CHAPTER X

CONCLUSIONS AND RECOMMENDATIONS

5.1. CONCLUSIONS

From this work, it can be concluded as follows:

1. Copolymerization of ethylene and norbornene was carried out with C_2-symmetry catalyst (rac-Et[Ind]$_2$ZrCl$_2$), C_{2v}-symmetry catalysts ((n-BuCp)$_2$ZrCl$_2$, Cp$_2$ZrCl$_2$, Cp$_2$TiCl$_2$) and half metallocene catalysts (CpTiCl$_3$, Cp*TiCl$_3$, Cp*TiMe$_3$) in the presence of MAO as a cocatalyst. The catalytic activity of ethylene and norbornene copolymerization using C_2-symmetry catalyst system was better than C_{2v}-symmetry catalyst systems. On the other hand, half metallocene catalyst systems copolymerization of ethylene and norbornene can not be proceeded. Among the used catalysts, rac-Et[Ind]$_2$ZrCl$_2$ gave copolymers containing the highest amounts of norbornene incorporation and also the lowest crystallinity.

2. Considering rac-Et[Ind]$_2$ZrCl$_2$ and Cp$_2$ZrCl$_2$ catalyst systems, Cp$_2$ZrCl$_2$ showed higher activity than that of rac-Et[Ind]$_2$ZrCl$_2$ in homopolymerization of ethylene however, opposite trend in copolymeriztion of ethylene and norbornene was found. The catalytic activity decreased with increasing norbornene concentrations for both zirconocene catalyst systems. The decreased activity for rac-Et[Ind]$_2$ZrCl$_2$ is higher than that of Cp$_2$ZrCl$_2$.

3. Ethylene and norbornene copolymerization with rac-Et[Ind]$_2$ZrCl$_2$/MAO catalyst system was performed in toluene or xylene as a solvent. For both systems, the catalytic activity and norbornene content in copolymer decreased with increasing the polymerization times, thus the effect of different solvents was not observed. The catalytic activity of ethylene and norbornene copolymerization conducted in toluene was higher than xylene for shorter polymerization time, however, norbornene content in the copolymer chain conducted in xylene was higher. However, ethylene and

norbornene copolymerization can not be proceeded in a system using aliphatic solvents (1-hexane, 1-heptane, 1-decane).

5.2 RECOMMENDATIONS

From the results in this work, the further investigation in the following subjects will be useful.

1. The effect of different types of metallocene catalyst on the catalytic activity and norbornene content in copolymer should be further studied with other metallocene catalysts such as C_s-symmetric catalysts, C_1-symmetric catalysts, constrained geometry catalysts (CGC) and late transition metal catalysts.
2. Further study on the effect of different solvents on the catalytic activity and norbornene content in copolymer using other cyclic solvents and aromatic solvents.
3. The effect of 3rd monomer on catalytic activity and polymer properties should be investigated.