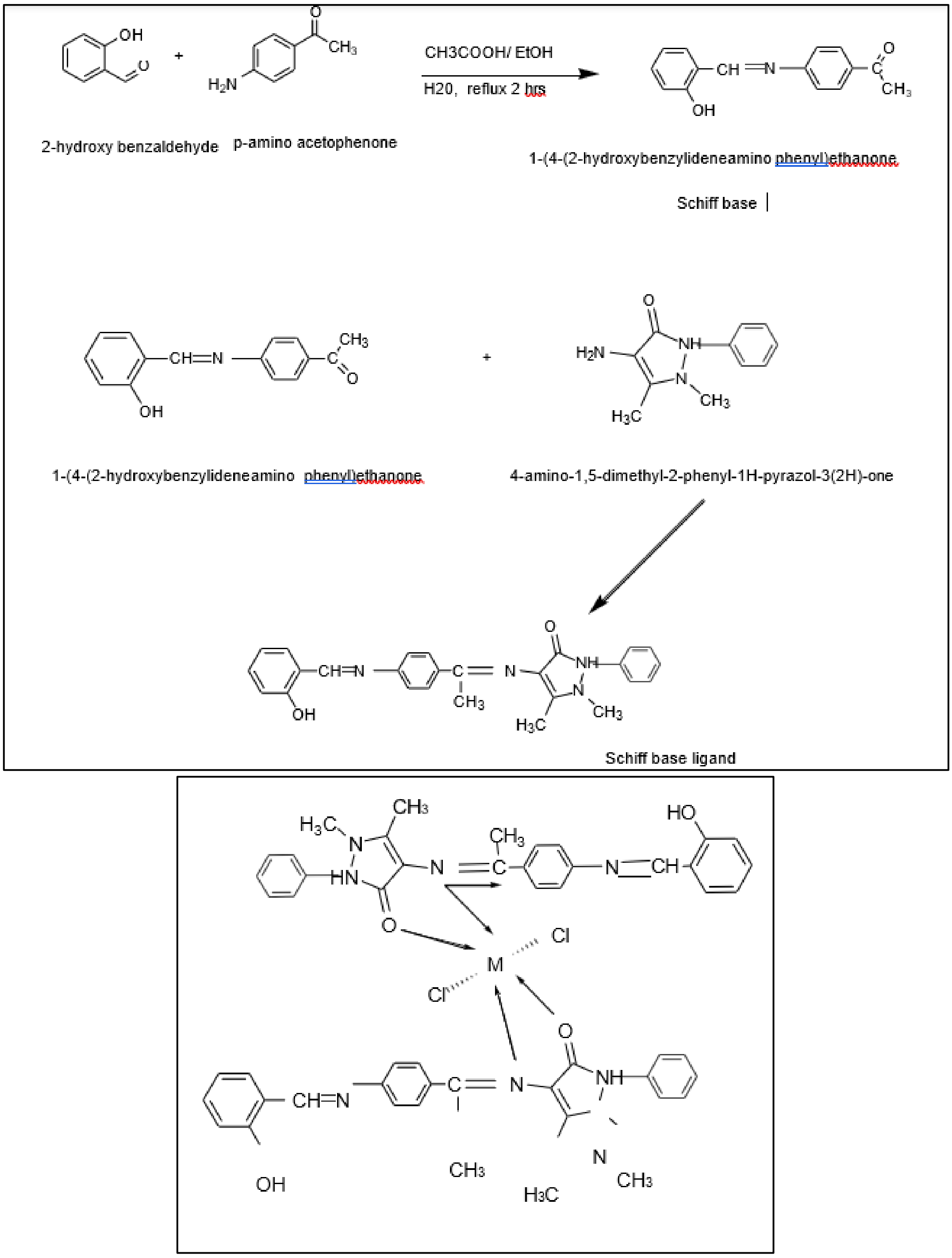
Scheme 2.18 Oxovanadium (IV) Schiff base complex

Sekaror Thiru-narayanan (2013) have stated a clear-cut manner and further yielding firm Aryl imido-imines. (E)-2-(substituted benzylideneamino)-N-(3chloro-4-fluorophenyl)-hexahydro-2Hcyclopenta[b] thiophene-3-carboxamide derivatives had been prepared through using the condensation of 2-Amino-N(three4-fluorophenyl-chloro-)-2H-c- hexahydroyclo-penta [b] thiophene-three-carboxamide and numerous substituted benzoic aldehyde using microwave irradiation inside the life of H3PO4-SiO2 catalyst underneath solvents-loose surroundings.



