Preface

Heterocyclic compounds form one of the largest groups among the family of organic compounds. In most biological systems, heterocyclic rings act as the major component. They have widespread use as drugs, insecticides, pesticides, dyes, fluorescent brightening agents etc. There is an enormous demand for new heterocyclic compounds in many areas and disciplines including chemistry, biology, medicine and environmental science. Owing to the widespread and varied applications of nitrogen heterocycles, research in the synthesis of new derivatives and development of new synthetic route is of prime importance.

Green chemistry is the area of chemistry that particularly aims at minimising the usage and generation of hazardous substances during chemical transformations. Recently developed microwave assisted organic synthesis (MAOS) has been considered superior to classical heating methods. The indolizine and cyclazine compounds are very important class of nitrogen heterocycles and the present investigation focussed on the synthesis of some new derivatives of four classes of bisindolizines, cycl[3.2.2]azines, imidazo[1,2-a]pyridines and 1-azacycl[3.2.2]azines. Further a green synthetic path is developed for the synthesis of all the derivatives of the above said four classes of compounds.

All the synthesised derivatives were characterised by elemental analysis, spectral data and crystal studies. The pharmacological action of all the derivatives was studied. The fluorescence behaviour of all the synthesised derivatives were analysed and four fluorescence sensors have been developed for the detection of metal ions.

The thesis entitled "**Green Synthesis and Sensor Applications of Indolizine and Cyclazine Derivatives**" is divided into six chapters. Brief outline of the chapters is given below.

Chapter 1 outlines a concise introduction about the general nature and synthesis of indolizines, cyclazines, imidazo[1,2-a]pyridines and azacyclazines. A detailed review on the research work in the field of indolizines, cyclazines, imidazo[1,2-a]pyridines and azacyclazines is incorporated in this chapter. A general outlook about microwave assisted synthesis, fluorescent sensors, pharmacological activity studies and certain antibacterial screening tests are also included.

Chapter 2 describes the green method of synthesis of eight derivatives of bisindoizines and their characterisation by elemental analysis and various spectral techniques. Further the development of a fluorescence sensor for the determination of Fe^{3+} based on a bisindolizine derivative is illustrated as an application study. The various techniques for the optimisation of experimental parameters and the fluorescence quenching mechanism is also discussed. Practical utility of the sensor is checked using pharmaceutical formulation and compared with standard spectrophotometric technique. Antibacterial activities of the synthesised derivatives are also studied.

Chapter 3 deals with the green technology adopted for the synthesis of eight cycl[3.2.2]azine derivatives and are characterised by elemental analysis and various spectral techniques. The fluorescence behaviour of cycl[3.2.2]azines is utilised for the development of a fluorescent sensor for the determination of Co^{2+} ion. Optimisation of parameters is done and the fluorescence quenching mechanism is proposed. Application studies are carried out on a commercially available pharmaceutical formulation and compared with standard spectrophotometric method. Antibacterial activities of the synthesised derivatives are also studied.

Chapter 4 details the green technology adopted for the synthesis of eight imidazo[1,2-a]pyridine derivatives (azaindolizines) and their characterisation using various techniques such as elemental analysis, UV, IR, ^{1}H NMR, ^{13}C NMR, mass spectral and crystal structure analysis. A fluorescence sensor is developed for the determination of Fe^{3+}ion based on one of the

imidazo[1,2-a]pyridine derivative and the optimisation of sensor parameters is also carried out. The mechanism of quenching is discussed. Application study is conducted using commercially available pharmaceutical formulation and compared with standard method. Using various microorganisms the biological activity of the synthesised imidazo[1,2-a]pyridines are studied.

Chapter 5 describes the efforts in developing a green synthetic route for five azacycl[3.2.2]azine derivatives. The steps involved in the fabrication of a fluorescent sensor using one of the green synthesised derivatives for the determination of Co^{2+}ion is illustrated. The biological activity of the various azacycl[3.2.2.]azine derivatives synthesised are studied and compared.

Chapter 6 gives a detailed account of the objectives, summary of the work done, and conclusions presented in the thesis.