

# CHAPTER I

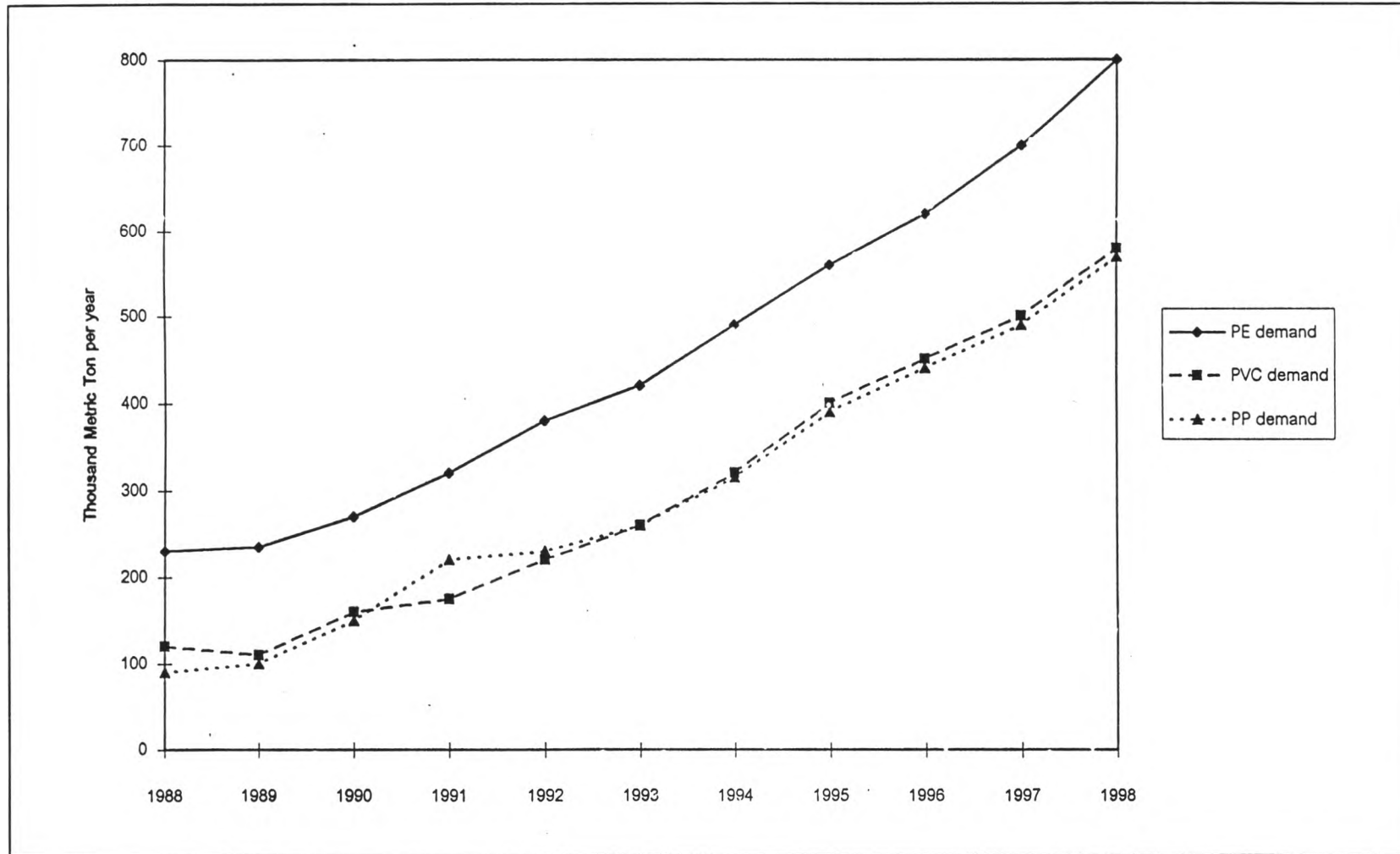
## INTRODUCTION



The quantity of plastics manufactured has increased in recent years, and, in consequence, the disposal of plastic waste has become a big problem. Plastic packaging is a very visible part of litter. This, together with its visibility and volume in landfill, has made plastic packaging an easy target for reduction, removal or elimination. This disposable packaging includes plastic bottles, plastic bags, shrink-wrap film, stretch film, blister packs and foam cups. Polyolefins, especially polyethylene, are widely used in film, bag and bottle applications.[1]

