CHAPTER I

INTRODUCTION
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Asymmetric synthesis is the most challenging task in current synthetic chemistry. \(^1\)-\(^{13}\) Chiral metal complexes have not only invoked interest to Organic Chemists but Inorganic Researchers are also actively engaged and have led to a new sub area- Inorganic Asymmetric Synthesis.

In chiral metal complexes, the stereochemistry of the metal center plays a pivotal role in enantioselective catalytic transformations. \(^{14}\)-\(^{20}\) Brunner et al. \(^21\) have synthesized benzene ruthenium(II) complexes using chiral salicylidene aminato ligand. They demonstrated that there is a correlation between the conformation of 1-phenylethyl group and the configuration of the ruthenium atom. The control of stereochemistry about the metal center is also useful in pursuing the chiral auxiliary, chiral reagent or chiral pool. \(^{22}\)-\(^{23}\)

Chiral ligands as chiral auxiliaries containing nitrogen, oxygen and phosphorous donor sets have been recognized as highly excellent and efficient building blocks due to their use in many enantioselective transition and nontransition metal catalyzed reactions. Chiral auxiliaries having nitrogen and oxygen donor sets have become a subject of extensive research since past few years. \(^{24}\)-\(^{27}\)

Chiral \(\text{N}_2\text{O}_2\) tetradeionate ligands and their complexes were synthesized by Cross et al. \(^28\) with hard (Ti\(^\text{IV}\), Mn\(^\text{IV}\), Mo\(^\text{VI}\)) and borderline (Cu\(^\text{II}\), Ni\(^\text{II}\)) transition metal ions (Fig. 1a & b).
These tetradentate ligands coordinate stereospecifically with the metal ions. The absolute configuration of the resultant complexes (Δ or Λ) mainly depends on the metal ion involved.

Reetz et al.\textsuperscript{29} have reported the synthesis of asymmetric diiminophosphoranes. They have converted chiral diamines such as (1R, 2R)-1,2-diaminocyclohexane or R'-2,2'-diamino-1,1'-binaphthalene into diimino(triphenyl)phosphoranes (Fig. 2).
Chiral Schiff base metal complexes have also attracted considerable attention as they are capable of catalyzing a number of enantioselective reactions. Leung et al have reported chiral manganese(III) complexes of quadridentate Schiff base (Jacobsen’s catalyst) (Fig. 3).
These catalysts are capable of catalyzing epoxidation of unfunctionalized alkenes in excellent enantiomeric excess. Jacobsen and co-workers, \(^{31-32}\) have reported the chromium(III) complex [CrL(Cl)] which also catalyzes highly stereoselective ring opening of meso-epoxides such as cyclohexene oxide with trimethylsilyl azide. To design such chiral metal Schiff base complexes, a reasonable data of their redox and structural properties is desirable. Thus, redox behavior of these complexes was studied by electrochemical experiments. \(^{33}\) Due to the stereoelectronic flexibility and easy availability, they are capable of catalyzing a number of enantioselective reactions. In a similar way, Cheng et al \(^{34}\) have reported chiral manganese(III) and copper(II) complexes of binaphthyl Schiff base (Fig. 4).

![Fig. 4](image-url)
The strategy of using chiral $N_2S_2$ macrocyclic ligands as chiral auxiliaries has not been done till date. Thiosemicarbazides, thiosemicarbazones and dithiocarbamates having nitrogen and sulphur ligands have been studied because of their highly interesting chemical and biological properties.\(^{36,37}\) These $N_2S_2$ donor sets show distinct spectroscopic properties and have high DNA binding affinity. The binding of metal ion to nucleic acid is important as it helps in determining the primary and secondary structure of nucleic acids and also these binding reactions regulate gene expression and initiate cleavage and linkage reactions.\(^{38-42}\) The binding affinities of small molecules give valuable information about the designing of new diagnostic and chemotherapeutic agents.\(^{43-46}\) The DNA binds with these metal ions through various binding modes.\(^{47-51}\) One mode of noncovalent binding involves intercalation of planar molecules between base pairs of DNA helix.\(^{52-56}\) Other mode of binding involves intercalation of planar molecules between the complex cation and anionic backbone phosphodiester residues.\(^{57}\)

Barton et al\(^ {58}\) studied the interaction of a $\Delta$and $\Lambda$ $[\text{Ru(Phen)}_2\text{dppz}]^{2+}$ with DNA where dppz = dipyridophenazine. The studies describe the

(a) Enantioselective binding by the octahedral complexes.

