CHAPTER I

INTRODUCTION

Over the last quarter century, the chemical industry has mainly depended on oil as the raw material for organic synthesis. In short, the petrochemical industry has relied on the abundant supply of low-priced oil from the Middle and Near East countries. The basic products of petrochemistry are the lower olefins, especially ethylene.

In Japan and some countries, ethylene was mainly produced by the cracking of naptha. The rising cost of naptha, aggravated by the second oil crisis, has induced a rise in the price of ethylene. The high cost of ethylene is now a problem for the whole petrochemical industry in Japan, and effective use of heavy crude oil and alternative carbon sources are in strong demand. Natural gas, coal, tar sand, oil shale, biomass, and even carbon dioxide have potential as alternative sources. Such fossil fuels and biomass can be converted at high temperatures in the presence of steam and air to synthesis gas (syngas) containing CO and H_2 as principal components. Next, syngas can be converted to methanol after purification and regulation of the H_2/CO ratio.

C_1 chemistry (a Japanese-coined term) is a now widely - accepted term for comprehensive synthesis technology, starting from compounds contained only one carbon atom such as CO, methanol, CO_2, or methane (CH_4) from natural gas. This is contrasted with

" petrochemistry " which can be regarded as " C_2 chemistry " because ethylene (C_2H_4) is used as a primary material in the petrochemical industry. Once lower olefins (C_2 to C_4) are synthesized using C_1 chemistry, the conventional petrochemical reactions can be utilized as they are. However, the proper province of C_1 chemistry is not limited to an alternative supply of olefins, but is a separate technology which covers a very wide region of organic synthesis chemistry.

Methanol leads to many derivative chemical products and usages, which can be devided into two categories, namely conventional derivatives and new derivatives, including potential uses as fuel.

Recent discovery and development of natural gas in Thailand make it technically feasible to substitute engine fuel with methanol in conjunction with the development of methanol internal combustion engines. Whether Thailand will have her own methanol plant would depend on our national policy on energy utilization and on the economic merit of the plant.

1.1 The Objectives of This Study

The main objectives are :

1. Develop a computer model for an industrial methanol reactor,

2. Find the optimum operating conditions with the aid of the computer model, and

3. Separately carry out methanol synthesis experiments from syngas using an industrial catalyst.

1.2 The Scope of This Study

The scope encompasses the following :

1. Develop a computer model for an industrial adiabatic four-stage plug-flow packed bed reactor,

2. Using the computer model, design an industrial reactor and search for its "optimum" operating conditions,

3. Construct a high-pressure through-flow tubular reactor which can be operated at a maximum pressure of 50 atg and a maximum temperature of 450^{o}C.

4. Separately carry out experiments on methanol synthesis using an industrial catalyst, and

5. Study the effect of reaction conditions, especially pressure, temperature, and space velocity on methanol synthesis.