PREFACE

The thesis work deals with different aspects of the chemistry of oxovanadium(IV) complexes, their interaction with DNA, photo-induced cleavage of double-stranded DNA, photocytotoxic effect on cancer and normal cells in visible light, mechanism of cell death, cellular uptake and localization behavior.

Chapter I presents a general introduction to cancer, its different treatment modalities, organic molecules and transition metal complexes as photo-chemotherapeutic agents. Various modes of interactions of small molecules, capable of targeting DNA leading to DNA strand scission, emphasizing particularly the photo-induced DNA cleavage activities are discussed for their potential application in PDT. The potential and the prospects of metal-based photoactivated chemotherapy (PACT) are discussed in brief. Objective of the thesis work is also dealt in this Chapter.

Chapter II of the thesis deals with the synthesis, characterization, DNA binding and near-IR red light-induced DNA cleavage activity of ternary oxovanadium(IV) complexes of polypyridyl ligands and phenanthroline bases to explore the red light-induced DNA cleavage activity and photocytotoxicity in visible light in HeLa cells.

Chapter III presents the synthesis, characterization, DNA binding and near-IR light-induced DNA cleavage activity, cellular uptake, visible light assisted photocytotoxicity in different cancer cells, mode of photo-induced cell death and cellular localization of ternary oxovanadium(IV) complexes containing curcumin or diglucosylcurcumin and phenanthroline bases. The main objectives of this work are (i) to make our complexes fluorescent for cellular imaging and (ii) to enhance the solubility and tumor targeting potential of the complexes.

Chapter IV describes the synthesis, characterization, DNA binding, red-light induced DNA cleavage activity, photocytotoxicity in normal and cancer cells, mode of light assisted cell death and cellular localization of ternary oxovanadium(IV) complexes having anacac/curcumin and pyridyl phenanthroline base with an objective to enhance the stereo-chemical rigidity and to improve the photoactivity of the complexes by introducing an additional pyridyl group.

Chapter V deals with the synthesis, characterization, DNA binding and photo-induced DNA cleavage activity and photocytotoxicity of the oxovanadium(IV) complexes of curcumin or diglucosylcurcumin ligands and acdppz base with the aim to augment the photocytotoxicity of the dppz complexes. Cell death mechanism and confocal microscopic studies are also carried out to gain more insight into the PDT effect caused by light in the presence of the complexes and the results are compared with the clinically used drug Photofrin®.

In **Chapter VI** we have designed the ternary oxovanadium(IV) vitamin-B6 Schiff base complexes of acdppz to achieve vitamin B6 transporting membrane carrier (VTC) mediated entry of these complexes into the tumour cells in preference to the normal ones. The complexes were synthesized, characterized and their cellular uptake, photocytotoxicity, mode of photo-induced cell death in various cancer and normal cells studied. Endoplasmic reticulum targeting photocytotoxic property of the complexes has been studied in details.

Finally, the summary of the dissertation and conclusions drawn from the present investigations are presented.

The references in the text have been indicated as superscript numbers and assembled at the end of each chapter. The complexes presented in this thesis are represented by bold-faced numbers. Crystallographic data of the complexes which are

characterized structurally by single crystal X-ray crystallography are provided in CIF format in the enclosed CD (Appendix-**I**). Due acknowledgements have been made wherever the work described is based on the findings of other investigators. Any omission that might have happened due to oversight or mistake is regretted.

INDEX WORDS: Oxovanadium(IV) complexes · Crystal structure · DNA binding · NIR-light induced DNA cleavage · Apoptotic photocytotoxicity · Cellular Imaging

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