(b) Ligand specific intercalation for dppz and Phi complexes where Phi = phenanthrene quinone diimine.

(c) Intercalation access by these metal complexes from the major grooves.
The DNA binding behavior of copper complexes \([\text{Cu}^2\text{(bcp)}_2]^+\), \([\text{Cu}^2\text{(dmp)}_2]^+\) and \([\text{Cu}^2\text{(dpsmp)}_2]^2-\) where bcp = 2,9-dimethyl-4,7-diphenyl-1,10-phenanthroline, dmp = 2,9-dimethyl-1,10-phenanthroline and dpsmp\(^2-\) = 2,9-dimethyl-4,7-bis-(sulfonatophenyl)-1,10-phenanthroline was studied by Mahadevan et al \(^{39}\) using spectroscopic as well as voltammetric techniques. The binding of intercalative drugs to DNA helix was characterized through absorption spectroscopic titrations by following the changes in absorbance (hypochromism/hyperchromism) and shift in wavelength. The percentage hyperchromism observed was found to be independent of the concentration of added dpsmp suggesting that hyperchromism is due to interaction of the complex with DNA. (Fig. 5)

Fig. 5- Charge transfer spectra of \([\text{Cu}^2\text{(dpsmp)}_2]^2-\) (0.035 mM) in the absence (---) and presence (—) of increasing amounts of CT DNA
The electrochemical methods employed to study coordination of metal ions and chelates to DNA provide a useful complement to their spectroscopic data such as UV-Visible spectroscopy.

The nature of DNA binding of the copper complexes was followed by cyclic voltammetry. The Cu(II)/Cu(I) redox potentials of the [Cu\textsuperscript{II}(dpsmp)]\textsuperscript{2-} reveal fairly reversible behavior and on addition of DNA, the complexes experience negative shift in \(E_{1/2}\) and a decrease in \(E_p\). The ratio of cathodic to anodic peak current, \(I_{pc}/I_{pa}\) decreases with increasing concentration of DNA suggesting strong absorption of the [Cu\textsuperscript{II}(dpsmp)]\textsuperscript{2-} complex in presence of DNA (Fig. 6).

Fig. 6- Cyclic voltammograms of 0.1 mM [Cu\textsuperscript{II}(dpsmp)]\textsuperscript{2-} in the absence (—) and presence (---) of 6 mM NP.
In addition to the changes in $E_{1/2}$ the voltammetric peak currents decrease on addition of DNA to [Cu$^{II}$(dpsmp)]$^{3+}$ complex. The decrease in current is mainly due to the diffusion of equilibrium mixture of free and DNA-bound metal complexes to the electrode surface. This suggests strong binding of the Cu complex to the DNA and a square scheme (scheme-I) showing the binding of Cu(II) and Cu(I) form of complexes to DNA for reversible redox behavior is given here.

\[
\begin{align*}
\text{CuL}_2^{2+} + e^- & \rightleftharpoons \text{CuL}_2^+ \\
\text{K}_2+ & \| \\
\text{CuL}_2^{2+} \text{DNA} + e^- & \rightleftharpoons \text{CuL}_2^+ \text{DNA}
\end{align*}
\]

Scheme -1

Asymmetric ligands have also been used as building blocks in the heterobimetallic complexes. Yet there is scarcity of literature on this subject. In the past decade, heterobimetallic chemistry has emerged as a challenging field of research. Different applications of heterobimetallic complexes have been thoroughly explored viz. magnetic properties, electrical properties, catalytic properties and biomodels or biological model systems. Due to their unique properties, heterodinuclear
complexes can be distinguished from mononuclear or homonuclear complexes. When the two metal ions are bound by same or different ligands in close proximity, they cooperate in catalytic processes. Cheng and Das have studied the effect of a second metal on the catalytic activity of Mn(III). They illustrated that metal-metal interactions are important in many bimetallic metalloproteins and in transport of dioxygen in biological systems.

The structure and geometry of these heterobimetallic complexes makes them versatile enough to be able to accommodate another metal ion. The formation of heterobimetallic complexes may be attributed to the difference in the set of donor atoms of the adjacent chambers. Macrocyclic Schiff base complexes are excellent for such purposes and allow the coordination of two different metal ions. Lisowski et al. have synthesized heterobimetallic complexes using macrocyclic Schiff bases containing nickel(II) and lanthanide(III) ions.

