

CHAPTER I

INTRODUCTION

The aromatization of n-alkanes is an important reaction to obtain high added-value products from a feedstock that is abundant in refinery operations. This reaction has many industrial applications and can be carried out on both bifunctional (acid-metal) and monofunctional (only metal) catalysts. The advantage of using monofunctional catalysts is the elimination of the isomerization paths, which are typical in the bifunctional catalysts and result in lower selectivity to aromatics. A monofunctional catalyst consisting of platinum on the non-acidic L zeolite has been reported to have high catalytic activity and high selectivity to benzene for conversion of n-hexane (Ko and Ahn, 1999).

The reaction mechanism for n-hexane aromatization on Pt/KL zeolite and the improvement of catalytic properties by varying promoters and preparation methods have been the focus of many publications. Less attention has been dedicated to the aromatization of longer chain alkanes, e.g. n-octane. The unique behavior exhibited by Pt/KL catalysts for n-hexane in terms of selectivity and catalyst life seems not to be present for n-octane. The activity for n-octane aromatization was low and it quickly dropped after a few hours on stream. Ethylbenzene (EB) and ortho-xylene (OX), produced by n-octane aromatization diffuse out of the system with much greater difficulty than benzene produced by n-hexane aromatization and can produce secondary products. Therefore, they form coke and plug the pores to greater extent than benzene. Moreover, the final amount of EB to OX (EB/OX) ratio was more than one, although, both compounds should be produced at the same quantities. Because the restrictive movement resulted in a longer residence time of OX than of EB inside the zeolite channel as a result of more effectively converted into benzene, toluene and methane (Jongpatiwut *et al.*, 2003). These results would suggest that the crystal size of the zeolite may have a great impact on product distribution and catalyst life, particularly when the feed contains C8 alkanes.

The aim of this work was to try to relate the different crystal sizes to the product results. This research was divided into two parts. The first part was to

synthesize KL zeolite in different crystal sizes by varying ageing time and amount of barium. Microwave oven was used as a heating source for synthesis of KL zeolite. The major advantage of microwave heating method is highly shortened synthesis time compared to conventional heating method. Synthesized KL zeolites were characterized by X-ray diffraction (XRD), Scanning Electron Microscope (SEM), Particle Size Analyzer (PSA), and Infrared Spectroscopy (IR).

The second part was to test reaction of catalysts at 500 °C by using n-octane as a clean feed and study the influence of the crystal size on product distribution, ethylbenzene to ortho-xylene ratio, and coke formation. The reaction products are analyzed by Gas chromatographic technique. The fresh catalysts were characterized by means of DRIFT of adsorbed CO, and Hydrogen Chemisorption. The amount of coke from spent catalysts can be calculated by Temperature Programmed Oxidation (TPO). In addition, the results from synthesized KL zeolites were compared with those of commercial KL zeolite.