

CHAPTER 5

**Summary and future scopes of the
present work**

5.1 Conclusion

1. Three imidazolium based Brønsted acidic ionic liquids such as [Msim][OCCCCl₃], [Dsim][OTs] and [Hmim][OCCCCl₃] were synthesized and characterized by FT-IR, ¹H NMR, ¹³C NMR and elemental analysis.
2. The acidity and thermal stability of the new ILs [Msim][OCCCCl₃] and [Hmim][OCCCCl₃] were compared with the parent ionic liquid [Msim][Cl] in **Chapter 2** (Section 2A) using UV-visible method and thermogravimetric analysis.
3. In addition the acidity and thermal stability of [Dsim][OTs] was compared with known ILs [Msim][OCCCCl₃], [Dsim][OCCCCl₃] and [Dsim][OOCFF₃] using the UV-visible spectrophotometer as well as TGA analysis in **Chapter 2** (Section 2B). The acidity order of four ILs was observed in the following decreasing trend according to their values of Hammett functions ([Dsim][OOCFF₃]) > ([Dsim][OTs]) > ([Dsim][OCCCCl₃]) > ([Msim][OOCFF₃]).

The thermal stability of [Dsim][OTs] was found to be less as compared to the other ILs which decomposed (approx. 40%) at 57.5 °C in spite of higher acidity.

4. The ILs [Msim][OCCCCl₃] and [Msim][Cl] were efficiently utilized as recyclable dual acidic solvent-catalyst systems for the preparation of quinoline derivatives via Friedländer annulation using 2-amino aryl ketone and variety of ketones/ketoesters under solvent free thermal condition in **Chapter 2** (Section 2A) within 45-70 min. The same reactions also furnished excellent yields during 4 h under solvent-free method at 100 °C using 10 mol% of CCl₃COOH as reusable catalyst.
5. The **Chapter 2** (Section 2B) also included the applications of sulfoimidazolium task-specific acidic ILs as catalyst/medium for one pot two-step synthesis of 2-styrylquinolines in presence of the three ILs [Msim][OCCCCl₃], [Dsim][OCCCCl₃] and [Dsim][OOCFF₃].
6. In **Chapter 3**, three silica supported organocatalysts namely SiO₂-TFA, SiO₂-TCA and SiO₂-AA were synthesized from three carboxylic

acids and characterized them by using various spectral techniques. After characterization, these supported acids were utilized as simple, efficient and reusable catalyst for the three component one pot synthesis of β -amino carbonyl compounds in solution as well as solvent-free grinding method at ambient temperature within one hour. The three carboxylic acids produced only 20-57% yields of product in solution during longer reaction time without silica support.

7. In **Chapter 4** nitrogen bound polymer poly(4-vinylpyridine) was successfully employed as mild, recyclable Lewis base catalyst for the clean synthesis of β -nitroaldol in water medium.
8. During the whole work, various greener components such as simplicity and improvement in procedure and techniques, milder reaction condition, enhancement in reaction rates using one pot methodology, higher yield and selectivity of products, and reusability of ionic liquids as well as solid catalysts were envisaged.

5.2 Future scopes of the present work

1. The physico-chemical properties of sulfoimidazolium ionic liquids can be studied as these are essential for theoretical and industrial applications.
2. The acidic sulfoimidazolium ionic liquids can also be further applicable as catalyst or medium for one pot preparation of pyrimidine, oxazine and other important heterocyclic compounds. Such types of sulfoimidazolium ILs can be easily designed to get improved properties of Brønsted acidic system.
3. The synthesized 2-styrylquinoline compounds can be further utilized as intermediates for the synthesis of some valuable addition products.
4. There is a possibility to study the biological activity of synthesized 2-styrylquinoline derivatives.

5. The asymmetric synthesis of β -amino carbonyls and β -nitroalcohols can be possible using chiral ILs.
6. There is a scope to employ the silica supported catalysts for other organic transformations as efficient heterogeneous catalyst.