SUMMARY AND CONCLUSION

Buckminsterfullerene (C₆₀), either derivatized or in pristine form, has been studied extensively for a wide range of applications since its discovery in 1985. Its unique and amazing physical and chemical properties makes them an ideal candidate for preparing biologically active compounds, artificial photosynthetic systems and biosensors. Most of the biologically active fullerene compounds reported till date are based on fullerene having ionic or hydrophilic groups. There are very few reports wherein moieties with potential or real biological activity have been attached to fullerene. The exciting property of fullerene to generate singlet oxygen upon photoexcitation have also been used to study DNA cleavage.

The low lying HOMO of C₆₀ makes it possible to accept as many as six electrons reversibly. This property has been used to prepare a wide variety of fullerene based donor-bridge acceptor systems. However there are no reports where indole moiety has been studied as a donor in fullerene based dyads.

Although fullerene have been thoroughly investigated for preparing dyads, triads and biologically active compounds, their ion sensing properties have been rarely studied. Fullerene with its photophysical and electrochemical property can be efficiently used either as a probe or for direct interaction with metal ions.

In the present investigation novel fullerene derivatives with heterocyclic moieties have been synthesized and screened for antimicrobial activity. In addition, for the first time a fullerene amino acid conjugate has been studied for DNA cleavage. Ion sensing properties of fullerene has been thoroughly investigated with the design and synthesis of
two novel derivatives. All this work including the state of art, synthesis of fullerene derivatives and their applications have been incorporated in this thesis.

This thesis is structured into 6 chapters

Chapter 1 deals with a general introduction on organic chemistry of fullerenes and their applications with special reference to biologically active fullerene derivatives, fullerene based dyads and triads. The Chapter also incorporates the aim and scope of the investigation.

Chapter 2 deals with the synthesis and characterization of 13 novel fullerene derivatives. Well established reactions like 1,3-dipolar cycloaddition reaction and cyclopropanation reaction have been used to prepare these derivatives. The structure and purity of the synthesized compound have been well supported by characterization data like elemental analysis, FT-IR, \(^{1}\)HNMR, \(^{13}\)CNMR and mass spectra.

Chapter 3 has been divided into two sections. Section A deals with the photophysical and electrochemical studies of novel fullerene-indole dyad. In Section B, the fullerene-ferrocene dyad with bilinkage has been used a metal ion sensor.

Chapter 4 has been divided into 3 sections. Section A deals with the antibacterial screening of novel fullerene s-triazine conjugates. Section B deals with the antimycobacterial studies of fullerene-isoniazid conjugate. In section C fullerene amino acid conjugate has been studied for DNA cleavage activity by gel electrophoresis studies.
Chapter 5 deals with fabrication of silver selective electrode (AgISE) with a novel fullerene derivative with pyridine pendants. The AgISE prepared has been used for bioanalysis of glucose using silver nanoparticles as the redox marker.

Chapter 6 deals with application of the novel crown ether derivatized fulleropyrrolidine as a ditopic receptor. The cation as well as anion recognizing ability of the receptor has been monitored by UV-vis, fluorescence, voltammetric and NMR titration studies.