There has been a phenomenal growth in technology since World War II and rapid strides had necessary to be made in the sciences to meet the requirements of new materials with specific properties, in order to meet the demands of growing technology. This often led to discoveries on the borders of different disciplines, which subsequently resulted in the developments of investigation of inter-disciplinary interests during this period, inorganic chemistry underwent a renaissance and the frontiers of the substituted began expanding. The chemistry of polymer, which had by now already advanced study of new class of compounds known as inorganic polymers.

Polymer in general can be defined as a substance in which many structural units are connected by valance bonds in any possible way on the basis of this definition, inorganic polymer would include a variety of substances, like mortar, natural silicates, quartz, Polyphosphates, polyphosphazenes, glass, diamond, graphite, polymeric boron nitride, sulphur nitrides, silicones and even ionic crystal aggregates like sodium chloride. Various organometallic and metal organic substances are often included in inorganic polymers in fact the oldest of all synthetic polymer was a simple also silicates glass used during the Buddelian period in Egypt (Ca 1200 BC) used as glaze in organometals amulets and beads. Subsequent improvements in glass manufacture continued through centuries and reached a stage of perfection [1] during the time of Tutankhamen (1300 B.C.). The next major discovery in the area of inorganic polymers occurred about 3600 years later when Thomas Graham [2] published an account of obtaining sodium polyphosphates both in crystalline and amorphous forms.

The terms coordination polymer includes a variety of substances and in general can be defined as a macromolecules entity involving a metallic element, which forms an integral part of the backbone. Coordination polymer [3] also known as metal-organic coordinate networks (MoC₅) or metal organic frameworks (MOFs) are metal ligand compounds that extend "Infininly" in to one, two or three dimension
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(1D, 2D or 3D) respectively, via more or less covalent metal-ligand bonding [4]. The ligand must be a bridging organic group. At least in one extended dimension the metal atoms must solely be bridged by this organic ligand. Furthermore at least one carbon atom must lie between the donor atoms. In finite metal ligand, assemblies where the metal-organic connectivity is interrupted by "Inorganic "bridges such as -(R)O-, -Cl-, -CN-, -N₃-, -(R,O)PO₃- and -(R,O)SO₃- or where an extend inorganic metal-ligand network is lined by only terminal organic ligands are called organic-inorganic hybrid materials [5]. It is the bridging organic ligands which allow for the large diversity in the topologies and possible properties of the metal-organic coordination networks.

Recently considerable interest has been created to obtain polymer in which the molecular skeleton is formed by the co-ordinate links through metal ion or atoms. These are termed as "Co-ordination polymers" which have been prepared by the interaction of metal ion and organic ligands. These co-ordination polymers are often called as chelate polymers or polychelates, when polymerization takes place through chelate loop formation. Many of these compounds show a thermal stability much higher than that of the organic substrate, employed as ligands in the synthesis of metal complexes. Ballar [6] has outlined the various factors that must be taken into account developing suitable co-ordination polymers.

Polymer mainly divided into two classes viz, inorganic and organic polymer. Inorganic polymer are non-metallic derivates, various organometallic and metal organic substances are often included in inorganic polymers. The inorganic polymers are thermally stable and hence are suitable for withstanding high temperature [7-15]. Moreover they are stronger, harder, usually insoluble and brittle, on the contrary organic polymer because of their high viscosity, plasticity and long-range elasticity are useful for their applications in technology. Lack of thermal stability and inflammability of these polymers are great disadvantages. Coordination polymers offer academic interest and at the same time provide materials of desired and superior qualities, which promise a variety of applications. Systematic study of co-ordination polymer, which

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was instigated reactions nearly five decade ago, is now attracting the attention by the scientist on undergoes a spectacular growth during the last few years. Recently much attention has been paid to inorganic elements as possible units are of component consists of co-ordination polymer in which metal ion is surrounded by di or polyfunctional organic ligands, co-ordination inorganic occupies an intermediate position between organic and inorganic polymer and it hoped that their study will lead to be production of desirable material such as thermally stable and semiconductor etc.

When a coordination polymer is used as general term, it covers a wide group of compounds including polynuclear complexes and polymeric metal salts. Casually these polymers can be divided into two categories i.e. polymer derived from a ligand having a) a pair of donor groups and b) two pairs of donor group. Coordination polymers of type(b) are of great interest both from applied as well as academic point of view and are often termed as chelate polymers.

