CHAPTER I
INTRODUCTION

Nowadays, C_8-aromatics are important raw materials in the petrochemical industry. Xylenes are used to produce polymers, plastics and plasticizers. Particularly, *p*-xylene (PX) is highly market required in the production of purified terephthalic acid (PTA) for polyester fiber products. *m*-Xylene (MX) occurs in largest quantity, but it has only specialized uses. So, the surplus of MX has to be isomerized into PX, for more valuable product. *o*-Xylene (OX) is used for the production of plasticizer and alkyd resin. For ethylbenzene (EB), it is used as raw material of styrene in the production of polystyrene (PS) and styrene copolymer, e.g. ABS and SAN.

The *n*-octane aromatization reaction prefers mono-functional catalysts because this reaction prohibits undesired products from isomerization of bi-functional catalysts. And a mono-functional catalyst that exhibits high selectivity to aromatics is, for instance, Pt (platinum) supported on non-acidic KL-zeolite (Bernard, 1980). Jongpatiwut *et al.* (2003) found that Pt/KL catalyst exhibited good performance for *n*-hexane aromatization, but the activity was low and it quickly dropped after a few hours on stream for *n*-octane aromatization. Most of the products obtained were toluene and benzene with small amount of EB and OX, which are the expected products from the direct closure of six-member ring. Moreover, the analysis of product evolution indicated that benzene and toluene obtained are resulted from the hydrogenolysis of EB and OX.

By contrast, on the Pt/SiO_2 catalyst, EB and OX were obtained as major products, although the overall aromatization activity was much lower than that on the Pt/KL catalyst. The rapid deactivation found in the aromatization of *n*-octane on Pt/KL compared to that of *n*-hexane can also be explained in term of the diffusional effects. The C_8-aromatics produced inside the zeolite diffuse out of the system with much greater difficulty than benzene or toluene. Therefore, they form coke and plug pores of zeolite to a greater extent than benzene. Temperature programmed oxidation and sorption studies on spent samples demonstrate that the degree of pore blocking is much higher during *n*-octane aromatization than *n*-hexane aromatization.

As mentioned earlier, the diffusional effects could be the problem because the proe size of L-zeolite is 7.1 Å whereas the critical size of EB and OX are 6.7 Å 7.4 Å, respectively. This could limit the diffusion of product in the zeolite channel. So, it is interesting to find out novel supports, which have larger pore diameter than L-zeolite. One feasible material is MCM-41, since its pores are straight uniform similar to L-zeolite but the pore diameter are much larger, therefore the transport limitations will be negligible. Moreover, since MCM-41 is non-acidic support with SiO_2-based, Pt/MCM-41 should result in high selectivity to C_8-aromatics as observed in Pt/SiO_2. Based on the hypothesis, Pt containing MCM-41 catalyst should increase the conversion and selectivity to C_8-aromatics for *n*-octane aromatization.

The aim of this research is to investigate the catalytic activity and selectivity of *n*-octane aromatization over Pt-containing different pore sizes of MCM-41 to the product distribution. This research is divided into two sessions; 1) Synthesis of MCM-41 with different pore sizes of MCM-41 by altering the chain-length of the surfactant template. The as-synthesized MCM-41 was characterized by mean of XRD and TEM analysis. Generally, the conventional method for MCM-41 preparation takes long time in the crystallization and aging steps. As a result, this work will utilize microwave oven as heating source to shoot high heating rate and provide high purity product (Kim *et al.*, 1998). 2) Preparation Pt/MCM-41 catalyst and study the activity and selectivity of *n*-octane aromatization over the Pt/MCM-41 catalyst compared to Pt/SiO_2 and Pt/KL. The reaction will be operated at 500°C and atmospheric pressure to study the effect of pore structure on the product distribution. The products will be analyzed by gas chromatograph. Fresh and spent catalysts will be analyzed by a number of techniques to explain the reaction activity and selectivity over the different catalysts.