CHAPTER I
INTRODUCTION

The prevalent presence of persevering organic chemicals as pollutants in wastewater effluents from industries or even normal habitation is an earnest environmental problem. Therefore, many processes such as biological treatment, chemical treatment, phase transfer and thermal oxidation have been proposed. These methods are not usually suitable for non-biodegradable compounds. A novel technology process for such the compounds is heterogeneous photocatalytic oxidation whereas the pollutants are degraded by irradiating metal oxide such as TiO_2 or ZnO with proper energy.

In most cases, TiO_2, which is a semiconductor, is used as a catalyst because it is stable, insoluble in aqueous solution, highly corrosive resistance, still active when reused and also inexpensive (De Lasa *et al.*, 1992). In practice, catalyst particles can be either suspended in an aqueous solution or immobilized on some surfaces, which can be quartz, glass and stainless steel (Fernández *et al.*, 1995). The slurry-type reaction system is obvious that such the operation has an inherent drawback to separation of ultra fine catalyst in order to reuse TiO_2 particles. To overcome this drawback, immobilizations of TiO_2 have been performed. Unfortunately, the effectiveness is lower than the slurry-type reaction system.

The photocatalytic reaction may be promoted or impeded by doping with a certain kind of metal. Several kinds of metal have been doped on TiO_2 by sol-gel, mechanical mixing, chemical deposition, and incipient wetness impregnation (Jin *et al.*, 2003). It was reported that 1.0%Ag and 1%Ag-1%Au on TiO_2 prepared by the sol-gel method enhanced and gave the highest photocatalytic efficiency among various Ag and Au doping. However, the use of a commercial catalyst (Degussa P25) resulted in much higher photocatalytic efficiency than metallized sol-gel TiO_2 (Wongvisate, 2003).

In the present study, a series of commercially available TiO_2 (Degussa P25) doped with Ag and Au and treated by temperature were evaluated for their photocatalytic activity on 4-chlorophenol decomposition. A new batch/continuous photocatalytic reactor was constructed and used for the

investigation with the highest activity of TiO_2 immobilized on stainless steel mesh. Effect of solution flow rate was also studied.