CHAPTER I

INTRODUCTION

1.1 Motivations

Nowadays, Thailand is moving toward industrialization. Environmental problems are following in many parts of this country and become a big problem. Especially, pollutants from hazardous chemicals that used in many manufactures and lack of good operating treatment before dumping or disposal cause death to the aquatic life in ecosystem as well as profoundly affecting the terrestrial ecosystem. Chlorophenols (CPs) are one of the most important groups of toxic pollutants listed in the U.S. EPA: Clean Water Act (Oturan, N., Panizza, and Oturan, M. A., 2009). It has been found in many kind of wastewater from industrial and urban sources. CPs can widespread in the aqueous environment due to its persistent and highly water-soluble substance, led to accumulation in the environment (Estevinho et al., 2007). Amongst the various types of CPs, 2,4-dichlorophenol (2,4-DCP) is the most important substance that should be observed, due to its highly toxicity. The various treatment technologies have been used removal of CPs from wastewater such as adsorption and ion exchange methods but not for complete mineralization. Biodegradation of CPs is more specific and relatively inexpensive, but it's not suitable for high concentration of CPs, due to its toxic to activated sludge bacteria (Kargi and Eker, 2005). In the recent year, advanced oxidation processes (AOPs) have been extensively utilized for the decomposition of hazardous or recalcitrant pollutants in the environment (Chang et al., 2009). One of the most hopeful methods of AOPs for environmental application is photocatalysis process because of its extensive utilization for the decomposition of hazardous or resistant pollutants in the environment. Moreover, photocatalysis has many advantages over the usual oxidation processes including completing mineralization of pollutants, utilizing in UV and visible light without addition of chemical.

As already known that photocatalysis is a chemical reaction in which catalysts are stimulated by light in a wavelength range appropriate to stimulate their catalytic activity. Titanium dioxide (TiO_2) is excellent for photocatalytically breaking down organic compounds and commonly used as a photocatalyst. Moreover, doping of metal or nonmetal ions in TiO_2 can enhance the photocatalytic degradation activity.

This research focuses on the effect of amine templates and amount of Fe(III) used in the photocatalyst synthesis and also studies the effect of catalyst loading in the photocatalytic test of aqueous 2,4-DCP solution.

1.2 Objectives

1. To synthesize Fe(III) and N co-doped TiO_2 (Fe-N-TiO_2) photocatalysts and characterize their properties by XRD, surface area analysis, UV-DRs, XAS, TGA and Zeta potential.
2. To study the effect of template types on physical and chemical properties of photocatalysts.
3. To examine the optimal condition for photodegradation of aqueous 2,4-DCP by using Fe-N-TiO_2.

1.3 Scope of the Study

1. Fe-N-TiO_2 catalysts are prepared by sol-gel method using $Ti(C_4H_9)_4$, $Fe(NO_3)_3.9H_2O$ and HNO_3 as precursors.
2. Fe-N-TiO_2 catalysts are prepared by various templates including triethylamine ($C_6H_{15}N$), dodecylamine ($C_{12}H_{15}N$) and octacylamine ($C_{18}H_{39}N$).
3. The synthesized photocatalysts are characterized by XRD, UV-DRs, XAS, surface area analysis, Zeta potential and TG techniques.
4. The photocatalytic activity is evaluated by the photocatalytic of 2,4-DCP in batch reactor under visible light.
5. Initial concentration of 2,4-DCP is in the rage of 5-25 ppm.

1.4 Expected Outcomes

1. Obtaining the high efficiency photocatalyst for 2,4-DCP degradation.
2. Obtaining the suitable template for 2,4-DCP degradation.
3. Obtaining the optimum condition for 2,4-DCP degradation.