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Research Article

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Synthesis, Characterization and Antioxidant Activities of Transition Metal Complexes

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ABSTRACT

In recent years the importance of metal ions for smooth operation of plant and animal organisms were evidenced by the publication of numerous papers in the field of biophysics and biochemistry. Latest researches in these areas focus on the synthesis and characterization of biological compounds containing metal ions, due to their applicability in pharmacy, medicine, agronomy and nutrition. Three Transition metal complexes of iron were synthesized by the Amino acids using Cysteine in presence of co-ligand NaN_3 using different metal, ligand and co-ligand ratio. Amino acids usually acts as bidentate ligand, coordinate with Nitrogen atom of Amino group (NH_2) and oxygen atom of Carbonyl group (CO), but in case of cysteine there are chances of Sulphur incorporation with metal. These complexes were characterized by means of electronic spectroscopy, Infrared spectroscopy, Powder X-rays diffractometer.

Keywords: Antioxidant activities; Metal complexes; Cysteine; Diffractometer

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INTRODUCTION

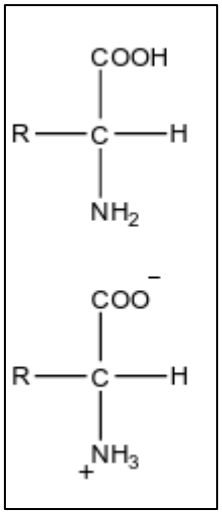
Metal Complexes or coordination compounds are the molecules that contain central metal atom or ion, which is usually surrounded by cluster of ions or molecules. This complex has a tendency to retain its identity in solution, although partial dissociation may occur. It may be cation or an anion or nonionic depending on the sum of the charges of central atom and surrounding ion and molecules, Complexes can be neutral or charged; if in case it is charged then it is stabilized by counter ion around the coordination sphere [1].

In recent years the importance of metal ions for smooth operation of plant and animal organisms was evidenced by the publication of numerous papers in the field of biophysics and biochemistry. Latest researches in these areas focus on the synthesis and characterization of biological compounds containing metal ions, due to their applicability in pharmacy, medicine, agronomy and nutrition. In recent years, an increased focus on studies carried out on the complexation of transition metal ions with different biomolecules.

Amino acid complexes with metals are similar in structure to the natural ones present in the body and release trace elements in exactly the cell or tissue that needs them. In literature various applications of metal complexes with amino acids are reported in medicine as antibacterial activity (complexes with Cu-alanine, arginine, histidine, lysine) on bacteria like Staphylococcus aureus, Streptococcus pyogenes and Escherichia coli, in regulating gastric functions (Cu-tryptophan, phenylalanine), as antitumour agents (Cu-leucine, Tyrosine, histidine), as inhibitors of HSV-1 virus (Co-lysine, arginine, histidine, Co-peptide), as insulin-mimetic compounds (Zn-aspartic acid, proline, threonine, valine) as vaso-constrictors (Zn-L-histidine) used in diseases of deficiency (Fe-ac.aspartic, serine) and as restorative iron supplements for human (Fe-glycine) [2].

An amino acid is a molecule that consists of two functional groups, an amine and a carboxylic acid, as shown in Figure. In this illustration there is an additional group called the side chain, designated with an R. The variation seen in naturally occurring amino acids arises from differences in this side chain. Only 20 amino acids are used in all biological life known on earth. Of these 20, the most stable amino acids are the aliphatic acids: glycine, alanine, valine, isoleucine, and leucine. In an aqueous solution, this structure may change such that a proton from the COOH transfers to the NH_2 and a zwitterion is formed. This structure depends on the pH of

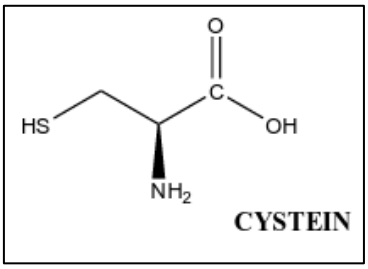
the solution [3]. The amino acid acts as bidentate ligand with coordination involving the carboxylic oxygen and nitrogen atom of amino group. The *v*(C=O), and *v*(N-H) vibrations are shifted to higher frequencies for complexes as compared to ligand [4].



In this research many Amino acids have been used *i.e*. leucine, lysine, glycine, alanine, proline but appreciable results were obtained from valine and cysteine so their structure and properties are given below:

Cysteine

Cysteine is known as a Sulphur-containing non-essential amino acid. This amino acid supports a lot of vital physiological functions.