In a recent report, the heterodinuclear macrocyclic complex containing both Yb³⁺ and Na⁺ ions was synthesized and characterized by X-ray crystallography and ¹H and ²³Na solution NMR. These studies reveal that a suitable ligand should contain a Schiff base chamber for lanthanide coordination and a crown-ether moiety for the coordination of the alkali metal ion (Fig. 7).
Fig. 7 - Schematic representation of the compartmental macrocycle design for coordinating a lanthanide(III) ion into the Schiff base \((N_3O_2)\) chamber and an alkali metal ion into the crown ether moiety.

Active sites involving more than one metal center have their own importance e.g. dicopper sites in hemocyanin and tyrosinase, diiron(III) sites in methemerythrin, ribonucleotide reductase and heterobimetallic sites of Fe\(^{III}\) and Cu\(^{II}\) in respiratory cytochrome oxidase which catalyze the 4e reduction of dioxygen to water in the mitochondria of eukaryotic cells. \(^{81-83}\)

Heterobimetallic complexes of iron(II) and vanadium(III) systems with an oxo transfer reaction were synthesized by Bosnich et al. \(^{84}\) (Fig. 8) The ligands used in these investigations have two metal-binding sites, one 6-coordinate (closed site) and one 4-coordinate (open site). \(^{85-87}\) The purpose of this design is to allow a substrate, such as \(O_2\) to bind to the open site but to be reduced by both metals.
For a dicobalt(II) complex, similar binding of O$_2$ to the open-site cobalt(II) could lead to the formation of dicobalt(III) peroxide complex analogous to the process in hemerythrin. In hemerythrin, two iron(II) ions are present, dioxygen binds to only one metal but both use reducing power to convert dioxygen to peroxide. When one of the metals in dicobalt(II) complexes was oxidized, the other metal was deactivated to oxidation. This mutual deactivation is not metal dependent and two metal oxidation is expected to occur by sequential electron transfer (eq-1)

\[
[\text{Fe}^{II}(L)\text{V}^{III}\text{Cl}_2]^+ \overset{[O]}{\longrightarrow} \text{Fe}^{II}(L)\text{V}^{V}(O)\text{Cl}^{2+} \overset{[O]}{\longrightarrow} [\text{Fe}^{III}(L)\text{V}^{IV}O]^{3+}
\]

Laccase employs four copper ions for the reduction of dioxygen to water. All the four copper ions take part in the reduction process, though
only two copper ions seem to bind to the dioxygen.  

Various other complexes of diiron(II) and dicobalt(II) containing dinucleating ligands with sterically bulky nitrogen bases were used to study the dioxygen binding. The substituents viz. 4,5-diphenyl weakens the electron donor ability of dinucleating ligand to stabilize the divalent oxidation state of iron and form a hydrophobic cavity for a $O_2$ binding site which suppresses the irreversible oxidation and facilitates the reversible oxygenation (Fig. 9).

![Dinucleating ligands](image)

Fig. 9 - Dinucleating ligands
In order to study the dynamics of oxygen binding to a cobalt(II) moiety, coordination environment with one vacant site is most suitable. The design of dioxygen carriers using tetradentate ligands, 4-coordinate species is preferred than 6-coordinate species which fails to provide a vacant coordination site. For 6-coordinate cobalt(II) dioxygen carriers, all six coordination sites of the cobalt(II) ion were occupied either by ligand donor atoms or solvent molecules. Thus dissociation of one of the coordinated groups was a requirement for \( \text{O}_2 \) binding. Busch et al. studied the kinetics of dioxygen binding of Co(II) complexes with vacant coordination sites (Fig. 10).

