# CHAPTER I

# INTRODUCTION

In general, natural gas liquid may be divided into two broad categories: (1) the pentanes and heavier fraction, which is commonly called debutanized natural gasoline, and (2) the butanes and lighter components, which are classified broadly as liquefied petroleum gas or LP-gas, and its data are usually reported separately [1,2].

The composition of debutanized natural gasoline will vary somewhat from field to field, depending on the character of the hydrocarbon reservoir. But in broad terms it consists of about 55 percent pentanes, 25 percent hexanes and $C_6$ ring compounds, 15 percent heptanes and $C_7$ ring compounds, and 5 percent $C_8$ hydrocarbon [1].

In 1911, the United States production of natural gas liquids was 500 B/D. Increasing motor gasoline markets spurred technological advances for extracting liquids from natural gas. By 1925 production had been expanded to 14,000 B/D. This product, called "natural gasoline", was used exclusively in motor-fuel blending. Natural gasoline is a highly volatile mixture of $C_4$ and $C_5^+$ hydrocarbons and constitutes part of the natural gas liquids. It is normally added to motor gasoline to raise its vapor pressure and increase the ease of starting in cold weather. Natural gasoline is also used as a petrochemical feedstock to provide isobutane and isopentane for alkylation processes.

Natural gasoline, the pentane and heavier fraction of natural gas liquids, falls into the same category as light naphtha. Its predominant use in present world markets can be expected to be in the manufacture of petrochemicals. On the other hand, LP-gas, because of its versatile

applications in the field of energy, will be channeled preferentially into energy markets except for those petrochemical operations in which it has premium value.

In 1986, the Gas Separation Plant in Thailand treated 350 million cubic feet per day of natural gas from the Gulf of Thailand with pressure of 45 times as high as the air pressure and at a temperature of 29°C. It also yielded 66,000 tons per year of natural gas liquid [3].

Benzene, toluene and xylenes (BTX) are the aromatic hydrocarbons of most value and widely used as petrochemicals. They are important precursors for plastics, such as nylon, polyurethane, polyesters and alkyd resins. These represent the large scale applications. On the lesser scale, they are precursors for insecticides, weed killer, medicines and dyes. The demand for aromatics in Thailand and SEA is increasing constantly, especially in Thailand which has a 10-15% average expansion up until 2002 [4].

The aromatic hydrocarbons are mainly produced by the pyrolysis and the reforming of petroleum products, such as condensate from Gulf of Thailand, Full Range Naphtha from the Gas Separation Plant or by import and pyrolysis gasoline from Thai Olefin Co. Ltd. This research used NGL in place of naphthas for this purpose.

## Objectives and Scope of the Research

The principle objectives of this research were to aromatize Natural Gas Liquid (NGL) and to study the properties of catalysts and products obtained from the reactions. The scope was to study the aromatization reaction of NGL under various reaction temperatures and different hydrogen pressures, and to study the catalyst concentration effect on the reactions. Furthermore, this research aimed at the investigation of the effect of solid support by comparison the effect of $Al_2O_3$ on aromatization process to that of 4A molecular sieve.