It has been proposed that a large measure of stability is gained through resonance energy while designed coordination polymers and thus it is desirable to preserve and if possible enhance the resonance features. These features are found to be presented in chelate polymers as polymerization with the additional ring formation. Specially these are predominant in polymers originated from ligands having conjugated double bond system and having aromatic rings in their structures. Against this background, it can be said that the chelate polymers are the most widely investigated class of coordination polymers.

Mostly inorganic polymers are heterochain structures. Inorganic homo-chain polymers are formed by elemental closely situated to carbon in the periodic table. The structure of both and hero-chain inorganic polymers are dependence upon valancy of the element forming the chains. Formation of a long chain polymer may be expected for a ligand with a two chelating sites, which form steric reasons cannot interact with same metal ion. Structure formed depending upon the nature of ligand and co-ordination characteristic of metal ion. The large number of chelating
ligands containing different functional group have been reported in the literature [15-19]. Metal in the co-ordination polymer expected to contribute to, thermal stability, electrical and thermal conductivity, where as organic portion would supply toughness fabricability properties and necessary for practical utility [20]. It may be possible to enhances the biologically important properties in co-ordination polymer using bio-ligand coordinating polymer using bioligand coordinating with metalionion-metalloenzyme is kinds of polymer metal complexes which is biologically importance in which metal ions is surrounded by a giant protein molecules.

Although there are some soluble polymers reported in the literature, most of the co-ordination polymer are highly insoluble in almost all-organic solvent and are poorly characterized in terms of molecular weight, structure and level of purity [21-23]. However attempts are continuously being made to modified the property of co-ordination polymer by varying their degree of polymerization or by introducing some soluble component in the structure to formed a linear co-ordination polymer of high molecular weight.

**Synthesis of co-ordination polymers**

There are three principle categories of inorganic reactions, which lead to the formation coordination polymers. i.e. a) Reactions which involve the elimination simple molecules b) Addition reactions in which the monomeric low molecules weight units are caused to react with themselves to yield polymeric products and c) Coordination polymeric process which although frequently classified under both condensation and addition polymerization, are sufficiently distinctive to warrant separate treatment.

Syntheses of co-ordination polymers mainly depend upon characteristic of metal ion and nature of ligand. In many cases metal ion is pendent to main polymer chain while in some cases metal ion is integral part of the polymer. It may act as cross-linking agents or enmeshed in a part of polymer [24]. The synthesis of co-ordination polymer is usually achieved by one of the following procedures.
A) Formation through complexation of polymeric ligand with metal ion.

The reaction of the polymer ligand with metal ion or metal complex usually results in various co-ordination structures as follows.

1) Pendent complexes:
   a) Monodentate pendent complexes:

   Formation taking place when a metal ion or metal complex has only one labile ligand which is easily substituted by a polymeric ligand and when other co-ordination sites are substitution inactive. The complex formed has a simple structure of monodentate type.

   

   

   b) Polydentate pendent complexes: Formed when a polymer pendant co-coordinating group has a polydentate structure.

   

   This type of complexes however is sometime considered to be accompanied with bridge structure.

2) Insertion of transition metal ion into polymer ligand:

   Such type of metal polymer synthesis involves the insertion of metal ion into an already existing polymeric ligand, which contains coordinating group or atom (mainly nitrogen, oxygen or sulphur).

   

   

   \[ 
   [ \begin{array}{c} \text{L} \\ \text{L} \\ \text{LY} \\ \text{LY} \end{array} ]_n + n\text{MX}_2 \rightarrow [ \begin{array}{c} \text{L} \\ \text{L} \\ \text{M} \\ \text{L} \end{array} ]_n - n\text{XY} \]
3) Inter and Intramolecular Bridging:

The reaction of polymer ligand with metal ion very often results in inter, and intramolecular bridging polymer.

\[ \text{L L L L L} + nM \rightarrow \]

B) The chain linked through complexation of bifunctional ligand with metal ion.

Weaker noncovalent interactions, such as hydrogen bonding or \( \pi-\pi \) stacking are important for packing of the one dimensional chains, two dimensional nets and three-dimensional frameworks. However the multi-dimensional para molecular architectures of metal complexes which are created by purely hydrogen bonding. Metallomacrocycles metallosuper pramolecular cubes, cages or capsules, metalloctcnanes, coordination clusters or helicates may be large metal–ligand assemblies, yet they are still finite super-molecular metal–ligands complexes.

\[ \text{L M E C E M L} \]

Coordination Polymers

\[ \text{L M E C E M E C E M L} \]

Organic–Inorganic hybrid materials
(Bridging organic and Inorganic ligands)
(Bridging Inorganic and terminal organic ligands)

Hydrogen bonded Frame works

A metal complex may yield polymer material during its formation due to favorable donor groups. Bis-chelating ligand co-ordinate with metal ion in number of ways as follows.