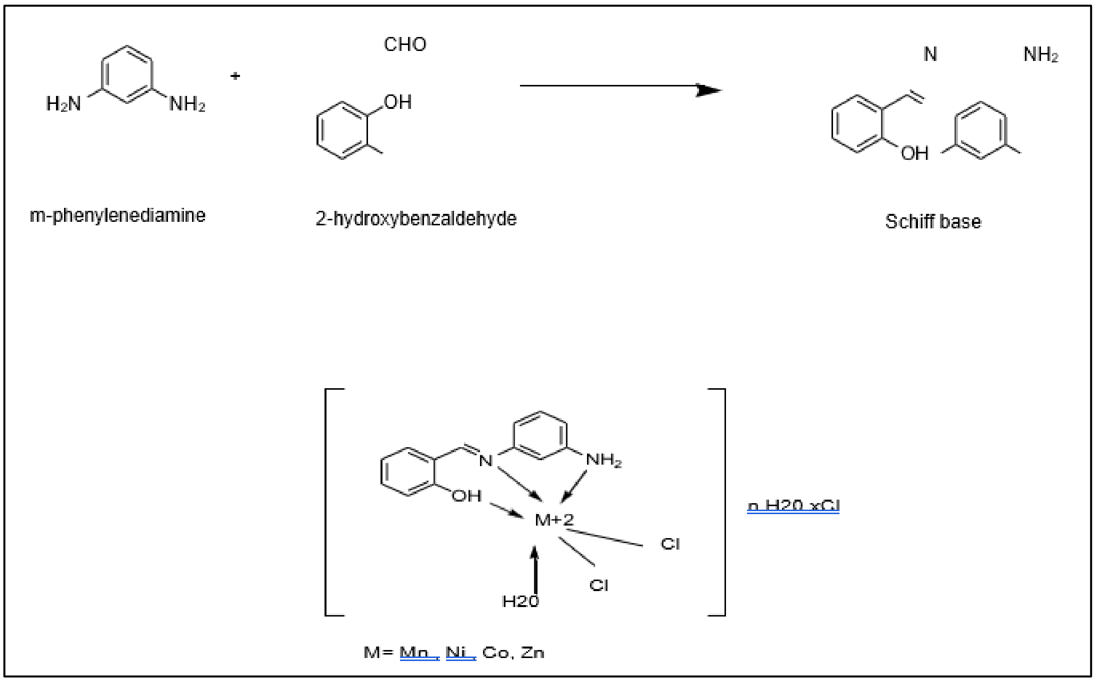
Scheme 2.19 The Synthesis of the Schiff bases

Li *et al.,* (2013) defined the production of Schiff base via the reaction of four-amino acetophenone in ethanolic solution of 2-hydroxybenzaldehyde after which adding only 2 droping of glacials acetic acids as a catalysts and reflux aggregate for 5 hours, and then cooled the resultant solution at room temperature. The resultant yellow strong precipitates then filtered washed with hexane and recrystallized in absolute ethanol. These bases and metal complexes manufactured by using dissolving 1-(4-(2-hydroxybenzylideneamino) phenyl ethenone in absolute ethanol with 3-dimethyl-four-aminopyrazol-five-one, 1-phenyl- 2, and then introduced three drops of glacial acetic acid and combination become refluxed for 8 hours. The resultant reaction aggregate was cooled with ice, then filtered and washed the yellow crystalline solid with hexane.



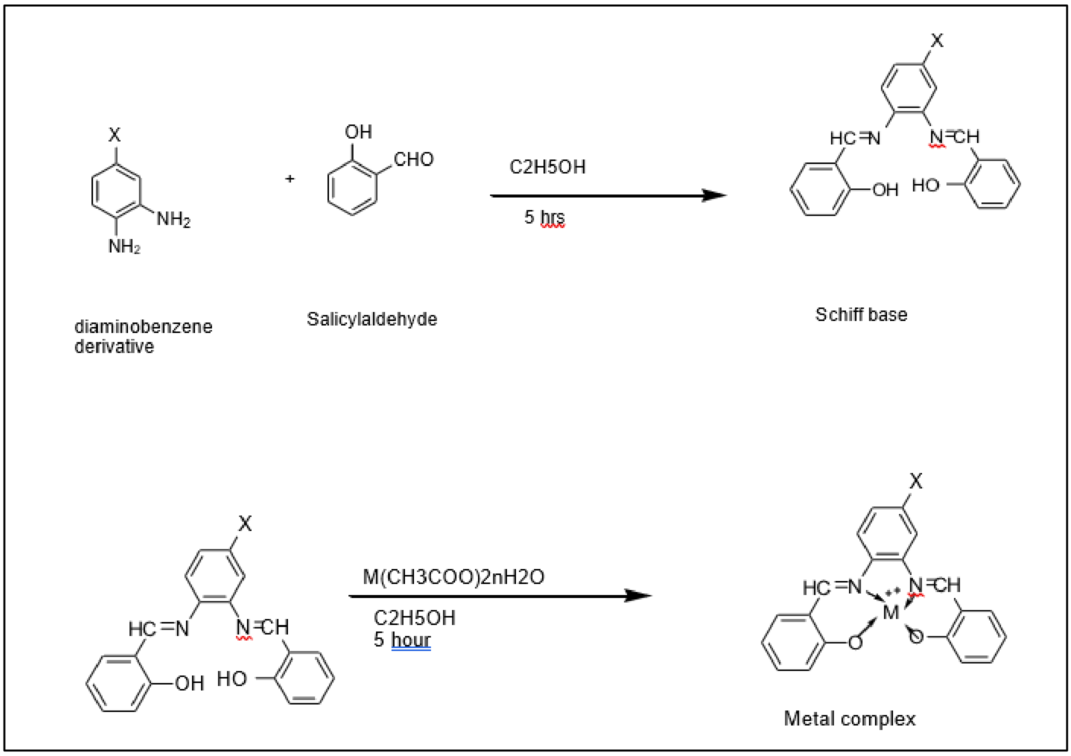
Scheme 2.20 Pathway for production of metal complexes and Schiff bases

El-Sonbati *et al.,* (2010) defined these bases ligand by way of response of 1,3 phenylenediamine with salicylaldehyde by usage of ethanol solvent. Then Schiff base metal complexes was prepared via them by using the ligand and metallic salts



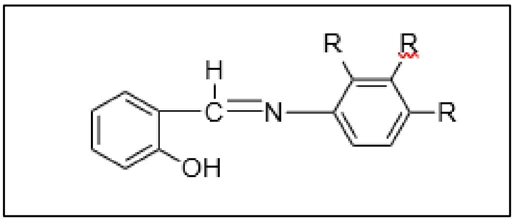
Scheme 2.21 Preparation of metal complexes and Schiff bases

Shaghazali *et al.,* (2020) described the synthesis of bidentate ligand through the reaction of ethanolic solution of Salicyaldehyde and substituted diaminobenzene spinoff at ordinary temperature for 4 hours. To the ethanolic solution of these base brought the ethanoic solution of metallic salts outcomes in the production of these metal complexes.



