CHAPTER I
INTRODUCTION

Presently, proton exchange membrane (PEM) fuel cell has become an appropriate propulsion system of vehicles because of their high power density, compactness, light weight, relatively low emission, extreme quietness, transient response, quick start up, and low operating temperature (Bernay *et al.*, 2002, Song, 2002, and Luengnaruemitchai *et al.*, 2008). Although the PEM fuel cell can convert chemical energy into electricity without combustion, it requires high purity of hydrogen (H_2) and is sensitive to carbon monoxide (CO) generated by reforming process and mixed in the hydrogen stream. A little content of CO can decrease efficiency of the PEM fuel cell. Many scientists have tried to solve this problem by using various techniques. One of those interesting methods is CO oxidation reaction using various types of catalysts, not only to keep the low cost but also to decrease amount of carbon monoxide to less than 100 ppm.

The catalyst used in CO oxidation should be active and sensitive. Transition metals, such as platinum (Pt), rhodium (Rh), ruthenium (Ru), and palladium (Pd), are outstanding choices to catalyze CO oxidation reaction (Lui *et al.*, 2014). From the previous works, several researchers reported that Pt-containing catalyst was a good choice for preferential oxidation of CO reaction (PROX) since it showed an accomplished carbon monoxide conversion in a wide temperature range with a high selectivity (Rosso *et al.*, 2004). PROX reaction is similar to CO oxidation except addition of hydrogen in the system. However, platinum containing catalyst was generally limited to be used at low temperature (Naknam[2] *et al.*, 2009). Gold (Au) dispersed on the support was another metal found to be more suitable in PROX reaction (Naknam[1] *et al.*, 2009 and Naknam[2] *et al.*, 2009), providing a high carbon monoxide conversion and selectivity at low temperature (Igarash *et al.*, 1997 and Schubert *et al.*, 2004). Recently, some scientists paid attention to a study of low temperature CO oxidation using many types of metal loaded support, such as Pt and Au (Kudo *et al.*, 2010, and Liu *et al.*, 2014). Moreover, previous works presented

that Pt-supported on zeolite had better selectivity than Pt-supported on alumina because of the molecular sieve property of zeolite. (Luengnaruemitchai *et al.*, 2008).

In this work, we thus choose zeolite-A as a support, Au and Pt as active metals loaded on the support by the impregnation method. The performance of Au and Pt was compared for CO oxidation. Furthermore, synthesis of zeolite-A was conducted using various types of alkaline species, namely lithium (Li), sodium (Na), and potassium (K), via sol-gel process and microwave heating technique to study the catalytic performance of each zeolite-A supporting Pt for the CO oxidation reaction. In addition, the influence of cation charge and size of cations on the catalyst activity was also studied.