CHAPTER I
INTRODUCTION

Aromatic hydrocarbons, including benzene, toluene, and xylene (BTX), that are commonly used as raw materials in the chemical industry, are mainly obtained from petroleum resources (Yiwen *et al.*, 2010). Generally, the catalytic reforming of naphtha and pyrolysis of hydrocarbon are the main reaction to production of these basic aromatics, both of which have been well developed in the petrochemical industry. The main reason for the push for new method of aromatic production is due to the depleting petroleum or natural gas resources.

There are a number of sustainable renewable sources that can replace the petroleum-based reserves to production of aromatics, such as light paraffins, and oxygenated compounds (alcohol, ether, etc.). One of the promising renewable sources is palm fatty acid distillate (PFAD), which is a by-product from refining crude palm oil. PFAD is a light brown semi-solid at room temperature melting to a brown liquid on heating. PFAD comprises mainly of free fatty acid (FFA) with palmitic acid oleic acid as the major components. A profitable way to increase the value of PFAD is to transform it directly into aromatic products, which have various applications in the petrochemical industries.

The objective of this work is to aromatization of PFAD over HZSM-5 catalysts. Aromatization of PFAD was performed in a packed-bed continuous flow reactor at 500 °C under atmospheric pressure. The liquid products were analyzed by gas chromatograph (GC) with FID detector and the gas products were analyzed by GC online with FID and TCD detector. The effect of SiO_2/Al_2O_3 ratios of HZSM-5 zeolites were also investigated, the results showed that the HZSM-5 with SiO_2/Al_2O_3 ratio equal to 30 gave the highest BTEX yield. In order to improve the aromatic selectivity, metal species including Zn and Ga were incorporated into HZSM-5 catalyst. Zn/HZSM-5 and Ga/HZSM-5 were prepared by incipient wetness impregnation (IWI) technique with $Zn(NO_3)_3$ and $Ga(NO_3)_3$ precursors, respectively. The presence of Zn and Ga on HZSM-5 (30) catalysts preferentially promoted the dehydrogenation activity, resulting in lower light paraffins and higher aromatics yield. In additional, the catalysts were be characterized by temperature programmed

reduction (TPR), Temperature programmed desorption of isopropylamine (TPD-IPA), X-ray diffraction (XRD), Brunaure-Emmett-Tellet Method (BET), atomic absorption spectroscopy (AAS), and X-ray photoelectron spectroscopy (XPS).