CHAPTER I

INTRODUCTION

This chapter contains two parts including the rational for the study and the objectives of the study. The details of each part are as the following:

The Rational for the study

The loss of tissue or organ is one of the most severe human health problems and still not totally resolved problems in surgical field. Patients with extensive burns require treatment with the quick reconstruction of a closed epidermis to prevent dehydration and infection. Because spontaneous healing of dermal defects does not occur, the scar formation for the full thickness skin loss is unavoidable.

The formation of scar tissue is associated with wound contraction, which occurs by the following events. In normal dermis, skin fibroblasts are inactive. After wounding, fibroblasts proliferate and synthesize a new collagen containing matrix called granulation tissue. Fibroblasts at the edges of the wound migrate and initiate contraction. Differentiation from fibroblasts to myofibroblasts has been shown to depend at least in part on extent to which the wound resists contraction. After the wound has healed, the number of fibroblast decreases and extracellular matrix remodeling begins [1].

In the past, skin substitutes (xenografts, allografts and autografts) were used for wound healing. Skin substitute is performed by a section of skin which is removed from otherwhere and grafted onto the wound. However, if the wounds are widespread, there is insufficient healthy skin available to graft onto all the wounded area. In some patients, the antigenicity is a problem of wound healing.

At present, a new route to resolve that problem is tissue engineering. One of an important factor for tissue engineering is the extracellular matrix, which functions as a template for host infiltration and physical support to guide the cell differentiation and proliferation into the target tissue. The matrix for tissue engineering should be suitable

physicochemical characteristics and structure. The matrix must be biocompatible and promotes cell adhesion and growth. Over time, as the cells produce their own natural extracellular matrix, the synthetic matrix should degrade into non toxic components that can be eliminated from the body. This process must be able to produce irregular shapes to match those of tissue to be replaced [1-4].

Polymer is the major material for producing the matrix. Natural and synthetic polymers can be used to produce the matrix. The natural polymers have frequently been used in tissue engineering application because they are the components of natural extracellular matrix. Examples of natural polymer used as the matrix are collagen, hyaluronic acid, gelatin, alginate, and chitosan. Collagen is interesting polymer to fabricate the matrix since it is biocompatible and biodegradable. It is the most abundant protein in mammalian tissue and the main component of extracellular matrix. However, the fast degradation rate and low mechanical strength of collagen matrix are its limitations to use in tissue engineering.

Chitosan is another interesting natural polymer that able to form as a film and it has strong mechanical properties. Chitosan is biocompatible, biodegradable, non antigenic and non toxic. Many applications of chitosan in skin tissue engineering have been reported [5-7]. However, highly brittle of chitosan is the limitation of chitosan matrix.

The synthetic polymers are appealing for tissue engineering because their chemistry and properties are controllable and reproducible. The synthetic polymer such as polyethylene oxide, polyvinyl alcohol, and polyethylene glycol has been use as the matrix for tissue engineering. Polyvinyl alcohol (PVA) is a hydrophilic synthetic polymer with good film forming property: good tensile strength and flexibility. The available PVA shows good physicochemical properties, and it is also biodegradable [8-10].

From the limitations mentioned above, development of the best matrix must go on to acquire the best outcome. Base on the theory, mechanical properties of the natural polymers can be enhanced by blending with other polymers: natural or synthetic polymers, such as chitosan, alginate and PVA. Another alternative method is introducing various chemical crosslink, such as glutaraldehyde or β-glycerolphosphate.

Therefore, in this study we hypothesize that blending collagen with other polymers (chitosan or polyvinyl alcohol) and/or chemicals crosslink may be effective methods in modifying the biodegradation rate and optimizing the mechanical properties of the natural polymers matrix.

Purposes of the study

The objectives of this study are as follows:

1. To investigate the physicochemical properties of the developed matrix.
2. To evaluate effects of the developed matrix on the growth of human keratinocyte.