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-1), TiO_2 (sol-gel-2), Pt/TiO_2 and Ag/TiO_2 was investigated. For TiO_2 prepared by two sol-gel methods, TiO_2 (sol-gel-1) and TiO_2 (sol-gel-2), under the presence of dissolved oxygen, the decrease in 4-CP concentration was much faster than those with TiO_2 (Degussa P25) because of their higher surface areas. On the contrary, the reduction rate of TOC with TiO_2 (Degussa P25) under the presence of oxygen was higher than those with TiO_2 (sol-gel-1) and TiO_2 (sol-gel-2) because of its higher crystalinity.

For Pt/TiO_2 with nitrogen aeration, the presence of 1.0 mol% Pt on TiO_2 enhanced the degradation rate in terms of TOC but the Pt/TiO_2 with dissolved oxygen decreased the photoactivity. For Ag/TiO_2 under the presence of dissolved oxygen, an addition of 0.5 mol% Ag into TiO_2 enhanced the degradation rate of the intermediate products resulted in the decrease of TOC. However, Ag did not have any effect on the degradation rate on 4-CP. Furthermore, 0.5% Ag/ TiO_2 showed the highest activity compared to other catalysts. Small amount of Ag on TiO_2 attributes to the acceleration of superoxide radical anion, $O_2^{\bullet-}$, formation resulting in decreasing the recombination process and Ag increases the rate of direct hole oxidation pathway leading to improving the photocatalytic activity.

The main intermediate products generated during the reaction under the absence of dissolved oxygen were hydroquinone (HQ), benzoquinone (BQ) and hydroxyhydroquinone (HHQ) but BQ was not observed under the presence of dissolved oxygen. The presence of dissolved oxygen played an important role in the photocatalytic degradation of 4-CP. Since the oxygen was added in the solution, both type and concentration of intermediate products decreased because dissolved oxygen can act as an electron scavenger and increased hydroxyl radical.

5.2 Recommendations

The kinetics of the photocatalytic degradation of 4-CP with TiO_2 prepared by the sol-gel method and Ag/TiO_2 should be studied. In conventional photocatalytic processes, the powder catalysts have two serious problems. First, the settling velocity of powder TiO_2 is very slow requiring a long retention time in the clarifier. Second, as the dosage of TiO_2 is increased in order to increase the photocatalytic rate, the high turbidity created by the high TiO_2 can actually decrease the depth of UV penetration. Therefore, an immobilized system by depositing sol-gel TiO_2 on a transparent solid support should be investigated.