CHAPTER I
INTRODUCTION

Petroleum is a classification of fossil fuels, which includes crude oil, natural gas and coal. Conventionally, all petrochemicals are produced from petroleum. Olefins and aromatic hydrocarbons are important petrochemicals. Light olefins include ethylene, propylene and butylenes, which are produced from fluid catalytic cracking unit in oil refineries and steam cracking of natural gas. Ethylene and propylene are important olefins used as raw materials in plastic and chemical industries. Butadiene is dominated in rubber and elastomer industries. Useful aromatic hydrocarbons such as benzene, toluene, and xylenes are derived from the catalytic reforming of naphtha. They are used in a wide range of raw materials; for examples, benzene is raw material for dye and resin production. Toluene is used as a solvent and in pesticides production. Xylenes have three forms used for different applications. Ortho-xylene is mainly used in the production of phthalic anhydride. Para-xylene is largely used in the production of terephthalic acid, and meta-xylene is used to produce isophthalic acid. Thus, petroleum is the important source of petrochemicals. However, tires are hydrocarbon materials which exhibit potential to be used as a source for petrochemical production. It is an alternative choice and an interesting way to handle waste tire problems.

Pyrolysis of waste tires is a interesting process to treat and recover valuable products. It is the thermal decomposition of substances at a high temperature in the absence of oxygen, involving the breaking of large molecules into smaller molecules. Researchers reported that products from waste tire pyrolysis can be used as fuels and raw material for petrochemicals. Islam *et al.*(2008) studied products from waste tire pyrolysis. They concluded that pyrolytic oils can be used as diesel fuel or heating oils after upgrading such as removing sulfur or blending with commercial fuels. Additionally, pyrolytic oils consisted of olefins and light mono-aromatics, which had high market values. In order to increase the quality and quantity of waste tire-derived oil, zeolites, and noble metals were used. Noble metals such as ruthenium, rhodium, and platinum exhibit high activity on hydrogenation and ring opening reactions that enhance the activity of waste tire pyrolysis. Dũng *et al.* (2009a) investigated the effects of using platinum catalyst supported on HMOR and HBeta zeolites in waste tire pyrolysis. They found that loading Pt on the zeolite supports caused the reduction of polar-aromatics. The distribution of polar-aromatics shifted to lighter fractions in the catalytic case ascribed to Pt that enhanced hydrogenation reaction, which converted polar-aromatic hydrocarbons to light hydrocarbons.

In order to reduce the cost of catalyst, non-noble metals that exhibit good performance and low cost are interesting for the pyrolysis process. Therefore, researchers had tried to apply non-noble metals instead of noble metals. Pinket (2011) investigated cobalt supported on KL zeolite. The result showed that Co/KL exhibited good catalyst for light olefins and cooking gas production. Especially, 1%Co/KL gave higher valuable gas production than the noble metal (1%Rh/KL). Co catalyst also showed a high production of mono-aromatics and a low concentration of multi-ring aromatics. These results were attributed to Co that provided good performance in hydrogenation and ring opening reactions, leading to the conversion of multi-ring aromatics into mono-aromatics. Moreover, in 2012, Saeaeh studied iron catalysts substituted to ruthenium catalysts in waste tire pyrolysis. The results showed that the presence of Fe catalysts led to a sharp increase in saturated hydrocarbons. Moreover, Fe catalysts decreased poly- and polar-aromatic hydrocarbons. It was attributed to the Fe site that promoted hydrogenation and hydrodesulfurization reactions of poly- and polar-aromatic hydrocarbons. Iron catalysts had high activity for waste tire pyrolysis as well as the reasonable cost that is lower than that of noble metals. Fe catalysts can also be a catalyst for Fischer-Tropsch synthesis. Fe-based catalysts were used for kerosene production. It was suggested that reduced Fe favored the production of olefins rather than paraffins in C_{6+} hydrocarbons range (Kumabe *et al.*, 2010).

The objective of this research work was to study the effects of zeolite supports (channel structure, pore size and acidity-basicity of supports) on the obtained products. Furthermore, the performance of Co and Fe supported with zeolites on the catalytic pyrolysis of waste tire were investigated, aiming to improve the quality and quantity of pyrolysis products. HMOR, HBeta, HZSM,-5 and KL zeolites were selected to be used in the experiments.