Fig. 10
At low temperature (from -40 to -20 °C) the absorbance changes correspond to completely reversible behavior of the complexes. However, at higher temperature, partial autoxidation takes place. The kinetics of dioxygen binding for cobalt(II) complexes was measured by a spectrophotometric stopped-flow technique in the temperature range (from -75 to 40 °C). For the simple reversible \( \text{O}_2 \) binding reaction, the observed rate constants depend on both the rate constant for binding and the rate constant for dissociation (\( k_{\text{on}} \) and \( k_{\text{off}} \)). When a large excess of dioxygen is present in the reaction mixture eq-2 holds good.\(^{100}\) Linear plots of \( k_{\text{obs}} \) vs \( [\text{O}_2] \) were observed for all cobalt(II) complexes (Fig. 11).

\[
\begin{align*}
  k_{\text{obs}} & = k_{\text{on}}[\text{O}_2] + k_{\text{off}} & \text{eq-2}
\end{align*}
\]

Fig. 11
Asymmetric metal complexes have widespread application in the field of medicine as antitumor and anti HIV agents and also as enzyme model systems. Cis-platin \([\text{cis-PtCl}_2(\text{NH}_3)_2]\) is one of the most widely used drugs in the treatment of several cancers. DNA replication is inhibited in the presence of cis-platin but due to problems regarding the resistance and immense side effects, development of new platinum drugs which may be active against a wide range of cancers with fewer side effects have taken place.

Knowledge of biological targets of these platinum drugs was not a hard task as structural X-ray and NMR data have identified \(N_7\) of the guanine base as the primary DNA binding site.

In a recent report, cis-platin DNA cross link models were explored with unusual type of chirality-neutral chelate amine carrier ligand (\(\text{N-N'}\)-Dimethylpiperazine). They proved the anticancer activity of these complexes in terms of DNA binding. They suggest that the guanine \(N_7\) is chiral and these bases gives different conformers with the Pt complexes. In distorted cis-platin intrastrand cross-linked DNA adducts, the dominant conformer has guanine in a head-to-head (HH) orientation. Conformation with head-to-tail (HT) orientation favors in cis-PtA\(_2\)G\(_2\) adducts. \((A_2 = \text{two monodentate or one bidentate amine ligand}, G = \text{guanine derivative not linked by a phosphodiester group})\). The evidence that linked adducts
favor the (HH form) and unlinked adducts favor the (HT form) has been witnessed through extensive studies spanning a quarter of a century.\(^{107-110}\) The solid data indicates that in all adducts the bases have either small tilt or large tilt and favor dipole-dipole interactions. Thus, they were proved as highly dynamic anticancer drugs.

Chirality greatly influences the anticancer activity of the metal complexes.\(^{106}\) It has been proved that the activity is related to NH groups of the cis-Pt(NH\(_3\))\(_2\) moiety. The NH groups are positioned to interact with the nucleic acid target and simultaneously break the symmetry and influence the position of the nucleic acid bases.\(^{102}\) Though chiral platinum complexes have been thoroughly studied, no attempt has been taken to synthesize new chiral anticancer organotin complexes. Although many organotin derivatives like diethyl tin(IV) and dibutyl tin(IV) derivatives were found to be effective anticancer agents.\(^{111-114}\) It has been proved that the dissociated diorganotin(IV) moieties act as antitumor agents.

Qingshan et al\(^{115}\) have synthesized diethyl tin(IV) complexes formulated as [Et\(_2\)Sn(Phen)(AMP)Cl], [Et\(_2\)Sn(Phen)(CMP)Cl] and [Et\(_2\)Sn(Phen)(GMP)Cl] where AMP = Adenosine-5'-monophosphate, CMP = Cytidine-5'-monophosphate and GMP = Guanosine-5'-monophosphate (Fig. 12).
The results indicate that diorganotin(IV) complexes coordinate with the phosphate group of the nucleotide and suggest them good anticancer agents.

Recently, a new class of compounds has gained interest due to their unique photochemical and electrochemical properties i.e. asymmetric metalloporphyrins and their dimers bearing chiral groups. Metalloporphyrins and their dimers have been extensively studied due to their role in many biological processes such as oxygen carriers in haemoglobin and myoglobin and as enzyme model systems. For example, cytochrome P-450 and horseradish peroxidase
(HRD) have been recognized as two heme enzymes responsible for the biological oxidation of toxic compounds. Chiral porphyrin complexes can induce more effective changes in the conformation of nucleic acids.

Porphyrin-nucleic acid interactions have been studied. They interact with DNA through both outside binding and intercalation. They have been recognized as excellent DNA binding and cleavage reagents and sensitizers for photodynamic therapy. These metalloporphyrins can be employed for studies as electron transfer agents through DNA, nucleic acid directed porphyrin aggregation and potential DNA damage induced by photodynamic therapy of neoplastic tissue. An X-ray structure of a tetraarylporphyrin DNA complex reveals that the porphyrin macrocycle is capable of binding to nucleic acids rather than flipping out into solution. The binding of DNA to the porphyrin macrocycle is evidence from changes in UV-Vis. spectroscopy, NMR properties of the porphyrins and redox potentials of the metal centers.