IUPAC Name: (2R)-2-amino-3-sulfanylpropanoic acid
Symbol: Three-letter code - Cys. One-letter code - C
Molecular Weight (Molar Mass): 121.15818 g/mol
Molecular Formula: C3H7NO2S
Melting point: 220 °C
Solubility in water: 280 g/L (25 °C); pKa – 1.96; pKb – 10.28

Biological role of cysteine

This amino acid provides resistance to the body against all harmful effects, because it is responsible for building up white blood-cell activity. Cysteine is also necessary for the proper functioning of the skin and helps body to recover from surgery.

Since Cysteine is a non-essential amino acid, it can be produced by humans to satisfy their bodies' demands. If, for some reasons, your body is unable to produce this amino acid, it can be found in lots of high-protein foods like chicken, eggs, milk, and cottage cheese. Cysteine is proved to be beneficial in numerous ways. First of all, it is essential for the detoxification and for the formation of skin. Besides, it participates in the recovery of hair and nail tissue. Then, Cysteine is used in manufacturing antioxidants and in protecting brain and liver from damage made by alcohol and drugs consumption and even by a cigarette smoke. Finally, this amino acid helps protect against harmful toxins and damages caused by radiation.

According to various researches, other benefits of Cysteine include reducing the effects of aging on the human body. Besides, this amino acid also helps promote building muscles, healing of severe burns, and fat burning. Cysteine also encourages the activity of white blood cells [5].

Research objectives

A development of coordination chemistry has revealed wide possibilities for the treatment of various diseases that are common now a days. Medicinal inorganic chemistry is rich in metal- or metalloid-based drugs, including organoarsenic compounds for the treatment of syphilis, and diagnostic agents for magnetic resonance imaging (Gd, Mn, Fe) among others. Some metals have been used as drugs and diagnostic agents to treat a variety of diseases. Platinum compounds, cis-platin (cis-[Pt $(NH_3)_2Cl_2$]), carboplatin and oxaliplatin are among the most widely used cancer therapeutic agents. Gold drugs, myocrisin and auranofin are used for the treatment of rheumatoid arthritis. This research is conducted to make such coordination complexes that can show its activity against various disease causing organisms.

Structural characterization techniques

Techniques that have been used in this research to analyze the structure complexes are given below:

- Powder X-ray diffraction
- Infrared spectroscopy
- UV/Visible spectroscopy

The principles and details of these techniques are given below:

X-ray powder diffraction analysis (XRD) is perhaps one of the most widely used X-ray based analytical techniques for characterizing materials. As the name suggests, the sample is usually in a powdery form, consisting of fine grains of crystalline material to be studied. The term 'powder' really means that the crystalline domains are randomly oriented in the sample. Therefore, when the 2-D diffraction pattern is recorded, it shows concentric rings of scattering peaks corresponding to the various d-spacing in the crystal lattice. The positions and the intensities of the peaks are used for identifying the underlying structure (or phase) of the material. For example, the diffraction lines of graphite would be different from diamond even though they both are made of carbon atoms. This phase identification is important because the material properties are highly dependent on structure.

Theory and methodology:

The three-dimensional structure of crystalline materials, such as minerals, is defined by regular, repeating planes of atoms that form a crystal lattice. When a focused X-ray beam interacts with these planes of atoms, part of the beam is transmitted, part is absorbed by the sample, part is refracted and scattered, and part is diffracted. Diffraction of an X-ray beam by a crystalline solid is analogous to diffraction of light by droplets of water, producing the familiar rainbow. X-rays are diffracted by each mineral differently, depending on what atoms make up the crystal lattice and how these atoms are arranged.

When an X-ray beam hits a sample and is diffracted, we can measure the distances between the planes of the atoms that constitute the sample by applying Bragg's Law, named after William Lawrence Bragg, who first proposed it in 1921. Bragg's Law is:

$$n\lambda = 2d \sin\theta,$$

where the integer n is the order of the diffracted beam, λ is the wavelength of the incident X-ray beam, d is the distance between adjacent planes of atoms (the d-spacing), and θ is the angle of incidence of the X-ray beam. The geometry of an XRD unit is designed to accommodate this measurement. The characteristic set of d-spacings generated in a typical X-ray scan provides a unique "fingerprint" of the substance or minerals present in the sample. When properly interpreted, by comparison with standard reference patterns and measurements, this "fingerprint" allows for identification of the material.

In X-ray powder diffractometry, X-rays are generated within a sealed tube that is under vacuum. A current is applied that heats a filament within the tube; the higher the current the greater the number of electrons emitted from the filament. This generation of electrons is analogous to the production of electrons in a television picture tube. A high voltage, typically 15-60 kilovolts, is applied within the tube. This high voltage accelerates the electrons, which then hit a target, commonly made of copper. When these electrons hit the target, X-rays are produced. The wavelength of these X-rays is characteristic of that target. These X-rays are collimated and directed onto the sample, which has been ground to a fine powder (typically to produce particle sizes of less than 10 microns). A detector detects the X-ray signal; the signal is then processed either by a microprocessor or electronically, converting the signal to a count rate. Changing the angle between the X-ray source, the sample, and the detector at a controlled rate between preset limits is an X-ray scan [6].

