CHAPTER 5

Conclusions and Recommendations

5.1 Conclusions

The photocatalytic degradation rate of 2-chlorophenol (2-CP) by TiO_2 catalysts synthesized by the hydrothermal process was investigated in a batch photo-reactor using under blue light irradiation. In the course of the study the following conclusions are made:

1. The optimal amount of cerium used for doping TiO_2 was found to be cerium-doped TiO_2 0.28 %mol. Increasing amount of TiO_2/Ce. Resulted in more electron and hole pairs availability, so the reaction rate increases. On the other hand, increasing the amount of TiO_2 to 0.35 %mol, decreased the performance of the oxidation process.

2. Calcination temperature was found to be 6 0 0 ºC. The calcinations temperature increased from 200 ºC to 600 ºC while, decreasing the amount of 2-chlorophenol and increasing the removal efficiency, consequently

3. The highest % 2-chlorophenol degradation observed at pH 7 and pH 5.5were 100% and 99%, respectively. The performance in 2-chlorophenol removal could be arrayed in order of initial pH 7 > initial pH 5.5 > initial pH 2 > initial pH 3 > initial pH 9 with the efficiencies of 99, 98, 85, 83 and 67%, respectively. The effects of pH can be explained by part of the point of zero charge (pzc) or surface charge. The studies of 2-chlorophenol degradation using Ce-doped TiO_2 revealed that for TiO_2 catalyst with a pH_{pzc} of 2.83 and operated condition on initial pH of 5 and 7, the degradation rate increases when increasing the initial pH up to 7, but decreasing significantly at a pH more than 8.53(pH 9).

4. The highest % degradation of 2-chlorophenol was found at a photocatalyst dosage of 3 g/L**.** The percent degradation efficiency was 98% at 240 minutes**.** This can be explained by the TiO_2 particles near the light source that blocked the light for the other particles thus, decreasing the photocatalytic activity.

5. The optimal conditions for the range of the parameters investigated were found to be cerium-doped TiO_2 0.28 %mol for the amount of dopant, 0.05 vol HNO_3/ vol $Ti(OBu)_4$ ratio of the amount of acid, and 600 ^{0}C for the calcination temperature with an initial 2-chlorophenol concentration of 20 ppm, pH 7 and TiO_2 concentration of 3 g/L were removed 100% of 20 ppm initial 2-chlorophenol concentration in 240 minutes.

6. The X-ray diffraction (XRD) for Ce-doped TiO_2 with different amounts of dopant, the characteristic plane diffraction peak for anatase phase of TiO2 was observed. However, rutile phase was not observed.

7. The photocatalyst synthesized at these conditions of 20 ppm initial 2-chlorophenol concentration present with That Calculated values of Correlation coefficient (R^2), specific rate constant (k_r) and equilibrium adsorption constant (K) were 0.9215, 3.13 x 10^{-3} m*M*.min^{-1} and 16.92 mM^{-1} respectively.

8. The total cost of Ce-doped TiO_2 catalyst with hydrothermal method is 3.898 baht/L or 1,068 baht/m^3

5.2 Recommendation for future study

1. Study the photoactivity TiO_2/Ce 100:0.28 %mol by using other pollutants and compared the results to 2-chlorophenol of this case.
2. Study photocatalytic activity by use other calcinations temperature (more than 600 ^{0}C) for cerium dopant to further investigate of the synthesized TiO_2 catalyst.
3. This is to determine the applicability of the technology on real setting to reuse and recovery the water treatment. Immobilization of TiO_2 can also be employed.