SYNTHESES AND CHARECTERISTICS OF CO-ORDINATION COMPLEXES

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Abstract:

There are various methods available to detect the formation of complexes in solution and Stereo chemistry.The chemistry of transition metal complexes with multidentate ligands can exhibit several oxidation states(1). Various oxidation states of these co-ordination complexes play a strong role in the red-ox enzyme system , facilitating its catalytic efficiency.

Key words: Chemical , Co-ordination compounds, Trace elements.

Introduction:

Numerous factors are responsible in determining stereo chemistry of the Metal complexes. However, the most important factors include following:

a) Size , charge and electronic structure of the metal ion ;
b) Position of the ligands in Spectrochemical series and in nephelauxetic series;
c) The spatial requirement of the ligands;
d) Pi-accepting ability of the ligands;
e) Size and polarisability of the anion ; and Experimental conditions and methods of preparations of the complexes(2).

The experimental conditions adopted during the preparation of complexes were uniformly maintained. All the complexes were prepared in non-aqueous solvents by adding an excess of ligand to the metal ion in the same solvent. Hence, it maybe assumed that the configurational changes are not due to the experimental conditions and the methods of Preparation.

Stability of co-ordination compounds in solution:

The formation of complex involves reaction between a metal ion (Lewis acid) and ligands (Lewis base). If the force of attraction between central metal ion and ligands are strong, complex will be stable.The stability of the complex depends upon

(i) nature of ligands
(ii) nature of metal ion
(iii) P_H of solution
(iv) Temperature.

The formation of complex in a solution is reversible and exothermic reaction.

For example:

$$M^{n+} + 4L \rightleftharpoons [M(L)_4]^{n+}$$

$$K = \frac{[M(L)_4]^{n+}}{[M^{2+}][L]^{4+}}$$

(i) Higher the value of stability constant, more stable will be the complex.
(ii) Smaller the cation, greater will be the charge on it, and hence more stable will be the complex.
(iii) Stronger the ligand, more stable will be the complex[3].

Usually, a variety of neutral ligands were chosen for the preparation of complexes. And they should be aromatic, having Pi-delocallisation , with ready to act as a good donors. During the formation of the perchlorate complexes, they contain maximum number of ligands while the chloride complexes take relatively less number of ligands. This is due to the fact that tetrahedral perchlorate anion shows no tendency for co-ordination, while the chloride complexes are strongly co-ordinating mechanism in green plants. It appears to be a function as redox catalyst in part of the The most prominent metal ions which are biologically active in the 3D-series are namely Mn(II) , Co(II), Ni(II), Cu(II) and Zn(II).

Manganese appears to be the essential in trace amounts in all forms of life virtually and its deficiency diseases are numerous in both plants and animals.The adult human body

contains about 15 mgm of Manganese. However very little is known about the chemical processes in which it participates. It is known to be an essential component of the photosynthetic mechanism, Photo system-(II) in which water is oxidised to di-oxygen[4].

The important biochemical role of cobalt is in vitamin B_{12} which is a co -factor for number of enzymes. The adult human body contains 2 to 5 gram of vitamin B_{12} and its derivatives, mainly in the liver[5].

The exact biological function of Nickel is not known. However it is suggested that it may have some undisclosed function in living organism[6]. It can activate number of metals invitro, it is found consistently bound to Ribonucleic acid, has a special affinity for bone and skin and has been found that a protein containing nickel occurs in blood serum of man and other mammals[7].

Copper is essential for both plants and animals. Copper is a co facter of a number of oxidation enzymes including tyrosinase,laecase,ascorbic acid oxidase and cytochrome oxidase. Copper is widely distributed in all human tissues with highest concentrations in liver, brain,heart and kidney. 100 mg of copper is present in a human body of weight 70 kg[8].

Zinc is very important micronutrient. It is a co-factor in number of enzyme systems especially carbonic anhydrase and several dehydrogenases , Phosphatases and other catalysts. It's most vital function is concerned with the syntheses of ribonucleic acid. Zinc is carried in blood, firmly bound to metalloproteins, loosely bound to albumins and in erythrocytes and leucocytes. A number of human diseases are associated with lowered blood Zinc[9]. The above biologically active metals have been chosen for the study of co-ordinating tendency with the ligands ,which are also biologically active[10].

Role of metals in biological processes:

Various biological phenomenon are dependent on the role of metal ions, Which themselves constitute many biological materials or affect the progress of the reaction. Kohn reported that drugs like tetracyclines[11,12] , a naturally occurring macromolecules, may be linked together by divalent cations, which suggests a mechanism by which tetracycline inhibit the growth of mechanism. Earlier classification of the trace elements in to essential and non essential and toxic groups are neither true nor accurate. All the essential elements become toxic at sufficiently high intakes and the margin level that are beneficial and those that are harmful may be small[13,14]. It would thus not be surprising that trace elements can be classically regarded as toxic elements were found to be beneficial or essential.

The resistance towards available drugs are rapidly becoming major world wide problem. The Chemistry of Co-ordination metal complexes acquired immense importance in recent years.

Role of metals in biological Processes and Medicines

Haemoglobin , chlorophyll and vitamin B_{12} contain Fe , Mg and Co^{2+} respectively are the best naturally occurring co-ordination compounds. Chlorophyll is essential for photosyntheses. The Mg atom present in chlorophyll lies above the plane of ring structure. It can add to itself one or two molecules of H_2O axially.The coordinated water molecules.The co ordinate water molecules help other chlorophyll molecules to associate with it through Hydrogen bonding

Vitamin B_{12} , it is a complex of cobalt with quadridentate ligand. Vitamin B_{12} is active only when cobalt is in +1 oxidation state . it has dark red crystals and can be Prepared synthetically it is produced by certain micro organisms and occurs in liver. It's deficiency leads to Pernicious anaemia(13).

Haemoglobin(14) It is a complex of iron coordinated with four porphyrin rings.It acts as oxygen carrier .It forms oxy haemoglobin on reaction with O_2 in lungs and carries in the arteries to the tissues where oxygen pressure is low and it releases oxygen. Oxy haemoglobin is scarlet red in colour It regulates acidity of blood and in carriage of co_2 muscle haemoglobin acts as respiratory catalyst.

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