



## **CHAPTER I**

### **INTRODUCTION**

#### **1.1 Introduction**

Nowadays, the plastic industry is the most wonderful growth industry among the others. Because the high resistance to physical and chemical attack of plastics and their very light weight, plastics are used to replace metal and wood in a variety of applications and are likely to find application in many new developments, such as clothing, the manufacture of machinery and others. As a consequence of the rapid growth and extensive utilization of plastics, the quantity of used plastics is rising. Plastics waste generally consists of two main types. First, industrial plastic waste is categorized as waste generated by various industrial sectors. Second, post-consumer plastic waste is generated by plastic consumers. Since 1990, methods are being developed to minimize the waste of plastics throughout the world. The main aim of minimization is to create the cycle of plastics through the products and reuse of plastic waste. Of particular interest is the recycling of poly(ethylene terephthalate) (PET) due to the high consumption of PET over the world, see figure 1.1. A major use of PET is in the manufacturing of bottles for soft drink. The increasing consumption of in this form is shown in figure 1.2.

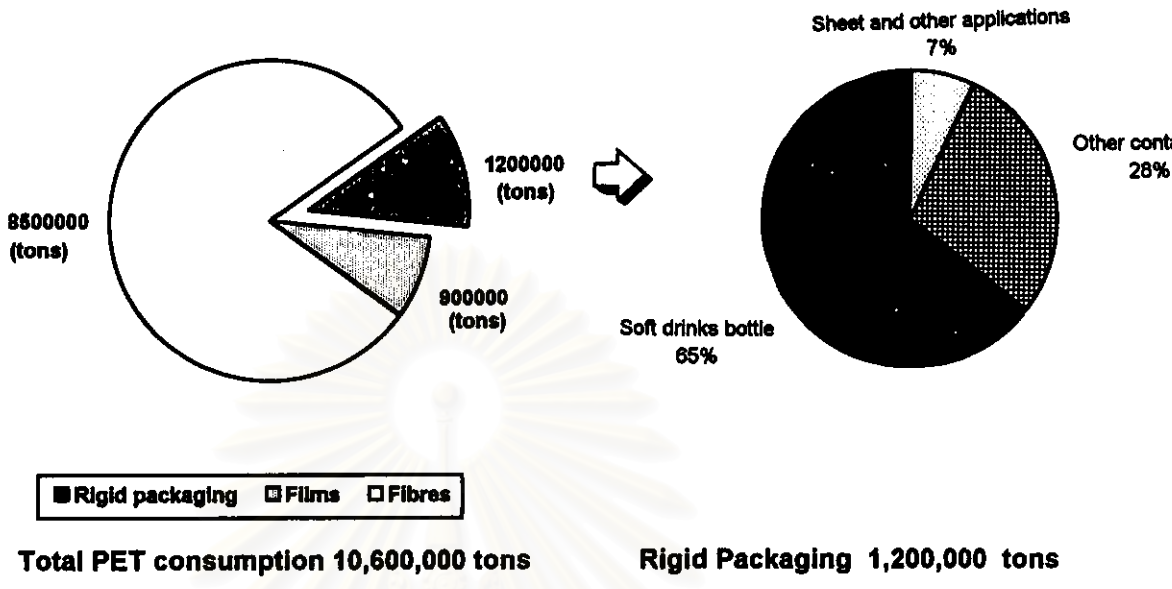


Figure 1.1 Estimate of overall PET consumption in the world,1990  
 M.A.Hughes and J.L. B. de Groot(1993)

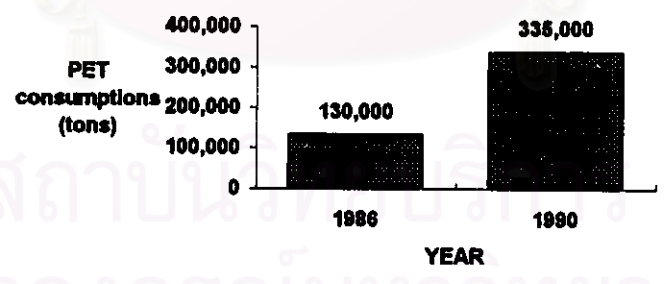


Figure 1.2 Increasing consumption of PET for rigid packaging in Europe  
 (1986-1990) M.A.Hughes and J.L. B. de Groot(1993)

A recent overview of the major uses of PET has been given by de Geoot and Hughes (1993). The disposal of waste plastics has been the focus of environmental problems. There are three methods to get rid of plastic waste, i.e. placing in permitted landfill, burning with a permitted waste-to-energy incineration for producing electricity and recycling. PET recycling is gradually gaining more interest and attention. Chemical recycling of wasted PET has been performed by methanolysis and glycolysis in an excess diols.

The depolymerization of PET waste by glycolysis gives oligomeric diols. The oligomers can then be used to synthesize other polymers such as, unsaturated polyester or polyurethane, because the terminated-hydroxyl group of oligomers can react with other chemicals to form polyols, the based-product of polyurethane or unsaturated polyester. This work will use the oligomeric diols from depolymerization of PET waste as a chain extender in the synthesis of polyurethane.

## **1.2 Purpose of the present study**

### **1.2.1 Objective of the Present Study**

Recycled poly(ethylene terephthalate) from post-consumer soft-drink bottles to be a chain extender of polyurethane is the aim of the work. Poly(ethylene terephthalate) was depolymerized by glycolysis in excess ethylene glycol. The product from depolymerization of poly(ethylene terephthalate) is named glycolyzed product. The terminated-hydroxyl groups of glycolyzed product can react with the isocyanate group in MDI to form urethane groups. The molecular chain of glycolyzed product was short. The short chain with terminated hydroxyl group reacts with MDI to form the hard-segment in polyurethane. Hopefully, this work will give an economically advantageous method of getting rid of post-consumer soft-drink PET plastics.

### **1.2.2 Scope of the Present Study**

The first step of this work is to determine the affect of the quantity of ethylene glycol, the time for depolymerization and the temperature of depolymerization on the hydroxyl value of glycolyzed product. The second step of this works is to choose the suitable glycolyzed product to add in polyurethane. The third step is to identify the important functional groups and the molecular weight of the glycolyzed products, which are chosen to add in polyurethane. The fourth step is to compare the properties of polyurethane used glycolyzed products as chain extender and the properties of polyurethane used ethylene glycol as a chain extender.



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