Hoffman et al have shown the binding of octa-plus porphyrazines to DNA. The kinetic studies were monitored by electronic absorption spectroscopy. Three binding modes were suggested (Fig.13)

(a) External binding with stacking.
(b) External binding (via interactions with the phosphates)

(c) Intercalation.

The shift in absorbance maxima and extent of hypochromism suggest that the binding between DNA and porphyrins take place through intercalation or through external stacking of the porphyrazines along the DNA phosphate backbone.

The biologically active porphyrins usually exist as dimers in solution\textsuperscript{158} and protein matrices, e.g. the “special pair” of chlorophylls in solution and photosynthetic reaction centers.\textsuperscript{159} Kimura et al\textsuperscript{160} have reported chiral twisted porphyrin dimers. They have proposed chiral porphyrin dimers (R)- and (S)- in which two porphyrin moieties are
linked by a chiral binaphthyl spacer (Fig. 14). In another attempt, they have reported the chiral twisted porphyrin dimers and their self assembly through the intermolecular formation of a \( \mu \)-oxo dimer between the porphyrin moieties (Fig. 15). The absorption spectra in \( \text{CH}_2\text{Cl}_2 \) changes in response to mixing with aqueous solution at various pH.

![Diagram](#)
Chiral porphyrin dimers linked through chiral groups have been recognized as good enantioselective catalysts. The multinuclear and dimeric porphyrins have been employed as catalysts for 4-electron reduction of oxygen. These dimers are designed to hold two different or same metals.
in 5-coordinate geometry and possess cooperative binding properties. \(^{169-171}\) Besides, 5-coordinate chiral porphyrin arrays are of great interest in specific catalytic reactions by the use of their chiral grooves and vacant site for oxygen binding. Yamamoto et al \(^{172}\) have investigated the electron transfer processes in dinuclear cobalt porphyrin complex by cyclic voltammetry. The studies gave important information about the redox behavior of the \(\text{Co(II)}\) dimer and the main objective of these studies was to know whether or not the two metal centers electrochemically interact with each other in the mixed valence state (\(\text{Co}^\text{II}-\text{Co}^\text{III}\)). The dimeric cobalt porphyrin was found to be a good model for elucidating interaction through space or a \(\pi-\pi\) stacking orbital between each porphyrin ring because the cobalt porphyrins are strongly attracted to each other by the 4 ionic groups on each. Two redox waves were observed at -0.37 V and -0.17 V in the cyclic voltammogram of dinuclear cobalt porphyrin which is different from that of monomeric cobalt porphyrin \(\text{Co(II)}\)TPPS at -0.33V. The redox couples are ascribed to \(\text{Co}^\text{II}-\text{Co}^\text{II}/\text{Co}^\text{II}-\text{Co}^\text{III}\) and \(\text{Co}^\text{II}-\text{Co}^\text{III}/\text{Co}^\text{III}-\text{Co}^\text{III}\) on the basis of spectrochemical data (Fig. 16).
Fig. 16- UV-Visible absorption spectra of cobalt porphyrins in DMSO obtained by spectroelectrochemical measurements. (a)Co(II)TPPS-Co(III)TMPyP (b)Co(III)TPPS-Co(II)TMPyP at -0.27 V (c) Co(III)TPPS-Co(III)TMPyP at 0.1 V

Present work

Chiral \( N_2S_2 \) macrocyclic complexes of transition metals are novel as they exhibit high DNA binding affinity. New \( N_2S_2 \) macrocyclic asymmetric ligands have been synthesized by condensing o-phenylene diamine with \( CS_2 \) and benzaldehyde/acetaldehyde and their complexes with \( Mn^{II}, Co^{II}, Ni^{II}, Cu^{II} \) and \( Zn^{II} \) were prepared and characterized by elemental analysis, conductivity measurements, IR, UV-Vis., EPR and NMR spectra.

