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Conclusion

8.1 Summary

The primary focus of the thesis entitled "**Calix[4]arene Derived Catalysts for Asymmetric Organic Transformations"** a variety of emerging homogeneous catalysts utilising calix[4]arene scaffold has been synthesised and characterized. Catalysts facile synthesis has been performed utilizing available knowledge of controlling reactivity and stereoselectivity. The chiral catalysts were used for asymmetric synthesis.

The most significant conclusions of the thesis are as follows:

1. A set of Cinchona moiety appended with calix[4]arene catalysts were synthesized using mono and disubstituted calix[4]arene. Two different bases have been used for mono and dialkylation of the calixarene. The cone conformation of the catalysts was confirmed with NMR spectroscopy. To understand the catalytic behavior of the catalyst asymmetric Michael addition reaction was studied. The disubstituted catalyst showed the highest conversion and enantioselectivity in the case of acetylacetone to β-nitrostyrenes under the optimized conditions. Density functional theory investigations throw light on the catalyst–substrate interaction and the reaction mechanism.
2. A set of quaternary ammonium Cinchona-Functionalized Crown Ether-Strapped Calixarene catalysts was synthesized and characterised. The addition of ethylene glycol units ensures the rigidity with which the compound is held in the cone conformation, enforcing the cavity. Two different catalysts were prepared by alkylation and acylation. The addition of cinchonidine resulted in the formation of chiral catalysts. The catalytic activity of the catalysts was utilised in asymmetric Alkylation reactions of α-alkylation of glycine imines to α-alkylated glycinates with remarkable selectivity under ambient conditions. The Cinchona cationic moiety of the catalyst transfers chirality through noncovalent interactions and π–π stacking, and the crown ether pendulum enhances enantioselectivities and the rate of reaction.
3. A series of α-methylbenzylamine functionalised catalysts were synthesised. Alkylated calixarene was appended with α-methylbenzylamine and in another catalyst was synthesised by appending α-methylbenzylamine to calix[4]arene crown 5 and a highly selective α-methylbenzylamine functionalized crown-ether-appended calix[4]arene derived phase transfer catalyst synthesised. Its catalytic activity utilised asymmetric nitroaldol reaction to provide the desired nitroaldol adducts in high yields with good to excellent enantioselectivities. The catalyst showed the selective recognition of K+ by calix-crown that generated nitronate anion. The nitronate anion was involved in non-covalent interactions with −O, N−H, and aryl groups of the catalyst to generate a chiral environment for the enantioselective addition of nitronate anion to the carbonyl group.
4. A series of simple and newly designed recyclable camphor sulfonyl functionalized crown ether tethered calix[4]arenes organocatalyst (C8) for asymmetric Strecker reaction that shows promising adaptability to high-throughput screening with remarkable efficiency and selectivity under ambient conditions (99% Yield and > 99% ee). Here the sulfonyl moiety transfers the chirality to the substrate through non-covalent interactions, π - π stacking, and the crown ether pendulum serves as a useful tool for control of asymmetric reaction which enhances enantioselectivity. Application of this chemistry for a two-step, gram-scale synthesis of (S)-Clopidogrel bisulfate with 73.2% yield and 98.5 % ee illustrates the power of the new protocols for the preparation of pharmaceutically relevant compounds.

8.2 Future scope

Because of the nature of calix[4]arene we have good reasons to suppose that the compounds synthesized and characterized in this thesis could be used as effective PTCs and organocatalysts in various reactions.

1. The Two new lower rim anchored *Cinchona* calix[4]arene organocatalysts (**C1** and **C2**) could be used in various catalytic reactions under Phase transfer conditions.
2. The two efficient new chiral PTCs derived from quaternary ammonium *Cinchona* functionalized crown-ether-strapped calix[4]arene (**C3** and **C4**) could be used to study the effect of counter ions and hence the chirality transfer from the counter ion.
3. The highly efficient Henry reaction of various aldehydes with nitromethane using a novel bifunctional phase transfer catalyst bearing calixarene moiety with a chiral NH donor could be engaged in an organocatalytic reaction where there is no requirement of a catalytic amount of base.
4. The Newly designed camphor sulfonyl functionalized crown ether strapped calix[4]arenes as organocatalysts(**C8**) for asymmetric Strecker reaction for cyano-adduct that show promising adaptability to high-throughput screening with remarkable efficiency and selectivity under ambient conditions(99% Yield and > 99% ee) this catalyst could be used in synthesis of homologous drugs e.g. Prasugrel and further modification in designing of catalyst to increase ee.