



CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The photocatalytic degradation of 4-chlorophenol (4-CP) using different catalysts, TiO_2 (Degussa P25), TiO_2 (sol-gel), AuTiO_2 and Ag/TiO_2 was investigated. For TiO_2 prepared by sol-gel method, TiO_2 (sol-gel), the decrease in 4-CP concentration was much faster than that with TiO_2 (Degussa P25) because of the higher surface area of TiO_2 (sol-gel). On the contrary, the reduction rate of TOC with TiO_2 (Degussa P25) was much higher than that with TiO_2 (sol-gel) because of the higher crystallinity of TiO_2 (Degussa P25).

The presence of 0.05% and 0.1% Au/TiO_2 degraded HQ into HHQ rapidly because of the high surface areas resulting in the increase of intermediate adsorption on the catalyst surface. The optimum point of adding Au was found to be 0.1%, when the degradation rates in terms of 4-CP and TOC were increased. The Au particles on the TiO_2 surface causes a strong increase in the rate of oxygen reduction resulting in faster generation of hydroxyl radicals. For Ag/TiO_2 , the addition of Ag did not have any effect on the 4-CP degradation rate. However, 0.1% Ag in TiO_2 enhanced the degradation rate of the intermediate products resulted in the maximum reduction of TOC. A small amount of Ag on TiO_2 attributes the acceleration of superoxide radical anion, $\text{O}_2^{\bullet-}$, formation resulting in decreasing the recombination process and Ag increases the rate of direct hole oxidation pathway leading to improving the photocatalytic activity. For the bimetallic catalyst, the presence of 0.1% Au and 0.1% Ag/TiO_2 did not improve the photoactivity as compared to 0.1% Ag/TiO_2 . That is because both catalysts had the similarity of the BET surface area. Moreover, besides TiO_2 (Degussa P25), 0.1% Ag/TiO_2 and 0.1% Au-0.1\% Ag/TiO_2 gave the highest photocatalytic activity in terms of TOC remaining fraction. The effectiveness of the immobilized TiO_2 (sol-gel-2) was lower than that of the suspended system.

5.2 Recommendations

As seen in this study, TiO₂ (Degussa P25) has high effectiveness to degrade 4-CP, so that impregnation of metals on TiO₂ (Degussa P25) may be of interest. Further investigation on the immobilized systems should be carried out.