Scheme 2.22 Preparation of these Schiff base and its complex of metal

Talti *et al.,* (2005) stated the condensation takes place among salicyaldehyde and oaminophenol and alcohol was extensively utilized in this reaction.



Scheme 2.23 Synthesis of Schiff base

3. EXPERIMENTAL

In this chapter, we have discussed techniques and procedure which are applicable for the preparation and structure descriptions of Schiff bases and complexes of metal with the ligand.

REAGENT AND CHEMICAL USED:

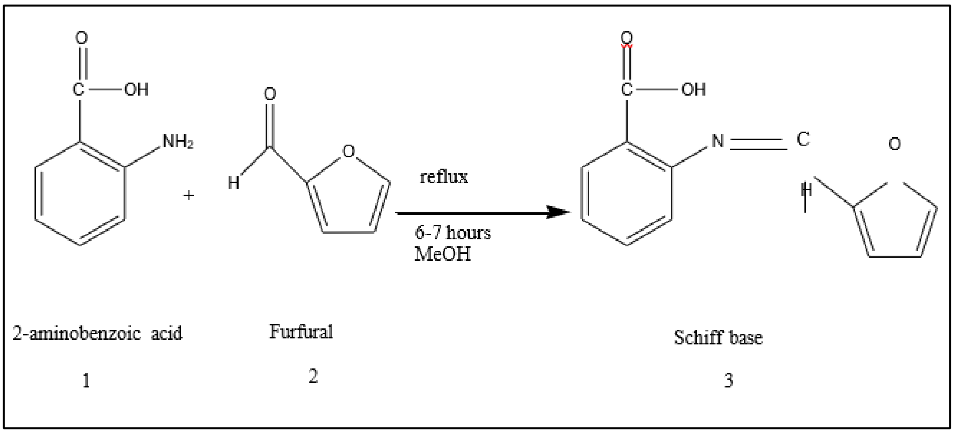
All the reagents were of synthetic grades which are applied for the formation of ligand and metal ligand complexes. The solvents used were also either pure analytical grade or purified by standard procedure.

Gallen kamp digital melting apparatus was used for melting point determination and Schimadzu IR prestige-21 FT-IR spectrometer was used for recording FTIR spectra and the progress of reactions monitored by TLC. The mobile phase employed usually were made up of n-hexane, ethyl acetate, methanol etc.

SCHEME OF WORK:

2.1 SYNTHESIS OF SCHIFF BASE LIGAND:

Equation:

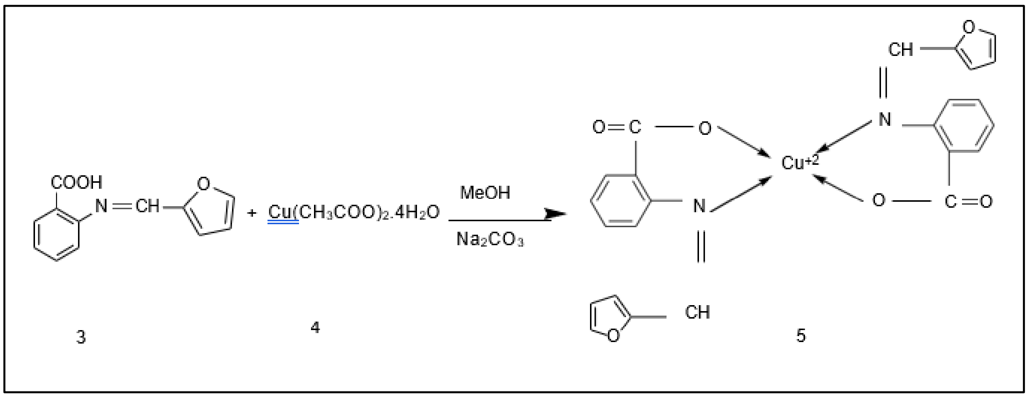


Procedure:

By dissolving anthranilic acid (0.5g, 3.64mmol) to a solution of Furfural (0.35g, 3.64mmol) in 50 ml distilled methanol in 1: 1 molar ratio in round bottom flask result in Schiff base synthesis. The mixture was allowed to reflux for 6- 7 hours with vigorously stirring. The progression of the reaction was tested by TLC. After reaction completed orange colored precipitates was appeared which was filtered off and washes the crystals with n-hexane and dried at room temperature. Ethyl acetate, n-hexane and methanol in 1:1:05 was employed as mobile phase for TLC.

2.2 SYNTHESIS OF COPPER (II) COMPLEX WITH LIGAND:

Equation:



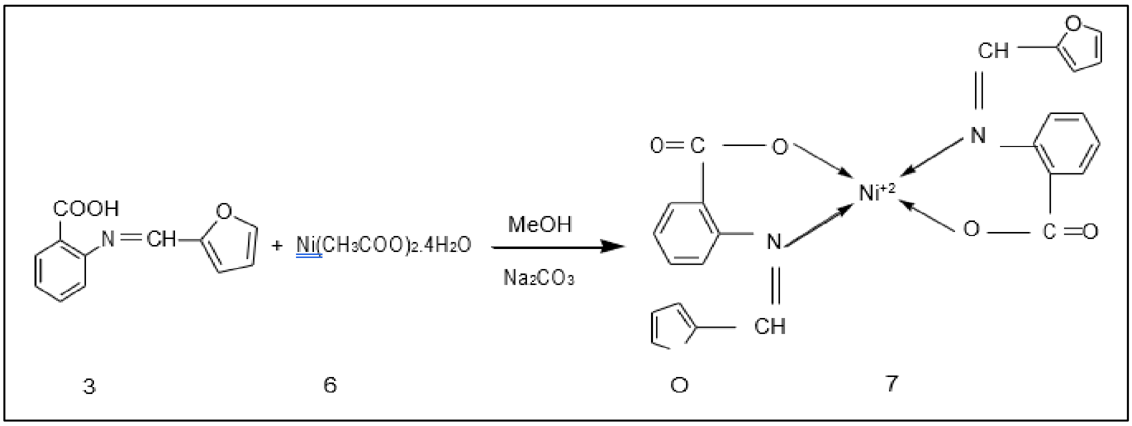
Procedure:

