CHAPTER I
INTRODUCTION

When the diameters of polymeric materials are shrunk from micrometers to submicrometers or even to nanometers, there appear to be several amazing characteristics such as very large surface area to volume ratio, flexibility in surface functionalities, and superior mechanical performance compared with any other known form of the materials. These outstanding properties make polymeric electrospun nanofibers excellent candidates for many important applications, some of which are filtration, reinforcing materials, wound dressing, tissue scaffolding, and controlled release materials, and etc. A number of processing techniques such as drawing, template synthesis, phase separation, self-assembly, electrospinning, etc. have been used to prepare polymeric nanofibers in recent years. The electrospinning process seems to be the only method which can be further developed for mass production of continuous nanofibers from various polymers (Z. M. Huang *et al.*, 2003).

Electrospinning is a unique process that uses an electrical field to create an electrically charged jet of a polymer solution or melt, which dries or solidifies to leave ultrafine fibers. The properties of the fibers obtained from this process depend on three types of parameters: which are (i) solution parameters including polymer properties (i.e. molecular weight, molecular weight distribution, and architecture of the polymers such as branched or linear chain), solvent properties (i.e. boiling point, density, and dipole moment), and solution properties (i.e. viscosity, conductivity and surface tension); (ii) processing parameters (i.e. applied voltage, collection distance, emitting electrode polarity, and needle size); and (iii) ambient parameters (i.e. humidity and nitrogen flow rate in the chamber, and temperature).

The advantages of electrospinning process are simple equipment, requiring a short setup time, cost-effective process, and ease for producing ultrafine fibrous webs with very small pore sizes. Therefore, the electrospinning process has regained much attention, due in part to the world-wide interest in nanotechnology. A survey of open publications related with electrospinning in the past 10 years is given in Figure 1.1.

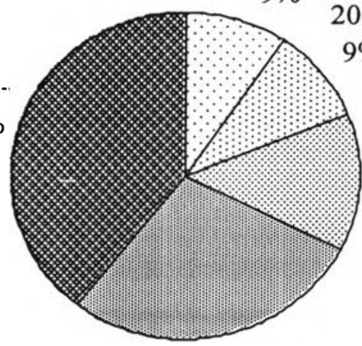

Figure 1.1 Comparison of the annual number of scientific publications since the term of "electrospinning" was introduced in 1994 (Data analysis of publications was done using the SciFinder Scholar search system with the term "Electrospinning", as on 4th June 2004).

Polystyrene is one of the most useful plastics. It has high electrical resistance and low dielectric loss. The normally brittle polystyrene can be made into a flexible material by fiberization and polymer fibers can be produced by electrospinning, because polymer fibers prepare by this technique were able to achieve the diameters in the range of nanometers to a few micrometers.

In this work, an attempt was made to understand the effect of process conditions for electrospinning of polystyrene solutions in various solvent systems on the morphological appearance of the as-spun polystyrene fibers. The solutions of polystyrene were tested for some basic properties such as viscosity, conductivity, and surface tension. The morphological characteristic and diameters of the as-spun PS fibers were investigated by means of scanning electron microscope (SEM).