CHAPTER I
INTRODUCTION

Propylene is one of the major used light olefins. Large quantities of propylene are used in producing polypropylene, and in feedstock for many chemicals, e.g., acrylonitrite, propylene oxide, 2-propanol, and cumene. In addition, propylene can be still used as an alkylation or polymer-gasoline feedstock for octane improvement. Propylene is produced primarily as a by-product of fluid catalytic cracking processes.

Propylene demand is expected to grown faster than its supply and there are technologies that can help to fill the need. They properly are fluidized catalytic crackers (FCC), propane dehydrogenation, methathesis, and methanol-to-olefins conversion. Although these technologies are developed, they have been little used, except the propylene production from FCC. Of the total current propylene production, about 67% come from steam crackers and about 30% come from FCC. From FCC or naphtha crackers in a typical have propylene:ethylene ratios of 0.65:1.

The significant part of future growth in propylene production will come from FCC units. The increasing demand for light olefins is directing many FCC units towards maximizing their yields. Integrated petrochemical industry is continuously looking for processes with improved flexibility in producing various olefins (mainly propylene) from hydrocarbon feedstock. The new process has been developed by Lurgi Oil-Gas-Chemie (in Germany), which called Propylur. Propylur accepts C_{4+} olefins from naphtha steam crackers or FCC units, light naphtha or gasoline from FCC, or raffinate from a butadiene plant. Approximately 85% of the C_{4+} olefins are converted to propylene and can improve the total propylene:ethylene yield to up to 1.1 to 1.5. The process takes place at 420-490 °C and 1.3-2 bar, using a shape-selective zeolite catalyst. UOP also offers for license the Atofina/UOP Olefins Cracking Process (OCP) that converts C_4-C_8 olefins to propylene and ethylene. The study has shown that the integration of OCP with naphtha steam cracker can increase the propylene yield by about 30%. In this process C_4-C_8 olefins are cracked over a proprietary zeolite catalyst in fixed-bed reactors at 500-800 °C and 1-5 bar.

One of the additives being used to maximize light olefins in commercial FCC operation is based on the zeolite ZSM-5. This zeolite was initially introduced into the FCC process as an additive for improving gasoline octane in the 1980s. The most applications of ZSM-5 in catalytic cracking were aimed at increasing the yield of the light olefins. By adding ZSM-5 to catalytic crackers has been found to be an effective means to increase olefins production. The mechanism of the reaction that causes the increasing olefins yields by ZSM-5 has not been completely understand. Most often it is reported that, at FCC reaction conditions, ZSM-5 cracks the gasoline-range olefins (C_4-C_{10} olefins) to light olefins (mainly C_2 and C_3 olefins).

Many industries are now interested in integrating the processes for increased propylene yields from their by-product for economical reasons. C_4-C_6 olefins, which are the elemental ingredients in these compounds, depend mostly on the by-product from many cracking processes.

Eventually, it has been observed that C_4-C_6 olefins cracking by shape-selective zeolite catalysts enhance the production of propylene. Therefore, this research will focus on using zeolite ZSM-5 to produce propylene by converting C_4-C_6 olefins, which are mainly by-product from steam cracking process.