Schiff base ligand (0.3g, 1.39 mmoles) was placed in 20 ml of methanol. Na2CO3 (0.147g, 1.39mmoles) was dissolved in 5ml of H2O solvent and added into the reaction mixture under constant stirring. Then heat the reaction mixture at 50 ˚C. Copper acetate (0.126g, 0.69 mmoles) dissolved in 5mL methanol was added into the resultant mixture under constant stirring and the reaction mixture was allowed to reflux for 2 hours. The progress of the reaction was monitored by TLC. Dark brown colored precipitates were appeared after two hours which was filtered and then washes the crystals with n-hexane and dried.

% yield: 65% Melting point: 226 ˚C

2.3 SYNTHESIS OF NICKEL(II) COMPLEX WITH LIGAND:

Equation:



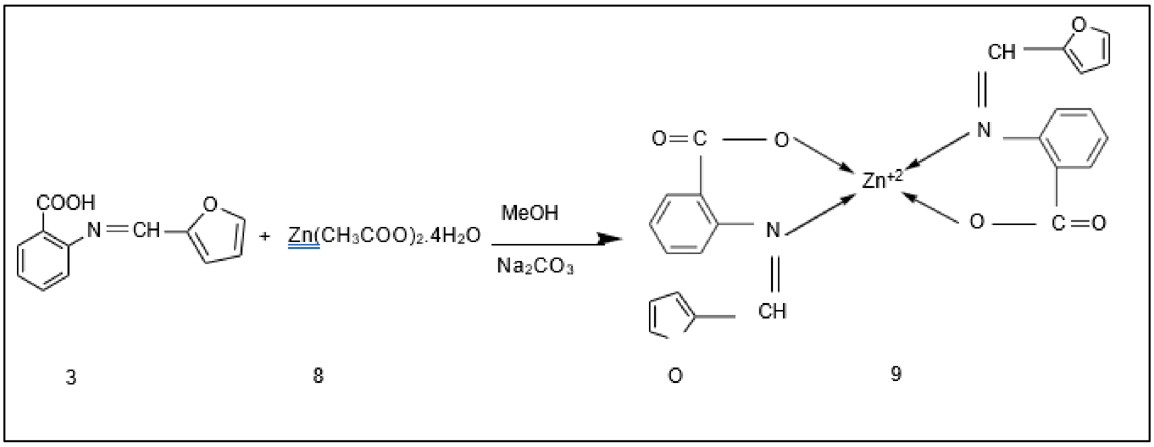
Procedure:

Schiff base Ligand (0.3g, 1.39 mmoles) was placed in 20 ml of methanol. Na2CO3 (0.147g, 1.39 mmoles) was dissolved in 5ml of H2O solvent and added into the reaction mixture under continuous stirring. Then heat the reaction mixture at 50 ˚C. Nickel acetate (0.123g, 0.69 mmoles) dissolved in 5 mL methanol was added into the reaction mixture drop wise with continue stirring and allowed the reaction mixture to reflux for 2 hours. The progression of the reaction was examined by TLC. Brownish red colored precipitates appeared after two hours which was filtered and washes the crystals with n-hexane and dried in vacuum.

% yield: 68% Melting point: 255 ˚C

2.1 *SYNTHESIS OF ZINC (II) COMPLEX WITH LIGAND:*

Equation:



Procedure:

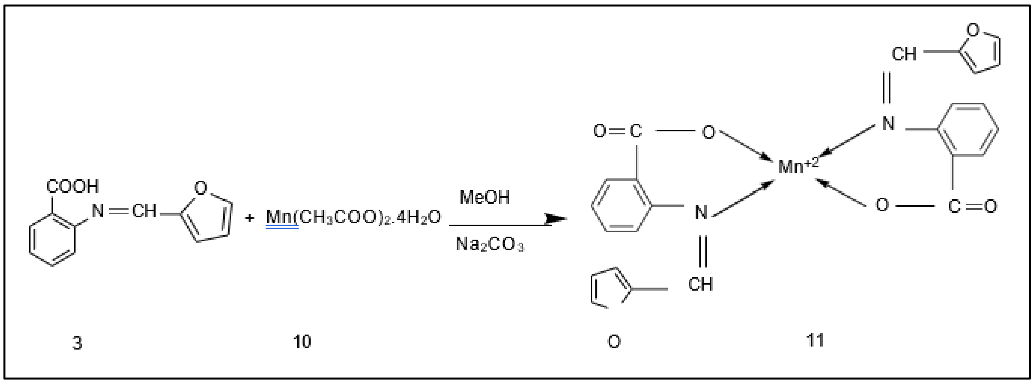
Schiff base ligand (0.3g, 1.39 mmoles) was placed in 20 ml of methanol. Na2CO3 (0.147g, 1.39mmoles) was dissolved in 5ml of H2O solvent and added into the reaction mixture under continuous stirring. Then heat the reaction mixture at 50 ˚C. Zinc acetate (0.127g, 0.69mmoles) dissolved in 5mL methanol was added into the reaction mixture drop wise with continue stirring and allowed the reaction mixture to reflux for 2 hours. The progression of the reaction was examined by TLC. After two hours off white colored precipitates was appeared which was then filtered and washes the crystals with n-hexane and dried in air.