In Thailand [2], demand for polyethylene, polyvinyl chloride and polypropylene has grown at annual rates of 13, 29 and 21 percent between 1989 to 1993. The PE, PVC and PP demand in Thailand is shown in Figure 1.1. The PE consumption is the highest and increases continuously. It can be estimated that the future growth rate will be approximate 14%. As the PE consumption grows, the polyethylene waste will also grow.

The plastic industries, by their formidable progress in the development of plastic materials, converting technology and end-use applications, cannot disclaim their share of responsibility in the waste problems. Once plastics have become waste, their presence in the general refuse will make itself felt all along the various process steps from the dustbin to the final disposal processes, irrespective of whether such waste is dealt with by dumping, controlled tipping, pulverisation, incineration, composting, compacting or dumping into the sea. However, whatever the method of disposal, it must be economically feasible as well as technically



**Figure 1.1** PE, PP and PVC demand in Thailand [2]

sound, and it should not constitute a nuisance nor should it become a source of pollution of water or the atmosphere. There are four strategies for addressing this problem : [3,5]

- **Sanitary Landfill**

This method has a number of positive features. It is truly sanitary if properly employed, it is economical, and it often results in the upgrading of submarginal land for recreational or commercial uses. Where land is available, landfill is an excellent solution to waste disposal problems. Desirable sites for landfill, however, especially near major pollution centers, are becoming very scarce. Plastics make a sizeable component of sanitary landfills. Since they do not decompose readily, they release no odors, gases or liquids that can pollute surrounding land, air or water.

- **Incineration**

Incineration of solid wastes is widely accepted because it provides for an 80% to 90% volume reduction, and the waste heat may be utilized. Many unresolved problems in the design and operation of conventional incinerators limit their use with plastics. In a complete and proper combustion process, polyethylene, polypropylene, polystyrene and large quantities of excess air will yield products of carbon dioxide and water. The combustion of polyvinyl chloride generate fumes of hydrogen chloride (HCl), a toxic and corrosive gas which must be controlled.

- **Recycling**

Of the four widely proposed solutions to the problem of solid waste disposal, recycling seems the strongest. Less controversial than incineration, more easily mandated than source reduction and landfilling,

recycling has broad appeal. It is not opposed by any voting blocks or economic interests.

**- Source Reduction**

One of the best single solutions to burgeoning solid waste is reduction of the material input. As noted, plastics are an important part of this solution because of their light weight and other physical properties. Free market forces, such as dramatic increases in costs since 1986 have contributed to the use of lighter gauge plastics in film and bottles. Packagers, concerned about costs, do not voluntarily overpackage products. Consumer awareness of the solid waste implications of overpackaging in the form of small servings and complex convenience packages should be a priority. The value of using larger containers and simple packages needs to be pointed out. Another aspect of source reduction, as defined by the Environmental Protection Agency (EPA), is the design of products for longer, more useful lives. This clearly points to increased use of plastics, particularly in corrosive applications now held by steel and other metals.

From the previous study by Sunan Intarapeecha, HDPE wax have been converted into hydrocarbon oil by hydroisomerization reaction [6]. Since PE is one of the most plastic waste, we should also investigate the conversion PE into hydrocarbon oil. PE has the molecular weight more than HDPE wax, so that PE may be converted to hydrocarbon oil at a milder condition. In this study, conversion of used PE into hydrocarbon oil will be attempted which may serve as one of disposal methods.

### Objectives and Scope of the Research

The principle objective of this research was to transform used polyethylene to a higher value product. This would be achieved by hydrocracking with various catalyst types, catalyst concentrations, reaction temperatures, hydrogen pressures and reaction times. In addition , the gasoline properties of the product from the optimum conditions would be determined.