Photokinetic studies of the DNA-metal complexes \([C_{10}H_{10}S_4N_2Cu](NO_3)_2\) and \([C_{10}H_{10}S_4N_2Ni](NO_3)_2\) were carried out and the rate constants \( k_{(DNA-complex)} \) were calculated.
In another set of experiments a series of asymmetric heterobimetallic complexes of the type \([\text{LML’Sn]}\text{Cl}\) and \([\text{LM’L’Sn]}\text{Cl}_2\) where \(\text{L} = \) ethylene diamine, \(\text{M} = \text{Mn}^{\text{II}}, \text{Co}^{\text{II}}, \text{Ni}^{\text{II}}\) and \(\text{Cu}^{\text{II}}, \text{M’} = \text{Cr}^{\text{III}}\) and \(\text{Fe}^{\text{III}}\) and \(\text{L’} = \text{l-tryptophan and l-valine have been synthesized and characterized by various physico-chemical methods. The Co}^{\text{III}}\) analogue of these complexes was characterized by two dimensional NMR COSY data. The kinetics of oxygen binding with the complex \([\text{C}_{15}\text{H}_{23}\text{N}_2\text{O}_2\text{SnCo]}\text{Cl}\) has also been studied spectrophotometrically. The electrochemical behavior of \([\text{C}_{15}\text{H}_{23}\text{N}_4\text{O}_2\text{SnCo]}^{\text{2+}}\) and \([\text{C}_{15}\text{H}_{23}\text{N}_4\text{O}_2\text{SnCu]}^{\text{+}}\) was monitored by cyclic voltammetry to study the influence of an adjacent metal ion tin(IV) on cobalt(III) and copper(II) redox potential as the redox potentials are sensitively modified by the presence of the second metal ion.

Chiral porphyrin complexes are promising chemotherapeutic agents as they can induce more effective changes in the conformation of nucleic acids. In this context, an attempt has been made to synthesize chiral template porphyrins \([(\text{TPP})\text{Co(Trp)}]\) where \(\text{TPP} = \) Tetraphenyl porphyrin and \(\text{Trp} = \text{l-tryptophan and characterized by various physico-chemical methods. These chiral porphyrin can serve as a chiral substrate passage to the metal center which generates a more active and more selective metal center. The conformational changes in DNA by \([(\text{TPP})\text{Co(Trp)}]\) have been studied spectrophotometrically.
and by kinetic experiments. The binding of CT DNA to the complex 
\[(TPP)\text{Co(Trp)}\] was further confirmed by the redox behavior of free and CT DNA 
bound \[(TPP)\text{Co(Trp)}\] which was studied by cyclic voltammetry.

The biologically active dimeric porphyrins are naturally occurring and have attracted considerable attention as they preferentially act 
as a catalyst. It is observed that catalytic reduction commences with 
the coordination of \(O_2\) to the cobalt(II) center of the metalloporphyrin. 
This adduct leads to enhanced rates of reduction of \(O_2\) and its 
reformation during the catalytic cycle. With the objective of 
understanding the catalytic behavior of \(\text{Co(II)}-O_2\) coordination, we 
have synthesized novel organotin linked porphyrin dimers of 
the type \[(TPP)\text{M(Trp)}_2\text{M'}\] where \(\text{TPP} = \text{Tetraphenyl porphyrin, M = Co(II)}\) 
and \(\text{Zn(II), Trp = 1-tryptophan and M' = dimethyl tin(IV)}\) and characterized 
by various physico-chemical methods. The oxygen binding of 
\[(TPP)\text{Co(Trp)}\text{Sn(CH}_3\text{)}_2\] was studied by electrochemical experiments 
(cyclic voltammetry) and kinetic studies were determined by 
spectrophotometric titration with dioxygen. The experiments were carried 
out in methanol under large excess of oxygen at 20 °C under pseudo-first 
order conditions.

There is an increased interest in synthesis of tin based anticancer 
drugs and activity of these complexes is closely related to their 
structure. Thus the chiral complexes of organotin have been synthesized
using amino acids as chiral auxiliary and 1,10-Phenanthroline as a secondary ligand. A series of di and tri organotin(IV) \([\text{LSnR}_n\text{L}']\) complex where \(n = 2\) or \(3\), \(L = l\)-amino acids like \(l\)-tryptophan, \(l\)-leucine and \(l\)-valine and \(L' = 1,10\)-phenanthroline have been prepared and structure elucidation was done by IR, UV, \(^1\text{H}, ^{13}\text{C}, ^{119}\text{Sn}\) NMR spectroscopy.