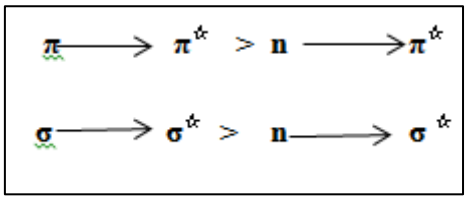
Infrared spectroscopy:

When infrared radiation is passed through an organic compound, some of the frequencies are absorbed and appear as absorption band, while other frequencies do not interact with the compound and are transmitted without being absorbed. Only those frequencies are absorbed which match with the vibrational frequency of the bonds. Out of all vibrations only those vibrations absorb the infrared radiations of matching frequencies which

cause a change in dipole moment of molecule. Such vibrations are said to be Infrared active vibrations. There are two modes of fundamental vibrations i.e. stretching and bending vibrations.

Structural analysis using infrared spectroscopy
As amino acids consists of two main group i.e. Amino group (-NH2) and carboxylic acid group (COOH). The amino acids act as bidentate ligand with coordination involving the carboxylic oxygen and nitrogen atom of amino group. The stretching frequency of N-H is usually occurring at 3300-3500cm^{-1} while carbonyl group usually stretches at 1670-1720 cm-1. If there is any increase in these frequencies, it indicates the presence of metal ion incorporated in the amino acid (Ligand) [4].

Electronic spectroscopy:
The absorption of ultraviolet (200-400 nm) and visible (400-800 nm) radiations by molecules is associated with the excitation of valence electron from the ground state to higher energy states. The absorption of UV/VIS radiation by a molecule results in the electronic transition from highest occupied molecular orbital (HOMO) to lowest unoccupied molecular orbital (LUMO). The wavelength of absorbed radiation depends on the energy difference between the orbital originally occupied by the electron and the orbital to which it is promoted.
There are four type of electronic transitions in terms of energy required are given below.



The $\pi \rightarrow \pi^{\star}$ transition requires less energy than the $\sigma \rightarrow \sigma^{\star}$ or $n \rightarrow \sigma^{\star}$ transition therefore absorb at longer wavelength.

Structural analysis using UV/VIS spectroscopy
The local symmetry around the metallic ions is determined by comparing the amino acid and metallic complexes UV-VIS spectra.
The $n \rightarrow \pi^*$ characteristic band in the UV spectra assigned to the C=O bond appear at 267nm for amino acid, and is shifted toward higher wavelengths if carbonyl of amino acid coordinated with metal ions confirming the presence of the ligand in the complex and the covalent nature of the metal-ligand bond [2].

EXPERIMENTAL SECTION

Complexes synthesis
Chemical reactants:
FeSO4.7H2O (0.25mM)
L-Cysteine (0.25mM)
Sodium azide (0.25mM)

Chemical reaction:

$$FeSO4.7H2O + Cysteine + NaN3 \longrightarrow Product$$

Procedure:
0.25mM iron sulphate heptahydrate was dissolved in mixture of distilled water and methanol in ratio of (1:1). It was then subjected to reflux for 10-15 minutes. 0.25mM Cysteine and 0.25mM NaN_3 solution was separately prepared in same solvent i.e. (water and methanol). It was then added into salt solution and refluxed for 5-6 hours. Orange colored precipitates were filtered, washed and were subjected to drying in oven at 100℃. M.P: 356 °C. U.V-vis.: λMax. = 292.00 nm. IR: 3035.53, 2606.98, 2498.99, 1620.81, 1578.26, 1482.37, 1402.83, 1380.43, 1336.50, 1295.63, 1192.26, 1124.01, 1088.78, 1039.93, 962.37, 872.14, 844.58, 775.68, 673.24 and 613.66 cm-1.

Complex (MAM-COMP-6)
Chemical reactants:
FeSO4.7H2O (0.25mM)
L-Cysteine (0.5mM)
Sodium azide (0.5mM)

Chemical reaction:

$$FeSO_4.7H_2O + Cysteine + NaN_3 \longrightarrow Product$$

Procedure:

0.25mM iron sulphate heptahydrate was dissolved in mixture of distilled water and methanol in ratio of (1:1). It was then subjected to reflux for 10-15 minutes. 0.5mM Cysteine and 0.5mM NaN_3 solution was separately prepared in same solvent i.e. (water and methanol). It was then added into salt solution and refluxed for 5-6 hours. Light Orange colored precipitates were filtered, washed and subjected to drying in oven at 100 ℃. M.P: 342°C. U.V-vis.: $\lambda_{Max.}$ = 293.00 nm. IR: 3032.29, 2915.86, 2078.57, 1576.38, 1488.05, 1402.79, 1336.99, 1295.61, 1192.32, 1124.01, 962.32, 844.58, 775.80, 663.69 cm^{-1}.

