CHAPTER I
INTRODUCTION

Electrospinning has been recognized as an efficient method for the fabrication of ultrafine fibers with diameters in submicrometer down to nanometers. When applied electric field between a needle capillary end and a collector, surface charge is induced on a polymer fluid deforming a spherical pendant droplet to a conical shape. If the voltage surpasses a threshold value, electrostatic forces overcome the surface tension and a fine charged jet is ejected. The jet moves towards an electrode of opposite polarity. Owing to the high enough viscosity of the polymer solution or melt, the ejected charged jet remains stable and does not break up into spherical droplets, resulting in the deposition of thin polymeric fibers on a collector as a non-woven membrane. Nanofibers have amazing characteristics such as very large surface area-to-volume ratio and high porosity with very small pore size. Therefore, nanofibers can be promising materials for many biomedical applications such as tissue templates, medicals prosthesis, artificial organ, wound dressing, drug delivery, and pharmaceutical composition (Fong et al, 2001). Drug delivery system is the formulation or device that delivers therapeutic agents to desired body locations and provides timely release of therapeutic agents. Indeed, the system is not a therapy, but improves the efficacy and safety of the therapeutic agents that it carries. One of the simplest methods to provide more effective ways of administering drugs and enhance therapeutic efficacy is to physically mix or blend it with a polymer.

Chitosan, a copolymer of D-glucosamine and N-acetyl-D-glucosamine linked through β-(1→4) glycosidic linkages, is a partially deacetylated derivative of chitin which originates from shells of crustaceans such as crabs and prawns. The difference between chitin and chitosan chemical structure lies in the degree of deacetylation. Chitosan has received a great attention for medical and pharmaceutical application due to its beneficial intrinsic properties. Chitosan has many useful properties such as biocompatibility, biodegradability, antimicrobial activity, wound healing property, antitumor effect, etc (Geng et al, 2005). Chitin nanofibrous matrix was fabricated via electrospinning of chitin in HFIP and regenerated into chitosan nanofibers via heterogeneous deacetylation with aqueous NaOH solution (Min et al,

2004). Electrospinning of chitosan was fabricated by using acetic acid solution (Geng et al, 2005) and the later has been produced by using trifluoroacetic acid (TFA) or a cosolvent system of TFA and dichloromethane (DCM) (Ohkawa et al, 2004). Hydrogels are the crosslinked macromolecular network that swell in water or biological fluids and the most commonly used crosslinking agent is glutaraldehyde (Aly, 1998). Chitosan is one of hydrogels that has become a potential candidate for carriers of bioactive macromolecules, wound dressing and controlled release of drugs (Kawaguchi, 2000).

Tetrahydrocurcumin (THC), one of the major colourless metabolite of antioxidant action obtained by the hydrogenation of curcumin, exhibits many of the same physiologic and pharmacological activities as curcumin and in some systems may exert stronger antioxidant action than curcumin.

The purpose of this work is to achieve electrospun chitosan/THC fiber mats for biomedical application by studying the effect of solution parameters (polymer concentration, THC concentration) for preparing the electrospun fibers. Crosslinking and neutralization treatment have been also studied. The release of model drug from post-neutralized and crosslinked electrospun chitosan/THC fiber mats and chitosan/THC films was evaluated by drug release assay. The characteristics of the electrospun chitosan/THC fiber mats were evaluated by studying the degree of swelling and weight loss behavior. The chemical structure of the electrospun chitosan/THC fiber mats was characterized by using Fourier Transform Infrared Spectroscopy (FTIR). The diameters and the morphology of the as-spun fibers were obtained by a scanning electron microscope (SEM). Moreover, the indirect cytotoxicity evaluation of all electrospun chitosan/THC fiber mats were conducted in adaption from the ISO10993-5 standard test method in a 24 well TCPS, using cell line L929 as reference cell.