1) One dimensional or linear co-ordination polymer:
   When bi-functional ligands form a complex with metal ions having more than two labile ligands, which are easy to be substituted, a polymer complex is formed through metal ion bridging.

   \[
   HL + n \text{M} \rightarrow \text{M} \left( \ldots \text{L} \ldots \text{L} \right)^n
   \]

2) Two dimensional or planer network or film of co-ordination polymer:
   When metal ion coordinated with three different ligands a two-dimensional lattice structure will be obtained.

   \[
   \left[ \ldots \text{L} \ldots \text{L} \right]^n
   \]
3) **Three dimensional coordination polymer:**

Co-ordination of each metal ion with four different ligand molecules can lead to three dimensional co-ordination polymers.

Octahedral chelations of metal ion with bis-chelating ligand also yield three dimensional co-ordination polymers.

C) **Formation through polymerization of metal complexes:**

The synthesis of the class of polymer is usually achieved by one of the following scheme.

i) This scheme describes the polymer synthesis involving polycondensation of monomeric chelate containing group with other organic molecule.

\[
X - M - L + n Y - R - Y \rightarrow -XY \rightarrow X - [M - L - R]_n
\]

ii) This type of co-ordination polymer scheme help to open the double bond in the metal complexes example vinyl compounds of metal complex are polymerized giving polymer metal complex.
iii) A metal complex act as bridge ligand giving a polymeric structure.

CHARACTERIZATION OF COORDINATION POLYMERS

The traditional method of characterization can not generally be applied to inorganic polymer since the majority of them are insoluble. Much attention has been given to characterizing of insoluble polymers only the solid state and the melt properties can help to deduce their structure significant contribution in developing techniques for characterization cross-linked polymers have been made by polymer technologists and energies DTA, high temperature viscosity measurements, vibrational spectroscopy the recently $^1$H NMR and X-ray scattering have yielded valuable information on structure and bonding on organic polymers.

Co-ordination polymers, which is either formed by reaction of polymeric ligand with metal ion or by bis-chelating agent with metal ion or by poly condensation of monomeric metal chelate, complex has been studied mainly by element analysis, IR, reflectance spectra, $^1$H NMR, magnetic, thermal analysis, electrical conductivity and catalytic activity studies etc.
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It is observed that high insolubility of co-ordination polymer in almost all organic solvent is the major reason that the molecular weight question cannot be answered by more conventional polymer technique [9]. Even today a great deal of research work is being carried out for assured the method for the determination of molecular weight, however in few cases molecular weight has been reported by various techniques such as osmometric [25-26] untracutrifugation [27] radioactive, end group technique [28] and vapour pressure osmometry studies [29-31].

Chelate polymer absorb electromagnetic radiation from almost all region of the spectrum which may recorded by appropriate commercial instruments. However the cosmic and gamma rays are highly energetic and considered to destructive for routine characterization. The X-rays and ultra violet radiation have been used for the characterization while the low energy microwaves are used as an energy source in nuclear magnetic resonance spectroscopy. The infrared region is externally important in spectroscopic studies [33-34].

In polymers the infrared spectrum confirm is often surprisingly simple considering the large number of groups involved. This simplicity result first from due the fact that many of the normal vibration have almost the same frequency and therefore appear in the spectrum as one absorption band and second from the to stick selection rules, that prevent many of the vibrations from causing absorption. Observations of langs wavelengths say, far infrared given valuable information.

Perhaps no field of polymer analysis has so rapidly expanded in recent years as that of thermal analysis. A systematic study of thermal behaviour of chelates provides information about the thermal stability, presence of water molecules, decomposition temperature and the nature of degradation products obtained at different temperatures. In addition to the traditional calorimetric and different analysis, the field how includes equipment and efficient gas analysis .Not only that it helps to but also to study of wide variety of response of the system to temperature including polymerization degradation or other chemical changes. Hankare et al. [32] have studied the thermal analysis of co-ordination complexes of Cu[II] and
Fe[II] with coumarium and reported thermally stability and hydrolytic stability along with thermal activation energy.

