CHAPTER I
INTRODUCTION

Nervous systems such as the peripheral nervous system (PNS) and central nervous system (CNS) found in human adults, are capable of healing and regeneration. Neural tissue, due to its complex and numerous long-distance interconnections, by true regeneration. Every year, hundreds of thousands of patients are treated for degenerative disease or traumatic PNS and CNS damages. Neural tissue engineering strives to provide new strategies to optimize and enhance regeneration cells by using conducting natural or synthetic polymeric fibers serving as nerve guidance channels in nerve tissue engineering.

Conducting polymers such as polypyrrole (PPy) and polyaniline (PANI) have been used in various biomedical applications including biosensor, neural tissue engineering, actuator and controlled release. They have also been used to regulate cell functions by applying electrical stimulation (ES) through the conductive polymers, especially for electrically excitable cells such as neuronal or muscle cells. Numerous studies have demonstrated that ES through a conductive polymer significantly enhanced neurite outgrowth and cell spreading.

Direct polymerization of conductive polymer on fibers have several methods such as *in situ* chemical, electrochemical, and via admicellar polymerization may provide useful tool for producing new conducting materials to overcome some limitations posed by the of polymer alone.

Natural and synthetic fibers is often utilized where high surface-to-mass ratios, good mechanical performance, flexibility, and ability to be shaped in various forms able to fit end use are needed.

The most common techniques to produce natural and synthetic fibers are melt spinning, and electrospinning. Elecectrospinning has been recognized as an efficient method for the fabrication of submicron-size fiber with a large surface area to volume ratio. It is well known in the research community due to its simplicity, adaptability, and inexpensive tooling costs.

Aliphatic fibers, such as poly(ethylene terephthalate) (PET), poly(lactic acid) (PLA), have been widely used in tissue engineering because of their good biocompatibility and mechanical properties, bioresorable degradation products and adjustable degradation rate. In this study, optimal condition to prepare PPy-coated PLA electrospun nanofibers by admicellar polymerization is attained. PPy-coated electrospun PLA meshes and non-coated as-spun PLA meshes are studied for their compatibility with cell culture as well as the physical effect of the PPy coating. Moreover, PPy-coated aligned PLA electrospun fibrous scaffolds are compared with PPy-coated random PLA electrospun fibrous scaffolds and non-coated as-spun PLA fibrous scaffolds.

The purpose of this work is to coated PPy on poly(lactic acid) fibers, by admicellar polymerization, in the hope of generating a novel biomaterial which is electrically conductive and biocompatible suitable for neural tissue application.