# CHAPTER I
# INTRODUCTION

Naphtha reforming is one of the important catalytic processes in petrochemical industry because the aromatization of paraffins increases the octane number and produces valuable aromatic hydrocarbons (benzene, toluene and xylenes). Different formulations and different kinds of catalysts were proposed in order to increase the selectivity to aromatics and to achieve a better stability than the traditional $Pt/Al_2O_3$ catalysts.

Pt/KL zeolite catalysts, which consist of Pt supported on a non-acidic zeolite L, have been recognized as a new generation of alkane reforming catalysts because they show an exceptionally high activity and selectivity for the n-hexane aromatization. There are many reasons to explain how Pt/KL, which only exhibit the metallic function, differ from conventional, bifunctional $Pt/Al_2O_3$ catalysts. Among them, some explanations ascribe the unique features of the Pt/KL catalysts to structural characteristics of the L zeolite. In addition to the geometric effects, there is evidence that supports the hypothesis that Pt inside the KL zeolite is electronically modified. Moreover, there is a study that shows the unique characteristics of Pt/KL catalysts to inhibit the coke formation. Regardless the fundamental reasons behind the unique characteristics of Pt/KL, it is well known that in order to be active and selective, Pt must be in the form of very small clusters inside the channels of the zeolite.

Although Pt/KL catalysts are accepted for the aromatization of hexane, they display a very high sensitivity to even small concentrations of sulfur in the feed. It has been shown that in presence of less than 1 ppm sulfur, the catalysts deactivate in hour. One possible approach to increase sulfur tolerant of Pt/KL catalysts was done by additional of rare earths (e.g. Tm, Yb, and Dy) as promoter. At the same time, these Pt/KL catalysts are sensitive to

the presence of water vapor in the feed. Therefore, development of sulfur- and water- resistant catalyst is one of major goal of this work.

In addition, the recent investigations have pointed out that the different preparation methods can greatly influence in the difference of size and morphology of Pt particles inside the channel of L zeolite. In this project the effect of preparation method was studied by focusing on conventional incipient wetness impregnation (IWI) and vapor-phase impregnation (VPI).

Despite the great disparity in the possible explanations offered by several authors, most of them agreed in the uniqueness of Pt/KL catalysts to promote high aromatization of n-hexane. There are not much studies in the open literature related to the aromatization of large alkanes, such as n-octane ($C_8$) but these reactions would indeed have very important industrial application.

This research focuses on the study of catalytic performance by using $C_6$ and $C_8$, under clean, sulfur- and water-containing feeds on standard Pt/KL and "novel" Pt/KL rare earth promoted catalyst (Ce). Each catalyst prepared by using two methods, incipient wetness impregnation (IWI) and vapor-phase impregnation (VPI). For the catalytic testing, the obtained products were analyzed by Gas Chromatograph. For catalyst characterization, the fresh and spent catalysts were characterized by means of fourier transform infrared spectroscopy (FT-IR) DRIFT of adsorbed CO and hydrogen chemisorption to provide the location and dispersion of Pt particles, temperature programmed oxidation (TPO) was also applied to measure amount of coke on the spent catalysts.