CHAPTER I
INTRODUCTION

Financial impact leads to adding low-value petroleum feedstock to high-value product because in general feedstock accounts for 60-70% of the total manufacturing cost. Light paraffins are considered low price fraction especially *n*-pentane which is not widely used as feedstock in chemical industry. Converting *n*-pentane to aromatics including *p*-xylene is an interesting process. Market supply of *p*-xylene does not balance with its demand because it is the one of highest demand intermediates for polyester manufacture such as terephthalic acid and dimethylterephthalate to produce fibers, medicines, pesticides, and pigments. Presently, xylenes is catalytically produced from toluene and heavy reformate in complex refinery. Therefore, it is interesting to use *n*-pentane as feedstock instead of toluene and heavy reformate due to its lower prices. However, the bottleneck of the catalytic process is coking remaining on the catalysts reducing their active sites over time on stream.

Distribution of xylene isomers occurs during aromatization of alkane. We can enrich *p*-xylene by using ZSM-5 zeolite which possesses strong acidity and shape-selective properties. Modified ZSM-5 can be performed by several techniques including hydrothermal treatment, metal ion exchange, and silylation. Firstly, hydrothermal treatment extends aromatic selectivity and coking resistance. At external surface, steaming prevents blocking of micropores. Furthermore, steaming depresses strong acid sites on the internal surface. Another, silylation deactivated external surface by chemical liquid deposition (CLD) with tetraethyl orthosilicate (TEOS) in cyclohexane. Lastly, gallium can be incorporated on ZSM-5 zeolite to promote aromatization hydrocarbon by ion-exchange method. In addition, gallium-loading enhances the activity of aromatization of olefin without effect on the cracking ability of zeolite.

From previous studies, modified HZSM-5 zeolite catalysts were pre- and post-acid leaching of steaming, Ga ion-exchange and silylation, respectively. For industrial scale, HZSM-5 zeolites have to be shaped due to insufficient strength. The aim of this research is to find optimum condition for aromatization of

n-pentane to reach a full activity of *n*-pentane conversion, aromatics and *p*-xylene selectivity over modified HZSM-5 catalysts. The effect of temperature and pressure of steaming will be explored. In addition, a modified HZSM-5 zeolite catalyst in powder form will be shaped to a cylindrical form in order to meet the mechanical and mass transfer requirements of an industrial application.