CHAPTER I
INTRODUCTION

Polymeric materials are used for a legion of applications in a host of technological fields. However, polymers are innately hydrophobic and low surface energy materials, and thus do not adhere well to other materials. This necessitates surface modification to render them adhesionable. (Mittal, 1994)

Polymer modification techniques can be divided into two types: chemical modification and physical modification. Chemical modification is the modification of a polymer, by which the chemical structure of the polymers is changed by chemical reaction, such as esterification, etherification, grafting, and cross-link, etc. On the other hand, physical modification is the modification of polymer by physical methods, such as blending with other polymers and mixing with suitable additives, etc. (Meister, 2007) The modification can be applied to polymers during or after their syntheses and during or after their manufacturing process into final products.

The pre-treatment and finishing of textiles by plasma technologies becomes more and more popular as a surface modification technique. It offers numerous advantages over the conventional chemical processes. Plasma surface modification does not require the use of water and chemicals, resulting in a more economical and ecological process. The enormous advantage of plasma processes concerns the drastic reduction in pollutants and a corresponding cost reduction for effluent treatment, so it can be considered as an environmentally benign technology (Carneiro *et al.*, 2001)

Polyethylene terephthalate (PET, PETE or the obsolete PETP or PET-P) is a thermoplastic polymer resin of the polyester family and is used in synthetic fibers; beverage, food, and other liquid containers; thermoforming applications; and engineering resins often in combination with glass fiber. It is one of the most important raw materials used in man-made fibers. In addition to the packaging materials, PET can also be processed into fabric form for textile and carpet applications. Particularly, to use PET in carpet application, it requires some surface modifications to improve properties of the product. There is a greater demand for antimicrobial property of textile goods as consumers have become aware of the potential advantages of these materials, which can be improved by coating antibacterial agent on the PET carpet surface.

Previous studies indicated that woven PET could be modified by using dielectric barrier discharge (DBD) plasma technique and subsequently coated with silver for antimicrobial property improvement (Onsuratoom, 2008). Dielectric barrier discharge (DBD) plasma modification is one of the promising methods of producing a wide range of high quality coating materials (De Geyter *et al.*, 2007). The textile industry continues to look for eco-friendly processes that substitute for toxic textile chemicals and reduce dyes in dyehouse wastewater. Chitosan has a great potential for a wide range of uses due to its biodegradability, biocompatibility, antimicrobial activity, nontoxicity, and versatile chemical and physical properties. However, the research on chitosan coating on PET carpet surface modified by DBD plasma technique for improving antibacterial property has less been reported.

In this research, woven PET fiber was plasma-treated with dielectric barrier discharge (DBD) under vacuum condition and air gas. In order to coat chitosan onto the fiber surface for improving antimicrobial property, the plasma-treated fiber was submerged into chitosan aqueous solution with various concentrations for different submerging times. The surface properties of the plasma-treated and chitosan-coated samples was characterized using scanning electron microscopy (SEM), Kjeldahl method, X-ray photoelectron microscopy (XPS), Fourier transformed infrared spectroscopy (FTIR), contact angle, and wickibility measurements. The antimicrobial property of the samples was also studied against *Escherichia coli* and *Staphylococcus aureus*.

OBJECTIVES AND SCOPES OF RESEARCH WORK

The objectives of this research are:

1. To study the surface modification of woven PET fabric by using DBD plasma technique for chitosan coating.
2. To examine and characterize chitosan coating ability on woven PET surface modified by DBD plasma.
3. To study the antimicrobial property of woven PET surface coated with chitosan.

The scopes of this research are:

1. To characterize the woven PET surface before plasma treatment.
2. To examine the effects of experimental parameters, including electrode gap distance, applied voltage, input frequency, pressure in reactor, and time for plasma treatment.
3. To investigate the effect of concentration of chitosan solution used for coating chitosan on polymer after plasma treatment.
4. To characterize the chitosan-coated woven PET surface.
5. To determine the optimum conditions for chitosan coating on woven PET fabric.
6. To evaluate the antimicrobial property of the chitosan-coated woven PET surface against *Escherichia coli* and *Staphylococcus aureus*.