CHAPTER I
INTRODUCTION

One of the most important functions of the food packaging is to preserve food products from sunlight, moisture, temperature, oxygen, and microorganisms. Among a variety of factors capable of affecting the food quality, microorganisms are considered to be the most significant because they can lead to cross contamination, discoloration, stinky adore, and food borne illness. Accordingly, the antimicrobial agents, either organic or inorganic compounds, are always used to minimize the amount of microorganisms in order to maintain the quality of foodstuffs.

In general, there are two approaches to incorporate the antimicrobial agents into food packaging – preparation of composite films and surface coating. However, the resulting composites show low antimicrobial activities because the incorporated antimicrobial agents do not cover the surface of the packaging films. Thus, they are not totally available for antimicrobial activity. On the contrary, the coating is an alternative approach to improve the antimicrobial activity via incorporating the antimicrobial agents into the food contact layer (Quintavalla and Vicini., 2002).

Zinc oxide (ZnO) is often used as an antimicrobial agent due to its several advantages, such as inexpensive cost, high antimicrobial activities, non-toxicities, high safety, and biocompatibilities. ZnO has been used as a filling in medical materials in diverse fields, including drug delivery, cosmetics, and pharmaceutical (Raghupathi *et al.*, 2011). The antimicrobial activities of ZnO are of great interest since it inhibits the microbial growth or kills microorganisms either with or without UV light (Ghule et al., 2006). Generally, the ZnO particles are frequently tested against Gram-negative and Gram-positive bacteria (Tayel *et al.*, 2011). Moreover, it can inhibit the growth of fungus, such as *Aspergillus Niger* (Ruffolo *et al.*, 2010). Regardless of its antimicrobial activities, ZnO is incorporated into a number of materials for introducing new properties, like photocatalytic activities, electrical conductivities, and resistivity to photo-degradation.

Polypropylene (PP) is commonly used in food packaging because of its many advantages, including abundant supply, inexpensive cost, good resistance to chemical and harsh environment, and excellent moisture barrier. However, the wettability, adhesion, and printability of PP are low (Chiang *et al.*, 2010). In this study, the dielectric barrier discharge (DBD) plasma technique is chosen to enhance the coating ability of the PP surface. The DBD plasma was used for surface modification by introducing the oxygen-containing functional groups at the surface of materials. Moreover, it also provides many advantages such as environmentally friendly, inexpensive, and easy to operate (Geyter *et al.*, 2007) which make the DBD plasma technique become a favorable technique.

In the present work, ZnO-coated PP films were accomplished with the aid of DBD plasma treatment. The optimum condition for DBD plasma treatment were chosen based on the results of water contact angle measurement, mechanical testing, X-ray photoelectron spectroscopy (XPS), scaning probe microscopy (SPM), and fourier-transformed infrared (FTIR) spectroscopy. The antimicrobial activities of ZnO-coated plasma-treated PP films at different ZnO contents were also tested against both Gram-negative *Escherichia coli* and Gram-positive *Staphylococcus auerus*.