CHAPTER I
INTRODUCTION

Chitosan can potentially be used as a food preservative in food packaging materials since chitosan has wide spectrum of antimicrobial activity against bacteria, yeast and fungi (Shahidi *et al.*, 1999; Rabea *et al.*, 2003; and Dutta *et al.*, 2009). Chitosan may be used in various food preservation applications such as, direct addition of chitosan into food, direct application of chitosan film or coatings onto food surfaces, addition of chitosan sachets into packages (Park *et al*, 2010). Coating of chitosan on the surface of polymeric films is one of the interesting methods because chitosan film itself does not possess good mechanical properties for food packaging. Many of the polymeric films are used in food packaging such as PVC, PE, PP and PLA because of its abundant supply, good chemical resistance, high impact strength, and low cost. For this reason, it is worth to produce polymeric films with the antimicrobial property by coating the film surface chitosan, a natural antimicrobial agent. However, the nonpolar properties of these polymeric films (PVC, PE, PP, and PLA) as well as the lack of functional groups to interact with chitosan, leading to the poor adhesion, poor wettabilities and low surface free energy, are the obstacle. As a result, surface modification of polymeric films prior to chitosan coating is required. Dielectric barrier discharge (DBD) plasma is one of the promising methods to improve surface wetting and adhesion properties (De Geyter *et al.*, 2007; Mittal, 1994; Upadhyay *et al.*, 2004). The speed of this method was just within a few minutes or even seconds which reduces the energy consumption. Moreover, the application of DBD plasma treatment allows for continuous in-line processing, no needed special gas, and lower operational costs (D'Sa and Meenan, 2009). The advantage of this technique is that plasma treatment only changes the uppermost atomic layers of material surface without modifying the bulk properties (Poll *et al.,* 2001). Plasma can generate activated species, such as electrons, ions, radicals and photons which are able to initiate chemical and physical modifications at the polymer surface (Riccardi et al, 2003).

In this research, polyvinylchloride (PVC), polyethylene (PE), polypropylene (PP), and polylactic acid (PLA) films were treated with dielectric barrier discharge (DBD) plasma under vacuum condition and air gas. In order to coat chitosan onto the

polymer film surface for achieving antimicrobial property, the plasma-treated films were immersed into chitosan aqueous solution having different concentrations. The objectives of the present contribution were to study the preparation of chitosan and to examine the surface modification of polymeric films by using contact angle measurment, atomic force microscopy (AFM), X-ray photoelectron microscopy (XPS), Fourier transformed infrared spectroscopy (FTIR). The amount of chitosan deposited on polymeric films was determined by Kjeldahl method. The antimicrobial property of the samples was also studied against *Escherichia coli* and *Staphylococcus aureus*.