SHORT ABSTRACT

The contents of the present thesis entitled as "***Metal- and Organo-Catalyzed Stereoselective Transformation of γ/δ-Hydroxyenones***" have been divided into five chapters based on the results achieved from the experimental works performed during the entire course of the PhD research programme.

Chapter 1 contains a brief introduction and the literature review of *γ*/*δ*-hydroxyenones including different strategies for the synthesis of useful products from hydroxyenone derivatives and also have been utilized in several asymmetric as well as non-asymmetric transformation reactions. The **chapter 2**, demonstrates an efficient and atom-economic method for the facile synthesis of 1,4-ketoaldehydes from organocatalytic redox isomerization of electron-deficient allylic alcohols. This protocol is quite general to access the isomerized products in a wide range of substrates with good to excellent yields. In addition, mechanistic studies (kinetic and deuterium labelling experiments) were performed to establish the plausible reaction mechanism for the isomerized product formation. **Chapter 3** describes a general route to access highly substituted tetrahydropyrans via $Sc(OTf)_3$ catalyzed [3 + 3] annulation of donor-acceptor cyclopropanes with *γ*-hydroxyenones providing the desired products with *cis*-diastereoselectivities. The relative stereochemistry of the final product was determined by 2D NMR studies. The generality of the reaction permitted the synthesis of tetra-substituted tetrahydropyrans bearing aryl, alkyl, and heteroaromatic groups. A catalytic asymmetric variant of this process is also studied preliminary using chiral PyBOX ligand. The synthetic utility of this method was also illustrated by performing different reactions using tetrahydropyran derivatives. **Chapter 4** illustrates the development of a new and convenient method for the synthesis of 2,5-disubstituted furans by employing the reaction between donor-acceptor oxiranes with *γ*-hydroxyenones with moderate to good yields which were achieved through one pot two-step reaction. The scope of the reaction is quite decent, allowing for the synthesis of disubstituted furans having aryl and heteroaromatic groups. The Hammett study was performed to understand the electronic substituent effect on the reaction. A few synthetic transformations of this method were also demonstrated in this chapter. Finally, the **Chapter 5** of the thesis highlights an organocatalytic asymmetric domino Michael/acyl transfer reaction between *γ*/*δ*-hydroxyenones and *α*-nitroketones by using quinine-derived bifunctional amino-squaramide catalyst. The substrate scope of this reaction is quite versatile resulting the products with high yield and excellent enantioselectivities. The applicability of this method was also explored in this chapter by the synthesis of pyrrolidine motif which is present in a wide range of biologically active compounds.