

CHAPTER I

INTRODUCTION



In the early day of organic chemistry, the building blocks for many organic chemicals came from the fractional distillation of coal tar, the liquid driven from coal when it is pyrolyzed to produce coke. Since most of the chemicals thus obtained were aromatic, this led to the more extensive development of aromatic chemistry compared with aliphatic at that time.

Chemistry is an area of vital importance in today's society, and within chemistry, catalysis is a mainstay, not only in many industrial applications, but also in numerous processes in the chemistry of life. Catalysis performs a key role in processes such as the conversion of crude oil into a wide scale of useful products, in the preparation of many nutrients, in the conversion of coal via synthesis gas into products like alcohol, gasoline, and in the removal of noxious components from exhaust gases.

Hydrocarbons, the primary product in petrochemical industries, are mainly used as fuel. The derivatization of the hydrocarbons to the high value compounds is very difficult because of the stability of C-C bond especially for alkane-type hydrocarbons [1]. Aromatization is an alternative way to synthesize higher value compounds. Conventional methods usually produce many different nonspecific product species; thus, the product separation becomes more difficult [2]. Selective aromatization catalysts have been prepared to reduce these problems. The size and shape selectivity of the reactants and products can be

produced by zeolite [3] as solid support for the aromatization catalyst. Zeolite is a crystalline fine porous material, which is composed of the rigid structure of silica and alumina units. The pore size is fixed; thus, it can control the shape and size selectivity of the reaction. Moreover, zeolite can stabilize the catalyst species by the alumina and silica subunits [4]. Another advantage of the zeolite is the separation of the zeolite-supported catalyst. Because the zeolite is a crystalline solid, it can be easily separated from the reaction mixture. The suitable size of the transition metal catalyst can be prepared inside the zeolite pore by ion exchanging process.

Furthermore, 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, herbicides, 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[5].

In this research, aromatization of saturated hydrocarbon was studied. The palladium (II) and zinc (II) were prepared in the zeolite ZSM-5 pore which was used as heterogeneous catalysts in a continuous tubular reactor.

1.1 Objectives of the Research

The principle objectives of this research were to aromatize *n*-hexane and to invent the continuous aromatization reactor for this project and study the properties of prepared catalysts and products obtained from the reactions. Furthermore, this research aimed at the investigation of the optimum condition and the effect of the different catalysts by comparison between Pt-F/Al₂O₃, Zn/ZSM-5, and Pd/ZSM-5 for the continuous aromatization.

1.2 Scope of the Research

The scope was to study the aromatization reaction of *n*-hexane by prepared catalysts under various reaction temperatures and different feeding rates of reactant and to study the type and catalyst concentrations effect on the reactions by using invented continuous reactor.