The crystal structure of the polymer is usually determinate by X-ray pattern it's the periodicity of molecular structure of the polymer is characterized by the existence of a repeat unit, so the periodicity if its crystal is characterized by repeat distance. The diffraction pattern of the polymers do not provide sufficient information to allow such analysis to be carried to complexation. Recently, Narang et al. [111] structurally characterized linear co-ordination polymer contains Y [II] La [II] Pd [II] and salicyladehyde benzoyl hydrozone by using single crystal X-ray diffraction method. So as to determine the structure of complex and Ni[II] complexes derived from N[(2,pyridyl) ethylidene]morpholine-4N[1(2,pyridyl)ethylidine]morpholine-4-carbo-thiohydrazide respectively a diamond shape structure.

Magnetic studies of the polymer provide useful information of the structure and electronic factors that govern spin exchange phenomena [29]. The determines of magnetic exchange coupling between paramagnetic metal center has been practically useful in the structure of chelates.

Like other materials chelates polymers may also be characterized by visual inspection but more objective tests are essential for more precise characterization of the polymers. Considerable information on chelate polymer structure may be obtained by chemical test. Hassan and Wills et al. [34] have described many chemical tests for obtaining information on chelate polymers. Further the elements analysis helps to propose the corporation of the chelate polymer.

APPLICATIONS OF COORDINATION POLYMERS

As chelates polymer are thermally stable, planning of their applications to high temperature problems can be numerous. Insolubility and low plasticity of these polymers stand in the way of their being useful for many particle purposes. Nevertheless, considerable numbers of useful materials have been synthesized.
1) **Semiconducting materials**:

Coordination polymers were used as organometallic semiconductors. The metal containing polymers were used as a conductor and superconductor. Electrical conducting polymer containing iron was reported where an important suggestion has been given for increasing the electrical conductivity of the polymer, which has to be doped with iodine. The conducting increase from $1 \times 10^{-6}$ $\Omega^{-1}$ cm$^{-1}$ for [Fe(II)(PC)(U-Pyz)] to $2 \times 10^{-1}$ $\Omega^{-1}$ cm$^{-1}$ for [Fe(PC)(U-Pyz)]. Electrical conductivity of polymer continues to be one of the most important research areas in materials science [35] conductivity is not the prime focus of research in coordination polymers as short inorganic bridges regarded for a good conductivity in extended metal–ligand structure [36] one dimensional coordination polymers constructed from stacked macromolecular metal complexes of the type $[M(L')(U-L')]$ ($M=$Fe,Ru,Os, $L=$octaethylporphyrinate, phthalocyninate. $L'=$Py2,4,4'-bipy) have been examined for their conductivity. The conductivity of 1D coordination polymers depends on the interaction of the metal d orbital with the $\pi^*$ level of the bridging ligand. Conductivity is greater for better $\pi$ bonding metal and for more $\pi$ acidic ligands (lower lying $\pi^*$orbital). Coordination polymer find an interesting application as semiconducting materials, various review [37-45] which deals with semiconducting and conductivity properties of polymeric complexes are reported by Patel, et.al [43].

2) **Catalyst**:

The porous nature of some coordination polymers and presence of possibility catalytically active transition metal centers is seen as in basis of size and shape selective catalytic application of such materials. Chelates resins prepared from the reaction of nitrile group. Containing resin, amine compounds containing primary or secondary amino groups and chelates forming agents were reported as catalytic. Enansioselective epoxidation using chiral Mn. (III) has become a useful preparative method in organic synthesis [46]. Several researchers have investigated the immobilization
of the catalyst-on polymer support. Sivaram and Dhal [47] reported a preparation and application of the polymer-supported chiral Mn (III) complexes as catalytic. A polymer bound scandium catalyst was used to promote alligation of a range of carbonyl compound in aqueous and organic solvents [48].

The catalytic activity of the coordination polymers for various oxidation and reduction reaction and petrochemical reaction have been reported in a number of reviews [50-52]. Epoxidation of 2-en-1-ol was studied with good yield (79%) of the product [49]. Successful oxidation of alcohol has been achieved using polymer supported Cr and Ce catalyst in presence of t- Buto-OH [49]. Polymer bound Pd catalyst for cross coupling reactions has been studied. The two dimensional square network materils [Cd(NO₃)₂ (4,4′-bipy)₂]₉₉₉ catalyzes the cyanosilylation of aldehydes. No reaction took place with either Cd(NO₃)₂ or 4,4′-bipy done. A shape specificity towards the aldehyde was manifested in product yield and ascribed to the activity size of the network [53].