Complex (MAM-COMP-7)

Chemical reactants:

FeSO4.7H2O (0.5mM)
L-Cysteine (0.5mM)
Sodium azide (0.25mM)

Chemical reaction:

$$FeSO_4.7H_2O + Cysteine + NaN_3 \longrightarrow Product$$

Procedure:

0.5mM iron sulphate heptahydrate was dissolved in mixture of distilled water and methanol in ratio of (1:1). It was then subjected to reflux for 10-15 minutes.0.5mM Cysteine and 0.25mM NaN_3 solution was separately prepared in same solvent i.e. (water and methanol) and added into salt solution and refluxed for 5-6 hours. Orange colored precipitates were filtered, washed and subjected to drying in oven at 100℃. M.P: 295°C. U.V-vis.: λMax. = 253.00 nm. IR: 3011.71, 2355.87, 1576.42, 1488.42, 1402.60, 1337.25, 1295.39, 1192.13, 1124.07, 962.48, 844.64, 776.06, 673.50, 613.40 cm^{-1}

Antioxidant activity

ABTS assay:

According to the method of Re *et al.*, ABTS [2, 2'-azino-bis (3- ethylbenzothiazoline-6-sulfonic acid)] was dissolved in water (7.0 mM – stock solution). The ABTS cation radical (ABTS•+) was a product of the reaction of the ABTS stock solution with 2.45 mM (final concentration) $K_2S_2O_8$ sodium peroxo-hexaodisulfate (VI) in water. ABTS•+ is a blue/green chromophore with absorption maxima at wavelengths 415 nm, 645 nm, 734 nm and 815 nm. In this study the 734 nm maximum for detection was used [7].

RESULTS AND DISCUSSION

Amino acids are good ligands for the synthesis of the transitional metal complexes in the presence of co-ligand such as sodium azide. Amino acid is usually bidentate ligand and coordinate with the Nitrogen atom of amino group (NH_2) and Oxygen atom of carbonyl group (CO).

X-Ray diffraction analysis

The diffraction or scattering pattern of X-rays given by the atoms of a powder crystal of a compound facilitates to establish the geometry and constitution of a complex. This technique may be regarded as the trademark gizmo for establishing the precise structure of coordination complexes. The positions and intensities of the X-rays diffracted by a powder crystalline solid can endow one with a wealth of information like composition of a solid; crystal structure; particle size; polymorphism; preferred orientation; evidence of decomposition; disorder and so on [8].

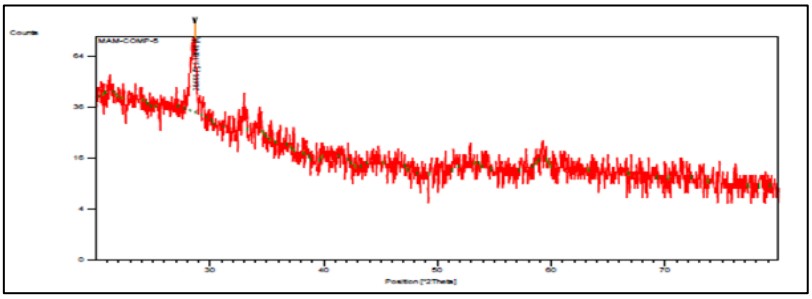
Powder X-Ray Diffraction analysis was performed for all the three samples. X'Pert HighScore v.2.0.1 was employed to determine physical characteristics of samples. Values for d-spacings and percentage relative intensities of samples are being mentioned in discussion in this chapter. Specific restriction sets were used for comparison of sample results with the reference compounds present in database. Plots of sample were compared with plots of selective reference compounds.

Simulated patterns of selective reference compounds can also be compared with the patterns of sample compounds in order to provide better visualization of the differences between the two. Conditions for measurements are provided below:

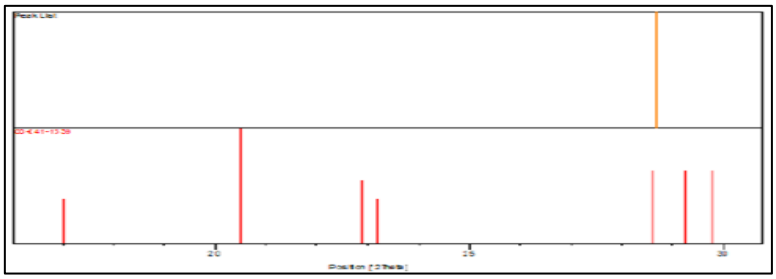
Measurement conditions:

