CHAPTER I

INTRODUCTION

On a volume basis, plastics are one of the world's most used materials in the world, especially in the industrial and commercial sectors of manufacturing. The demand for plastics has increased steadily. In 1994, the production of plastics increased 9% over 1993. The average annual growth is just over 5% for all plastic production between 1985 and 1994. [1] That increase has been caused by the advantages that plastics hold over traditional materials such as wood and glass : design flexibility (they can be modified for a wide variety of end uses), high resistance to corrosion, low weight, and shatter resistance.

As the usage of plastics has grown, the role of plastics in municipal solid waste (MSW) has become both more obvious and more worrisome. Plastics make up about 8% by weight of annual MSW produced. (Fig.1.1)

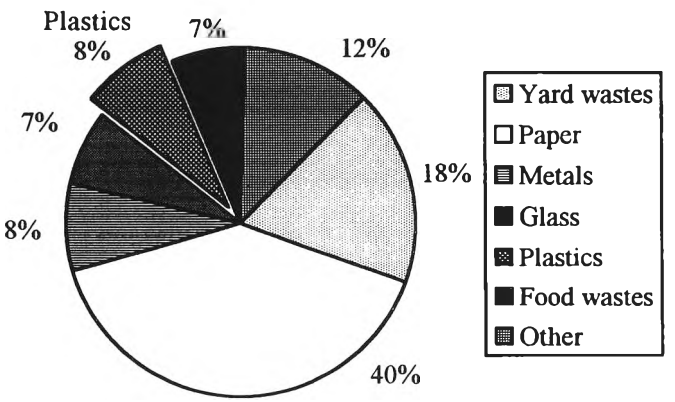

Figure 1.1 Materials generated in MSW by weight. [2]

Because of various chemical structures, plastics are difficult to destroy. The best choice is "Recycling". But, to date, only 2% of all plastics produced in 1993 were recycled. Fortunately, a little more than 3% of all plastics to be produced in 1998 will be recycled [1].

Limits to recycling plastics include the high costs and difficulty of collecting and sorting recyclable plastics. Small amounts of Polyvinyl chloride (PVC) resins mixed in with Polyethylene terephthalate (PET) can seriously contaminate the batch. Incinerating plastics to recover the energy values of plastics is possible, but can generate air pollution and hazardous waste by-products, particularly from PVC.

Hence, it is interesting to study the recycling of mixed plastic in order to abate pollution, preserve the environment, and conserve energy by the reprocessing of the reclaimed waste materials.

The purpose of this research is focus on the recycling of polyethylene terephthalate. PET is widely used in the production of fibres, molded articles, and packaging materials. The increase of imported-exported quantities between 1992 and 1996 is shown in Table 1.1. [3] PET does not degrade at acceptable rates by natural processes in the environment, and, hence, presents both a litter and a disposal problem.

One desirable way to lessen the amount of PET refuse in the environment is to recycle the polymer into new PET. Because of fortuitous contact of some post-consumer PET with harmful substances, such as pesticides, a successful recycling technique will almost certainly mandate that the polymer be depolymerized to purified monomers. Much of PET produced is prepared from purified terephthalic acid (PTA) rather than dimethyl terephthalate (DMT). The quantities of imported monomers are shown in Table 1.2 and 1.3. [3] Thus, a suitable recycling method should produce PTA for processes that use it as a starting material.

Table 1.1 Imported-Exported Polyethylene terephthalate in primary forms.

Year	Import		Export	
	Quantity (Kg)	Value (Baht)	Quantity (Kg)	Value (Baht)
1992	5,496,160	171,844,167	5,475,449	105,449,620
1993	5,457,895	176,484,890	30,650,093	272,847,192
1994	8,714,272	272,883,350	2,174,394	48,022,502
1995	20,043,788	940,989,085	2,996,721	128,702,419
1996	21,707,298	642,670,629	7,374,485	198,809,503

Table 1.2 Imported Terephthalic acid between 1992 and 1996.

Year	Quantity (Kg)	Value (Baht)
1992	213,648,092	3,436,516,655
1993	289,248,161	4,726,752,660
1994	306,448,166	5,967,829,238
1995	353,959,282	10,059,274,713
1996	256,745,702	6,118,479,315

Table 1.3 Imported Dimethyl terephthalate between 1992 and 1996.

Year	Quantity (Kg)	Value (Baht)
1992	41,521,000	510,593,862
1993	46,783,002	638,309,246
1994	53,430,503	877,359,381
1995	67,848,651	1,783,247,767
1996	33,000,006	649,362,658

Objective and Scope of the Research

The principle objective of this research was to depolymerize PET from post-consumer PET for reclaiming terephthalic acid (TPA) as starting material, which is valuable and could be used to remake PET. Specifically, we planned to study the reclamation of TPA by two methods : saponification and neutral hydrolysis, varying parameters such as the NaOH content, reaction time and temperature to find each optimum condition. Furthermore, studying the case of PVC mixed with PET was planed.