3) Coating materials:

Coordination polymer finds numerous applications in the coating industry in the form of paints, varnishes, lacquers, water base paints etc. Application of aqueous dispersions of polymer ranging from primers for automobile frames to exterior paints. In the literature, several patents are devoted to coating applications of poly (β-dicarbonyl) coordination polymers. A clear and hard film is obtained when poly (allylacetoacetate) is cross-linked by chelates exchange with tri (methylsalicylate) beryllium upon air drying or backing at 120°C [54]. The formation of polymer coating of thickness 5x10⁻⁶ to 3x10⁻⁵ cm have been reported to form when metallic sheets of copper, iron and nickel were heated in vapours of teteracyanoethylene at 150-400 °C for 5-10 hours[55].

4) Chirality:

With chirality being an element of life there is also interest in the formation of chiral coordination polymer. It is expected that chiral super
molecular architectures could play a role in optical devices chiral microporous materials are envisioned for enantiomer separation or chiral synthesis [56]. Examples for enantiomer separation using porous chiral frameworks are described under porosity zeolite behavior [57-58]. Examples of chiral non-racemic helical coordination polymers have been reported where the chirality is included by a stereogenic center of an enantiometrically pure ligand.

5) Biological and medicinal importance:

Coordination polymer find versatile applications in the field of medicine since a long time. Thiosemicarbazides and thiosemicarbazones have gained special attention due to their activity against protozoa [59], influenza [60], small pox [61], malaria, cancer [62] and tuberculosis. They are found to be more effective than deferroxamine in reducing tissue iron levels in the patients with cooley a naemia [63]. Some chelate polymers are also reported to have in controlling the antitumor activity in symphocytic leukemia test system in mice.

The fungicidal activity of these compounds is due to their ability to form chelates with the essential metal which the fungus needs in its metabolism [64]. The heterocyclic thiosemicarbazones as well as their metal complex passes potentially beneficial biological activities such as antitumour, antibacterial, antiviral, antifungal and antimalerial properties [65-67]. The application of Schiff base metal complex as biological agents have been the subject of many recent studies [67-72]. Recently Perer et al [68-69] reported cytotoxic activity of some thiosemicarbazones against pam-ras cell and ras transformed cells.

6) Dyes:

The fascinating bright and vivid colours of the coordinating polymer provoke their use as dyes. In earliest attempts poly (metal-phthalocyanamines) have been used as dyes [73-74]. These polymers were sulphonated to impart water solubility. The direct preparation of thin film of metal phthalocyanines on substance has been patented [75]. Inorganic
coordination polymers are useful as lubricants stabilizers and fire retardants. Inorganic polymer models were constricted from polyurethane sheet and then painted to yield a useful teaching aid in representing the three dimensionality of structures. For such types of inorganic and organic materials, an approach for exploring magnetic polymers were also reported. In literature, reviews were presented showing many references to identify inorganic-polymers with potential use as matrix resin for advanced composites. Chelated polymers were reported as metal adsorbants. The flexible organic structure linked by coordinating metal atoms has a potential application in aircraft and space vehicle construction.

7) **Luminescence** :-

Coordination polymer are studies for luminescence properties owing to their higher thermal stability than the pure organic ligand and the ability of affecting the emission wavelength of organic materials by metal coordination. The combination of organic spacers and transition metal centers in coordination polymers is seen as an efficient method for obtaining new as light emitting diodes (LED) [76], when the luminescence is a ligand to metal charge transfer (LMCT) bands only in few of the above studies it may be deduced that luminescence could be a specific property of coordination polymer and as such would differ from the luminescence behaviour of related molecules complex. An example may be \([\text{Cd}(1,4\text{-bdc})(\text{py})]\) where complex formation significantly (about 100 times) enhances the fluorescence intensity of the free 1,4 bdc ligand ,probability due to the symmetry decreases by saviors ligand twisting [77]. Such a ligand twisting may be indeed be brought up by the 3D coordination polymer.

8) **Non-linear optics (NLO)** :

Non-linear optical materials are used in frequency conversion and intensity modulation of light. Inorganic metal oxides eg. Li NbO$_3$ or phosphates eg. KH$_2$PO$_4$ (KDP) K-Ti OPO$_4$ (KTP) are current work horses for second harmonic generation (SHG) frequency doubly.NLO materials can be
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Based on coordination polymers that fulfill both requirements of containing organic ligands with large molecular first hyperpolarizabilities $\beta$ and having ordered, non-centrosymmetric structure [78]. Ideal NLO chromophores typically contain a good electron donor and acceptor connected through a conjugated bridge.

