# CHAPTER IV

# CONCLUSION

Heterobimetallic complexes of *N*-salicyl-β-amino alcohols were prepared and evaluated as catalysts for asymmetric Michael addition of dialkyl malonates to enones. The best condition of asymmetric Michael reaction was to use 10 mol % of $LiAlH_4$ and ligand **87e** in ratio of 1:1, THF and 15h at room temperature. The difference in the ratio of complexes of $LiAlH_4$ to ligand **87** (1:1 versus 1:2) did not have any effect on the configuration of the product which is in sharp contrast to previous reports.[*40-41*] Under this condition, up to 88 % *ee* of the product was obtained according to chiral GC analysis. Effect of substituents on the ligand on the reaction outcome were investigated which revealed several interesting structure-activity relationships. There are good correlation between the size of the α-substituent and *ee*. It was found that R = $^t$Bu in **87e** was the best side chain. In contrast, the bulky substituents on the salicyl moiety afforded little or no enantioselectivity. The electronic effect of substituents on the salicyl moiety can be summarized as follows: electron donating substituents did not have significant effect on the yield and enantioselectivity, although electron withdrawing substituent on salicyl moiety provided somewhat lower enantioselectivity. The number of chelating groups of the ligand has to be three (two OH and one NH groups). This strongly proves that these ligands coordinate to the metals in a tridentate fashion. The non-salicyl ligands could catalyze the same Michael reaction with high yields but with poor or no enantioselectivity. The best source of metals for catalyst was $LiAlH_4$. However, the scope of this reaction was still limited in terms of substrate structures and nucleophile species.