CHAPTER VII

Concluding Remarks

In this present research dissertation the synthesis of some β-cyclodextin based ligands and their transition metal complexes by using conventional method have been described. Chapter I constitute the introduction of the thesis. Chapter II deals with experimental section. Chapter III to Chapter VI describe the synthesis, and physicochemical characterization of the transition metal complexes of *β*-cyclodextin based ligands and their potential applications in various field.

Chapter I contains the general overview of transition metal complexes of functionalized *β*-cyclodextin and of some possible applications has been described in literature. It also includes the background and thinking process behind the synthesis of *β*-cyclodextin based metal complexes using conventional method and their application in different field.

Chapter II deals with the experimental sections giving the reagents and solvents used to synthesize various *β*-cyclodextin based ligand and their transition metal complexes. The details of instruments used in different spectroscopic and analytical techniques were described briefly in this chapter.

In **chapter III** the synthesis, characterization and the antioxidant and free radical scavenging capacities of the two zinc(II) complexes of β-cyclodextrin based Schiff bases, *viz.*, mono-6-deoxy-6-(4-(5-chloro-2-hydroxybenzylideneamino)-3,4-diaminotolune)-*β*-cyclodextrin (4a) and mono-6-deoxy-6-(4-(5-nitro-2-hydroxybenzylideneamino)-3,4-diaminotolune)-*β*-cyclodextrin (4b) were discussed. It was found that the amino modified *β*-cyclodextin based Schiff bases acted as a tridentate ligand and formed tetrahedral 1:1 (M:L) complexes with Zn^{2+}. The Schiff base and its complexes were water soluble. The synthesized compounds were subjected to study immune cell cytotoxic properties, antioxidant and free radicals scavenging activities. The observations revealed that the synthesized complexes have cell cytotoxicity, antioxidant and free radicals scavenging activities. The Zn(II) complex of mono-6-deoxy-6-(4-(5-nitro-2-hydroxybenzylideneamino)-3,4-diaminotolune)-*β*-cyclodextrin ligand shows better result than the Zn(II) complex of mono-6-deoxy-6-(4-(5-chloro-2-hydroxybenzylideneamino)-3,4-diaminotolune)-*β*-cyclodextrin ligand.

In **chapter IV** the synthesis and physic-chemical charecterization of newly synthesized Co(II) and Cu(II) complexes of a *β*-cyclodextrin based Azo functionalized Schiff base ligand were reported. The complexes are soluble in water. It was found that the β-cyclodextin based azo containing Schiff base ligand acts as tetradentate ligand. But both the Co(II) and Cu(II) complexes acquire distorted octahedral geometry by coordinate with two water molecules. The complexes were formed in 1:1 (M:L) ratio as confirmed by the various analytical and spectral data analyses. Both the complexes were highly potent to cleave DNA. The DNA cleavage efficacy of the metal complexes was also studied by agarose gel electrophoresis using pBR DNA. These studies revealed that both the metal complexes followed intercalative mode of binding to CT-DNA and also effectively cleaved the supercoiled pBR DNA. The Co(II) complex, however, more efficiently cleaved CT-DNA than the Cu(II)complex as much as the experimental results are concerned.

In **chapter V** the synthesis, characterization and biological activity of S, N containing S-modified *β*-cyclodextin based ligand and its Fe(III) complex were described. It was found that the bidentate ligand coordinates to the metal ions through the S-atom and N-atoms. The complexes were formed in 1:1 (M:L) ratio .The spectroscopic data suggesting Fe-complex has high spin octahedral geometry. The synthesized ligand and Fe (III) complex do not showed any reasonable antibacterial activities against *viz.*, gram positive (*Staphylococcus aureus*, *Bacillus subtilis*) and gram negative (*Escherichia coli, Klebsiella pneumoniae*) bacteria although both are having biologically active donor sites (N and S).

In **chapter VI** the synthesis and physico chemical cherecterization of a new Pd(II)-complex [κ^3-N, N$^{/}$, O-Pd(1⊂2)H_2O]OAc (4) of *β*-cyclodextin based polydentate ligand was reported. The ligand was prepared by two steps. At first the ionic liquid ChCD was synthesized from *β*-cyclodextrin and Choline bromide (ChBr). Then Supramolecular ligand (3) was prepared by the partially encapsulation of 2,6-diaminopyridine in the hydrophobic *β*-cyclodextin cavity in ChCD (1).Due to the partial inclusion, the –NH_2 groups of 2,6-diaminopyridine can act as coordination sites in the ligand (3). The stoichiometry of the inclusion complex 1⊂2 (3) was found to be 1:1 based on UV-Visible spectrophotometric study. Pd^{2+}-complex [κ^3-N, N$^{/}$, O-Pd(1⊂2)H_2O]OAc (4) was then synthesized from the supramolecular ligand (3) with1:1 stoichiometry and various spectroscopic and physicochemical methods and

the data suggests the complex (4) to have square planner geometry. The presence of *β*-cyclodextin moiety in the Pd-complex makes it highly water soluble. The Pd-complex showed high catalytic activity for Suzuki reaction in aqueous media in terms of lesser recation time, lower temparature (ambient temparature) and optimum load bereft of any phase transfer catalyst and organic solvents. The catalysts are easy recoverable. The catalyst was found to have sufficient catalytic activities after 4 cycles.

Anyway, the most of the synthesized *β*-cyclodextin based polydantate ligands and their transition metal complexes were air and moisture stable, water soluble and biologically/ catalytically active. There are so many scopes to designing different types of polydentate ligands by modifying and fictionalizing the hydoroxyl group of *β*-cyclodextin and turn them for specific applications. The major concerns regarding their synthesis are poor yield, multistep process, complicated purification process and difficult to separate single crystal due to their bulky size. However, the incorporation of *β*-cyclodextin moiety in ligand molecules makes the ligands and their transition metal complexes water soluble. This fascinating aspect makes them often suitable materials for various homogeneous catalyses in aqueous phase, biological system and in variety of pharmaceutical applications. Their application processes are environment benign, cost effective and they are more available in bio fluids as they are water soluble. Therefore, further investigation on their easy way of preparation, purification, good yield and potential applications in different catalytic reactions/biological system especially in aqueous phase is required. The preparations of single crystal of *β*-cyclodextin based transition metal complexes are rare but not impossible. So, some works regarding these issues are underway in our laboratory.