CHAPTER I
INTRODUCTION

Wound dressings have experienced continuous from natural materials that simply covered the wound. By the evolutionally technique, many kinds of materials focused on moisture management and more recently to materials that either deliver active compounds or exhibit extraordinary function on the local wound environment or directly to the cells (Falanga 2004, Martin 2007, Boateng, Matthews et al. 2008, Morton and Phillips 2012). Now a day, the dressing technology have led to a new creation of topical products that do more than just cover and conceal, but that also can enhance the healing process. Wound dressings may play an important role to control the biochemical state of the wound such as inflammatory state with the right choice of biomaterial contributes with controlled morphology to manage the basically causes of chronic non-healing wounds (Ovington 2007, Schreml, Szeimies et al. 2010).

Silk has been known as biomedical material due to the successful use of silk as a bandage and suture material for centuries and also are widely available in Thailand. In our researches, silk fibroin (SF) has been established as an attractive biomaterial for scaffolding (Vepari and Kaplan 2007, Hardy and Scheibel 2010). Silks are generally composted of. β-sheet structures due to the dominance of hydrophobic domains consisting of short side chain amino acids in the primary sequence that different in each species. These structures permit tight packing of stacked sheets of hydrogen bonded anti-parallel chains of the protein. Large hydrophobic domains interspaced with smaller hydrophilic domains foster the assembly of silk and the strength and resiliency of silk fibers. The unique structure of silk fibroin allowed the engineering of architecture in various forms with extraordinary functions in tissue engineering (Alessandrino, Marelli et al. 2008, Hardy and Scheibel 2010).

Many biomaterials need to degrade at a rate commensurate with new tissue formation to allow cells to deposit new extracellular matrix (ECM) and regenerate functional tissue (Zahedi, Rezaeian et al. 2009). In addition, biomaterials may need to include provisions for mechanical support appropriate to the level of functional tissue development. In general, biomaterials must be biocompatible and elicit little to no host immune response (Charu Vepari et al. 2007).

Adapting ideas from biology can involve copying the complete appearance and function of specific creatures. as in toy manufacture where simplistic imitations are increasingly being incorporated to form electro-mechanized toys such as dogs that walk and bark, frogs that swim, and many others. Flying was inspired by birds using human-developed capabilities, whereas the design and function of fins, which divers use, was copied from the legs of water creatures like seals. Once human flying became feasible, improvements in aircraft technology led to capabilities that far exceed any creature living on earth. Biological materials have capabilities that surpass those of man-made ones and these include silk, leather and wool that are widely used to make clothing (Liu and Jiang 2011). Biomaterial design is an important factor of tissue engineering, incorporating physical, chemical and biological cues to guide cells into functional tissues via cell migration, adhesion and differentiation.

Electrospinning is a unique nanofiber approach, regained attention in the 1990s partly due to interest in nanotechnology, which has attracted attention as it is simple, effective and can be scaled-up (Agarwal, Wendorff et al. 2008). Moreover, various set of polymers can be used to produce fibers from a few micrometers down to the tens of nanometers in diameter by adjusting process parameters. The porous nature of these mats is highly suitable for the drainage of the wound exudates and, allows appropriate permeation of atmospheric oxygen to the wound (Boateng, Matthews et al. 2008). Thus scaffolds with desired morphology and properties can be controlled by selecting suitable material or composite components along with processing parameters (Payam Zahedi et al. 2009).

For the past several years, Chidchanok et al. (2007) have proposed the preparation of silk fibroin from cocoons of indigenous Thai silkworms (Nang-Lai) and Chinese/Japanese hybrid silkworms (DOAE-7) for use as electrospinning solution. They focus on the effect of silk fibroin concentration in formic acid on morphology and size of electrospun fibers. The evidences show that the average diameter of the e-spun fibers from both types of SF solutions was found to increase monotonically with the increase in the solution concentration. For the potential used of tissue engineering, they focused on bone tissue culture with mouse osteoblast-like cell (MC3T3-E1) and found that the e-spun SF fiber mats could be used as scaffolding materials for bone cell culture, as the cells adhered and proliferated well on their surfaces.

Here, it comes to our question whether the morphology can be designed according to preparation process or not. The present work shows a successful case to direct electrospinning of silk fibroin by increasing silk concentration. A great deal of this work has been put into the design of scaffolds, and the concept has evolved from silk fibroin based serving as structural support for cells, to more complex, dynamic biomaterial environments to direct cells towards desired outcomes in terms of tissue development. Therefore, a useful approach to design tissue-engineered scaffolds is to mimic the natural ECM used for wound dressing application.