CHAPTER I
INTRODUCTION

Air pollutants affect both human health and environment. They can enter the human body by inhalation or touching. Their toxicity on human health can cause premature death, respiratory illness, alterations in the lung's defenses, and aggravation of existing cardiovascular disease. Furthermore, they are also precursors to smog, ozone and acidic precipitation (acid rain) and they can affect both terrestrial and aquatic ecosystems and finally global warming (Papaethimiou *et al.*, 1997). Emissions of pollutants come from many mobile sources and industrial processes including chemical industry and petroleum refineries.

There are various methods for air pollution abatement, such as liquid absorption, solid adsorption, scrubbing, precipitation, capture devices (fibers, membranes, condensers, etc.), biodegradation, thermal incineration, and catalytic combustion (Cheng, 1996). Combustion is the most effective way to achieve complete destruction of organic pollutants but the energy requirement for combustion is rather high. Non-thermal plasma and photocatalytic processes have been considered as promising alternatives to offer economical operation because the complete oxidation of organic pollutants at ambient temperature and pressure is possible. Moreover, main products from the plasma or photocatalytic processes are carbon dioxide, and water, which are environmental friendly. Plasma reactors are already being used to study different possible applications in control of toxic gases, volatile organic compounds, hazardous emissions, and for ozone synthesis (Eliasson *et al.*, 1987; Eliasson and Kogelschatz, 1991; Futamura *et al.*, 2001; and Huang *et al.*, 2001).

Non-thermal plasma is generated by applying electric field with high voltage across the metal electrodes to produce high-energy electrons that can decompose pollutants. Moreover, during plasma generation, light and active species including radicals, and ions are also produced apart from high-energy electrons. Previous work has shown that the degradation of ethylene using a combined plasma and photocatalytic process, was greatly affected by the ethylene residence time (Harndumrongsak *et al.*, 2002).

In this work, a multi-stage plasma reactor unit with their own plasma generators was developed and tested for the ethylene oxidation. Moreover, the presence of TiO_2, used as a photocatalyst, was investigated the effect on ethylene oxidation reaction.