Equipment	PANalytical X'Pert HighScore
Raw Data Origin	XRD measurement (*.XRDML)
Scan Axis	Gonio
Start Position [°2Th.]	20.01
End Position [°2Th.]	79.99
Step Size [°2Th.]	0.02
Scan Step Time [s]	0.2
Scan Type	Continuous
Offset [°2Th.]	0
Divergence Slit Type	Fixed
Divergence Slit Size [°]	1
Specimen Length [mm]	10
Receiving Slit Size [mm]	0.1
Measurement Temperature [°C]	25
Anode Material	Cu
K-Alpha1 [Å]	1.5406
K-Alpha2 [Å]	1.54443
K-Beta [Å]	1.39225
K-A2 / K-A1 Ratio	0.5
Generator Settings	40 mA, 40KV
Goniometer Radius [mm]	173
Dist. Focus-Diverg. Slit [mm]	91
Incident Beam Monochromator	No
Spinning	No

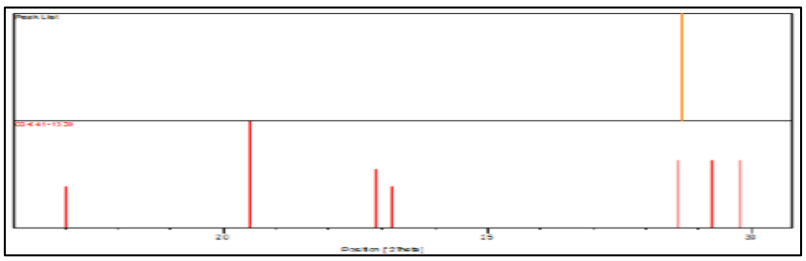
MAM-COMP-5



Diffractogram of MAM-COMP-5

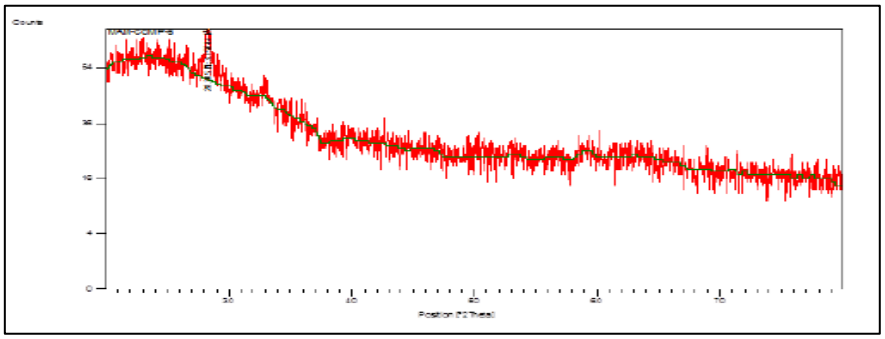


Diffractogram of MAM-COMP-5



Plot of identified phases of MAM-COMP-5

MAM-COMP-6

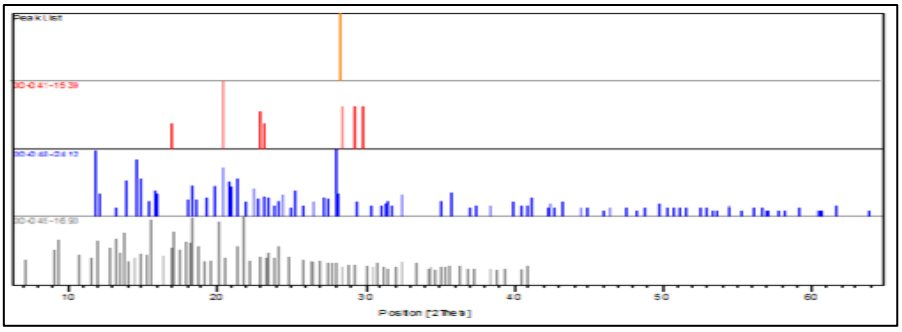


Diffractogram of MAM-COMP-6

Matched peak list

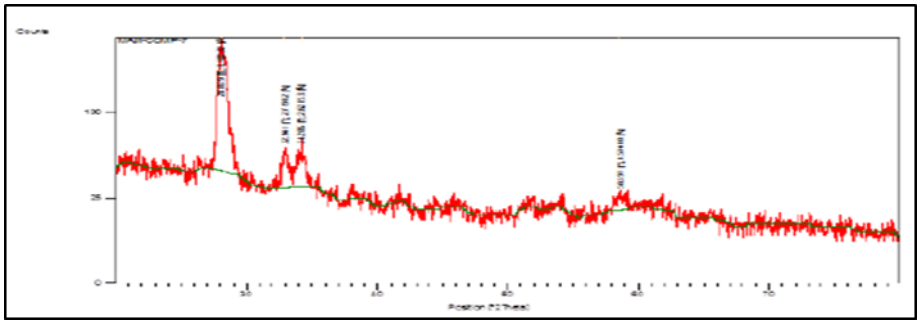
Compound Name	Pos. [°2Th.]	FWHM [°2Th.]	d-spacing [Å]	Rel. Int. [%]
MAM-COMP-6	28.3052	0.576	3.15044	100
Refrence Code: 00-041-1539	28.587	-	3.12	40
Reference Code: 00-048-2414	27.923	-	3.186	100
	28.181		3.164	12
Reference Code: 00-045-1693	27.996	-	3.18456	10
	28.384		3.1419	70

Note: All other matched peaks of reference compounds were different than those of samples



