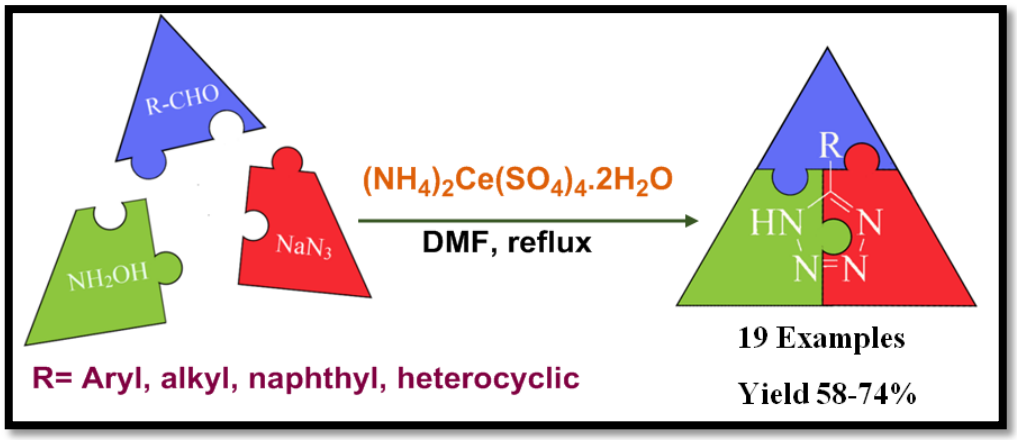
ABSTRACT

Beginning from the wintry days of 2016, it took nearly five long years to finish the research work incorporated in this thesis entitled "**DEVELOPMENT OF NEW PROTOCOLS TOWARDS CONSTRUCTION OF BIOACTIVE HETEROCYCLIC COMPOUNDS**". The work is mainly focused on development of efficient and environment benign methodologies for synthesis of bioactive heterocyclic molecules. The entire work depicted in this thesis has been divided into six chapters.

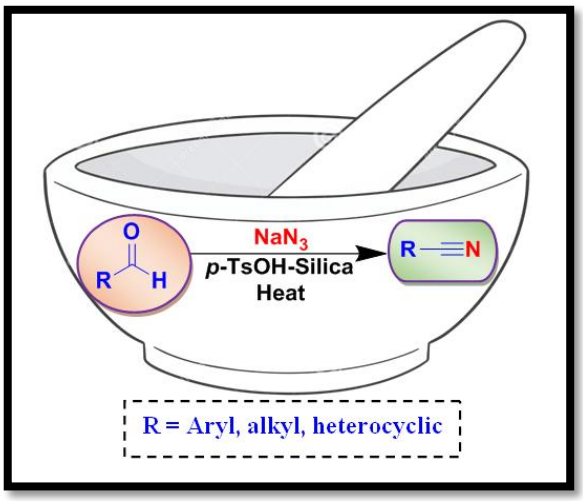
In the beginning, **Chapter I** deals with a brief review on the significance of biologically active heterocyclic compounds and synthesis of some bioactive moieties from suitable synthons. Heterocyclic compounds have been extensively used in designing of various pharmaceutically significant compounds. Apart from this, they are considered to be powerful starting materials for construction of naturally occurring biologically active compounds.

In **Chapter II**, a versatile, robust and efficient strategy for synthesis of vast range of highly functionalized 5-substituted 1*H*-tetrazole derivatives is described through one-pot three-component synthesis from various aldehydes, hydroxylamine hydrochloride and sodium azide in presence of catalytic amount of ceric ammonium sulphate, a non-toxic, easily available, inexpensive, unexplored and reusable catalyst. This one-pot synthesis has several advantages such as mild reaction conditions, shorter reaction time, low catalyst loading, good to moderate yields and functional group tolerance making this methodology practically feasible.

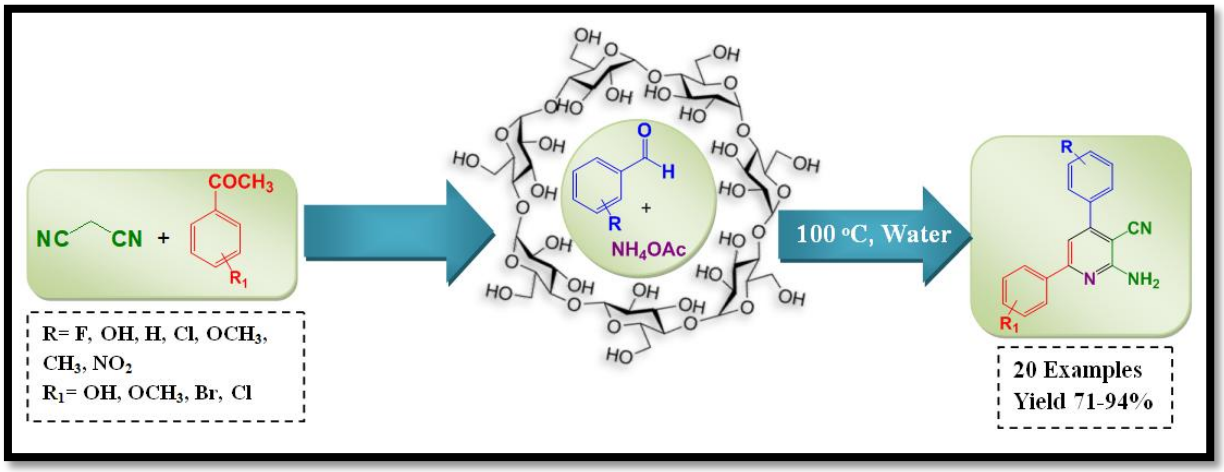


In **Chapter III**, a new and efficient method for the transformation of aldehyde into nitriles by modified Schmidt reaction is established. This reaction is carried out under solvent-free condition using sodium azide as a source of nitrogen and catalyzed by stoichiometric amount