% yield: 55%

Melting point: 288 ˚C

3.5 SYNTHESIS OF MANGANESE (II) COMPLEX WITH LIGAND:

Equation:



Procedure:

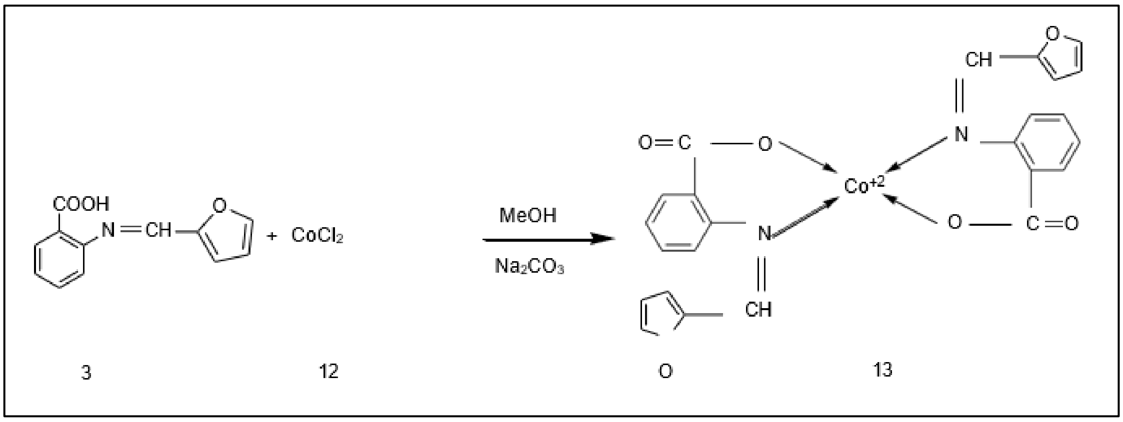
Schiff base ligand (0.3g, 1.39mmoles) was dissolved in 20 ml of methanol. Na2CO3 (0.147g, 1.39mmoles) was dissolved in 5ml of H2O solvent and added into the reaction mixture under continuous stirring. Then heat the reaction mixture at 50 ˚C. Manganese acetate (0.12g, 0.69mmoles) dissolved in 5mL methanol was added drop wise into the reaction mixture under continuous stirring and then the reaction mixture was refluxed for 2 hours. The reaction progress was examined by thin layer chromatography. After two hours orange colored precipitates was appeared which were then filtered off and washed with n- hexane and dried in air.

% yield: 58%

Melting point: 258 ˚C

3.6 SYNTHESIS OF COBALT(II) COMPLEX WITH LIGAND:

Equation:



Procedure:

Schiff base ligand (0.3g, 1.39mmoles) was dissolved in 20 ml of methanol. Na2CO3 (0.147g, 1.39mmoles) was dissolved in 5ml of H2O solvent and added into the reaction mixture under continuous stirring. Then heat the reaction mixture at 50 ˚C. Cobalt chloride (0.122g, 0.69mmoles) dissolved in 5ml methanol was added drop wise into the reaction mixture with constant stirring and the reaction mixture were refluxed for 2 hours. The reaction progress was examined by thin layer chromatography. Clay colored precipitates was appeared at the end of reaction which was filtered off and then washes it with n-hexane and dried at room temperature.

% yield: 60%

Melting point: 268 ˚C

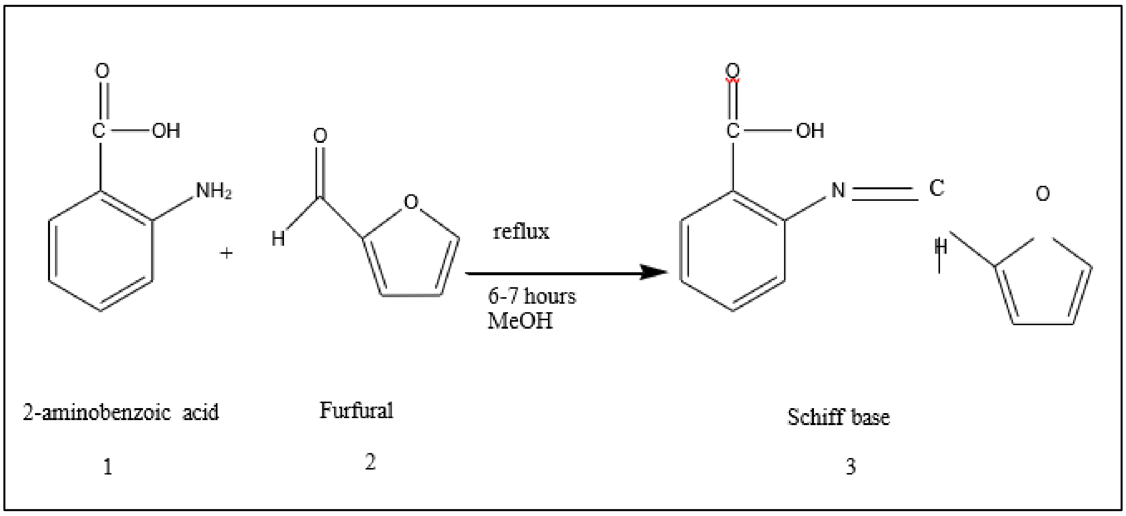
4. RESULTS AND DISCUSSION

The synthesis of new ligand and their transition metal complexes were examined and characterized by different types of physical methods and spectroscopic analysis.

ELECTRONIC SPECTROSCOPY:

The UV absorption spectrum of Schiff base and its metal complexes were taken in methanol at 25 ˚C. Higher energy bands are attributed due to π-π^* transitions in benzene ring and iminic functional group. The lower energy transitions are attributed due to n-π^* transition of nitrogen atom p-orbital lone pair in imines and benzene ring. The difference between the spectrum of ligands and coordinated complexes indicated coordination bond. Further charges changes in wavelength also supported coordination of Schiff base with metals.