Plot of identified phase of MAM-COMP-6

MAM-COMP-7



Diffractogram of MAM-COMP-7

Matched Peak List

Compound Name	Pos. [°2Th.]	FWHM [°2Th.]	d-spacing [Å]	Rel. Int. [%]
MAM-COMP-7	28.0395	0.3542	3.18232	100
	32.9413	0.4723	2.71912	18.05
	34.2046	0.6298	2.62154	17.91
	58.5968	1.152	1.5741	4.91

Note: No particular reference compound was found to be present for this data

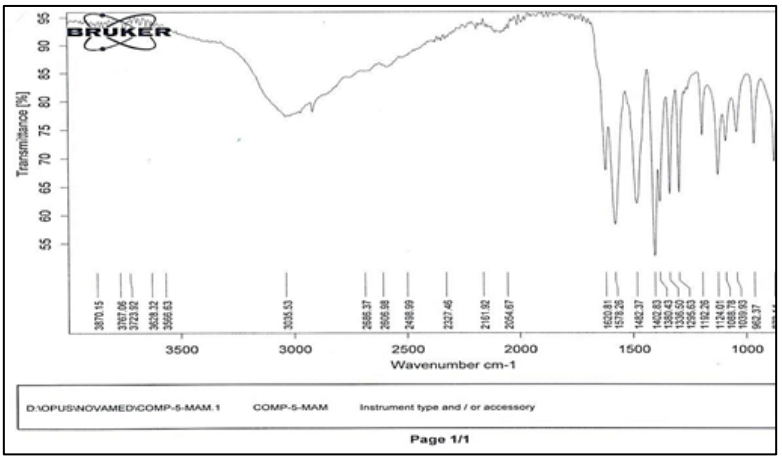
Infrared spectrophotometry:

Infrared spectroscopy is most widely technique used for the identification of functional group. It is an extensively applied characterization technique. The theory in the rear of application is that, stretching modes of the ligands diverge upon complexation owing to change of bond strengths and accordingly changes in the position of the bands emerge in IR spectrum. In the fingerprint region i.e., 1500-750 cm-1, the changes in the structural features of the ligands appear as changes in bands. However, bands due to metal ligand bonds occur in the far IR region i.e., 50-500 cm^{-1} [9].

The major characteristic peaks in the amino acids are of –OH, __C=O and _NH2. Any increase or decrease in the vibrational frequencies of these vital groups will give us major clue about metal incorporation.

