CHAPTER I
INTRODUCTION

Cellulose is the most abundant biopolymer in nature. It is the main component of all plants and can be produced by metabolism of many strains of bacteria. Cellulose derived from the latter one is known as bacterial cellulose (BC). Although the chemical structure of BC is identical to plant cellulose (Czaja *et al.*, 2004), the cellulose synthesized by bacteria involved in a complex process. The obtained BC thus has three-dimentional and gelatinous structure. Presently, BC is an interesting material to use instead of plant cellulose, in order to reduce environmental damage. Besides, it has an ultrafine structure and high chemical purity, free of lignin and hemicelluloses, which is difficult to remove from plant cellulose (Luiz *et al.*, 2009).

Many applications of bacterial cellulose is the result of its unique properties, one important application is as biomedical material such as wound dressings (Wojciech *et al.*, 2006) since it can maintains the optimum conditions, control wound extrudates and provides moist environment to a wound resulting in a better wound healing. The ability to maintain the proper moisture level as a hydrogel or the never dried-state and high strength is due to its strong inter- and intra-fibrilar hydrogen bonding (Maneerung *et al.*, 2008). However, bacterial cellulose itself cannot prevent the wound from becoming infected. Therefore, to achieve the antimicrobial activity, antimicrobial agents have been impregnated into bacterial cellulose. The most commonly used antimicrobial agents are metallic nanoparticles like silver nanoparticle. In 2008, Maneerung *et al.*, found that "The freeze-dried silver nanoparticle-impregnated BC exhibited strong antimicrobial activity against *E. coli* (Gram-negative) and *S. aureus* (Gram-positive)". The major problem of silver nanoparticle is its very high reactivity that can interact with not only DNA of bacterial cells, but also human cells, consequently, it can cause toxicity or irritation to human skin (Schierholz *et al.*, 1998). To overcome this problem, chitosan, a natural antimicrobial agent is an alternative material to replace the use of silver nanoparticle.

Chitosan, derivative of chitin, is a natural polysaccharide having larger molecular size and lower reactivity resulting in many advantages such as biocompatibility, biodegradability, board spectrum of activity, versatile chemical and physical properties and lower toxicity to mammalian cells than metallic nanoparticles (Dutta *et al.,* 2009). Moreover, chitosan has found to have a similar structure to cellulose (Phisalaphong *et al.,* 2008). In this study, chitosan was coated on bacterial cellulose to improve its antibacterial properties by immersing the BC pellicle in the chitosan solution for 24 hours.

There are several techniques to improve the surface adhesion between materials. Plasma treatment is an interesting technique due to its potential environmental and energy conservation benefits. It is a method of surface preparation prior to bonding, deposition and coating. It provides an increasing of bond strength, wettability, permeability, hydrophobicity and biocompatibility. It removes organic and inorganic materials that prohibit desired bond strengths without affecting the bulk properties (Borcia *et al.,* 2006). One of the promising non-thermal plasma technique, dielectric barrier discharge (DBD) plasma, has many advantages such as it is relatively easy to fabricate, it can be operated at low temperature and atmospheric pressure, the modification is efficient and uniform over the whole surface.

The objective of this work is to produce chitosan-coated BC biomaterial haveing antimicrobial property for wound care application. In addition, the aid of DBD plasma treatment on the enhancement of chitosan coating was also investigated. The surface properties of material were characterized by Scanning Electron Microscopy (SEM), X-ray Photoelectron Spectroscopy (XPS) and Fourier Transformed Infrared Spectroscopy (FTIR). The chitosan content coated on the bacterial cellulose surface was determined by the Kjeldahl method. The antimicrobial property of the samples against *Escherichia coli* and *Staphylococcus aureus* was carried out by the colony counting method.