4.1 SYNTHESIS OF LIGAND:



Conductivity (1mM, methanol) = 0.09 µS / cm

The small insignificant value forthcoming clearly reflected to the non-ionic in nature the ligand (L_1H) which dissolved in methanol. Almost ligands were insoluble in the water at the room temperature.

UV-Vis (λ_{max}, nm), (0.25mM)= 590(0.5344), 439(0.5298), 327(0.5106)

Two types of the n-π* and π-π* transitions absorption maximum were ultra violet regions and visible indicated whose were an consequently of the two types of electronic systems in ligand (L_1H). The λ_{max} value in were in the visible region are observed as an the expectedly in the balancing color combinations.

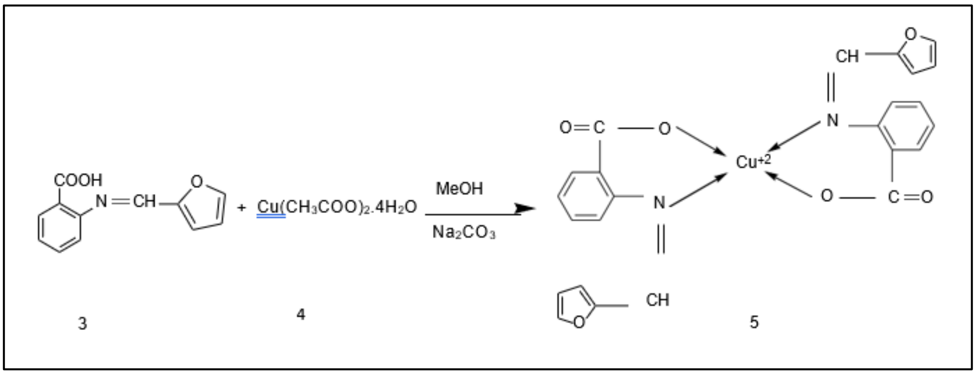
FT-IR=(cm^{-1}): 1626cm^{-1}(C=N), 1706cm-$^{-1}$(C=O) 2855cm,3105cm,
(CHaliphatic, CH aromatic) 1242cm-1 (C-C aliphatic), 1509 cm-1 (C=Caromatic).

Melting points and IR results indicated the formation of new compound. The disappearance of peak of NH_2 of anthranilic acid at 3240 cm^{-1} and appearance of C=N peak at 1626 cm^{-1} indicate the formation of Schiff base (3), an imine. A band at 1706 cm^{-1} is assigned to C=O stretching frequency in the spectrum of Schiff base, the stretching frequency of aromatic C=C and aliphatic C-C groups present at 1509 cm^{-1} and 1242 cm^{-1}, and the peaks at 3105 cm^{-1} and 2855 cm^{-1} assigned the stretching frequencies of $CH_{aromatic}$ and $CH_{aliphatic}$ respectively.

SYNTHESIS OF M-L COMPLEXES

4.2 SYNTHESIS OF COPPER METAL COMPLEXES WITH LIGAND:

Equation:



Melting point: 226 °C

Physical appearance: Dark brown powder

Conductivity (1mM, MeOH and DMF) = 0.20µS / cm

The complex of Cu were seemed to be non-ionic in nature predicted very minimum amount of conductivity values of 1mM solutions.

UV-Vis (λ_{max}, nm) (0.25mM)= 610 (0.1141), 459 (0.1281), 438 (0.1312), 337 (0.1213).

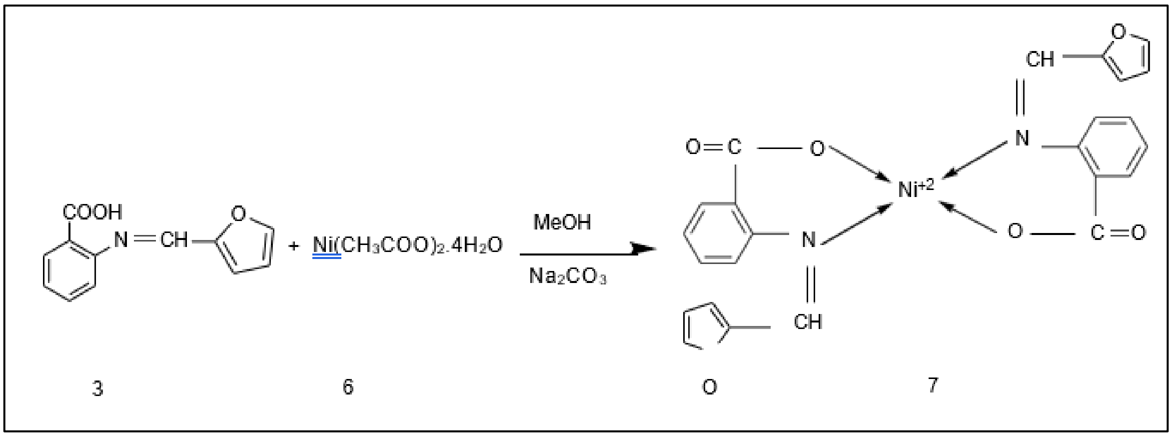
Two types of the n-π* and π-π* transitions absorption maximum were ultra violet regions and visible indicated whose were consequently of the two types of electronic systems in ligand (L_1H). The λ_{max} value in were in the visible region are observed as an the expectedly in the balancing color combinations.

FT-IR= (cm^{-1}): 1598 cm^{-1} (C=N) 1653cm^{-1} (C=O) 475 cm^{-1} (Cu-N) 556 cm^{-1} (Cu-O)

Melting point and IR results have been supported the formation new proposed Cu complex. The peak at 1626 cm^{-1} assigned to C=N shifted to lower wave number 1598 cm^{-1} indicated the involvement of iminic N in chelation. The peak at 1706 cm^{-1} which is assigned to C=O is shifted to lower wave number at 1653 cm^{-1} in metal complex. The shifting of this band to lower region indicates the involvement of oxygen atoms from the hydroxyl group of COOH, which bonds with the metal ions. Further appearance of peaks at 475 cm^{-1} and 556s cm^{-1} is of Cu-N and Cu-O bonding in complex formation.