LITERATURE SURVEY

The literature survey reveals that, when coordination polymers is used as general term it covers a wide group of compound including metal chelates organics complexes. Coordination polymers, macromolecular metallic organic polymer, polynuclear complexes, polymeric metal salts etc. Survey relevant to present investigation is briefly cited in the following paragraph.

Among the wide choice of ligands Schiff base occurring an importance position in coordination chemistry. Schiff base commonly referred as, azomethines, amines, hydrazones, carbazones, thiosemicarbazones, imines and allied derivatives contain to provide the most interesting factors in the field of coordination chemistry evident from some excellent review [79-93]. Chelates derived from polymeric Schiff bases has evolved much theoretical interest became they seemed to earlier worker to be important in bonding.

Salen type Schiff base complex has been known since 1933 [84] and they constitute a standard system in coordination chemistry. The investigation of salen complexes has been varying active during the last decade, especially following the discovery of salen catalyzed. Enansioselective epoxidation olefins by the group of Jacobsen [85] and Kasturi et al [86]. The introduction of bulky group in ligand also influences the overall catalytic properties of the complexes. Haikaraiah et.al. [87] have reported synthesis and characterization of bulky, Salen type complexes of first row transition metals with amphiphisc solubility properties of following type.
On the parallel lines reports are found to synthesis and characteristic of mono and bi-metallic Mn (III) complexes containing Sales type ligands, Dey and Carry et al. [89] Structural magnetic properties and epoxidation activity of Fe (III) salicylandiamine complexes were ported by Wei et al. [89].

In recent years there has been considerable interest in metal containing plasma-polymers for which optical and electrical application has been suggested. Morosoft et al. [90] have prepared plasma polymer by explosive of cobalt-Salen base and phorphrin complexes to plasma during sublimation. The preparations of surface unmodified catalytic application are some of the possible uses for such plasma polymer films.

The electrochemical properties of copper (II) complexes with several polydentate Schiff base have been exploited successfully [91]. The influence that ring number of member in chelate rings and the presence an imines group have upon the redox potentials, have been studied [92-93]. A great deal of information regarding of properties of Schiff bases of potential biological interest has arise during the last few years. Information relating to coordination compounds of Cu (II), Ni (II) and Fe(II) with some bidentate and tetradentate Schiff bases derived from salicylaldehyde and hydroxynaphthaldehyde have been reviewed. The more relevant spectroscopic, structural and electrochemical properties are discussed and comparisons are made with certain metals proteins.

The polymeric metal complexes of Co(II), Ni(II) Cu(II), Zn(II) Cd(II), Ce(II), La(II) and UO$_2$(II) with 1,4-[5-disulphonyl-8-hydroxyquinoline]piperazine] have been synthesized by El-Gahams et al [94].
The synthesis and crystal structure of a two-dimensional non cluster vanadium (II) coordination polymer with nonfloxain have been reported by Liang [95]. The application of polychelates of poly(2-hydroxy-4-methoxybenzophenone)propylene] with lanthanides have been reported by Joshi et al [96]. The polychelates of N,N'-di(o-hydroxyphenyl) terephthaldehydedimine with Mn(II), Co(II), Ni(II), Cu(II), Zn(II) and Cd(II) have been synthesized and characterization on the basis of elemental analysis, IR, Electronic spectra, Magnetic measurements and TGA by Patel et al [97]. Khlobystov et al [98] reported that the choice of the metal ions, the ligand design, the counter ions and solvents can have a considerable effect on the final architecture of the coordination polymers and particularly its dimensionally.

The El-said et al [99] have described the preparation and characterization of Fe (III), Cu (II), Ni (II) and Co(II) complexes with Schiff base and containing ligand 4-azo malononitrile antipyrrine. These have been characterized by IR, electronic and ESR spectra as well as magnetic susceptibilities.

The polymeric complexes of bis-bidentate azodye ligand with transition metal ions were prepared and characterized by analytical, thermal, magnetic infrared, electronic, NMR and EPR, spectral data by Sonabati, and co-workers [100] Mahaputra et al. [101-103] have reported a series of polymetallic complexes of Co(II), Ni(II), Cu(II), Ni(II), Ed(II) and Hg(II) with chelating azo dye ligands.

Dey et al. [104] have reported the preparation and characterization of Cr [III] complexes with neutral bidentate Schiff bases N,N'-ethylene bis- (benezophenonimine) and N,N'-ethylene bis-(acetophenonimine). The
complex were reacted with different ligands like N-phenyl salicylaldehyde to get heterochelates of the type $[\text{Cr}(L)_2(\text{lig})]\text{Cl}_2\text{H}_2\text{O}$. The stereochemistries of the complexes have been discussed.

