CHAPTER I
INTRODUCTION

The wound healing process is commonly divided into three or four overlapping phases: hemostasis, inflammation, proliferation, and remodeling (MacKay *et al.*, 2003, Deng *et al.*, 2007, Enoch *et al.*, 2008, Stojadinovic *et al.*, 2008). During these complex biochemical events, there are high incidence rates for infections. Larger breaks in the skin have a higher risk of developing an infection. However, infections can also occur in small wounds, from poor hygiene or in people with impaired immune defense systems. An infected or inflamed wound will lengthen the healing process, specifically by stimulating an inflammatory response (Boāteng *et al.*, 2008). Therefore, proper healing without infection and inflammation should be a priority. The application of a wound dressing has been practiced in order to protect the wound from contaminants, as well as to absorb exudate, reduce infections, reduce inflammation, and promote wound healing (White *et al.*, 2006).

Among the many types of wound dressing materials, hydrogel and nanofibrous wound dressing may offer superior benefits over conventional dressing materials. Hydrogel dressing has several advantages such as its biocompatibility, the fact that it is tailor-made with specific needs (Kokabi *et al.*, 2007, Boateng *et al.*, 2008, Singh *et al.*, 2008), non-irritating and non-adhering properties, immediate pain relief, ease of handling, transparency to allow easy monitoring of the wound bed, and facilitation moisture to wound bed. Nanofibrous wound dressing have advantages that include extremely high specific surface area, non-woven form with microporous structure that is effective against bacterial permeation and attraction of fibroblasts to the dermis, which are necessary for the repair of damaged tissues (Kanani *et al.*, 2010). In addition, these mats can be cut into any size or shape, are non-irritating, are attractive in appearance, and are practical and comfortable, all of which makes this type of dressing an appealing alternative.

Presently, the development of wound dressing has changed from the traditional passive to the more functionally active types, with an aim of imparting specific functions (Sai K *et al.*, 2000, Kokabi *et al.*, 2007). Therefore, in this study the concept of interactive biomaterial polymer was used to achieve the most

desirable properties for wound care. The purpose of the present contribution is to develop wound materials with antimicrobial activity through the use of nAg or pharmacological agents or with anti-inflammatory property through the use of silk sericin in order to enhance wound healing.

The scope of this research is to prepare the hydrogel-based (in the form of either pad or amorphous gel) and nanofibrous-based wound materials containing active substances. These substances are the effectual antimicrobial agent; nAg, the antibacterial pharmacological agent; doxycycline hyclate, and the naturally anti-inflammatory agent; silk sericin. Hence the nAg-embedded PVP hydrogels, the DOXY-h loaded-PAA (PAA/DOXY-h) nanofiber mats, and SS-alginate nanoparticles topical gel were prepared and investigated for the physical properties, antibacterial properties, release profiles and kinetic, cytotoxicity, adsorption isotherms of DOXY-h, *in vivo* wound healing tests of nAg-embedded PVP hydrogels, and *in vivo* anti-inflammatory effects, which were all evaluated.