4.3 SYNTHESIS OF NICKEL METAL COMPLEX WITH LIGAND

Equation:



Melting point: 255 ˚C

Physical appearance: Brownish red

Conductivity (1mM, MeOH and DMF) = 0.04µS / cm

The complex of Ni were seemed to be non-ionic in nature predicted very minimum amount of conductivity values of 1mM solutions.

UV-Vis (λ_{max}, nm) (0.25mM) = 625 (0.4039), 458 (0.0717), 323 (0.0903).

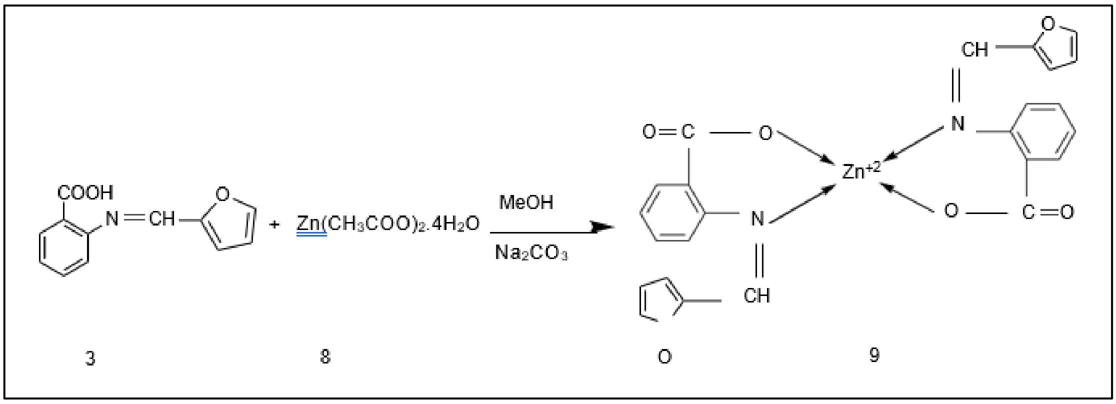
Two types of the n-π* and π-π* transitions absorption maximum were ultra violet regions and visible indicated whose were an consequently of the two types of electronic systems in ligand (L_1H). The λ_{max} value in were in the visible region are observed as an the expectedly in the balancing color combinations.

FT-IR= (cm^{-1}) : 1586 cm^{-1} (C=N) 1663 cm^{-1} (C=O) 467 cm^{-1} (Ni-N) 548 cm^{-1} (Ni-O)

Melting point and IR results have been supported the formation new proposed Cu complex. The peak at 1626 cm^{-1} assigned to C=N shifted to lower wave number 1586 cm^{-1} indicated the involvement of iminic N in chelation. The peak at 1706 cm^{-1} which is assigned to C=O is shifted to lower wave number at 1663 cm^{-1} in metal complex. The shifting of this band to lower region indicates the involvement of oxygen atoms from the hydroxyl group of COOH, which bonds with the metal ions. Further appearance of peaks at 467 cm^{-1} and 548 cm^{-1} is of Ni-N and Ni-O bonding in complex formation.

4.4 SYNTHESIS OF ZINC METAL COMPLEX WITH LIGAND

Equation:



Melting point: 288 ˚C
Physical appearance: off white
Conductivity (1mM, MeOH and DMF) = 0.24µS / cm

The complex of Zn were seemed to be non-ionic in nature predicted very minimum amount of conductivity values of 1mM solutions.

UV-Vis (λ_{max}, nm) (0.33mM) = 618 (0.4339), 439 (0.4076), 333 (0.1510).

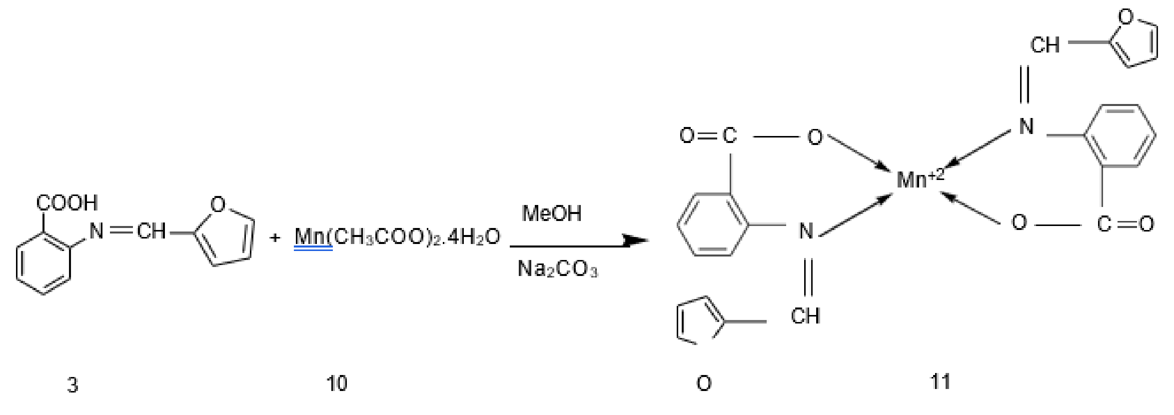
Two types of the n-π* and π-π* transitions absorption maximum were ultra violet regions and visible indicated whose were an consequently of the two types of electronic systems in ligand (L_1H). The λ_{max} value in were in the visible region are observed as an the expectedly in the balancing color combinations.

