ABSTRACT

C-C and C-X (X= O, S, N, metal, halogen etc.) bond formation reactions form the backbone of organic synthesis. All naturally occurring and man-made vital organic moieties contain these types of linkages. A vast arena of such reactions is dominated by the transition metal catalysed coupling reactions. Most popular among them are Suzuki, Ullmann, Negishi, Buchwald-Hartwig, Mizoroki-Heck, Kumada, Stille and other similar reactions. Nevertheless, metal free and organocatalysed variations of these reactions are also developed in recent past.

Many popular conventional methods of chemical synthesis or chemical transformations have added a great deal of pollutants in our ecosystem in several ways that we are all aware of. Current education of science is hence aimed towards realisation of one’s responsibilities towards environment and the idea of green (environmentally benign) and sustainable chemistry is therefore receiving impetus. Green Chemistry oriented synthesis deals with the design of chemical products and processes to diminish or eradicate the use and generation of toxic substances.

In my research work, I have attempted “green chemistry oriented”, crucial C-C and C-X bond forming reactions through both transition metal catalysis and metal free methodologies. An endeavour is made to proceed towards greener perspectives of various coupling reactions under ambient conditions. Successful and presentable works are compiled in the present thesis. The thesis comprises of four chapters:

As a prelude to present work **Chapter I** discusses a brief review on green chemistry, recent developments and green initiatives in transition metal catalyzed and metal-free C-C and C-X coupling reactions.

Chapter II describes our methodology of Pd catalyzed ligand free homocoupling reaction of arylboronic acids at ambient conditions. The method allows a greener access to valuable biaryl compounds. The reaction uses low catalyst loading and completes within a short span of 15 minutes. Substrates bearing electron rich and electron withdrawing substituents are all well tolerated in the reaction. Heteroarylboronic acids also performed well in the reaction condition.

Chapter III discusses an efficient green protocol for the synthesis of imidazo[1,2- *a*]pyridine from 2-aminopyridines and aryl ketones catalyzed by iodine as a catalyst. This protocol avoids the requirement of an anaerobic procedure, metal catalyst, base, and ligands. It offers several practical advantages such as mild reaction conditions, short reaction time, toleration of an array of functional groups, proceeds well at ambient atmosphere. It is operationally simple, additive free and could be applied for the efficient synthesis of some structurally important motifs such as 2,3-diarylimidazo[1,2-*a*]pyridines.

In **Chapter IV** our protocol of transition metal free, ligand free, additive free C-O coupling reaction leading to the formation of ether compounds is discussed. The reaction is easy to perform and utilises comparatively less toxic substrates as compared to aryl halides and phenols used in trivial methods of etherification. Variety of nitroarenes and aryl boronic acid moieties can be coupled using this methodology. A concise observation based study of the plausible reaction mechanism is also discussed.