CHAPTER I
INTRODUCTION

In contemporary times, people face many problems such as those associated with energy, the economy, and health. Perhaps the most important issues are that of the price of energy and the consumption crisis. These matters can lead to another serious problem that is about pollution, especially the emission of pollutants (CO, CO_2, NO_3, and SO_2) due to the burning of fossil fuel.

As we know, the oil price crisis can also affect the global economy. For example, Thailand has to import crude oil into the country at a cost of approximately 5.5 billion baht per year. By last year, the price of gasoline in Thailand almost reached 40 baht per liter. Moreover, the price of crude oil in the Singaporean market reached over 130 dollars per barrel in 2008. A way to solve this problem is by using renewable energy.

The employment of renewable energy is currently being considered as a substitute for petroleum. It can be divided into two categories, which are alternative energy from depleted resources (liquid biofuels, biogas, and tar) and renewable resources (solar energy, fuel cell, and wind energy). The renewable energy can generate energy as fossil fuel and emits fewer pollutants into the atmosphere. Therefore, the renewable energy area has received much attention due to the oil price crisis and a reduction of the green house gas emission.

The development of fuel cells (renewable energy) for commercial applications is currently of great interest. This interest is driven by technical and environment advantages offered by the fuel cell. These consist of high performance characteristics, reliability, durability, and clean power. The source of fuel cell energy is hydrogen, which is usually produced from the reforming unit in the refinery plant. This is due to this unit's generation of a huge capacity of hydrogen via the dehydrogenation, isomerization, and aromatization reaction. However the fuel generated from reforming process contains a small amount of CO (1.5–1 Vol%). CO is preferentially adsorbed on the Pt cathode in the Proton Exchange Membrane (PEM) fuel cells; this component is poison to the PEM Fuel Cell. They can reduce

the efficiency of fuel cell rapidly. Therefore, the removal of CO is needed to lower the concentration of CO below 10 ppm for maintaining the efficiency of fuel cells.

Gold is generally known as an inert metal; therefore, it is very difficult to react with other components. However, it has been proved by many researchers that gold has high active on the CO oxidation reaction. Furthermore, support selection has much influence on the catalysts activity. It has been reported that Au/TiO_2 exhibited extremely high conversion and selectivity at a low temperature. In addition, it was found that operation of Preferential oxidation of CO (PROX) reaction in multi-stage reactor can increase the selectivity towards CO oxidation, when compared to that operated in single-stage reactor (Srinivas and Gulari, 2006).

The purpose of this work is to study the CO removal method by using PROX to convert CO to CO_2 at low temperature over Au/TiO_2 catalysts prepared by deposition-precipitation (DP) method. The parameters of catalyst preparation, which can affect the performance of CO oxidation (such as calcination temperature and %Au loading), will be investigated with simulated reformate gas. Then, the optimum reaction temperature, oxygen feed ratio, and catalyst weight split ratio for single-stage and multi-stage reactor, will be tested in a simulated reformate unit. Finally, the prepared catalysts will be applied in the real methanol reformate stream.