FT-IR= (cm^{-1}): 1600 cm^{-1} (C=N) 1658 cm^{-1} (C=O) 472 cm^{-1} (Zn-N) 556 cm^{-1} (Zn-O)

Melting point and IR results have been supported the formation new proposed Cu complex. The peak at 1626 cm^{-1} assigned to C=N shifted to lower wave number 1600 cm^{-1} indicated the involvement of iminic N in chelation. The peak at 1706 cm^{-1} which is assigned to C=O is shifted to lower wave number at 1658 cm^{-1} in metal complex. The shifting of this band to lower region indicates the involvement of oxygen atoms from the hydroxyl group of COOH, which bonds with the metal ions. Further appearance of peaks at 472 cm^{-1} and 556 cm^{-1} is of Zn-N and Zn-O bonding in complex formation.

4.5 SYNTHESIS OF MANGANESE METAL COMPLEX WITH LIGAND

Equation:



Melting point: 258 ˚C
Physical appearance: orange colour
Conductivity (1mM, MeOH and DMF) = 0.22µS / cm

The complex of Mn were seemed to be non-ionic in nature predicted very minimum amount of conductivity values of 1mM solutions.

UV-Vis (λ_{max} , nm) (0.50mM) = 604 (0.1339), 429 (0.4076), 319 (0.1510).

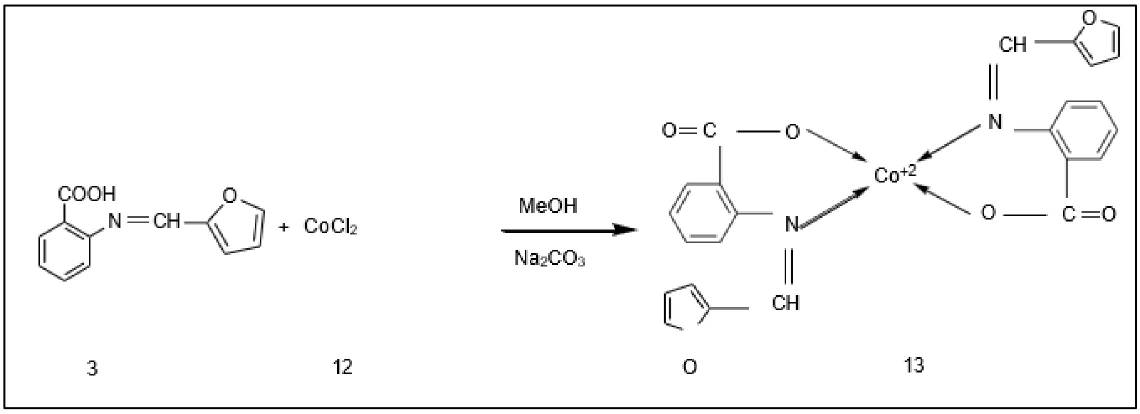
Two types of the n-π* and π-π* transitions absorption maximum were ultra violet regions and visible indicated whose were an consequently of the two types of electronic systems in ligand (L_1H). The λ_{max} value in were in the visible region are observed as an the expectedly in the balancing color combinations.

FT-IR= (cm^{-1}) : 1586 cm^{-1} (C=N) 1653 cm^{-1} (C=O) 461 cm^{-1} (Mn-N) 558 cm^{-1} (Mn-O)

Melting point and IR results have been supported the formation new proposed Cu complex. The peak at 1626 cm^{-1} assigned to C=N shifted to lower wave number 1586 cm^{-1} indicated the involvement of iminic N in chelation. The peak at 1706 cm^{-1} which is assigned to C=O is shifted to lower wave number at 1653 cm^{-1} in metal complex. The shifting of this band to lower region indicates the involvement of oxygen atoms from the hydroxyl group of COOH, which bonds with the metal ions. Further appearance of peaks at 461 cm^{-1} and 558 cm^{-1} is of Mn-N and Mn-O bonding in complex formation.

4.6 SYNTHESIS OF COBALT METAL COMPLEX WITH LIGAND

Equation:



Melting point: 268 ˚C
Physical appearance: Clay colour
Conductivity (1mM, MeOH and DMF) = 0.17µS / cm

The complex of Mn were seemed to be non-ionic in nature predicted very minimum amount of conductivity values of 1mM solutions.

UV-Vis (λ_{max} , nm) (0.50mM) = 612 (0.4376), 397(0.0968), 333(0.2917)

Two types of the n-π* and π-π* transitions absorption maximum were ultra violet regions and visible indicated whose were consequently of the two types of electronic systems in ligand (L_1H). The λ_{max} value in were in the visible region are observed as the expectedly in the balancing color combinations.

FT-IR= (cm^{-1}): 1575 cm^{-1} (C=N) 1663 cm^{-1} (C=O)
478 cm^{-1} (Co-N) 553 scm^{-1} (Co-O)

Melting point and IR results have been supported the formation new proposed Cu complex. The peak at 1626 cm^{-1} assigned to C=N shifted to lower wave number 1575 cm^{-1} indicated the involvement of iminic N in chelation. The peak at 1706 cm^{-1} which is assigned to C=O is shifted to lower wave number at 1663 cm^{-1} in metal complex. The shifting of this band to lower region indicates the involvement of oxygen atoms from the hydroxyl group of COOH, which bonds with the metal ions. Further appearance of peaks at 478 cm^{-1} and 553 cm^{-1} is of Co-N and Co-O bonding in complex formation.

CONCLUSIONS

Schiff Base Ligands are mostly dominated in the Coordination Chemistry for its chlelating ability and complexing ability along the Transition metal ions. In the Biological field the Schiff base complexes have wide applications. Over the past few years, due to their numerous biological applications, Schiff bases along with Transition metal complexes have gained a lot of interest and potential for usage in the development of medicines. But still some efforts are needed to synthesize new complexes of Transition metals and ligands.

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