## Abstract

Imidazo[1,2-*a*]pyridine is an important heterocylic motif which is widely present in a range of biological active compounds as well as in compounds with interesting optoelectronic properties. Synthesis and functionalization of imidazo[1,2-*a*]pyridine with novel methods is desired both from economic and environmental point of view. The current thesis focuses on synthesis of imidazo[1,2-*a*]pyridines and their functionalization *via* C–C and C–N bond formation using transition metal catalysts. In this thesis, synthesis of 3-aroylimidazo[1,2-*a*]pyridine has been achieved using inexpensive copper catalyst and further functionalization of imidazo[1,2-*a*]pyridine has been achieved using copper and vanadium catalyst. A brief outline of the work presented in the thesis is given below.

**The first chapter** of the thesis describes the synthesis of 3-aroylimidazo[1,2-*a*]pyridines using copper catalyst. This chapter is divided into two parts. **Part A** described the reaction of different substituted chalcones and a range of 2-aminopyridines. The reaction conditions are benign, require shorter reaction time and furnished good yields of 3-aroylimidazo[1,2-*a*]pyridine with a variety of substrates. All synthesized product were characterized using NMR, IR and mass spectroscopic technique. In **part B**, we have further improved the methodology for the synthesis of 3-aroylimidazo[1,2-*a*]pyridines through one-pot, three-component tandem reaction. Use of simple and readily available precursors like aceto-phenones, aldehydes and 2-aminopyridines, synthesis of functionalized bio-active imidazo[1,2-a]pyridines, single step reaction, atom and step-economy, simple isolation procedures, moderate to good yields of tandem products, air as a sole oxidant, and good functional group tolerance are the salient features of the method.

**The second chapter** of the thesis describes a simple and highly efficient protocol for the regioselective synthesis of azole-substituted imidazo[1,2-*a*]pyridines using ligand-free, copper-catalyzed Ullmann-type C–N coupling reaction. This chapter is divided in two parts. **Part A** of the chapter deals with synthesis of azole-substituted imidazo[1,2-*a*]pyridines by the reaction of 2-(2-bromophenyl)imidazo[1,2-*a*]pyridines with different azoles in the presence of copper catalyst without any external ligand. In the **part B** of this chapter we have reported the synthesis of 1,2,3-triazolo-imidazo[1,2-*a*]pyridines derivative through tandem Click–Ullmann C–N coupling reaction. 1,2,3-Triazol were *in situ* generated by the reaction of alkyne and sodium azide *via* Click chemistry which further coupled with 2-(2-bromophenyl)imidazo[1,2-*a*]pyridines through Ullmann-type C–N coupling reaction. All the synthesized compounds were well characterized.

**The third chapter** of the thesis deals with the vanadium-catalyzed functionalization of imidazo[1,2-*a*]pyridine by activating the C($sp^3$)–H bond of coupling partners. Third chpter is divided in two parts. **Part A** describes the coupling of 2-arylimidiazo[1,2-*a*]pyridines with *N*-methylmorpholine oxide to produce aminomethylation of imidazo[1,2-*a*]pyridines in the presence of vanadium catalyst. The developed methodology was also applied to 2-substituted indoles to give corresponding product in good to excellent yield. According to mechanistic investigations, reaction is believed to proceed *via* Mannich-type aminomethylation. This is a useful alternative method for conventional Mannich-type reactions to introduce tertiary amines into heterocycles. **Part B** of this chapter describes an efficient protocol for the methylenation of imidazo[1,2-*a*]pyridines using dimethylacetamide (DMA) as methylene source in the presence of vanadyl acetylacetonate catalyst. A wide range of bis(imidazo[1,2-*a*]pyridin-3-yl)methanes were synthesized *via* coupling of $sp^3$- and $sp^2$-hybridized carbons. A gram-scale reaction was performed to demonstrate the potential for the scale-up processes.

Finally, in the fourth chapter of the thesis, a summary of the thesis work is presented along with future scope of the research work.