CHAPTER I
INTRODUCTION

Nowadays, the productions of rubber have been increased in demands. 85% and 15% of rubber are used as passenger car tires and truck tires, respectively (Kongkadee, 2008). Tires components are typically composed of natural rubbers, synthetic rubbers, steel core, and other additives. Tires are non-biodegradable materials resulting in many problems such as landfill and hazardous environmental problems. In case of landfill problem, a considerably amount of space is required to fill waste tires due to they are incompressible materials. Moreover, many harmful chemicals and additives are emitted to the environment (e.g. SO_2, NO_2, CO_2, CO, NO, and HCl) when tires are burnt.

At present, there are many ways to eliminate the waste tire such as incineration, gasification, grinding, landfilling, reclaiming, and retreading. Pyrolysis is an effective choice to manage the waste tire problem. It is a thermal decomposition of large molecular weight molecules to lower molecular weight products in the absence of oxygen. In general, the products of tire pyrolysis can be separated into liquid, gas and solid char. The advantage of tire pyrolysis is valuable products that can be useful as fuels and chemical feed stock (Choosuton, 2007). Solid char is a low grade carbon. If the process conditions of pyrolysis are different, the products of pyrolysis are not same.

The liquid products from pyrolysis are usually rich in aromatics, but they also contain some fractions of saturated hydrocarbons as well. Saturated hydrocarbons are required for fuels (naphtha, kerosene and gas oil). Aromatic compounds are the significant petrochemical feedstocks and solvents such as benzene, toluene, and xylene used in many process plants. The gas products are composed of C_1-C_4 (Rodriquez *et al., 2001*). Ethylene and propylene can be used in the production of polyethylene and polypropylene, which are very important in plastic industry.

Catalysts are important for industrial processes. It can reduce the production time in the reaction, save energy, and improve product selectivity. At present, catalysts are categorized into two large groups: homogeneous catalysts and heterogeneous catalysts (solid-state catalysts). The heterogeneous catalysts are the most preferable type because the ease of separation and handling during the production. The catalyst which is used in this work for catalytic pyrolysis is a bifunctional catalyst, Ru/MCM-41, which can increase gas yield (light olefins) due to its high cracking and dehydrogenating activity (Choosuton, 2007).

Mobil Composition of Matter (MCM) is the name given for a series of mesoporous materials that were first synthesized in 1992 (http://en.wikipedia.org/wiki/Mobil_Composition_of_Matter). The MCM-48 is a one of three phases mesoporous material which are consisted of MCM-41(hexagonal), MCM-48(cubic), and MCM-50(lamellar). The MCM-48 is the cubic mesoporous hydroxylated silicate which is consisted of crystal-like sub-micron-sized particles (Viveka *et al.*, 1997).

HMOR is a mordernite zeolite with 12-membered rings and crossed 8-membered rings. It is a very strong acid catalyst which can promote cracking, isomerization, aromatic alkylation, and etc. When HMOR is used together with Ru as a bifunctional catalyst, it can produce high amount of light olefins and other light products (Kongkadee, 2008). From the previous work, it was found that Ru/HMOR and Ru/MCM-48 were considered as the effective cracking catalysts for the production of light olefins and reduce oil products.

In this work, the Ru/HMOR and Ru/MCM-48-based catalysts were developed to be used as industrial catalysts by the addition of a matrix and a binder. The final extruded catalysts were investigated for their effects on the quality and quantity of pyrolysis products. The effects of zeolite-matrix interaction and performance toward light olefins production were studied in this work.