CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

From the photocatalytic study, the presence of TiO_2 catalyst was necessary for the reduction of total organic carbon (TOC). The TOC reduction rate increased significantly with increasing the amount of TiO_2 catalyst and the optimum amount of TiO_2 catalyst was 0.7 g/l. The TOC reduction rate decreased with increasing the calcination temperature because of the transformation of TiO_2 from anatase to rutile at the higher calcination temperature. The initial pH of the 4-chlorophenol solution did not significantly affect the TOC reduction rate. The commertial TiO_2, Degussa P25, showed a higher TOC reduction rate than the sol-gel TiO_2 because of the higher pore volume and crystallite size.

In case of Pt/TiO_2, the presence of Pt on TiO_2 enhanced the TOC reduction rate. Adding small amount of Pt improved the activity of TiO_2 and the highest activity was obtained with $1\%Pt/TiO_2$. The small amount of Pt on TiO_2 is attributed to the acceleration of superoxide radical anion, $O_2^{\bullet-}$, formation and consequently decreases the recombination process and enhances the photocatalytic activity.

For TiO_2-SiO_2, the highest activity was achieved with $10\%SiO_2$-TiO_2 because of its highest adsorption of 4-chlorophenol. The higher adsorption constant means that more organic molecules are adsorbed and reacted on the catalyst surface. The activity of $10\%SiO_2$-TiO_2 decreased with increasing the calcination temperature because of the lower surface area. The other reason is that decreases in the OH group and the adsorbed water at the higher temperature result in having less of hydroxyl radical and consequently decrease the catalyst activity.

For the photocatalytic study of Pt/TiO_2-SiO_2 with 1 %Pt and 10 %SiO_2, the synergistic effect of adding both 1 %Pt and 10 %SiO_2 was not observed. It can be explained by two reasons. The agglomeration of the catalyst decreases active area and consequently lowers the catalyst activity. The other reason is that the large particle size of Pt on the surface can act as the recombination centers resulting in the decrease of the catalyst activity.

5.2 Recommendations

The physical properties and photocatalytic activities of catalysts may be affected by the other parameters such as the types of precursors, the supports and the types of metal. In this work, titanium ethoxide was used as a precursor, the other types of precursors such as titanium butoxide and titanium diisopropoxide should be investigated. The types of supports such as alumina, zeolite and the types of metal such as Ag, Au and Pd should be studied instead of silica and Pt, respectively.

The operation conditions such as the dissolved oxygen and light wavelength may affect the photocatalytic activities and should be studied. The mechanisms, amount and concentration of intermediates should be determined.