# CHAPTER V
# CONCLUSIONS AND RECOMMENDATIONS

All the (HSA) $Ag/Al_2O_3$ sol-gel catalysts showed no selectivity to EO in ethylene oxidation; hence these (HSA) $Ag/Al_2O_3$ sol-gel catalysts were poor catalysts for ethylene epoxidation. In the study of hydrogen effect on activity of (HSA) $Ag/Al_2O_3$ sol-gel catalysts, hydrogen enhanced the combustion reaction rate and gave more carbon dioxide. In addition, the different calcination and oxidation-reduction methods to this type of catalyst did not enhance the selectivity of the reaction towards EO, even though the metallic silver favors to partial oxidation.

The activities of (LSA) $Ag/\alpha\text{-}Al_2O_3$ catalysts decreased as the reaction temperature increased. The maximum selectivity to EO of 72% with 1.8% yield of EO was found at a temperature of $210^0$C with 15 wt% silver loading. The selectivity to EO decreased when the loading was increased to 17 and 20 wt% or decreased to 13 wt%. Since it was known that a higher oxygen concentration promotes the ethylene oxide production, the reaction with 6 % $C_2H_4$ and 12% $O_2$, molar ratio of 0.5 gave the maximum selectivity to EO on the most active catalyst, 15 wt % (LSA) $Ag/\alpha\text{-}Al_2O_3$, which pretreated with $H_2$ (20 ml/min) at $400^0$C for 2.5 hours.

In addition, the calcination and oxidation-reduction method also effected to the activity of (LSA) $Ag/\alpha\text{-}Al_2O_3$ catalyst. The reduced catalyst showed higher selectivity to EO than the oxidized catalyst.

For the future work, it is interesting to test the effect of alkaline earth metals promoter on the activity of sol-gel catalyst for the ethylene oxidation reaction. And also the promoting effect of hydrogen or alkaline earth metals on the catalytic activity of $Ag/\alpha\text{-}Al_2O_3$ catalyst should be carried out.

Furthermore, other types of support such as $TiO_2$ and $SiO_2$ should be tested for the ethylene oxidation reaction.