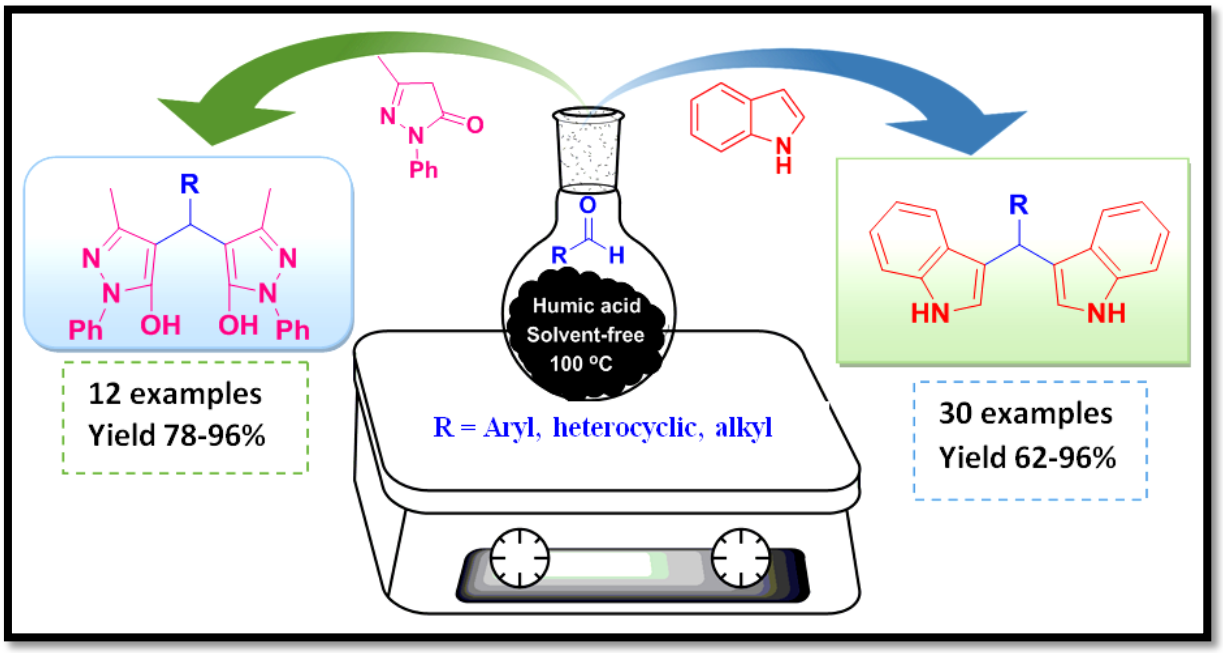
of *p*-toluene sulphonic acid in presence of silica surface with no side product. This transformation gives good to excellent yield for numerous aromatic, aliphatic and heterocyclic nitrile using very simple reagents. This method avoids the use of any transition metal catalyst, toxic cyanide and hazardous solvent and offers a greener, simple and eco-friendly procedure.



Chapter IV deals with β-cyclodextrin, a green and widespread supramolecular catalyst. It has been explored as a highly proficient promoter for the metal-free one-pot four-component synthesis of vast range of highly functionalized bioactive heterocyclic moiety, 2-amino-4,6-diphenylnicotinonitriles from easily available precursor aldehydes. The main endeavor of this protocol is to explore this organic supramolecule in one-pot four-component synthesis. Absence of metal catalyst or toxic acid and harsh reaction conditions, excellent functional group tolerance, inexpensive, greener and environmentally safe protocol are the key advantages of this work.



Chapter V is divided into two sections, **Section A** deals with the synthesis of bis(indolyl)methanes and **Section B** comprises the synthesis of bis(pyrazolyl)methanes. In these two sections, humic acid, a biodegradable, non-toxic and easily accessible high molecular weight organocatalyst has been explored for the straightforward and environmentally benign approach in preparation of diverse array of bis(indolyl)methanes and bis(pyrazolyl)methanes by the reaction of vast range of aldehydes, ketones and isatins with indole and 3-methyl-1-phenyl pyrazolone respectively under solvent-free condition. These protocols proceed without any hazardous solvents, toxic metal catalyst and harsh reaction condition. In addition, low catalyst loading, good yield and excellent functional group tolerance are the key advantages of these protocols. The catalyst used and solvent-free approach make this strategy safe to our mother earth. For the first time reusability of humic acid was investigated and found that it can be recycled up to fifth run without any significant loss of its activity at the end of the reaction.



Chapter VI also has two sections, **Section A** depicts synthesis of thioamide derivatives and **Section B** demonstrates synthesis of thiopyran derivatives. In this chapter, glycerol, a green, bio-degradable and benign solvent has been recognized to act as a highly efficient medium for the catalyst-free synthesis of vast range of highly functionalized thioamide by modified Willgerodt-Kindler Reaction and 4*H*-thiopyran *via* one-pot multi-component synthesis from easily accessible precursors. These protocols avoid hardnosed reaction conditions and proceed

without any metal catalyst or toxic acid or solvent. In addition, these protocols have numerous advantages such as shorter reaction time, high yield and excellent functional group tolerance. Further the solvent can be recovered and reused at the end of the reaction which makes these methodologies inexpensive, greener and environmentally safe.