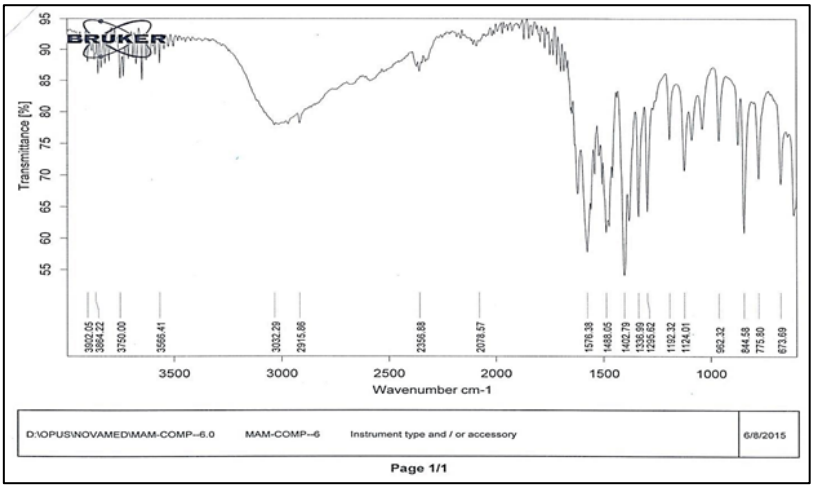
IR spectrum of MAM-COMP-5

The OH peak of Carboxlyic acid group usually appears in the range of 3200-3650 cm-1 which is quite broad but it is shifted to 3053.53cm-1 in the case of compound being discussed. This may show some sort of interaction of OH group. This usually happens in case of complexation. The peaks at 2606.98cm-1 and 2498.99cm-1 and are due to S-H symmetric and antisymmetric stretching vibrations which are deviated from 2550cm-1. It shows there are the chances of incorporation of Sulphur in complexation. Absence of characteristic sharp peak of azide at 2034cm-1 indicates that azide is not incorporated into the final product. The stretching vibrations of –COO- in case of amino acid appears at 1690-1588cm-1 and in the spectrum of complex it is shifted to lower frequency that is 1578.26cm-1 which may show its involvement in Complexation.



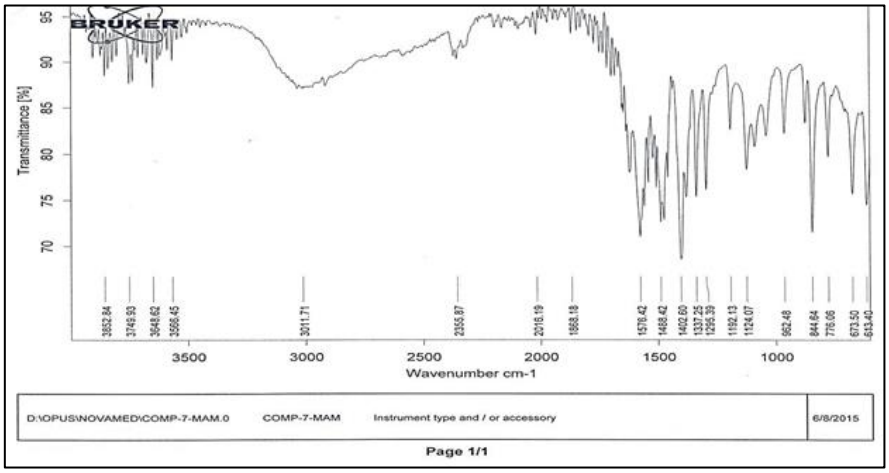
IR spectrum of MAM-COMP-6

The OH peak of the Carboxlyic acid group usually appears in the range of 3200-3650 cm-1 which is quite broad but in the case of this compound, it is shifted to frequency of 3032.29cm-1. This may show some sort of interaction of OH group. The peak at 2356.8cm^{-1} appears to be of S-H stretching vibrations which is deviated from 2550cm^{-1}. It may indicate the chances of incorporation of Sulphur in complexation. Absence of characteristic sharp peak of azide at 2034cm-1 indicates that azide is not incorporated into the final product. The stretching vibrations of –COO- in case of amino acid appears at 1690-1588cm-1, and in the spectrum of complex it is shifted to lower frequency that is 1576.38cm^{-1} which may show its involvement in Complexation.



IR spectrum of MAM-COMP-7

The OH peak of the Carboxylic acid group usually appears in the range of 3200-3650 cm^{-1} which is quite broad but in the case of this compound, it is shifted to frequency of 3011.71cm^{-1}. This may show some sort of interaction of OH group. The peaks at 2355.87cm^{-1} are due to S-H stretching vibrations which are deviated from 2550cm^{-1}. It may show that there are also the chances of incorporation of Sulphur in complexation. Absence of characteristic sharp peak of azide at 2034cm^{-1} indicates that azide is not incorporated into the final product. The stretching vibrations of $–COO^-$ in case of amino acid appears at 1690-1588cm^{-1}, and in complex spectrum it is shifted to frequency that is 1576.42cm^{-1} which may show its involvement in Complexation.



U.V-visible spectrophotometry

Usually organic compounds or ligands easily show absorbance in U.V-region and this absorbance can be the result to any of these transitions: $\sigma \rightarrow \sigma^*$, $n \rightarrow \sigma^*$, $\pi \rightarrow \pi^*$ and $n \rightarrow \pi^*$. Upon complexation, Bathochromic (red) shift or Hypsochromic (blue) shift is mostly observed. In transition metal complexes, usually Bathochromic shifts are observed due to the involvement of d-d transitions related to transition metals. This shift shows to be really helpful in indication of structure of complexes [9]. Electronic spectra of prepared complexes were taken. (All solutions were prepared in DMSO). Values of λMax. (nm) of Samples are also given in table:

Serial No	Compounds	λ (nm)	Significant Absorbance λ (nm)
1	$FeSO_4$.7H2O	303	3,12,32,23,42,362
2	L-Cysteine	235	2,14,24,12,62,271
3	MAM-COMP-5	295	28,02,88,290
4	MAM-COMP-6	293	29,02,86,270
5	MAM-COMP-7	253	24,42,50,240
7	NaN_3	263	2,60,259

