CHAPTER I
INTRODUCTION

Hydrogenation of aromatic compounds in diesel fuel is gaining more interest due to the current and future stringent environmental legislation. To reduce the harmful emission from exhaust gases, the amount of particulate matter (PM) emissions in diesel can be reduced by decreasing the sulfur content of the fuel, raising the cetane number, and decreasing the aromatics content. In addition, the quality of diesel fuel generally shown as cetane number (CN) has decreased with increasing aromatic compounds (Rojas *et al.*, 2003).

There are several forms of the aromatic compounds such as triaromatics, diaromatics and monoaromatics. Polyaromatics is one of the most components in diesel fuel, however less attention has been paid to the hydrogenation of polyaromatic compounds. The hydrogenation of polyaromatics to monoaromatics can be easily achieved but not well as the hydrogenation of the last ring e.g. the hydrogenation rate of the first ring for naphthalene has been reported to be 20-40 times faster than the hydrogenation of the last ring. The last ring of monoaromatics is remained because of the more stabilization of itself (Rautanen *et al.*, 2001).

The hydrogenation of tetralin is rarely reported although it represents the simplest form of partly hydrogenated polyaromatics. Tetralin hydrogenation is typically incorporated as a sequential reaction step in the naphthalene hydrogenation as shown in Figure 1.1. The hydrogenation of tetralin in liquid phase has been investigated by a number of research groups (Rautanen *et al.*, 2001). However, kinetic study of the last ring hydrogenation by using tetralin in gas phase as a feed over Ni/Al_2O_3 catalyst has not been reported.

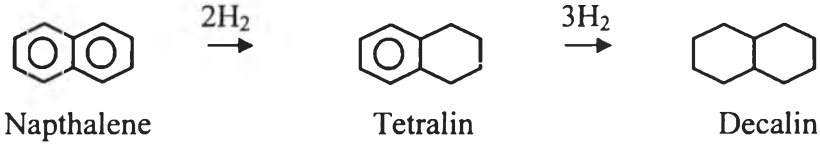

Figure 1.1 The sequential reactions of naphthalene hydrogenation (Huang and Kang, 1995).

Ni/Al_2O_3 catalyst has been known as one of the metal catalysts widely used in the hydrogenation reactions. The reaction over this catalyst can be occurred at mild conditions compared to noble metal catalysts. Moreover, nickel catalyst is much cheaper than others such as platinum and palladium containing catalyst.

This work was aimed to study the kinetics of the hydrogenation of tetralin in gas phase by using Ni/Al_2O_3 catalyst over the temperature range of 255-300 °C and at pressure of 300 psi. The integral reactor analysis was used to obtain the kinetic parameters. The empirical kinetic model based on a Langmuir-Hinshelwood mechanism in which the tetralin is hydrogenated to *cis*- and *trans*- decalin is proposed for this work.