CHAPTER I
INTRODUCTION

The total amount of plastic wastes generated by our society is growing rapidly. The main source of plastic wastes in Western Europe (16,871,000 tons in 1996) is the municipal solid wastes (MSW) 63.3 wt%), followed by distribution and large industry 19.5 wt%. Plastics contained in MSW represent 8% of the total waste by weight and goes up to 20% when considered in volume. The low biodegradability of those creates a serious environmental problem that is directing the governments and environment agencies to propose a hierarchical solution to solve the plastic wastes problem based on source reduction, re-use and recycling. Up to now and considering the case of Western Europe only and considering the case of Western Europe only around 10 wt% of the plastic wastes were recycled. While around 73 wt% went to landfills and 17 wt% were incinerated.[1] In North America, waste plastics account for roughly 20% by volume and 10% by weight of landfill trash. Only about 3% of the waste plastics generated in the US is currently recycled. [2]

In Thailand from 1992-1999 solid waste amount was increased dramatically from 29,540 tons in 1992 to 37,879 tons in 1999 (Figure 1.1). In 1999 solid waste was generated nationwide approximately 37,879 tons a day. Around 25 wt% of solid waste was plastics and foam. It means that plastics and foam wastes increase almost 9,500 tons everyday.

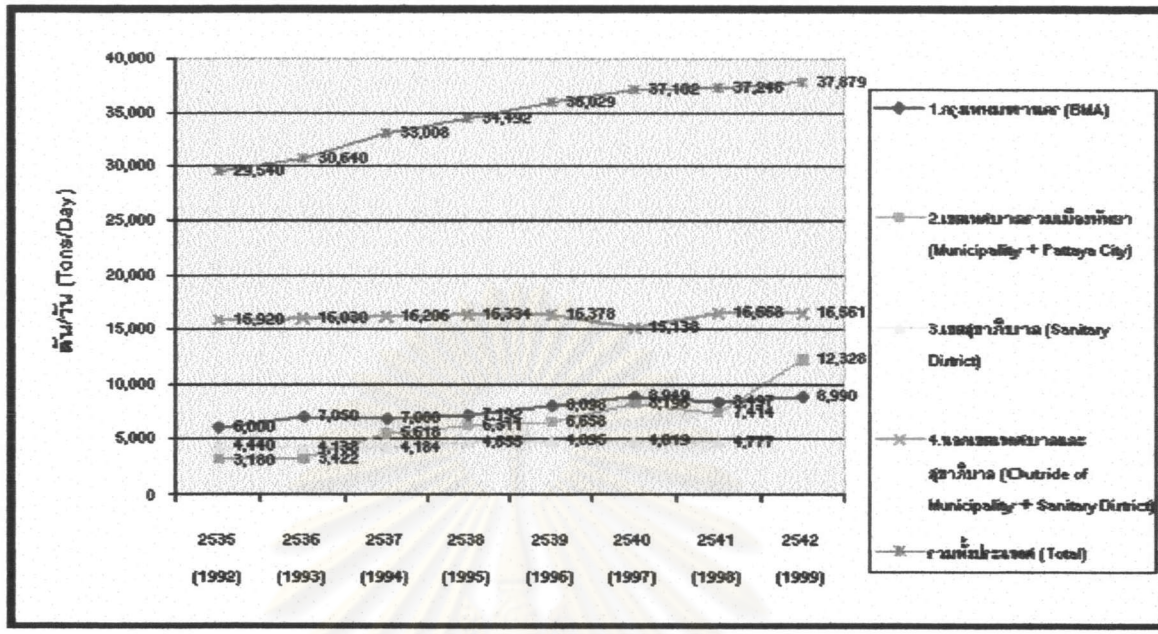

Figure 1.1 Solid waste in Thailand from 1992-1999

In 1999, Thailand final energy consumption increased 4.4% over the previous year. Modern energy consumption which comprises petroleum products, natural gas, condensate, coal and lignite, electricity, and others increased 4.3%, and renewable energy (fuel wood, charcoal, paddy husk and bagasse) also increased 5.1%. 89.35% of the total energy imported. The total value of crude oil import was 168,983.6 million Baht, an increase of 23.3% when compare to 1998.

The problems of waste plastics together with the lack of energy from oil and hydrocarbon gas have been increasing for many years. Many researchers have tried to transform these waste plastics into other useful substances, especially to transform waste polyolefinic plastics, such as polypropylene into hydrocarbon. Currently, the solution to the waste plastics problem is handled through 4 methods: land filling, burning and recycles energy, recycling, and reduction of plastic use. However, some of these processes cause the problem of air pollution and inadequate land for covering. Although, waste plastics can be recycled into plastic pellets and reused for producing new products or used with new plastics, unfortunately new products produced from

recycled plastics may not be as effective and durable as its original ones. This is why new research has emphasized transforming plastics into other useful chemical substances by thermal cracking method at high temperature along with various catalytic cracking methods, such as metal on zeolite support, zeolite etc. (but a disadvantage of using zeolite is that it is costly). [3]

Polybutene-1 is one of the polyolefinic group polymers., the main application is water distribution pipe. From the records in the year 1997 the world class producers of butane-1 such as Amoco, Chevron, Exxon, Shell and Texas Petrochemical produced 775 million pounds. Around 14% of butane-1 production used as the raw material to produce polybutene-1. It means that polybutene-1 production was around 110 millions pounds in the year 1997.

In Thailand polybutene-1 consumption in the year 2000 was around 5,000 tons and it increases around 2-3% per year

The idea of this research is to transform polybutene-1 into different molecular weight hydrocarbons and use some of its liquid qualifications as oil, while at the same time reduce waste plastics as well. The processes to serve these intended purposes have been carried out through catalytic cracking reaction by iron on activated carbon under hydrogen atmosphere in a microreactor.

The objectives of this research are to:

1. Study the hydrocracking of polybutene-1 by using iron on activated carbon catalyst in a microreactor using batch process.

2. Search for the optimum conditions of catalytic cracking reaction to yield suitable percentage of products and composition.

3. Investigate and analyze oil products, conversion and products distribution produced from cracking reaction

The scopes of this research are;

To investigate the performance of the prepared catalyst on the polybutene-1 conversion to oil under the following conditions;

- Reaction temperature range of 385-425 ^{o}C
- Catalyst amount 0.3-0.6 g
- Pressure of hydrogen gas range of 20-50 kg/cm^2
- Reaction time range of 30-90 minutes
- % Fe on activated carbon 1,5 and 10% per 15 g of polybutene-1