Concluding Remark

This thesis discusses the synthesis of ferrite magnetic nanoparticles and composites viz. CoFe$_2$O$_4$, Pd-CoFe$_2$O$_4$, CoFe$_2$O$_4$-Cr$_2$O$_3$-SiO$_2$ and CoFe$_2$O$_4$-ZnS and their characterization using various physico-chemical techniques like SEM, TEM, XRD, IR, RAMAN, EPR, UV-Vis, VSM etc. The catalytic activity of these magnetic nanomaterials has been looked into a number of synthetically important reactions including Knoevenagel condensation, Aldol condensation, Nitroaldol reaction, Acetylation of alcohols and amines, Boc-protection of amines, Suzuki couplings, and synthesis of new spirocyclic ethers. The thesis also explores the recently attractive area of magnetic nanomaterials in environmental applications, such as for photo-catalysis. These materials display high activity, selectivity, and stability in addition to their characteristic facile magnetic separation as compared to their unsupported counterparts.

These nanomaterials show great promise as chiral catalysts, which can be designed by functionalizing these materials using chiral ligands and thus offering great potential to reuse these otherwise expensive catalyst systems. Moreover, considering their ease of synthesis using cheaper starting materials, these materials can perform better than the alternatives in large-scale applications, favorably replacing conventional materials such as silica and zeolites. However, in addition to better characterization techniques, computational study is appreciably needed to understand the nature of the active species at the surface of these magnetic materials. This type of study can help to explain the mechanistic aspect in reaction and can, in turn, help to design and develop better nanocatalyst systems.