Co-ordination polymers Cu(II), Ni(II), Co(II), Mn(II) and Zn(II) with poly-Schiff base derived from 5,5-Methylene-bis-[3-nitrosalicylaldehyde] and 1,4-diaminobutane have been prepared by Patel et al [105] and characterized by elemental analysis, magnetic spectral, thermal properties, and electrical conductivities of the chelates have been studied[106].

Patel and Patil [106] reported polymeric Schiff bases [PSB] of azodialdehyde with o-phenylenediamine. The Cu(II) Ni(II), Co(II), Mn(II) and Zn(II) polychelates with PSB have been isolated and characterized. A four coordinated tetrahedral structure for Zn(II) chelates and others are six coordinated octahedral to others were suggested.

Patel et.al. [107] have reported synthesis and characterizations of polychelates of bis (bromosalicylaldehyde) suphene with Mn(II), Co(II) Ni(II) and Zn(II) ions. On the basis of IR, reflectance spectral and magnetic moment measurements, the cross linked polymeric structures is built up favoring six coordination for the metal ion, the polychelates of Fe(II), Mn (II) are Ni (II) are proposed to have the following structure to accommodate the additional vacancy of these metal ions.
M = Mn(II) and Ni(II) \quad X = Y = H2O
M = Co(II) \quad Cu(II) and Zn(II) \quad X = Y = Nil

Karampurwala et al. [107] prepared polychelates of transition metal ions with Schiff base of 5, 5' methylene bis (salicylaldehyde) with amine, various ligand and nephelauxetic parameters have been evaluated for Ni(II) and Co(II) polychelates, chelate polymers of β-hydroxy-γ-amino Schiff base were synthesized and Cu(II) and Zn(II) polymers were shown to be compatible with polyethylene [108].

Mishra et al. [109] have synthesized the heterocyclic Schiff base by the condensation 2-hydroxy-1-benzaldehyde with 2-amino-4-phenylthiazole and 2-amino-4-phenyl-5-phenylazothiazole and polymerized in with 1,2 dichloroethane in the presence of acid-catalyst. Chelates of Cu(II), Ni(II), Co(II), Mn(II), Pd(II), Zn(II), Sn(IV), VO(IV) and UO₂(VI) with these polymeric ligands were prepared and characterized by different physico-chemical studies. Their IR spectra suggest that the metals were coordinated with the polymeric ligands through azomethine nitrogen and phenolic oxygen atoms.

Two Schiff bases have been synthesized by the reaction of P-aminoazobenzene with salicylaldehyde and oxidative polycondensation products of L₁H, [L₂H₂]. The Co[II] and Ni[II] complex of with L₁H and C₂H₂
have been prepared and characterized by elemental analysis, IR spectra and magnetic susceptibility, TGA, DTA, measurement mass spectra $^1$H and $^{13}$C NMR electronic absorption[110].

Narang [111-113], reported, complexes of Y(III), La(III), Pr(III), Nd(III), Sm(III), Gd(III), Tb(III) and Dy(III) with salicylaldehyde benzonyl hydrazine H$_2$L have been synthesized and characterized. The analytical data are suggestive of 2:3 metal ligand stoichiometry in the complexes except in the case Y(III) which is a 1:1 complex. A dehydration study at two temperature 110°C and 150°C indicates water molecules both in the lattice and co-ordination sphere of the metal ions. Magnetic moments, IR, spectra, electronic spectra, and $^1$HNMR spectra have been recorded to establish the bonding sites of the ligand. The complexes are coloured soluble in methanol, dimethyl sulfoxide, dimethyl formamide and insoluble in benzene, chloroform and acetonitrile. Solid-state conductances at various frequencies show the semiconducting, nature of the complexes while solution state conductance indicates their non-electrolyte nature X-ray analysis show that the structure of most the complexes are orthorhombic.

