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What is Coordination Chemistry

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Short Communication

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ABSTRACT

Coordination chemistry is the field which is concerned with the chemical interaction of organic and (or) inorganic ligand with transition and late transition group metal centres. It concentrates on understanding the physical and chemical properties as well as it investigates the synthesis and detailed structures of these coordination complexes.

Prussian blue is one of the earliest known coordination complexes, whose properties were first tried to be understood in the early 1800s by Blomstrand and it was in the year 1893; when Alfred Werner gave one of the most universally accepted theories in Coordination Chemistry, till date.

Coordination compounds contain a central metal atom surrounded by nonmetal atoms or groups of atoms, called ligands. For example, vitamin B_{12} is made up of a central metallic cobalt ion bound to multiple nitrogen-containing ligands.

According to this model, transition-metal ions form coordination complexes because they have empty valence-shell orbitals that can accept pairs of electrons from a Lewis base. Ligands must therefore be Lewis bases: They must contain at least one pair of nonbonding electrons that can be donated to a metal ion.

INTRODUCTION

The idea of chirality in coordination complexes was also brought in by Werner. The structure of any coordination complex can either be square planar, tetrahedral, square pyramidal and octahedral. The higher order complexes are also known which consist of multimetal centres bonded to a variety of ligands. The category of ligands binding to the metal center are also enormous and range from the alkyl to larger pincer and primer ligands. The importance of such complexes also range from a variety of applications, either biological or chemical or for charge balance (Na, K), quaternary protein structure (Zn, Ca), cell signaling, acid or base catalysis, atom (or group) transfer and redox catalysis. Based on the wide range of fields in which these compounds find their purpose, rigorous attempts were made to study their value in the biological processes.

Coordination complexes of various substances having distinct pharmacological effects e.g., pyrazinamide (PZA), nicotinamide (NAM), nicotinic acid (NIC), theophylline (TEO), captopril (CPL), tolbutamide (TBA), clonidine (CLN), guanfacine (GUAF), with transition metals are synthesized and are used for drug analysis as well as control. The use of instrumental techniques such as elemental analysis, thermal methods, Raman Spectroscopy, Fourier transform Infrared Spectroscopy (FTIR), electron paramagnetic resonance, UV-Vis spectrophotometry, mass spectrometry, Surface Enhanced Raman Spectroscopy (SERS), X-ray spectroscopy and scanning electron microscopy are used for the characterization of the complex

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composition. Significant interests in the metal complex-based drugs with unique research, therapeutic and diagnostic opportunities is currently witnessed in medicinal inorganic chemistry. Many of them are used containing metals such as Pt and Ru (cis-platin as anticancer drug), Au (as auranofin for arthritis), Tc and Re (as radiopharmaceuticals used in imaging), Gn, Co, Fe, Ca, Cu, Zn, Al, V, and Mn. A lowered number of Co^{+3} complexes are known to have biochemical properties; Vit. B_{12} (a natural organometallic complex of Co^{+3} with glyoxime). In addition to this, use of these complexes in the biomedical field can be comprehended for various purposes such as the introduction of deficient metal ions in the human body and the attainment of pharmacotherapy consequences by blocking metal ions essential for enzymatic action. Moreover, chelating complexes are an evolving tool in drug discovery and widely used as therapeutics to treat diseases such as diabetes, anti-inflammatory, lymphomas, and neurological disorders. Further, it was also revealed that the antibacterial action can be pronounced upon chelation to the metal complexes [1,2].

CONCLUSION

The structure of mononuclear coordination complexes can be directly correlated to the kind of application they are utilized for, like in industries as catalysts or as drug-carriers for their use in the pharmaceutical sector.

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