CHAPTER I
INTRODUCTION

Nowadays, biodegradable materials, especially those from natural polymers, have received more attention in biomedical applications. It is known that wound dressing is one of the most important tools in wound management. In recent years, the large number of new dressings have been developed to achieve improved wound healing. From the development of wound dressings, it can be divided into 2 types which are traditional wound dressings and modern wound dressings. Traditional dressings are dry and do not provide a moist wound environment. However, the essential characteristic of modern wound dressing is to retain and create a moist environment around the wound to facilitate wound healing (Boateng *et al.*, 2007). The modern wound dressing consists of 2 parts which are the matrix that can provide moisture and the incorporation of active ingredients to promote wound healing.

Generally, the active ingredients are released to the wound site with following mechanisms: diffusion, swelling and erosion. Hydrogel dressing is one of the interested modern wound dressing which can response to the release of the active ingredients due to the hydration of the polymer by fluids and swelling capability. Hydrogel is a three dimensional crosslinked hydrophilic polymeric network containing mainly of water which is excellent for helping to create moist environment that able to clean and remove necrotic tissue (Yoshii *et al.*, 1999). In addition, hydrogel dressing is not to stick to wounds, then, it can be easily taken out without damaging the wound and provide less pain for patients. As a result, hydrogel material is very suitable for development modern wound dressing containing active ingredients which facilitate in wound healing.

Chitin, poly (β-(1-4)-*N*-acetyl-□-glucosamine), is known to be able to biodegrade by the nature and in the body. Chitin possesses interesting biological properties which made it attractive to use as biomaterial. However, highly crystalline structure of chitin causes a problem in solubility which can be solved by chemical modification. The introduction of carboxymethyl (CM) groups into chitin leads to the formation of anionic derivatives which would be useful in biomedical fields. Moreover, CM-chitin is able to form hydrogel by cross-linking that makes it can

provide a moist environment to a wound, resulting in an effective wound therapy. There are many researches that has been supported the use of CM-chitin as wound dressing in various forms such as water-soluble chitin hydrogel (Cho *et al.*, 1999), carboxymethyl modified surface of chitin beads (Yusof *et al.*, 2000), CM-chitin films (Wongpanit *et al.*, 2005), etc. Thus, CM-chitin is suitable raw material to fabricate as biomedical devices.

However, the high degree of swelling of hydrogels results in the cracking of materials and lead to burst release of active ingredients. So, the additional substance is required to hold the structure and slow down the release of active ingredients. Chitin whisker, the crystalline nanofibrils chitin with high aspect ratio providing stiffness and strength, is remarkable to improve the properties of hydrogel. In previous report, chitin whisker was used in biomedical application as the wound medicament composite (Muzzarelli *et al.*, 2007). In addition, chitin whisker was also used to improve dimensional stability in the composites (Wongpanit *et al.*, 2007).

The aim of this research is to fabricate bionanocomposite films consisting of CM-chitin and chitin whiskers for wound care system via solution casting technique by using glyoxal as a crosslink agent. Moreover, the effects of crosslinking concentrations on physical properties of the films were evaluated in terms of swelling behavior and weight loss. Methylene blue, a cationic dye and methyl orange, an anionic dye, were selected as model compounds in order to examine the adsorption and desorption characteristics of the films. The effects of solvent of dye, blend composition and types of dye on the dye adsorption of the films were investigated as a function of adsorption time. Moreover, the effects of lysozyme and the ionic strength in released media on the dye desorption of the films were observed as a function of desorption time.