**OUR LABORATORY WORK**

Polychelates of Mn(III), Fe(III), Ti(III) Vo(IV), Th(IV), Zr(IV) and UO$_2$(VI) with 4,4′bis-[N-phitrophenyl-salicylaldianie]-5]azo) biphenyl [BNSAB] have been prepared by Aswale et al [119-126] and synthesized by elemental analysis, magnetic susceptibility, electronic, IR spectral data and thermogravimetric analysis. The ligand BMSAB act as bis-bidentated ONNO donors. The thermal data have been analyzed for kinetic parameters by Boido method. The electric conductivity of the ligand and polychelate has been measured which indicate their semi-conducting behaviour in the studied temperature range. The ligand and its polychelates have also been screened for their antimicrobial activity various microorganism.
Bhadange [120-124] have isolated some poly-Schiff bases ligands and their chelate with Mn(III), Fe(III), V(IV), Th(IV), Zr(IV) and UO₂(VI) ions. Mohod [114-117] has prepared the polychelates of Mn, Co, Ni, Zn and Cd with poly-schiff bases derived by the condensation of i.e. 4'4 dihydroxy 3,3'dipropyl biphenyl with various diamines. Besides other physicochemical investigation their antibacterial proportions have been also studied in details.

**PRESENT WORK**

The prodigious growth of the published literature reveals that several chelates polymers obtained by the condensation of transition metal ion with the organic ligand containing oxygen, nitrogen as donors atoms have been synthesized. In fact metal polychelates with bis-chelating ligands have occupied a very importance place in the further development and progress of coordination chemistry. Physico chemical studies of metal chelate polymers have received wide attention because of their importance, currently attached to the problem of producing new materials of high thermal and chemical stability also due to their use as catalysis. Oxygen carrier in energy conversion system.

The transition metals are characterized by their ability to form a wide range of coordination complexes in which the octahedral, tetrahedral and square planar geometry are predominate. Thus it seemed advantageous to attempt to design and synthesize bis-chelating ligands, which would be able to form complexes with a variety of transition metal ions.

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In the above context, our interest lies to plan the present work in designing new bis-ligand and so synthesis their chelate. Stress has been laid to elucidate the structural features of these polychelates with the aid of elemental, spectral, magnetic and thermal studies. The electrical properties, catalytic activity and antimicrobial activities of these newly prepared compounds were undertaken.

In a nutshell, the object of the present work is the synthesis of the following bis-ligands namely.
1) 4,4'-bis[(N-Propanesalicilaldehydediamine-5)azo]biphenyl (BNPSAP)
2) 4,4'-bis[(N-Butane salicylaldehydediamine-5) azo] biphenyl (BNBSAP)
3) 4,4'-bis[(I-Propane salicylaldehydediamine-5) azo] biphenyl (BIPSAP)
4) 4,4'-bis[(N-Ethane salicylaldehydediamine-5)azo]biphenyl (BNESAP)

Since these ligands synthesized in the laboratory they have been characterized by IR, ¹H NMR and elemental analysis.

Chelate polymers of the above ligands with Mn(II), Fe(II), Co(II), Ni(II), Cu(II), Zn(II) and Cd(II) have been prepared. The preparative conditions in terms of reaction media, stoichiometric ratio of the reactants, time and temperature of reflux have been set up by a number of trial and error experiments. In short a systematic investigation have been carried out regarding their synthetic route and properties.

To elucidate the structural aspects of these synthesized chelates various physicochemical method have been used. The salient features of the physico-chemical method employed are jotted below.

The composition of the chelates polymers was determined by elemental analyses, which include the estimation of the elements present in the synthesized compounds.

Spectral studies confirmed the formation and the nature of compounds under investigation, IR, spectroscopy was employed to identified the coordination groups, variation in the proposed ligands and their chelates. The Schiff of frequency to lower or higher energies explains the nature of the bonded groups of special interest.

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Electronic absorption spectra are usually employed to characterize new compounds. This has provided information concerning the stoichiometry, oxidation states of the central metal ions and nature of the metal-ligand bond.

The magnetic moment data further supplements the observation made by electronic spectral regarding their structural geometry.

The thermal stability and the presence of water molecules (hydrated /coordinated) have been studied by thermogavimetric analysis. Thermal techniques have been used to evaluate kinetic parameters. The property of electrical conductance is usually employed to study the nature of concerning mechanism of conduction.

The catalytic activity have been evaluated toward the epoxidation of styrene using Mn(II), Fe(II), Co(II) and Ni(II) chelate polymers.

The antimicrobial study have been employed to check the potency of the ligands and their chelate polymers prepared by measuring the zones of inhibition of the agar medium.

Attempts have been made in the present investigation to reduce the ambiguity of information in individual technique by making use of the above different physico-chemical methods to arrive at the conclusion. In spite of this no claims is made that the conclusion regarding stereochemistry and structure of the chelate polymers are unequivocal and final. They are inevitably tentative.
REFERENCES

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