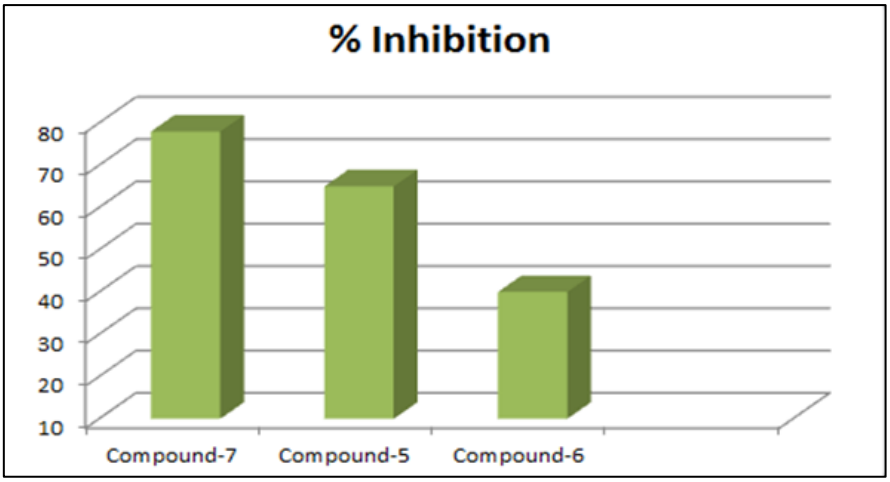
U.V-vis. spectra of products

UV-Vis. Method is considered to be a preliminary one in determining the possibility of complexation. When a complex is formed, a Bathochromic shift is usually observed due to the involvement of d-d transitions of central metal atom. Absorbance values of all the reactants as well as products were recorded in order to indicate the presence or absence of metal atom in the final product. In the research work undertaken, a slight Bathochromic shift was observed in case of all compounds. For MAM-5, 6 and 7, FeSO4.7H2O, Cysteine and NaN_3 were used as reactants. Both cysteine and NaN_3 showed maximum absorbance at 235 and 263 nm respectively. These wavelengths are considerably lower than those shown by the products. MAM-COMP-5, 6 and showed maximum absorbance at 292, 293 and 253 nm respectively. This could be the indication of some kind of interaction between cysteine and the metal atom. (Possibility of presence of NaN3 ruled out on the basis of IR spectra of these compounds.)

Anti-Oxidant activities

Antioxidant potential of a compound is basically the competence of a compound to decelerate the oxidative stress. Three chief mechanisms of action of antioxidants are exploited for the evaluation of the antioxidant potential of prepared samples. The ABTS•+ assay is the decolorization assay and it measures the capacity of antioxidants to scavenge free radicals. Results are expressed in terms of TEAC value which describes the antioxidant capacity of the compound relative to a standard antioxidant trolox. ABTS of Complexes decreases in the following order:

Comp-7 > Comp-5 > Comp-6 >



DISCUSSION

Three Coordination complexes were prepared by using iron, cysteine and sodium azide. Comparison was done by changing the mole ratio of reactants, temperature and time for the reactions. Resulting products were objected to various characterization techniques like PXRD, IR spectroscopy and UV-Vis. spectrophotometry. In case of using iron with cysteine and azide, the metal complexes were formed in all the reactions. In MAM-COMP-5, reactants were used in mole ratio (M: Cysteine: Azide) 1:1:1, and results indicate that metal complex was formed. By changing mole-ratio to 1:2:2 in MAM-COMP-6, the results still indicated complex formation but, the compound was not much crystalline in nature according to the PXRD analysis. PXRD analysis showed quite interesting results for MAM-COMP-7, the graph indicated very good crystalline nature. All other results also showed the metal complex formation. IR results of all the compounds indicated the absence of azide in the final product. Antioxidant activity was also measured as metal complexes are considered to be good antioxidants. As indicated, the results proved to be somewhat satisfying in nature.

CONCLUSION

An improvement in Coordination chemistry has uncovered wide potential outcomes for the treatment of different diseases that are common now a day .So at great scale, synthesis on coordination complexes has been started. The basic aim of it is that, to synthesize such Coordination complex that shows its activity against the different diseases. Amino acid complexes show effective inhibition against the different virus. Platinum complexes with amino acid $[Pt(2,2'\text{-bipyridine})(\text{amino acid})]^{n+}$ and where amino acid is an anion of L-histidine, L-tyrosine, L-asparagine, L-lysine, L-phenylalanine, or L-tryptophan have the anti-cancer property. So, Amino acid complexes (three) were synthesized using cysteine as ligand with iron salt under basic condition in presence of co-ligand as NaN3 using different metal, ligand and co-ligand ratio.

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