CHAPTER I
INTRODUCTION

4-Chlorophenol (4-CP), known as a toxic and non-biodegradable organic compound, is widely used for the production of dye, drug, and fungicide (Theurich *et al.,* 1996). As a result, 4-CP causes serious wastewater problems. The removal of this compound from wastewaters is currently performed by conventional wastewater treatment methods such as biological treatment, chlorination and adsorption. However, the biological process usually requires a considerably long treatment time to break down organic pollutants. In addition, some toxic organics may kill the active microorganisms. Chlorination poses another problem since it often generates carcinogenic by-products. Granular activated carbon adsorption is another commercialized process but the spent carbon needs to be disposed of (Chen and Ray, 1999).

Photocatalytic oxidation has been accepted as promising alternative to the conventional methods because, with suitable catalysts, most pollutants can be completely mineralized to carbon dioxide in the presence of UV or near–UV illumination. Moreover, this technique does not utilize toxic materials and can be operated at room temperature (Falconer *et al.,* 1998). The photocatalytic process starts with illumination of light at an appropriate wavelength to a photocatalyst that is normally a semiconductor. The catalyst, which is activated with photo energy, produces electrons and holes that easily migrate to the catalyst surface and initiate the redox reaction. Although a wide range of catalysts has been applied, titania (TiO_2) seems to be the most widely used catalyst because it is stable in aqueous solution, corrosion resistant, and relatively inexpensive (Reutergardh and Iangphasuk, 1997).

It was reported that 4-CP was completely degraded in the presence of TiO_2 and Pt/TiO_2 but the total organic carbon (TOC) still remained at a high level (Tharathonpisutthikul, 2000). That is because 4-CP was transformed to other intermediate products rather than carbon dioxide. To minimize the unwanted intermediate products, the photocatalytic degradation of 4-CP should be further investigated, and catalysts may be modified so that the photocatalytic oxidation can

completely mineralize all toxic species without leaving behind any intermediate products.

In this work, further investigation on the formation of the intermediate products of the photocatalytic degradation of 4-CP using TiO_2 and Pt/TiO_2 was carried out. Ag/TiO_2 was employed to investigate the possibility of improving the activity of TiO_2 for the decomposition of 4-CP. The effect of the Ag content for the decomposition of 4-CP along with the types and amount of the intermediate products generated during the reaction and the effect of dissolved oxygen were also investigated.