CHAPTER I
INTRODUCTION

Air pollution has caused serious environmental problems both indoors and outdoors. Several methods have been applied to manage such the problems. Biofiltration by activated carbon, adsorption by zeolite, and absorption by water, are some widely used methods. However, the mentioned technologies only remove contaminants from a source to a receptor. Thus, regeneration of the receptor and the destruction of contaminants are still necessary. Other technologies include incineration, which directly eliminates pollutants and has been applied for organic and inorganic compounds. Because of its energy extensive nature, using the incineration is sometimes cost ineffective, not to mention other pollution problems resulted from the improper control of the incineration. Nonthermal plasma and photocatalytic processes are promising alternatives for air pollutant removal because degradation of pollutants at ambient temperature and atmospheric pressure is possible.

In the nonthermal plasma production, a little electrical energy input is needed to generate extremely high-energy electrons at the temperature of which is higher than 10,000 K rather than heating gas molecules. These electrons initiate reactions and produce a number of active species, which propagate chain reactions. In addition to the formation of electrons, radicals, and ions, photons or light are also produced during plasma generation. Sathiamoorthy *et al.* (1999) reported that the ratio of number of photons to electrons produced by the pulse corona discharge was about 0.01. The VOCs decomposition of this technique is more energy-efficiency and the degree of decomposition of many chemicals is over 90 % but poorly selective to the CO_2 production (Futamura *et al.*, 1998, and Czech *et al.*, 1997).

For the photocatalytic treatment, light is used as an energy source to activate photocatalysts such as TiO_2 and ZnO. The decomposition or oxidation of organic compounds by this reaction results in carbon dioxide, water, and inorganic compounds as main products, and the deactivation of photocatalysts is very slow. However, the rate of the contaminant elimination is relatively low.

In this work, the degradation of ethylene in a plasma reactor was studied. Moreover, to utilize the generated UV light from plasma, a photocatalyst (TiO_2) was added in the reactor to investigate the effect of both plasma and photocatalysis on the CO_2 selectivity.