



CHAPTER I INTRODUCTION

Volatile organic compounds (VOCs) are one of major sources of air pollution. Common VOCs in the atmosphere are liquids or solids containing organic carbon (carbon bonded to carbon, hydrogen, nitrogen, or sulfur, but not carbonate carbon as in CaCO_3 nor carbide carbon as in CaC_2 or CO or CO_2) which vaporizes at significant rates (De Nevers, 2000). VOCs not only increase the depletion of stratospheric ozone, but also cause widespread environmental contamination such as groundwater and soil contamination. It is well known that several kinds of VOCs are very harmful to human health because of carcinogenic and mutagenic effects. In addition, they are recognized as major contributors to air pollution, either directly through their toxicity or malodorous nature, or indirectly as ozone precursors, smog precursors, acidic precipitation (acid rain) and finally global warming (Papaetimiou *et al.*, 1997).

Many countries have attempted to evaluate the toxicity of various environmental pollutants including VOCs in order to establish emission regulations from pollution sources. There are various methods for available air pollution control 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 pollutants. As known, the energy requirement for combustion is rather high while the other methods require further treatment and have some disadvantages. Non-thermal plasma and photocatalytic processes have been considered as promising and economical alternatives because the decomposition of pollutants at ambient temperature and pressure is possible to be obtained.

Non-thermal plasma is simply generated by applying an electric field across metal electrodes to produce high-energy electrons that can potentially decompose pollutants. For the photocatalytic process, light is necessary to

activate photocatalysts (Harndumrongsak, 2002). During plasma generation, the light and active species including electrons, radicals, and ions are produced. If oxygen is present at a sufficiently high level, desirable products from VOCs decomposition are carbon dioxide, water, and inorganic compounds, which are environmentally friendly.

Among the VOCs, benzene is an important chemical feedstock and a gasoline ingredient. Moreover, it has distinct volatility, solubility and very stability. It should be disposed of from the exhaust gases emitted from petrochemical plants, petroleum tanks, coke ovens, printing offices, distillation towers, and the chemical industries in which benzene is used as an organic solvent.

In this study, the oxidative removal of benzene as a model pollutant was studied using a multistage plasma reactor system with the presence of photocatalyst. Effects of photocatalyst (TiO_2) and platinized titania (Pt/TiO_2) coated on glass wool support on the benzene oxidation were also determined in the plasma conditions.