

CHAPTER IV

CONCLUSIONS

The novel chiral salens containing ethylene glycol monomethylether and diethylene glycol monomethylether chains were synthesized starting from *t*-butylhydroquinone in three steps, alkylation, formylation and condensation. While the yields of alkylation step remained relatively low (39% - 41% yields), the yields of formylation step was significantly improved by using SnCl₄-mediated formylation (60% - 64% yields) in place of Duff's reaction (14% - 16% yields). In the condensation step, the reaction between the salicylaldehydes **3** and **7** and (*R,R*)-1,2-diaminocyclohexane mono(+)-tartrate salt afforded the desired chiral salens **4** and **8** in excellent yields (83% - 98% yields). Treatment of salen **4** and **8** with Mn(OAc)₂ in the presence of oxygen gas gave manganese (III) complexes **9** and **10** in moderate yields (38% - 50% yields).

The catalytic properties of these chiral manganese (III) salen complexes in the enantioselective epoxidation of styrene and indene were investigated. Two oxidizing systems, the *m*-CPBA/NMO homogeneous oxidizing system and the aqueous NaOCl/PPNO heterogeneous oxidizing system were tested. For the *m*-CPBA/NMO system, the reaction proceeded best in dichloromethane with 10 mol% catalyst and 5 eq. of NMO. For the aqueous NaOCl/4-PPNO system, the best results were obtained when using 4 mol% catalyst and 0.15 eq. 4-PPNO. Complexes **9** and **10** gave very similar results in terms of yields and enantioselectivities for both homogeneous and heterogeneous oxidizing systems indicating that the ethylene glycol and diethyleneglycol chains did not post significant difference in the catalytic properties of manganese (III) salen complexes for the epoxidation. Furthermore, the enantioselectivities of alkenes achieved from both complexes were comparable to the Jacobsen's catalyst also implying that the glycol substituents have similar stereocontrol as the *t*-butyl group.

Suggestions for future work:

- 1) A chiral salen with triethylene glycol chain as a substituent should be synthesized.
- 2) The enantioselective epoxidation of another alkene substrates with different types of substitution patterns should be explored.
- 3) Other enantioselective reactions such as ring opening of epoxide and nucleophilic addition of aldehydes or imines with other types of metal complexes with these chiral ligands can be a very good project for future Ph.D. work.



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